Initiative for Climate Action Transparency - ICAT

ICAT Transformational Change Pilot Case Study:

Transformational Change

Development of a Tonga Energy Efficiency Master Plan

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LIST OF ACRONYMS

BAU	Business as usual
CO_2e	Carbon dioxide equivalent
COP	Conference of the Parties
CTCN	Climate Technology Centre & Network
EE	Energy efficiency
EV	Electric vehicle
GDP	Gross domestic product
GHG	Greenhouse gas
GJ	Gigajoule
HEV	Hybrid electric vehicle
ICAT	Initiative for Climate Action Transparency
IRP	Integrated resource plan
LDV	Light-duty vehicle
MCCTIL	Tonga Ministry of Commerce, Consumer, Trade, Innovation and Labor
MEIDECC	Tonga Ministry of Meteorology, Energy, Information, Disaster Management, Climate Change and Communications
MEP	Minimum energy performance standards
MET	Tonga Ministry of Education and Training
MOI	Tonga Ministry of Infrastructure
NDC	Nationally determined contribution
NDE	National Designated Entity
PCREEE	Pacific Centre for Renewable Energy and Energy Efficiency
PRDR	Pacific Regional Data Repository
PV	Solar photovoltaic
RE	Renewable energy
TEEMP	Tonga Energy Efficiency Master Plan
TERM	Tonga Energy Road Map
TPL	Tonga Power Limited
UNFCCC	United Nations Framework Convention on Climate Change
VKT	Vehicle Kilometers Travelled

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1. SUMMARY

At the request of the Government of Tonga, the Climate Technology Centre and Network (CTCN) has worked closely with the Tongan Energy Department in 2018 to develop a Tonga Energy Efficiency Master Plan (TEEMP) for adjustment and adoption by the relevant Tongan entities. The plan is based on a study of existing frameworks, plans, programs, and projects; extensive stakeholder consultations; and data development and analysis. The TEEMP encompasses electricity use and ground transportation and complements the approach of the 2009 Tonga Energy Road Map 2010–2020 (TERM). The TERM focuses on reducing Tonga's fossil fuel dependence through increased energy efficiency and improved supply chains to mitigate the price volatility of imported products as well as reduce greenhouse gas (GHG) emissions and improve national energy security.

The CTCN has applied the Initiative for Climate Action Transparency (ICAT) Transformational Change Guidance on the technical assistance in Tonga as a pilot in order to provide further clarity on the transformational impacts of its operations, as requested in the Technology Framework of the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC). The assessment was performed ex-ante during January to April 2019. The intended audience of this assessment is Tonga's Energy Department, Tonga National Designated Entity (NDE), the CTCN Secretariat, Advisory Board, and partners with an interest in understanding the positive impacts and transformational change resulting from CTCN technical assistance. Finally, developing country representatives from countries with similar climate mitigation and adaptation needs as Tonga may also be counted among the potential audiences.

The assessment concludes that the extent of transformation expected to be achieved by the TEEMP is *moderate* and the outcome is *possibly* sustained over time. The TEEMP, if implemented, is *expected* to result in GHG emission reduction and *moderate* sustainable development impacts such as job creation, energy security and reduced energy intensity on a multi-scale level. This overall impact may be achieved through scale-up of national capacity and access to energy efficiency technologies (EE) and conservation measures, engaging agents of change such as consumers and beneficiaries, using financial and other incentives and regulations for behavioral change, and strengthening national institutions to implement the proposed policies and actions in the TEEMP. At the time of writing this assessment, the results suggest that the TEEMP is potentially transformational if adopted, adjusted and implemented by the relevant Tongan entities, given further attention is given to some of the process and outcome characteristics related to ensuring *sustained* technical capacity building and a more comprehensive focus on adoption and scale-up of proposed EE technologies and conservation measures on the scale levels assessed herewith, to avoid a relapse to a high-carbon pathway.[1]

[1] In 2019, the government of Tonga started revising the TEEMP to make it both more comprehensive and more specific, with further technical assistance and capacity building by CTCN: https://www.ctc-n.org/technical-assistance/projects/revision-draft-tonga-energy-efficiency-master-plan-teemp

2. OBJECTIVES OF THE ASSESSMENT

- Evaluate the potential transformational change as a result of CTCN technical assistance in Tonga to develop a Tonga Energy Efficiency Master Plan (TEEMP). The assessment results of such an evaluation can be presented to the technical assistance proponents (in this case, the Tonga Energy Department) to demonstrate the benefits and co-benefits of implementing the policy recommendations for the Electricity and Transport sector as defined in the TEEMP. As the assessment is performed ex-ante, results may also be used to inform adjustments to recommended policy objectives or actions to increase the potential for transformational change.
- Understand how the technical assistance supports Tonga's Nationally Determined Contribution in relation to climate change mitigation, while simultaneously complementing multiple other national goals as envisioned in for example the Tonga Energy Road Map (2010-2020).
- Support CTCN technical assistance monitoring & evaluation and impact reporting processes by:
    - Building the Centre's internal capacity and understanding of transformational change and impact, as requested by various Conference of the Parties (COP) decisions including the Technology Framework of the Paris Agreement.
    - Contributing to the definition of 'transformational change' in the context of the Technology Mechanism, including both climate mitigation and adaptation.
- Contributing to the development of checklists and tools for a) assessing potential for transformational change of new and completed technical assistance requests in support of technical assistance prioritization processes, and b) reporting to donors, host organizations, the COP and the public.
- Provide feedback on the ICAT Transformational Change Guidance in view of the development of a new version of the guidance.

2.1 Policies assessed

The assessment applies to a package of policies and action as recommended in the TEEMP within the transportation and electricity sectors. The policies and actions assessed are in the form of taxes and charges, subsidies and incentives, information instruments, infrastructure programs, regulations and standards, and implementation of new technologies, processes, or practices. As the CTCN technical assistance was completed in 2018, the policies and actions recommended in the TEEMP are not yet implemented. For this reason, the date that the policies come into effect or cease cannot be established. The policies and actions assessed are on national level within the transportation and electricity sectors. For several policies and actions, the implementation level is subnational or city level, while others have implications on multi-level scales.

While several other potential policies and actions have been recommended in the TEEMP, this assessment only includes the top ten recommendations in each category, as presented in Table 1and

Table 2 below. The table below also highlight the entities that have been recommended to lead the implementation of the policies or actions as well as their intended impacts as described in the deliverables of the technical assistance.

Table 1: Ground transportation actions and policies assessed

Action/policy	Leading organization	Objectives and intended impacts or benefits of the policy or action
Use a platform as NextBus to track and coordinate buses	Tonga Ministry of Commerce, Consumer, Trade, Innovation and Labor (MCCTIL)	**Modeled impact:** GHG reduction from all VKT (Vehicle Kilometers Travelled) reduction projects by 2030 of 12,700 metric tonnes of CO2e (carbon dioxide equivalent) per year.
Enact a safe bicycle passing law	Tonga Ministry of Infrastructure (MOI)	**Modeled impact:** GHG reduction from all VKT reduction projects by 2030 of 12,700 metric tonnes of CO2e per year.
Send a mechanic to HEV/EV maintenance training in Japan or New Zealand	Tonga Ministry of Education and Training (MET)	**Modeled impact:** GHG reduction from all electric vehicle (EV) projects by 2030 of 300 metric tonnes of CO2e per year.
Provide pedestrians (particularly school children) and cyclists with safety reflectors and lights	MET	**Modeled impact:** GHG reduction from all VKT reduction projects by 2030 of 12,700 metric tonnes of CO2e per year
Install rumble strips and painted lines demarcating lane boundaries parallel to sidewalks to increase pedestrian safety	MOI	**Modeled impact**: GHG reduction from all VKT reduction projects by 2030 of 12,700 metric tonnes of CO2e per year.
Limit idle time with the help of fleet partners and idle reduction technologies	MEIDECC	**Modeled impact**: GHG reduction by 2030 of 10,300 metric tonnes of CO2e per year.
Adjust vehicle registration tax and import tariff according to vehicle weight, displacement, or fuel economy	Ministry of Revenue and Customs	**Modeled impact:** GHG reduction from all fuel efficiency improvements by 2030 of 5,700 metric tonnes of CO2e per year.

Blend diesel fuel with waste grease and coconut oil biodiesel at 10% blend	MEIDECC	**Modeled impact:** GHG reduction by 2030 of 4,500 metric tonnes of CO2e per year.
Begin a water taxi in the laguna (and some associated dredging)	MOI	**Modeled impact**: GHG reduction from all VKT reduction projects by 2030 of 12,700 metric tonnes of CO2e per year.
Build a strategic parking lot and bus stop at intersection of Taufa'ahau Rd. and Loto Rd. and accompany with Nuku'alofa parking policy	MOI	**Modeled impact**: GHG reduction from all VKT reduction projects by 2030 of 12,700 metric tonnes of CO2e per year.

Table 2: Electricity actions and policies assessed

Action/policy	Leading organization	Objectives and intended impacts or benefits of the policy or action
Implement building standards for resilience and energy efficiency (e.g. passive ventilation and daylighting with appropriate external shading)	MEIDECC develops energy components of codes, the MOI implements, and the attorney general's office approves permits	**Modeled impact**: 1,100 metric tonnes CO2e, with several secondary effects (passive shading or cool roofs, resilience benefits, identifying energy saving opportunities)
Perform energy audits of buildings to create baselines and implement energy conservation measures	MEIDECC, with consultation of the attorney general's office (which approves and enforces the building code)	**Modeled impact**: 700 metric tonnes CO2e, with several secondary effects (identifying other energy efficiency opportunities, encouraging net metering).
Minimum energy performance standards (MEPs) for equipment and appliances	Unknown	
Set packaging and recycling standards to limit the amount of waste imported to Tonga	Unknown	
Implement a public awareness campaign on energy efficiency and conservation	MET	**Modeled impact**: 600 metric tonnes CO2e, with several secondary effects (identifying other energy efficiency options). 10,100 metric tonnes CO2e possible through MEPS.

Establish a demand-side management revolving loan or rebate program to aid in financing more efficient equipment (residential, commercial and industrial)	Tonga Development Bank	With a small initial investment—potentially funded in part by development banks—the existing capabilities of the Tonga Development Bank could be leveraged to provide ultra-low interest loans to projects that demonstrate they can generate energy savings. These savings are used to pay off the full amount of the loan in a 5 to 10-year period, at which point the fund is redistributed to subsequent projects. Rebate programs similarly encourage customer uptake of efficient technologies
Prioritize on-site renewable energy (RE) with islanding controls and energy storage within critical infrastructure	Unknown	
Implement distributed energy generation projects that incorporate RE and fossil fuels to enhance resilience and reduce emissions associated with diesel generation, particularly when electrifying new areas or islands	Unknown	
Work with TPL (Tonga Power Limited) to create an integrated resource plan to incorporate RE, EE, and more efficient reciprocating engines that can be dual fuel	MEIDECC, Tonga Electricity Commission, TPL	An integrated resource plan (IRP) provides an opportunity for the company to lay out a long-term, realistic framework outlining how goals will be met in a scope not captured by annual reports.
Data collection exercise/database to manage energy data by sector	MEIDECC (to potentially house the data), Ministry of Statistics, MCCTIL, TPL—working with regional organizations like Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) and the Pacific Regional Data Repository (PRDR)	Standardize annual reports and increase reporting of data to include figures such as sectoral consumption and load profiles by source of generation.

2.2 Vision for transformational change

“Transformational change can happen as a result of pressures created by people, policies or new disruptive technologies at different levels of society. Such pressures may enable a reconfiguration of existing structures, policies and practices. A policy or action can contribute to transformational change by reconfiguring high-carbon and unsustainable structures in society through intervention(s) at one or several interacting societal levels” (K.H. Olsen & N. Singh, 2018). Figure 1below illustrates how the TEEMP interacts at multiple levels. The policies and actions proposed in the TEEMP, supported by international organizations and donors, are envisaged to create change in national policies for the electricity and transportation sectors and in cities and communities. This will be achieved by promoting technologies and solutions which contribute to GHG emission reduction, climate resilience and energy security. The vision for transformational change is further described below at three societal levels and over three time periods.

Macro level (global or international level): The TEEMP contributes to the global vision for reduced energy usage, greenhouse gas emissions, and increased energy efficiency, by supporting the Sustainable Development Goals 7 and 13 (Affordable and Clean Energy, Climate Action). The TEEMP is supported by international and regional organizations and donors which contribute to the implementation of the various policy recommendations via funding, technical assistance, capacity building and knowledge sharing. While the desired change is to achieve zero-carbon development and strengthen energy security with international support, the planned policy does not lead to transformational change on a global or international level. However, Tonga receives global recognition for its energy efficiency ambitions and inspires other SIDS and countries with similar needs and conditions.

Medium level (national, sectoral or states/provincial level): The TEEMP addresses 55% of the emissions on national level in Tonga. Electricity generation account for 23% of Tonga’s emissions and ground transportation accounts for 32%. The reduction in energy demand and usage resulting from implementation of the key policy options identified in the TEEMP contribute to a reduction of 106,000 metric tonnes of carbon dioxide equivalent per year by 2030, which is a 50,5% reduction from business as usual (BAU) emissions of 210,000 metric tonnes of carbon dioxide equivalent. Transportation accounts for 30.4% of the reduction, renewable electricity for 40% of the reduction, and energy efficiency in buildings and lighting for 29.6% of the reduction. Furthermore, by increasing renewables penetration and decreasing fuel consumption, Tonga’s dependence on imported fuel—as measured by energy intensity—stabilizes and is reduced to 160 GJ per 1 USD, compared to 260 GJ per 1 USD in a BAU scenario.

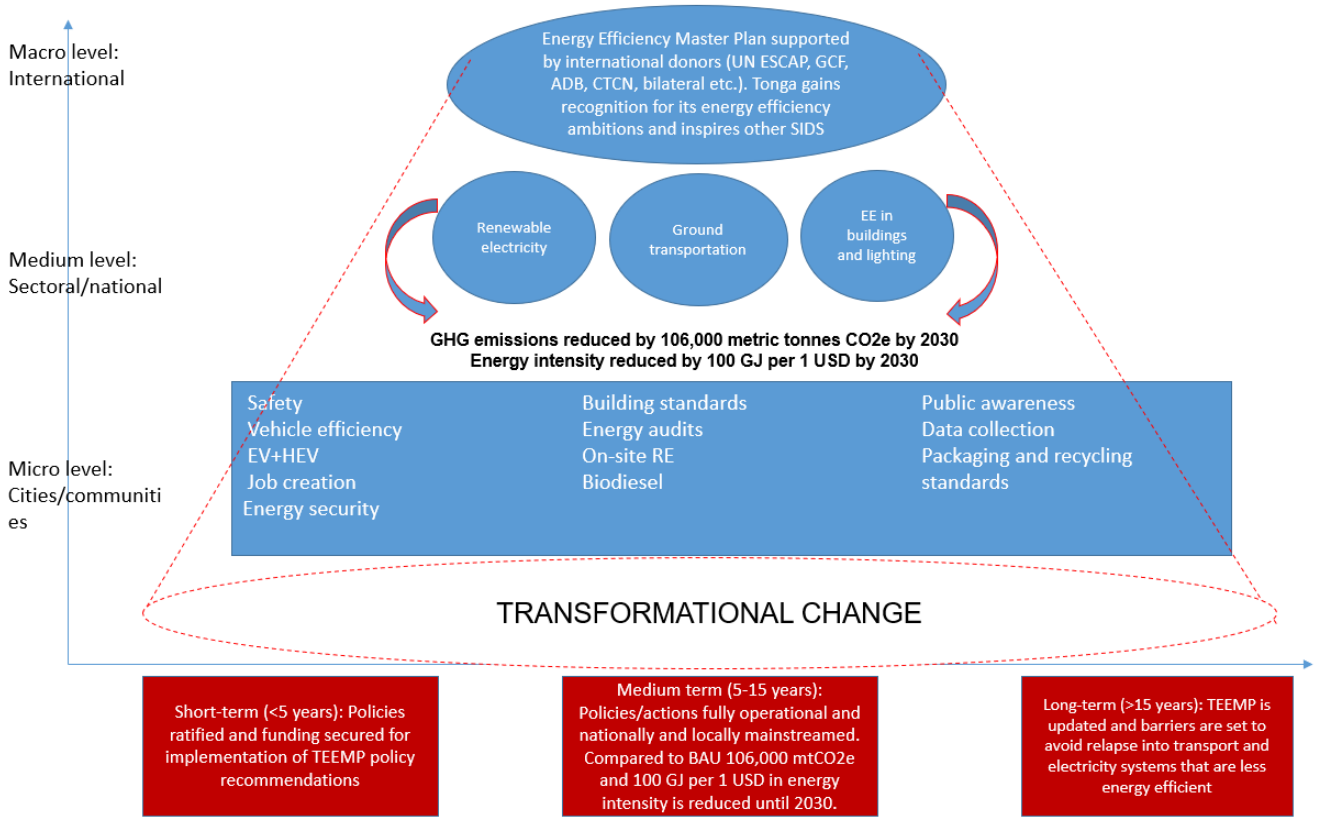
Micro level (cities, communities or towns): The TEEMP policies are implemented on subnational levels while creating an enabling environment for technology adoption and up-scale through knowledge sharing, financial incentives, and safety measures in order to overcome barriers and ensure long-term sustainability. In cities and communities, actions and policies for energy audits, electric vehicles and building, packaging and recycling standards lead to climate resilience, energy security and increased public awareness on energy efficiency measures and their environmental and financial benefits.

Short-term (<5 years): TEEMP policies are ratified and international and national funding is secured for implementation of TEEMP policy recommendations.

Medium-term (≥5 years and <15 years): Policies/actions fully operational and nationally and locally mainstreamed. Compared to BAU scenarios, 106,000 metric tonnes of CO2 equivalents are reduced and the national energy intensity is reduced by 100 GJ per 1 USD.

Long-term (≥15 years): TEEMP is updated and barriers are set to avoid relapse into transport and electricity systems that are less energy efficient.

Figure 1: TEEMP multi-level interaction and vision for transformational change



2.3 Defining the assessment

2.3.1 Assessment boundary and period

Geographical coverage: The anticipated transformational impact will be assessed on a national level. This is, at times, distinct from the geographic coverage of some of the policies and actions assessed and recommended in the TEEMP. For example, the recommendation to build a strategic parking lot and bus stop was specified on city-level, for the capital city of Nuku'alofa. However, the impact GHG emission reduction will be aggregated for all actions and presented on national level.

Time period: The anticipated transformational impact will be assessed up to the year 2030. This is the time period over which the extent of transformation expected or achieved by the TEEMP is assessed and is not the same as the policy implementation period, i.e. the time during which the policies are in effect. The time period has been set to capture the full range of relevant impacts based on when they can be expected to occur. This is also in line with the time period for impact estimation in the TEEMP. For example, the TEEMP has assessed the potential for GHG emission reduction as well as energy intensity compared to BAU scenarios by 2030.

Sectoral coverage: The assessment covers the sectors transport and electricity. While sub-sectors include buildings, equipment and appliances, ground transportation, lighting, packaging and recycling, the assessment will be conducted on the main sectoral levels transport and electricity. In the TEEMP a baseline assessment of Tonga's GHG emissions was built from Tonga's nationally determined contribution (NDC), which identifies the key emitting sectors as transport (40%), electricity generation (23%), agriculture (21%), waste (11%), and other energy (5%). The TEEMP addressed 55% of these total GHGs: electricity generation (23%) and ground transportation (32%).

Impact coverage: The assessment covers the following impact categories:

- GHG emission reduction
- Energy intensity
- Energy security

Sources: Data sources for the assessment include the documents, tools and policy recommendations delivered as an output of the CTCN technical assistance on Tonga Energy Efficiency Master Plan, including the TEEMP itself. Sources are based on extensive research conducted in 2017 and 2018 via in-person stakeholder consultations, policy and regulatory analysis, and modeling. Further information may also be sought through various online resources as well as through direct communication with the technical assistance implementer, National Renewable Energy Laboratory (NREL), and national stakeholders in Tonga. All the deliverables can be found on the public technical assistance page on the CTCN website[2] and include but are not limited to:

- Tonga Energy Efficiency Master Plan
- Presentation of Tonga Draft Baseline and Least-Cost Options
- Least-Cost Energy Efficiency and Transportation Policy Options
- Baseline and Benchmarking Study
- Web-based Discussion on Baseline and Benchmarking Study
- Summary Document on Capacity Building Opportunities
- Progress and Tracking Tool

2.3.2 Characteristics to be assessed

Figure 2 below illustrates the framework of characteristics of transformational impact. There are two types of impacts: outcomes and processes. Within each type there are categories and within the categories, there are characteristics. Together the outcome and process impacts are used to determine the extent to which the CTCN technical assistance is transformational. **Fehler! Verweisquelle konnte nicht gefunden werden.**Table 3 and Table 4 summarize the descriptions of the chosen process and outcome characteristics and their justifications.

[2] https://www.ctc-n.org/technical-assistance/projects/development-tonga-energy-efficiency-master-plan

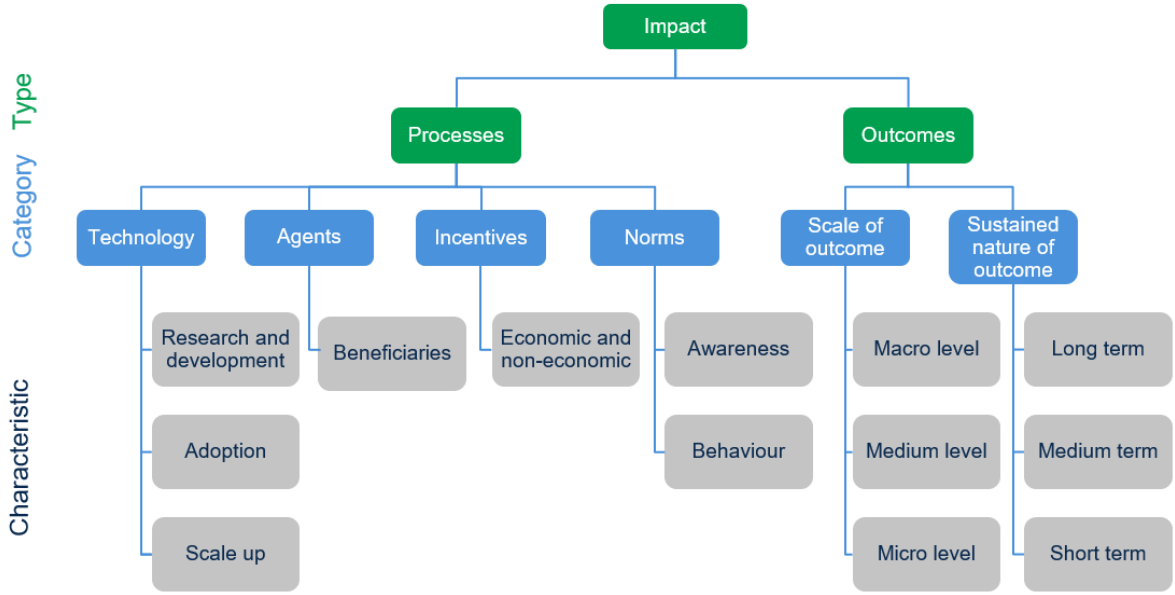


Figure 2: Characteristics of transformational impact

Table 3: Description of process characteristics and their justification

Category	Process characteristics	Description	Justification
Technology	Research and development (R&D)	The TEEMP supports R&D for building technological capabilities favoring a zero-carbon and resilient economy through: Development of knowledge/skill base: Sending a mechanic to HEV/EV maintenance training in Japan or New Zealand Capacity building: MEIDCC staff participation in a training in New Zealand on MEPS, building codes and efficient transportation Research networks: Working with regional organizations such as PCREEE and PRDR to standardize annual reports and increase reporting of data to include figures such as sectoral consumption and load profiles by source of generation	Ten percent of all light-duty vehicles (LDVs) are assumed to be electric by 2030 and GHG reduction from all EV projects in Tonga are estimated to 300 metric tonnes of CO2e per year by 2030. EVs and hybrid electric vehicles (HEVs) have been identified as efficient GHG-mitigating technologies (in this case, regardless of the electricity mix). Tonga currently lacks the technical capacity to repair and maintain new vehicle technologies. Up to 3.5% of total consumption on Tongatapu originates from a Church of Later-Day Saints temple, most likely a result of superfluous air conditioning. Strengthening energy-efficient building standards and performing audits on the largest consumers—including government buildings—can play a large role in reducing overall demand. Tongan officials indicated during in-

			person training sessions that no ministry currently has the capacity to assess building standards. Training can help prepare energy auditors. Institutional capacity building is needed for application of data and tools that Tonga can use when developing and implementing efficient electric and transportation systems. A key opportunity for capacity building within institutions in Tonga for implementation of the TEEMP is to strengthen the Tongan Department of Statistics to enhance and better organize data related to energy and transport sectors.

Category	Process characteristics	Description	Justification
Technology	Research and development (R&D)	The TEEMP supports R&D for building technological capabilities favoring a zero-carbon and resilient economy through: Development of knowledge/skill base: Sending a mechanic to HEV/EV maintenance training in Japan or New Zealand Capacity building: MEIDCC staff participation in a training in New Zealand on MEPS, building codes and efficient transportation Research networks: Working with regional organizations such as PCREEE and PRDR to standardize annual reports and increase reporting of data to include figures such as sectoral consumption and load profiles by source of generation	Ten percent of all light-duty vehicles (LDVs) are assumed to be electric by 2030 and GHG reduction from all EV projects in Tonga are estimated to 300 metric tonnes of CO2e per year by 2030. EVs and hybrid electric vehicles (HEVs) have been identified as efficient GHG-mitigating technologies (in this case, regardless of the electricity mix). Tonga currently lacks the technical capacity to repair and maintain new vehicle technologies. Up to 3.5% of total consumption on Tongatapu originates from a Church of Later-Day Saints temple, most likely a result of superfluous air conditioning. Strengthening energy-efficient building standards and performing audits on the largest consumers—including government buildings—can play a large role in reducing overall demand. Tongan officials indicated during in-person training sessions that no ministry currently has the capacity to assess building standards. Training can help prepare energy auditors. Institutional capacity building is needed for application of data and tools that Tonga can use when developing and implementing efficient electric and transportation systems. A key opportunity for capacity building within institutions in Tonga for implementation of the TEEMP is to strengthen the Tongan Department of Statistics to enhance and better organize data related to energy and transport sectors.
	Adoption	The TEEMP supports early adoption of more energy efficient	Due to high capital costs and lack of economic incentives, adoption rate for energy-efficient equipment and vehicles is

		equipment and vehicles through: A revolving loan or rebate program to aid in financing equipment and energy efficiency (EE) projects among residential, commercial and industrial consumers. An adjustment of the vehicle registration tax and import tariff according to vehicle weight, displacement or fuel economy to increase the competitiveness of efficient vehicles	low across Tonga and requires targeted action.
	Scale up	The TEEMP supports scale-up and diffusion of low-carbon technologies through: Implementing a public awareness campaign on EE and conservation Public-private network partnerships between the Government of Tonga and the electricity generator and distributor Tonga Power Limited.	Even though 80% of Tongans said appliance running costs are important to them, only 34% plan on looking for an Australian/New Zealand MEPs label next time they purchase an appliance. Creating an EE public awareness campaign focusing on both the environmental and personal economic benefits to rate payers who reduce their consumption, should go hand in hand with introducing a minimum energy performance standard (MEPS) program for appliances and equipment as proposed by the TEEMP, in order to scale up the use of energy efficient appliances.

Agents	Beneficiaries	The TEEMP can support a diverse range of beneficiaries by Empowering consumers and raising their awareness on environmental and economic benefits of energy efficient equipment Reducing energy consumption through energy efficient measures making a positive impact on household to industrial level economies Supporting domestic energy production over imported which will create local job opportunities	Beneficiaries such as car-owners, the national energy labour force, industry and household consumers are important stakeholders and have a role to play in the context of the adoption and scale-up of EE technologies and measures
Incentives	Economic and non-economic	The TEEMP utilizes fiscal incentives to increase market penetration of more energy efficient equipment through the establishment of a demand-side management revolving loan or rebate program to aid in financing more efficient equipment (residential, commercial, and industrial).	The provision of ultra-low interest loans by the Tonga Development Bank to projects that demonstrate they can generate energy savings could facilitate substantial long-term EE savings. The loans could be fully repaid by the energy savings made in a 5 to 10-year period, at which point the fund could be redistributed to new projects. People are most responsive to up-front costs when purchasing vehicles; they are less responsive to life cycle ownership costs. Therefore, registration fees and import tariffs can be set to make efficient vehicles much less expensive than inefficient ones.

		The TEEMP also promotes lower-carbon vehicles through adjusting a vehicle registration tax and import tariff which would be based on GHG emissions (to allow for alternative fuels), be constant across size categories (to avoid perverse incentives to increase size), and be a “feebate,” which is much more politically feasible.	
Norms	Awareness	The TEEMP supports awareness raising for the implementation of EE measures in electricity and transport sectors in Tonga by implementing a public awareness campaign on EE and conservation Furthermore, the CTCN technical assistance supported awareness raising among policy-makers by hosting training sessions with Tongan officials with the dual purpose of capacity building and in-depth review of the	Awareness raising among general public in Tonga on EE measures is important to increase the uptake of energy efficient equipment, as it has been reported that only 34% of Tongan’s reported they would look for minimum energy performance standards next time they purchase an energy appliance.

		TEEMP by Tongan officials.	
	Behavior	The TEEMP promotes lower-carbon vehicles through adjusting a vehicle registration tax and import tariff which would be based on GHG emissions (to allow for alternative fuels), be constant across size categories (to avoid perverse incentives to increase size), and be a "feebate," which is much more politically feasible.	People are most responsive to up-front costs when purchasing vehicles; they are less responsive to life cycle ownership costs. Therefore, registration fees and import tariffs can be set to make efficient vehicles much less expensive than inefficient ones.

Table 4: Description of outcome characteristics and their justifications

Category	Outcome characteristics	Description and starting situation
Scale of outcome – GHGs	Macro level: GHG outcome is large in magnitude at international/global level	This level is outside the assessment boundary. No description necessary.
	Medium level: GHG outcome is large in magnitude at national or sectoral levels	The TEEMP has a goal of reducing emissions by 106,000 mtCO2e by 2030
	Micro level: GHG outcome is large in magnitude at subnational, subsector, city or local levels	The TEEMP is implemented at subnational levels supported by financial incentives, private and public collaboration, and public awareness raising.
Scale of outcome – Sustainable development	Macro level: Sustainable development outcome is net positive in magnitude at international/global level	This level is outside the assessment boundary. No description necessary.

	Medium level: Sustainable development outcome is net positive in magnitude at national or sectoral levels	The TEEMP aims to reduce energy intensity by 100 GJ per 1 USD by 2030.
	Micro level: Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels	On city and community level, local jobs are created by investments in national energy projects, and reduction in reliance on imported fuels and appliances increases energy security.
Outcome sustained over time – GHGs	Long term: GHG outcome is achieved and sustained ≥15 years from the starting situation	The period is longer than the assessment period. No description necessary.
	Medium term: GHG outcome is achieved and sustained ≥5 years and <15 years from the starting situation	The TEEMP has a goal of reducing emissions by 106,000 mtCO2e by 2030
	Short-term: GHG outcome is achieved and sustained <5 years from the starting situation	The TEEMP has goals for emission reduction on sector and technology level broken down on a yearly basis and aims to achieve its short-term goals
Outcome sustained over time – sustainable development	Long term: Sustainable development outcome is achieved and sustained ≥15 years from the starting situation	The period is longer than the assessment period. No description necessary.
	Medium term: Sustainable development outcome is achieved and sustained ≥5 years and <15 years from the starting situation	The TEEMP aims to reduce energy intensity by 100 GJ per 1 USD by 2030.
	Short-term: Sustainable development outcome is achieved and sustained <5 years from the starting situation	The TEEMP does not have specific sustainable development goals set for this time period but net positive sustainable development impacts can be expected within the first five years of policy implementation, in terms of job creation, energy intensity reduction and energy security.

2.4 Estimation of transformational impacts ex-ante

2.4.1 Assessment of the starting situation

Phase of transformation: A system undergoing transformation to zero-carbon and sustainable development can be described to be in any of the four stages depicted in Figure 3: Criteria to identify the phase of transformation of a system, K.H. Olsen & N. Singh (ICAT 2018).

Figure 3: Criteria to identify the phase of transformation of a system, K.H. Olsen & N. Singh (ICAT 2018)

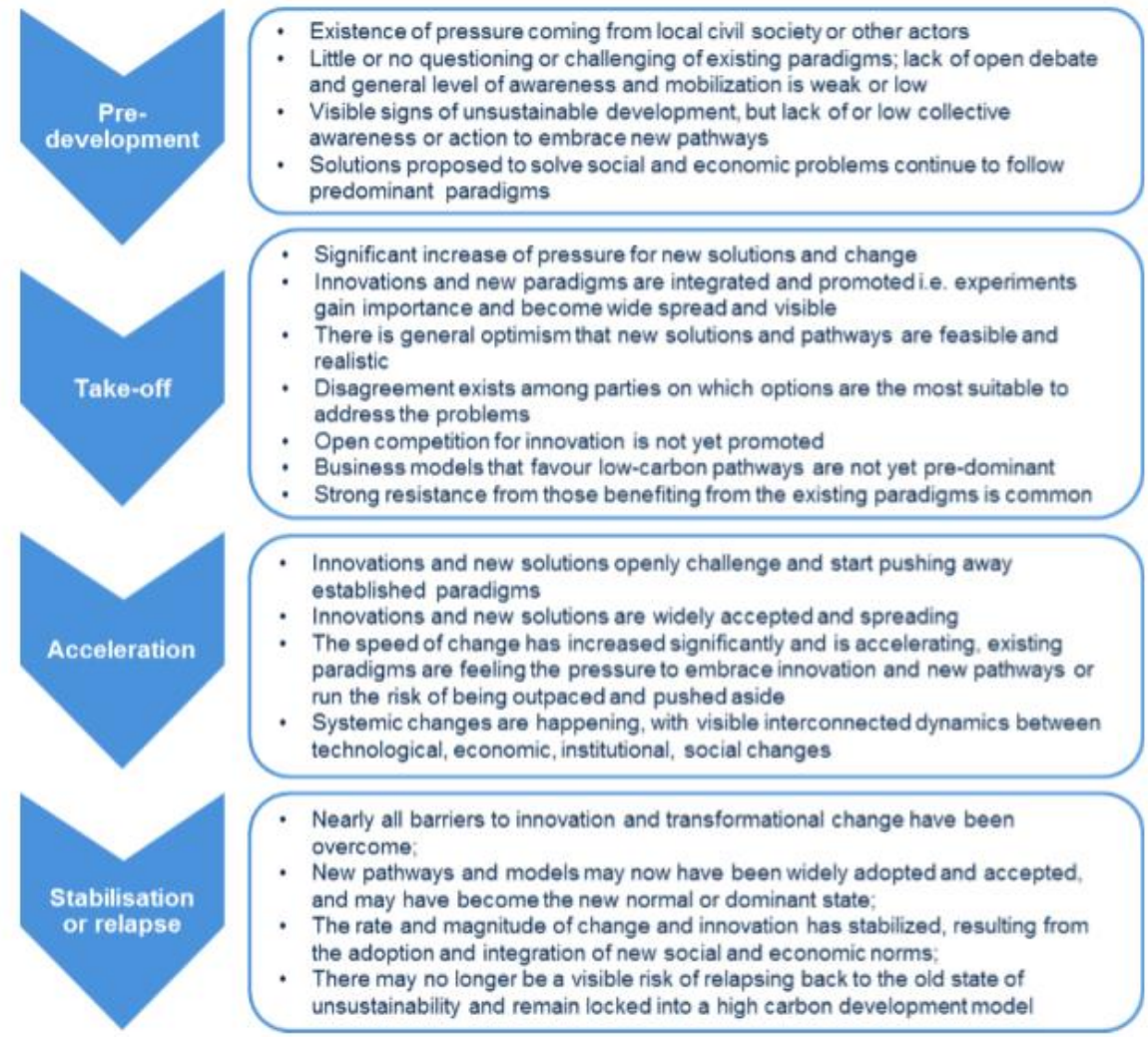
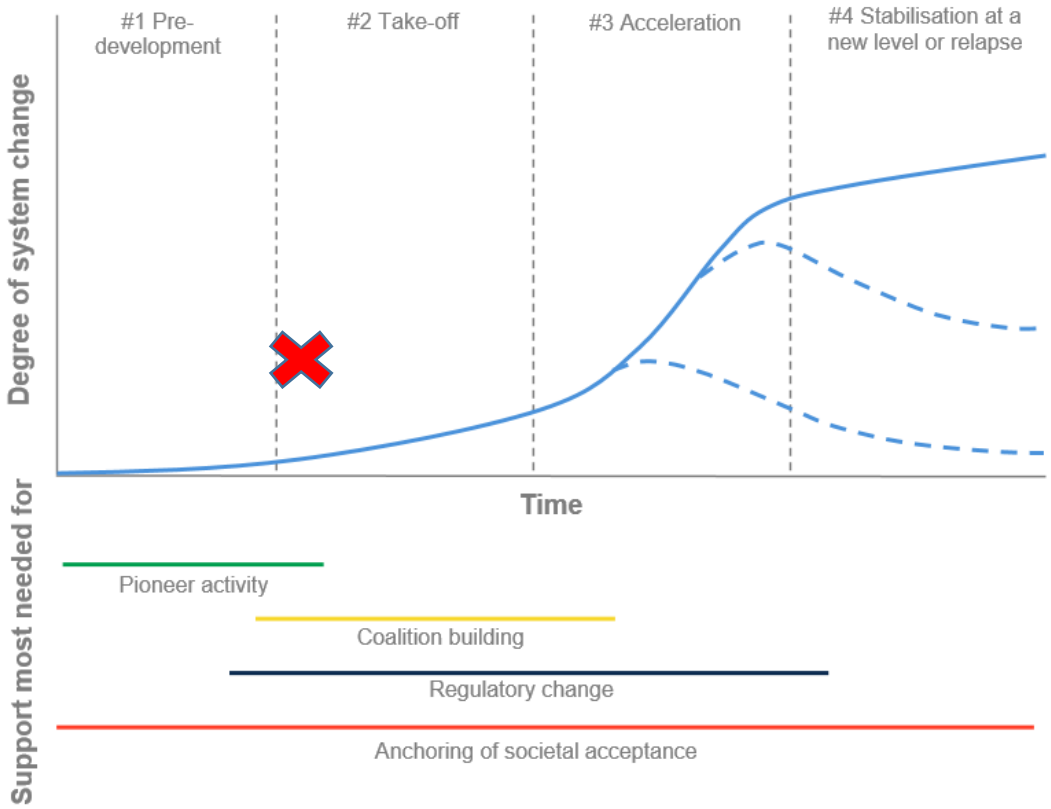


Figure 4: Phases of transformation and (Mersmann et al. 2014; Adapted Rotmans et al. 2000) shows a useful framework for the assessment and visualization of the current status of a system, which is on a pathway of transformation towards zero-carbon and sustainable development. It helps answer the question “Where are we today and where are we heading?”

Figure 4: Phases of transformation and (Mersmann et al. 2014; Adapted Rotmans et al. 2000)



In order to understand the context in which the TEEMP is being planned or implemented it is of interest to highlight that the current pathway towards a zero-carbon and resilient electricity and transport sector in Tonga can be considered to be **in between pre-development and take-off phase of transformation,** considering the following:

- **While general level of awareness** of energy efficiency measures and their environmental and economic benefits are low there is an **increasing pressure** for new solutions, and in 2017 the first Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) opened in Tonga which aims to support improved access to modern, affordable and reliable energy services, energy security and mitigation of negative externalities of the energy system by promoting RE and EE investments, markets and industries.
- As of 2017 the percentage of renewable energy in the country was 11%. However, the Department of Energy and Tonga Power Ltd have **expressed optimism** over the country being on track to reach its renewable energy targets of 70% renewables by 2030 from the TERM, and to date the country has invested millions of donor funds in construction of off-grid and on-grid solar PV systems.[3] This is an important prerequisite for implementing the policies in the TEEMP which are dependent on a sustainable national energy mix, such as the EV and HEV policies.
- While there is **little questioning of existing paradigms**, steps have been taken towards **integration and promotion of new paradigms** through the institutional set-up for addressing

[3] https://matangitonga.to/2019/02/13/tonga-track-reach-renewable-energy-target

climate change issues and integrate climate change into national planning processes, such as through the adoption of Tonga's National Climate Change Policy and the establishment of the Ministry for Environment and Climate Change. [4]

- **New ideas** for RE generation and EE are integrated in national policies, plans and strategies, including in the TERM, TEEMP and through current projects funded by the Green Climate Fund.
- However, there is a slow implementation of policies and while the demand for electricity is growing due to social and economic development with an increasing number of electrical appliances such as fans and air conditioning being used in households, **business models that favor low-carbon pathways are not yet pre-dominant**. Furthermore, as the policies and actions recommended in the TEEMP are not yet implemented, new solutions such as electric vehicles or revolving loans for energy saving projects, have not yet received wide acceptance and spread.

2.4.2 Assessment of barriers to transformational change

Table 5 below describes the barriers to transformational change identified. The scale of scoring barriers can be found in Annex I.

Table 5: Reporting on barrier impacts

Barriers	Characteristics affected	Score	Description and rationale	Barrier directly targeted by the policy or action
Lack of commitment to implementation of zero-carbon development policies	Economic and non-economic (incentives) Awareness	High	Much of the political commitment in Tonga has been centred around resiliency; not unlike many other Small Island Developing States whose vulnerabilities are rapidly increasing and who are subjected to coastal erosion, rising sea-levels, increasing occurrences of flash flooding and tropical cyclone.[5] The monarch remains a significant power broker in Tonga—policy changes, related to energy or not, are subject to the consideration of both the king and the prime minister. Both the king and the prime minister are supportive of reducing Tonga's climate vulnerability and improving the nation's energy	No

[4] http://ccprojects.gsd.spc.int/wp-content/uploads/2016/06/TO2-Tonga-CC-Profile-v2.pdf

[5] https://unfccc.int/sites/default/files/tonga_cop23cmp13cma1-2_hls.pdf

			independence. A potential barrier in relation to some of the policy recommendations in the TEEMP may be the lack of incentive to prioritize investments related to emission reduction, compared to those focused on improving climate resilience and improving energy independence.	
Insufficient communication and access to information and data among key institutions	R&D Beneficiaries	Low	There is a lack of formal agreements between national institutions that require information sharing on climate change and other data needed for effective implementation and follow-up of policies and actions. Although the availability of information from government ministries has markedly improved, a lack of consistency in statistics reported year-to-year and a difficulty in obtaining this information persists. These problems are also apparent for state-owned enterprises such as TPL. Data availability has important implications for analysing and tracking changes and opportunities in the energy sector, and, thus, for the design and implementation of the TEEMP.	Yes
Lack of public awareness of environmental and private economy benefits of EE measures and conservation	Awareness Behaviour	Medium	Expanding energy labelling across all appliances, and even potentially lightbulbs, could result in a nearly 11% reduction of energy consumption in Tonga. However, the effectiveness of MEPS and labelling is highly dependent on promoting public awareness on how to read EE labels and the importance of conserving electricity. Although 80% of Tongans said appliance running costs are important to them, only 34% plan on looking for an Australian/New Zealand MEPs label next time they purchase an appliance. Lack of awareness may also lead to reluctance to introduce low-carbon technologies, such as EV or HEV, which may disrupt conventional technologies.	Yes

Geographical isolation and dependence on imported fuels, appliances and vehicles; lack of domestic manufacturing base; lack of domestic energy production facilities (e.g. biodiesel);	R&D Adoption Scale-up	High	Tonga is dependent on imported petroleum to meet its energy needs for electricity and transportation. Electricity generation consumes nearly 13 million litres of fuel per year, at a cost equivalent to about 10% of total gross domestic product (GDP) and transportation consumes 25 million litres at a cost close to 20% of GDP. Dependence on imported fuels places Tonga in a vulnerable position due to volatile fuel prices, which have a downstream effect on electricity, transportation, and cost-of-living expenses. Due to its small economy and lack of significant manufacturing base, Tonga also imports vehicles, appliances and electronics. Tonga currently lacks local production needed for implementation of the TEEMP such as biodiesel production facilities for blending biodiesel into diesel fuel. Due to Tonga's geographic location, appliances are most commonly imported from Australia, New Zealand, Fiji, China, and Singapore. The minimum energy performance standards (MEPS) or energy labelling schemes vary in these countries, and the point of origin (i.e., the place where the good is manufactured) may not be the same as the country from which the good is imported. This creates a challenge when determining the energy performance of appliances imported through customs.	To some extent
Lack of trained technical personnel for production, installation and maintenance of low-carbon technologies; lack of capacity among public	R&D Adoption Scale-up Awareness	Medium	Lack of trained personnel to ensure that Tonga has the technical capacity to repair and maintain new vehicle technologies Tongan officials indicated during in-person training sessions that no ministry currently has the capacity to assess building standards- a barrier for ensuring that new building standards are	Yes

institutions for implementation of policies and practices;			appropriate for the climate and EE needs of Tonga. Lack of capacity and modalities to collect and share relevant data and information on EE measures	
Dependency on international funding for implementation of zero-carbon and energy efficient policies and actions in the transport and electricity sectors	Economic and non-economic	High	The Government has reported slow achievement of RE targets due to lack of funding. There is also a lack of national financial instruments in place to support implementation of policies such as those recommended in the TEEMP.	No

2.4.3 Assessment of characteristics

The scoring of the process and outcome characteristics describe the likelihood and extent of transformational change expected from the policies and actions in the TEEMP. A description of the scales used for scoring can be found in Annex I.

Table 6 and Table 7 below represent the assessment and scoring of process and outcome characteristics, taking into consideration the assessment boundary and period. The TEEMP policies and actions are more likely to impact any given characteristic, if the characteristic represents a key element of the TEEMP and if the TEEMP includes measures to address existing barriers.

The TEEMP focuses on not one but a set of 20 proposed policies and actions within the electricity and transport sectors, on various scale-levels and directed towards various user groups. While one policy or action might have a large impact on a certain characteristic, the impact on that characteristic might be smaller taking all policies and actions into consideration as a group. This was given attention to in the scoring, as the policies likelihood to impact the characteristics were considered as a whole rather than individual policies.

Table 6 Assessment and scoring of process characteristics

Category	Process characteristics	Score	Rationale justifying the score
Technology	Research and development (R&D)	2	The TEEMP includes training and capacity building components which are essential to building the national knowledge base and technical capacity for introducing new technologies and EE standards in Tonga. Success is dependent on continual training and capacity building, rather than single interventions which is what is currently proposed under the TEEMP. To seize the potential of R&D there is also a need for reliable data. As the TEEMP also includes actions for increased reporting on sectoral data and tools it is possible that the TEEMP will have a significant impact on this characteristic.
	Adoption	3	The revolving loan or rebate program proposed in the TEEMP can have a significant impact on this characteristic to increase adoption of energy efficient appliances. Furthermore, an adjustment of the vehicle registration tax and import tariff according to vehicle weight, displacement or fuel economy feed-in tariffs, is likely to have an impact on the adoption of alternative vehicles such as EV's and HEV's by making efficient vehicles much less expensive than inefficient ones.
	Scale up	2	The TEEMP facilitates a closer partnership between the Government of Tonga and the electricity generator and distributor TPL - an important precondition for scaling up EE measures envisioned. However, while the TEEMP also promotes a public awareness campaign on EE and conservation which is likely to have a positive impact on this characteristic, the campaign does not support scale-up of other initiatives in the TEEMP related to waste, building standards, energy audits and infrastructure development. In order to significantly impact this characteristic, awareness raising campaigns would need to be coupled with other means for replication and

			up-scale of the proposed technologies and solutions.
Agents	Beneficiaries	3	The TEEMP supports local job creation through the facilitation of domestic energy production facilities and empowers consumers to improve their private economies by informing them of the environmental and economic benefits of EE and conservation. The TEEMP is likely to have a significant impact on this characteristic.
Incentives	Economic and non-economic	4	Improving EE of appliances, equipment, buildings and cars provides both environmental and financial benefits. Coupled with an awareness-raising campaign about the benefits as well as various fiscal measures such as financial support for efficient equipment and import tariffs according to vehicle fuel consumption, the TEEMP is very likely to support increased economic and non-economic incentives for increased EE measures. Furthermore, the focus on better coordination of buses and improved pedestrian and biker safety provides further incentives to leaving the car behind.
Norms	Awareness	3	As the TEEMP includes clear recommendations to increase the awareness of the general public on the economic and environmental benefits of EE and conservation through an awareness campaign, it is likely that this will have a significant positive impact on this characteristic. The TEEMP also includes capacity building and training for Tongan officials and technical experts in order to raise the awareness among involved stakeholders.
	Behavior	3	It is likely that the TEEMP will have a positive impact on this characteristic, considering the number of policies and actions that have a component which include awareness raising and the provision of economic and non-economic incentives for behavior change. The awareness raising campaign on EE and conservation is expected to support a change in consumer behavior (e.g., turning off lights when not in use, walking stairs rather than using an

		elevator, and adjusting thermostats on air conditioners to use less energy). It is also expected that the vehicle registration fees or import tariffs set to make efficient vehicles less expensive will encourage consumers to prioritize more efficient vehicles such as EV's and HEV's (especially if mechanics are trained and available). Furthermore, improved public transport and pedestrian and biker safety measures are expected to reduce the reliance on cars.

Table 7: Assessment and scoring of outcome characteristics

Category	Outcome characteristics	Score	Rationale justifying the score
Scale of outcome – GHGs	Macro level: GHG outcome is large in magnitude at international/global level	N/A	This level is outside the assessment boundary. No description necessary.
	Medium level: GHG outcome is large in magnitude at national or sectoral levels	3	Taken together, the TEEMP policies and actions are expected to offer reductions in energy use in both transport and buildings of 106,000 metric tonnes of carbon dioxide equivalent per year by 2030, which is a 50.5% reduction from BAU emissions of 210,000 metric tonnes of carbon dioxide equivalent. As the TEEMP addresses the electricity and transport sectors which make up about 55% of Tonga's national emissions, the TEEMP policies and actions can be expected to have a large GHG emission reduction impact relative to the starting and BAU situation at the national and sectoral level
	Micro level: GHG outcome is large in magnitude at subnational, subsector, city or local levels	3	The TEEMP policies and actions are expected to contribute to large GHG emission reductions at the subsector level relative to the starting and BAU situation by 2030. Emission reductions expected include the following: Transport sector:

			Vehicle-kilometers travelled (VKT) projects: 12,700 mt CO2eq/year Electric vehicles: 300 mt CO2eq/year Heavy-duty vehicle idle time reduction: 10,300 mt CO2 eq/year Fuel efficiency improvements: 5,700 mt CO2 eq/year by 2030 Biodiesel: 4,500 mt CO2eq/year Electricity and building sector: MEPS: 10,100 mt CO2 eq/year Residential and commercial space cooling: 16,000 mt CO2 eq/year Residential and commercial appliances and equipment: 4,200 mt CO2 eq/year Residential and commercial lighting reduction: 1,100 mt CO2 eq/year Streetlight reduction: 1,142 mt CO2 eq/year
Scale of outcome – Sustainable development	Macro level: Sustainable development outcome is net positive in magnitude at international/global level	N/A	This level is outside the assessment boundary. No description necessary.
	Medium level: Sustainable development outcome is net positive in magnitude at national or sectoral levels	2	The TEEMP results in sustainable development impacts that relative to the starting situation represent net positive moderate impacts at the national and sectoral level, through an increased energy security and stabilized dependence on imported fuels, measured by a reduction of energy intensity by 100 GJ per 1 USD by 2030. Furthermore, the TEEMP supports Tonga's climate resilience by reducing unnecessary grid and road load, distributing power generation, diversifying the fuel mix, and strengthening vulnerable infrastructure while identifying opportunities for EE improvements.

	Micro level: Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels	1	The TEEMP also increases local job creation through facilitation of national energy projects and improves household economies through raised awareness on EE measures. The stabilization of dependence on imported fuels also has a positive impact on Tonga's cost of electricity, transportation and cost of living which results in better public welfare outcomes.
Outcome sustained over time – GHGs	Long term: GHG outcome is achieved and sustained ≥15 years from the starting situation	N/A	The period is longer than the assessment period. No description necessary.
	Medium term: GHG outcome is achieved and sustained ≥5 years and <15 years from the starting situation	2	The reduction of GHG emissions by 106,000 mtCO2e by 2030 will possibly be achieved in the medium term. The scoring takes the barriers into consideration, including the TEEMP policies and actions' potential to overcome those barriers. It also considers that achievement of the goals is highly dependent on access to funding and implementation rate of the policies and actions recommended in the TEEMP. In the medium term, barriers are also put in place to avoid relapse into transport and energy systems that are less energy efficient. However, as the TEEMP does not propose specific actions to avoid such a relapse or update the TEEMP beyond 2030, this is only a possible scenario.
	Short-term: GHG outcome is achieved and sustained <5 years from the starting situation	2	In the short-term the TEEMP policies and actions are possibly fully funded and implemented with no expected reversal of impacts in order to meet the short-term GHG emission reduction targets envisioned in the TEEMP.
Outcome sustained over time –	Long term: Sustainable development outcome is achieved and sustained ≥15 years	N/A	The period is longer than the assessment period. No description necessary.

sustainable development	from the starting situation		
	Medium term: Sustainable development outcome is achieved and sustained ≥5 years and <15 years from the starting situation	2	Energy intensity will possibly be reduced by 100 GJ per 1 USD by 2030 through implementation of the policies recommended in the TEEMP.
	Short-term: Sustainable development outcome is achieved and sustained <5 years from the starting situation	2	Employment generation, energy security and reduced energy intensity is possibly facilitated through TEEMP policies and actions within this assessment period

2.5 Aggregate results

To arrive at a more general conclusion of the transformational potential of a policy or action, it is necessary to aggregate the results from the in-depth assessment conducted in the previous steps. Assessment at the category level of processes and outcomes (i.e., technology, incentives, norms, scale of outcome, outcome sustained over time) is based on the assessment of individual characteristics (from

Table 6 and Table 7). Table 8 and Table 9 below summarize the aggregated and weighted scoring of process and outcome characteristics.

Table 8: Aggregated and weighted scoring of process characteristics

Category	Score	Rationale for scoring	Relative importance	Rationale for importance
Technology	2	The TEEMP policy could potentially influence the penetration of new technologies in Tonga such as EV and HEV, through the training of EV and HEV mechanics and financial incentives for consumer preference for efficient vehicles. As this technology is known, efforts are placed on adoption and scale up over the assessment period. Trainings on MEPS, building	30%	The country is in between pre-development and take-off phase, and introduction of new technologies and standards such as EV's, building standards, and biodiesels play an important role in achieving the expected results envisioned in the TEEMP.

		codes and energy audits can also contribute to uptake of more energy efficient technologies and practises, supported by an increased data gathering and sharing between institutions.		
Agents	3	The TEEMP policies and actions are likely to engage households and the general public in EE and conservation measures due to associated cost savings, support for domestic energy production and the creation of local job opportunities.	20%	While the scale-up of EE technologies and conservation measures are dependent on the engagement of consumers and beneficiaries, their influence in terms of initial implementation of the recommended TEEMP policies are limited.
Incentives	4	The TEEMP will support incentives for increased EE measures through policies and actions which among other things increase cross-institutional information sharing, encourage public transport (incentives relate to better infrastructure and safety), uptake of efficient vehicles (through financial incentives).	30%	Implementation of the EE policies and actions proposed are highly dependent on the establishment of incentives on several scale levels to promote uptake of for example public transport, efficient vehicles, labelled appliances and equipment and consciousness about reduced energy consumption in the households
Norms	3	The TEEMP policies and actions are likely to promote awareness and behavioural change through outreach and awareness raising campaigns and the facilitation of incentives for adopting new consumption and energy usage patterns	20%	Expanding labelling across all appliances, and even potentially lightbulbs, could result in a nearly 11% reduction of energy consumption in Tonga. However, the effectiveness of MEPS and labelling is dependent on promoting public awareness about how to read EE labels and the importance of conserving electricity. Behavioural change can be further promoted by facilitating more

				energy efficient choices and making them the normative standards through providing financial incentives.

Table 9: Aggregated scoring of outcome characteristics

Category	Score	Rationale for scoring
Scale of outcome-GHGs	3	The TEEMP policy and actions are expected to result in GHG emission reduction that relative to the starting situation represent large impacts at national and subnational levels
Scale of outcome – sustainable development	2	Net positive moderate impact on sustainable development is expected with regard to national level reduction of energy intensity and increased energy security, and subnational level job creation.
Outcome sustained over time - GHGs	2	Based on the policy's expected impact on adoption and scale up, it is possible that the policy or action will, over time, lead to sustained reductions in emissions through facilitation of EE technologies and conservation measures in Tonga
Outcome sustainable over time – sustainable development	2	With the actions and policies proposed in the TEEMP it is possible that Tonga will, over time, experience a reduced energy intensity on a national level, and that the policies and actions will facilitate job creation and strengthened households and industrial economies

The results indicate the extent of transformation expected by the policy or action and how likely it is that this expected transformation can be realized given the way the TEEMP policies and actions are designed. Figure 5: Final ex-ante assessment result expressed in terms of extent of transformation expected and likelihood that expected transformation can be realized over the assessment periodillustrates the matrix of possible qualitative scores for process and outcome impacts and includes the final aggregated score for potential for transformational change should the TEEMP policies and actions be implemented. When the result for the policy or action falls in the green area, it indicates that the policy or action is expected to be transformational. When it is situated in the red area, the policy cannot be considered transformational. The color gradient of the matrix reflects the qualitative nature of the analysis and the high uncertainty associated with the assessment.

Figure 5: Final ex-ante assessment result expressed in terms of extent of transformation expected and likelihood that expected transformation can be realized over the assessment period

FiguresFigure 6Figure 7Figure 8 below illustrate a break-down of the assessment results on the level of disaggregated process and outcome characteristics. Figure 6 illustrates the scoring and likelihood that the assessed Tonga Energy Efficiency Masterplan policies or actions may impact the transformational change characteristics over the assessment period. Figure 7 illustrate to what extent said policies or actions may result in GHG impacts that relative to the starting situation represent large emission reductions at the *levels of assessment* targeted. Figure 8 illustrate to what extent said policies or actions may result in GHG or sustainable development impacts that are likely to be sustained over the assessment period.

Figure 6: Potential for policies to impact transformational change characteristics over the assessment period (scale 0 to 4)

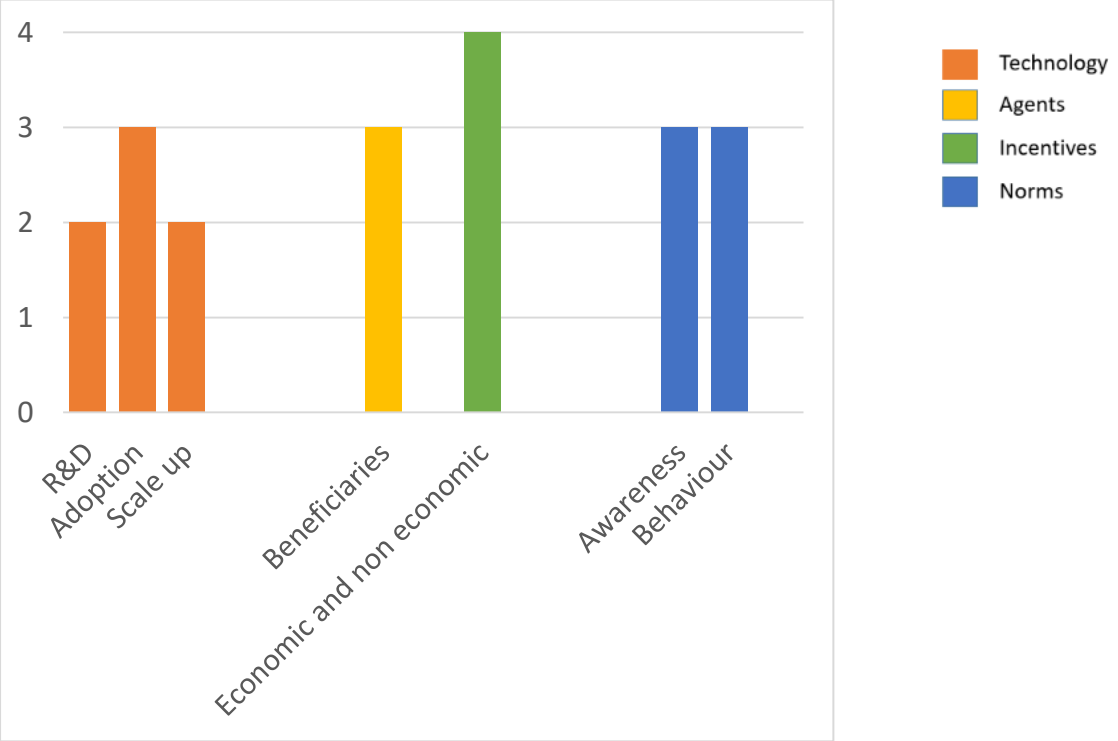


Figure 7: Potential for policies to result in GHG and sustainable development impact at the levels of assessment targeted (scale -1 to 3)

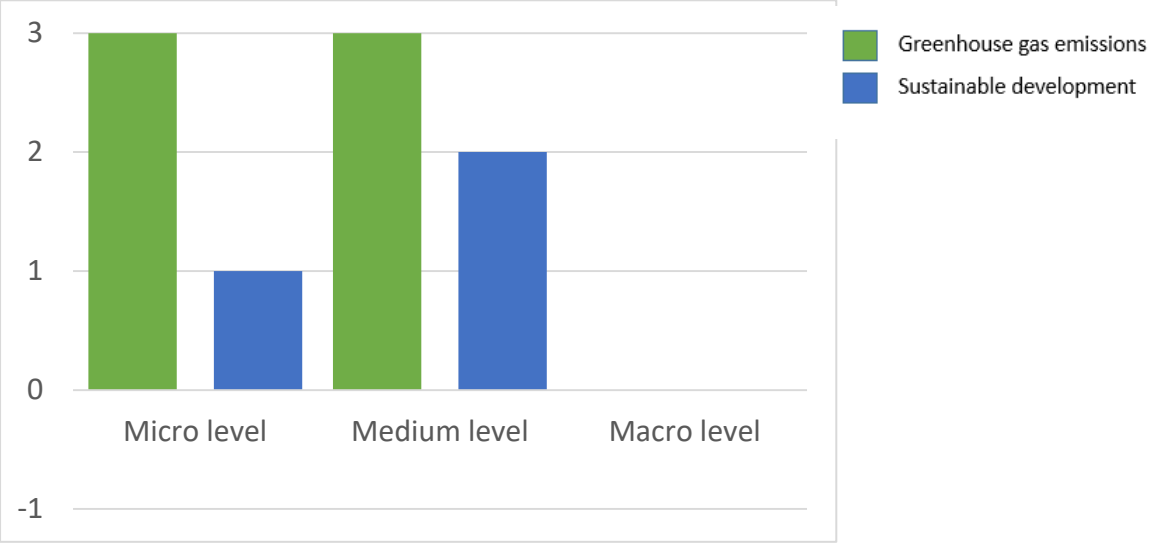
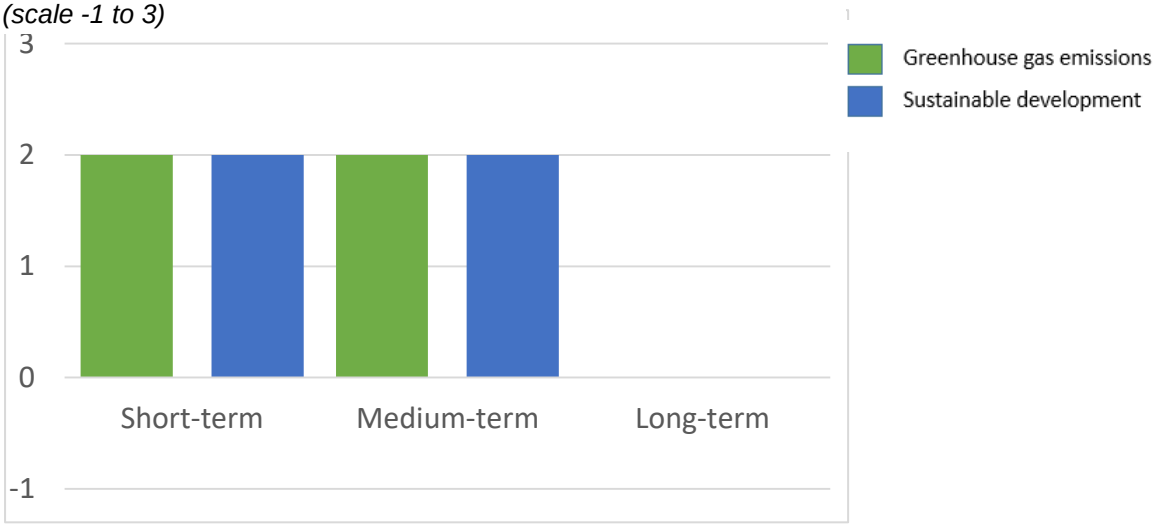


Figure 8: Potential for policies and actions to result in GHG and sustainable development impact over the assessment period (scale -1 to 3)



3. CONCLUSION

The assessment concludes that the extent of transformation expected to be achieved by the TEEMP is *moderate* and the outcome is *possibly* sustained over time. The TEEMP, if implemented, is *expected* to result in GHG emission reduction and *moderate* sustainable development impacts such as job creation, energy security and reduced energy intensity on a multi-scale level. This overall impact is achieved through scale-up of national capacity and access to EE technologies and conservation measures, engaging agents of change such as consumers and beneficiaries, using incentives and regulations for behavior change, and strengthening national institutions. The results suggest that the TEEMP is potentially transformational if implemented, given further attention is given to some of the process and outcome characteristics related to ensuring *sustained* technical capacity building and a more comprehensive focus on adoption and scale-up of proposed EE technologies and conservation measures, to avoid a relapse to a high-carbon pathway.

While the ICAT Transformational Change Guidance applied in this assessment allows for analysis of more than one policy or action per assessment, the assessment of 20 policies and actions within two different sectors on national level proved challenging in terms of aggregation of scores and weighting. For future assessments involving multiple policies and actions it is recommended to apply it sector-wise. Sources used for the assessment were mainly the deliverables of the CTCN technical assistance for development of a Tonga Energy Efficiency Masterplan.[6] The current assessment was conducted as an ex-ante analysis, i.e. transformational impact results are to be viewed as anticipated and potential, given the TEEMP policies and actions will be implemented within the assessment boundary and time period. For potential monitoring and follow-up of transformational change impacts of the CTCN technical assistance through an ex-post assessment it is recommended to include inputs from implementers, proponents and other relevant stakeholders utilizing the ICAT Stakeholder Participation Guidance.

[6] https://www.ctc-n.org/technical-assistance/projects/development-tonga-energy-efficiency-master-plan

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ANNEX I

Scale for scoring barriers (K.H. Olsen & N. Singh, 2018)

Scale	Description
High impact	The barrier has the potential to completely counteract the envisaged effect of the characteristic
Medium impact	The barrier is expected to have a moderate impact on the achievement of a characteristic
Low impact	The barrier is expected to have a very limited impact on the achievement of a characteristic

Scale for scoring characteristics (K.H. Olsen & N. Singh, 2018)

Scale[6]	Description of scale
Process characteristics	
4	It is very likely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 90-100%)
3	It is likely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 66-90%)
2	It is possible that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	It is unlikely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 10-33%)
0	It is very unlikely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 0-10%)
Outcome characteristics – scale (for GHG impacts and sustainable development impacts)	
3	The policy or action results in GHG impacts that relative to the starting situation represent large emission reductions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net positive large impacts at the level of assessment targeted

2	The policy or action results in GHG impacts that relative to the starting situation represent moderate emissions reductions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net positive moderate impacts at the level of assessment targeted
1	The policy or action results in GHG impacts that relative to the starting situation represent minor emission reductions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net positive minor impacts at the level of assessment targeted
0	The policy or action does not result in GHG impacts relative to the starting situation at the level of assessment targeted The policy or action does not result in sustainable development impacts relative to the starting situation at the level of assessment targeted
-1	The policy or action results in GHG impacts that relative to the starting situation represent a net increase in emissions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net negative impacts at the level of assessment targeted

Outcome characteristics – sustained over time (for GHG impacts and sustainable development impacts)	
4	The policy or action results in GHG impacts that are very likely to be sustained over the assessment period (for example, a probability in the range of 90-100%) The policy or action results in sustainable development impacts that are very likely to be sustained over the assessment period (for example, a probability in the range of 90-100%)
3	The policy or action results in GHG impacts that are likely to be sustained within the assessment period (for example, a probability in the range of 66-90%) The policy or action results in sustainable development impacts that are likely to be sustained within the assessment period (for example, a probability in the range of 66-90%)
2	The policy or action results in GHG impacts that are possibly sustained within the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible. The policy or action results in sustainable development impacts that are possibly sustained within the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	The policy or action results in GHG impacts that are less likely to be sustained over the assessment period (for example, a probability in the range of 10-33%) The policy or action results in sustainable development impacts that are less likely to be sustained over the assessment period (for example, a probability in the range of 10-33%)
0	The policy or action results in GHG impacts that are unlikely to be sustained over the assessment period and risk being reversed to negative impacts (for example, a probability in the range of 0-10%)

	The policy or action results in sustainable development impacts that are unlikely to be sustained over the assessment period and risk being reversed to negative impacts (for example, a probability in the range of 0-10%)