MARCH 2023

PACIFIC REGION INFRASTRUCTURE FACILITY

REGIONAL RECYCLING NETWORK SCOPING STUDY

PRE-FEASIBILITY STUDY REPORT - APPENDICES

Pacific Region Infrastructure Facility

Appendices

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Appendix A Risk Register

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
ID	Risk Description	Cause	Category	Potential Impact	L	C	Risk Rating	Mitigation Action Plan
1	Missing recycling operation licensing	Review of the national waste audit reports indicate that licensing systems/standardized recycling operation procedures are rarely enforced across Pacific Island Countries (PICs).	Environmental	This poses serious environmental and human health risks, since, while some operators will invest in and operate appropriate machinery and equipment, others lack these resources and resort to uncontrolled methods of recovery (particularly of metals). With increased recycling activities encouraged through the Regional Recycling Center, there is a risk that, without licensing, harmful practices such as copper fuming could become more widely practiced as demand for these materials and access to market grows.	4	3	12	The implementation of a licensing system is required across all PICs to ensure certain standards (most important environmental/health and safety) are met when conducting recycling activities.
2	Missing crisis and disaster preparedness plan	COVID-19 severely impacted shipping frequency, routes, and the ability to service PICs.	Operational	If there is no management plan or preventative action, the Recycling Center will be vulnerable to these kinds of disruptions. This is problematic noting the region's unique vulnerability not only to natural disasters, but also to economic and political adversities.	3	4	12	A network that is resilient against the impacts of such occurrences is necessary to ensure the longevity and success of the Regional Recycling Center. This includes the drafting of a crisis and disaster preparedness plan.
3	Plastic bans	Several PICs have introduced plastic bag bans	Operational	The trend of plastic bag bans spreading throughout the Pacific could result in feedstock supply	1	1	1	The Regional Recycling Center will include other

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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		in recent years, with varying stipulations around manufacture and import requirements.		issues for a plastic bag recycling option. For the Regional Recycling Center to continue to consider plastic bags as a feedstock material, the management of soft plastics beyond just plastic bags should be considered.				plastics, notably plastic film (e.g., comprised of Low-Density Polyethylene [LDPE], Linear Low-Density Polyethylene [LLDPE], High Density Polyethylene [HDPE], etc.).
4	Lack of informed decision making	Differing monitoring and evaluation plans and systems across the region	Institutional	This has, in the past, led to a lack of informed decision-making capacity, progress, and efficiency of implementation which in turn has led to an opportunity loss in collection of valuable recycling data.	4	2	8	For the establishment of the Regional Recycling Center, the ability of each nation to collect and maintain accurate records of recycling activities that can be tied to a regional monitoring and evaluation plan will be critical to determining the progress, level of success, and impacts/ achievements of the Center over time. Such a plan should provide the framework for PICs that

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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								identifies minimum standard criteria and methods to allow them to positively contribute to the Center.
5	Missing shipping infrastructure	A Regional Recycling Center is novel to the Pacific and the existing infrastructure will require review across the PICs.	Operational	Some PICs do not have international ports. Likewise, countries that have little or no history of shipping/exporting wastes may not have the necessary financing. Combined, these two factors risk impeding the movement of materials, limiting the ability of some PICs to properly engage with and benefit from the Regional Recycling Center. The Regional Recycling Center will not be for everyone, but rather only for those with the infrastructure and financing to access it.	3	3	9	PICs without appropriate shipping infrastructure can take advantage of backloading schemes, where ships delivering goods to the island load up recyclables on their return journey, using the space already paid for and used for the outward leg. Small PICs also have the possibility to cooperate with each other and charter ships for collecting and delivering recyclables to the RRC, thus splitting the costs and also accounting for smaller amounts of recyclables.

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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6	Missing waste management legislation and plans	Inconsistencies in waste legislation among countries. Several PICs had incomplete or incongruent legislation while legislation was absent in other PICs.	Institutional	This poses risks to the enforceability of waste management plans at local and national levels which has cascading effects on recycling activities and impedes overall recovery. Likewise, there is often confusion, disconnect, and inconsistencies within and between national and state waste management plans and who the responsible agencies are for implementation. This causes a disparity in service and enforcement and could contribute to community distrust hampering the system's ability to function effectively. In short, dysfunctional systems at the local and national level will struggle to successfully support a regional system.	4	3	12	To tackle this issue, specific waste management legislation needs to be developed, reviewed (if necessary), and properly implemented/enacted into law, as well as clearly linked to local and national plans to ensure optimum recovery of recyclables for the Regional Recycling Center. A clear definition of roles and responsibilities among agencies and ministries is needed.
7	Missing Multilateral Environmental Agreements (MEAs)	A recent review of ratification status for PICs[31] has shown that several nations have not yet ratified MEAs, e.g., some have	Institutional	Ratification, and therefore the vertical integration, of such MEAs is critical to strengthening coordination between the Regional Recycling Center contributors and to streamlining the movement of recyclable materials.	2	3	6	Ratification and integration of MEAs. This will also safeguard against MEA violations and their associated penalties.

[31] Farrelly et al. 2021

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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		yet to ratify the Rotterdam Convention (among other international conventions, protocols, and agreements).						
8	Funding mismanagement	Across the PICs studied in this report, waste and recycling initiatives are not always clearly defined or optimized.	Financial	This has in the past resulted in opportunity loss, inefficient use and insufficient supply of funding, as well as ambiguity around funding management (collection of fees and distribution of funds). The continuation of funding mismanagement at a national level risks the regular flow of funding which enables sustainable operation. This directly burdens the material flow supply chain into the Regional Recycling Center.	3	3	9	PICs should have effective and sustainable financing mechanisms such as Concessional Donor Loan (CDL) or Advanced Recycling Fee (ARF), levies, import tax, service fees, Extended Producer Responsibility/Private Sector Participation (EPR/PSP), user pays system, polluter pays penalties, and Special Waste Funds, to support recycling recovery.
9	Mismanagement of	Across the PICs, there are tons of recyclables in stockpiles. Stockpiles are	Environmental	Left unmanaged or poorly managed, these stockpiles pose significant risk including fire hazards, corrosion, uncontrolled air and	4	3	12	Proper storage and maintenance of stockpiled materials must be planned for and

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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	stock-piled recyclables	commonly left exposed to the elements at landfill, junk yards, or illegally abandoned/dumped on roadsides and in the environment.		soil pollution, and personnel OHS risks.				enforced. The construction of additional storage space may be necessary
10	Lack of waste management services	Lack of waste collection services and drop-off points for rural and outer island communities are a major concern regarding waste disposal practices.	Environmental	Without formal systems, valuable recyclables that could feed into the Regional Recycling Center are lost to and pollute the local environment. Without segregation practices such as source separation, comingled waste entering landfills is shortening valuable landfill lifespan and creating an environmental burden, especially in PICs where land is already a precious commodity.	5	3	15	To prevent any further missed opportunity, the recovery of recyclables from these more isolated communities needs to be planned for through formal channels like national and provincial waste management plans. Source segregation recyclable waste recovery chain will maximize recovery of valuable feedstock while also extending landfill lifespans for waste

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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								that currently lacks other management options in PICs.
11	Missing support to private recyclers and informal waste workers	These parties may continue to operate outside the Regional Recycling Center.	Social	This will likely lead to a loss of not only materials but potentially powerful private counterparts who have existing networks and knowledge.	4	3	12	To capture these enterprises and individuals and have them positively contribute the Regional Recycling Center, it is essential that favorable conditions be developed. These include, but are not limited to, reliable and competitive prices, improved work conditions (e.g., personal protective equipment (PPE), equipment, infrastructure, training), and streamlined processes.
12	Lack of community support	Currently, a range of recycling services are being underutilized in PICs which is often reported	Social	Awareness, education, and motivation are driving factors that inform normative behavior. Failure to engage the community in recycling activities could have a knock-on effect along the recycling waste value chain in the	3	3	9	It is important that recyclable recovery is fully understood, practiced, and incentivized at the community level through

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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		as being due to 1) a lack of awareness of the services provided (i.e., do not know the services exist), 2) a lack of clarity on how to engage with services (i.e., do not know how to find or use the service), or 3) a lack of motivation to use the services within the community (i.e., do not feel inclined to change their behaviors).		form of lost or unretrievable recyclables (e.g., via bury/burn/dump or co-mingling of wastes).				large-scale education and awareness campaigns which have been adapted to the target audience (i.e., children, adults, academic institutions, etc.)
13	Mismanagement of waste from tourism industry	Tourism is an important source of revenue for many PICs; however, it is also a source of relatively significant volumes of solid waste (including recyclables),	Environmental	In many countries, waste management systems are not currently designed to recover recyclables from tourism sector waste (e.g., Fiji). Therefore, valuable recyclables often end up at the landfill. This additional waste may also leach into the environment and end up in the ocean	4	3	12	Measures need to be taken to ensure that the recyclable waste generated through the tourism sector is captured by the nation's recycling system. If this is achieved, the Regional Recycling

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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		which are not properly managed.						Center could positively assist in relieving the waste burden of the tourism sector on PICs.
14	Mismanagement of residuals	One set of environmental impacts from waste are transferred to polluting industry practices (e.g., hazardous waste, air emissions, liquid pollutants, etc.).	Environmental	Clean technologies are required to ensure harmful wastes and emissions are not produced. This may mean that recyclers must make an investment for which they lack the funds.	4	4	16	Measures need to be taken to ensure that cost-effective, clean technologies are selected and support for financing is available to reduce the likelihood of reversion to unsanitary practices.
15	High levels of capital and ongoing operational funding	There is a need for investors and a suitable business enabled environment.	Financial	Insufficient capital and operating funds will negatively impact the long-term sustainability of a Regional Recycling Center.	4	3	12	Continuation of feasibility studies to focus strategic efforts and facilitate multi-stakeholder funding relationships where overlapping interests exist.
16	Shipping cost volatility	When compared to the global situation, shipping of recyclables from each PIC will be	Financial	Shipping rates are highly volatile and depend on a wide variety of factors, from global supply and demand to unexpected alterations to shipping routes, to the price of fuel. The ongoing	5	3	15	Maximize the benefits of shipping schemes like Moana Taka and consider extension/development

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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		on relatively small scale. Fluctuations in shipping costs will therefore have a greater impact.		COVID-19 pandemic has caused additional disruptions in recent times. These fluctuations are often difficult to predict, and may, in connections with price fluctuations for recyclables, cause shipping to the Regional Recycling Center to become uneconomical.				of future schemes to take advantage of backloading activities.
17	Price volatility in the recycling market	Price fluctuations have important consequences for profitability and long-term sustainability of the Regional Recycling Center.	Financial	An unstable market for recyclables, lack of recyclate and competitive virgin prices can all have a negative impact on the long-term financial sustainability of the Regional Recycling Center.	4	4	16	Maximizing competitive engagement with incentivization models (such as with organizations committed to the Australia, New Zealand and Pacific Islands Plastics Pact (ANZPAC) recycling targets) to ensure competitive prices are obtained. Improving value chain through high-quality compaction and value-adding processes.
18	Lack of political will	Change of government or policies, which decrease support of project. No	Institutional	National hubs with more unstable political conditions are negatively impacted and/or unsuccessful. Feed-in countries may want a share of the economic benefits of	3	3	9	Target bipartisan support for the hub to ensure that the ownership of the hub project is

Risk Identification				Risk Analysis & Evaluation				Risk Mitigation
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		desire to change existing or adopt new legislation (such as MEAs).		additional processing in their country.				not linked to any single part but to the broader goal of regional progress.
19	Lack of technical skill	Pacific countries are smaller, imported expertise would be required.	Operational	Technical capability may not be achieved. Maintenance is insufficient due to lack of funding and/or lack of technical capability.	4	4	16	Provide technical expertise and ongoing operational training to workers as part of the start-up process and/or encourage immigration of skilled workers, which will ensure a transfer of knowledge and the creation of a new job sector.

PIC = Pacific Island country, OHS = occupational health and safety, MEA = multilateral environmental agreement.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix B Financial and Economic Analysis – Cook Islands

This Appendix on the Cook Islands recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for the Cook Islands and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on the Cook Islands, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 72 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	100,000	30
Mechanical parts	17%	34,000	15
Electrical parts	20%	40,000	10
Legal	5%	10,000	
Planning	8%	16,000	
Total investments	**100%**	**200,000**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on the Cook Islands are estimated to be $200,000.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 73 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	154	108
Waste fraction 2 – ULAB	71	57
Waste fraction 3 – PET	174	87
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	-	-
Waste fraction 7 - Glass Bottles	68	20
Waste fraction 8 - Plastic Bags (Plastic Film)	119	36
Total waste	**586**	**308**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total, 586 tons of annual waste have been identified and delivered to the recycling facility and 308 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 74 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	154	361	55,579
Waste fraction 2 – ULAB	71	300	21,429
Waste fraction 3 – PET	174	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 4 - Scrap Steel	-	-	-
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	-	-	-
Waste fraction 7 - Glass Bottles	68	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	119	-	-
Total	**586**		**77,009**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 75 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	154	19	2,925
Waste fraction 2 – ULAB	71	19	1,357
Waste fraction 3 – PET	174	19	3,309
Waste fraction 4 - Scrap Steel	-	19	-
Waste fraction 5 - Steel Cans	-	19	-
Waste fraction 6 - Paper & Cardboard	-	19	-
Waste fraction 7 - Glass Bottles	68	19	1,293
Waste fraction 8 - Plastic Bags (Plastic Film)	119	19	2,254
Total	**586**	**-**	**11,139**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 76 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	108	278	29,937
Waste fraction 2 – ULAB	57	208	11,905
Waste fraction 3 – PET	87	455	39,586
Waste fraction 4 - Scrap Steel	-	250	-
Waste fraction 5 - Steel Cans	-	250	-
Waste fraction 6 - Paper & Cardboard	-	333	-
Waste fraction 7 - Glass Bottles	20	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	36	333	11,864
Total	**308**		**93,292**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 77 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	77,009	33%
Maintenance costs of the facility	12,000	5%
Transportation costs to the facility	11,139	5%
Operational costs of the facility	28,000	12%
Transportation costs from the facility	93,292	40%
Cost of depositing non-recycled waste fractions	13,913	6%
Total operational and maintenance costs	**235,353**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $235,353.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 78 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	-
Expected revenues from sales of waste fractions	271,959
Total revenue	**271,959**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $271,959. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 79 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,500
Waste fraction 2 – ULAB	800
Waste fraction 3 – PET	650
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	125
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	188

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 80 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	40,000	
Domestic government or commercial loans	80,000	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	40,000	8.0%
Promotional loans	40,000	4.0%
Total	**200,000**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling Hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on the Cook Islands.

Table 81 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	157,481
IRR	14.1%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 14.1% and an NPV of the cash flow of $157,481 based on a 6% real discount rate. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in Chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 82 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	170,488	14,564
NPV of avoided cost of CO_2 through recycling	425,116	36,315
NPV of avoided CO_2 at the landfill	-	-
NPV of reduced leachate production	1,875	160
NPV of additional wages	262,119	22,391
Total NPV of economic benefits	859,598	73,430

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $73,430 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.36 for the Cook Islands recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement	Cook Islands								
	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fract	USD			217,567	231,165	244,763	258,361	271,959	271,959
Gate fees or subsidies	USD			0	0	0	0	0	0
Total revenues	USD			217,567	231,165	244,763	258,361	271,959	271,959
Operational and maintenance costs									
Cost of waste	USD			61,607	65,457	69,308	73,158	77,009	77,009
Maintenance costs of the facility	USD			9,600	10,200	10,800	11,400	12,000	12,000
Transportation costs to the facility	USD			8,912	9,469	10,026	10,583	11,139	11,139
Operational costs of the facility	USD			22,400	23,800	25,200	26,600	28,000	28,000
Transportation costs from the facility	USD			74,634	79,298	83,963	88,627	93,292	93,292
Cost of depositing non-recycled waste fractions				11,131	11,826	12,522	13,218	13,913	13,913
Total operational and maintenance costs				188,283	200,050	211,818	223,586	235,353	235,353
EBITDA	USD			29,285	31,115	32,945	34,775	36,606	36,606
Depreciation and amortization	USD			14,800	14,800	14,800	14,800	14,800	9,600
EBIT	USD			14,485	16,315	18,145	19,975	21,806	27,006
Interest payment	USD			6,400	6,400	5,720	5,040	4,360	3,680
Profit or loss - before tax	USD			8,085	9,915	12,425	14,935	17,446	23,326
Tax	USD			1,617	1,983	2,485	2,987	3,489	4,665
Profit or loss - after tax	USD			6,468	7,932	9,940	11,948	13,957	18,661
Dividend payments	USD			0	1,707	2,470	3,333	4,288	5,542
Profit or loss after dividends	USD			6,468	6,225	7,470	8,615	9,669	13,118

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Cook Islands								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	7,005	6,538	15,997	26,601	38,258	48,656
Inventory	USD	-	0	18,131	19,264	20,397	21,530	22,663	22,663
DSRA	USD		0	6,400	14,400	13,720	13,040	12,360	11,680
Total short term assets	USD	0	0	31,535	40,202	50,114	61,171	73,281	83,000
Long term assets									
Tangible long term assets	USD	87,000	174,000	164,400	154,800	145,200	135,600	126,000	116,400
Intangible assets amortization	USD	13,000	26,000	20,800	15,600	10,400	5,200	0	
Other long term assets	USD								
Total long term assets	USD	100,000	200,000	185,200	170,400	155,600	140,800	126,000	116,400
TOTAL ASSETS (I + II)	USD	100,000	200,000	216,735	210,602	205,714	201,971	199,281	199,400
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	10,268	10,910	11,551	12,193	12,835	12,835
Total short term liabilities	USD	0	0	10,268	10,910	11,551	12,193	12,835	12,835
Long Term Liabilities									
Domestic government or commercial loans	USD	40,000	80,000	80,000	72,000	64,000	56,000	48,000	40,000
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	20,000	40,000	40,000	35,000	30,000	25,000	20,000	15,000
Total long term loans	USD	60,000	120,000	120,000	107,000	94,000	81,000	68,000	55,000
TOTAL LIABILITIES (I+II)	USD	60,000	120,000	130,268	117,910	105,551	93,193	80,835	67,835
EQUITY									
Equity	USD	40,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
Retained earning	USD	0	0	0	6,468	12,693	20,162	28,778	38,446
Profit (Loss) for the current financial period	USD	0	0	6,468	6,225	7,470	8,615	9,669	13,118
Total Equity	USD	40,000	80,000	86,468	92,693	100,162	108,778	118,446	131,565
TOTAL LIABILITIES AND EQUITY (I+II+III)	USD	100,000	200,000	216,735	210,602	205,714	201,971	199,281	199,400

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	Cook Islands								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	6,468	6,225	7,470	8,615	9,669	13,118
Depreciations	USD	0	0	14,800	14,800	14,800	14,800	14,800	9,600
Operating profit before working capital chan	USD	0	0	21,268	21,025	22,270	23,415	24,469	22,718
Investing activities									
Investments	USD	100,000	100,000	0	0	0	0	0	0
Net cash flow used for investing activities	USD	100,000	100,000	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	20,000	20,000	0	0	0	0	0	0
Domestic government or commercial loans	USD	40,000	40,000	0	-8,000	-8,000	-8,000	-8,000	-8,000
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	20,000	20,000	0	0	0	0	0	0
Promotional loans	USD	20,000	20,000	0	-5,000	-5,000	-5,000	-5,000	-5,000
Net cash generated from financing activities	USD	100,000	100,000	0	-13,000	-13,000	-13,000	-13,000	-13,000
Changes in working capital	USD		0	-7,863	-491	-491	-491	-491	0
Net annual increase in Cash and Cash Equiv	USD	0	0	13,405	7,534	8,778	9,924	10,977	9,718
Cash and Cash equivalents (Start of year)	USD		0	0	13,405	20,938	29,717	39,641	50,618
Cash and Cash Equivalents (End of year)	USD	0	0	13,405	20,938	29,717	39,641	50,618	60,336

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix C Financial and Economic Analysis – Fiji

This Appendix on the Fiji hub project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Fiji and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling hub is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in USD.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Fiji, i.e., from 2023 to 2025 and operations will commence in 2026.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 83 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	28,668,721	30
Mechanical parts	17%	9,747,365	15
Electrical parts	20%	11,467,488	10
Legal	5%	2,866,872	
Planning	8%	4,586,995	
Total investments	**100%**	**57,337,442**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Fiji are estimated to be $57 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 84 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	9,787	3,921
Waste fraction 2 – ULAB	6,209	2,710
Waste fraction 3 – PET	9,193	3,266
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	119,444	58,839
Waste fraction 7 - Glass Bottles	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	5,170	1,198
Total waste	**149,803**	**69,934**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total, 149,803 tons of annual waste have been identified and delivered to the recycling facility and 68,934 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 85 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	9,787	942	9,218,767
Waste fraction 2 – ULAB	6,209	496	3,078,024

Waste fraction 3 – PET	9,193	360	3,308,302
Waste fraction 4 - Scrap Steel	-	-	-
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	119,444	52	6,245,908
Waste fraction 7 - Glass Bottles	-	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	5,170	54	279,293
Total	**149,803**		**22,130,293**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 86 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	9,787	59	577,423
Waste fraction 2 – ULAB	6,209	59	366,338
Waste fraction 3 – PET	9,193	59	542,399
Waste fraction 4 - Scrap Steel	-	59	-
Waste fraction 5 - Steel Cans	-	59	-
Waste fraction 6 - Paper & Cardboard	119,444	59	7,047,196
Waste fraction 7 - Glass Bottles	-	59	-
Waste fraction 8 - Plastic Bags (Plastic Film)	5,170	59	305,023
Total	**149,803**	-	**8,838,379**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 87 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	8,807	104	917,349
Waste fraction 2 – ULAB	5,908	104	615,419
Waste fraction 3 – PET	7,435	91	675,893
Waste fraction 4 - Scrap Steel	-	125	-
Waste fraction 5 - Steel Cans	-	125	-

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 6 - Paper & Cardboard	117,624	67	7,841,615
Waste fraction 7 - Glass Bottles	-	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	2,946	67	196,367
Total	**142,719**		**10,246,643**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 88 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	22,130,293	42%
Maintenance costs of the facility	3,440,247	6%
Transportation costs to the facility	8,838,379	17%
Operational costs of the facility	8,027,242	15%
Transportation costs from the facility	10,246,643	19%
Cost of depositing non-recycled waste fractions	354,195	1%
Total operational and maintenance costs	**53,036,998**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $53 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 89 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	5,062,061
Expected revenues from sales of waste fractions	72,814,119
Total revenue	**77,876,180**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $78 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 90 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	2,000
Waste fraction 2 – ULAB	1,800
Waste fraction 3 – PET	1,050
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	300
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	500

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 91 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	11,467,488	
Domestic government or commercial loans	5,733,744	6.0%
International grants	-	
International loans	22,934,977	4.0%
Equity from owners	11,467,488	8.0%
Promotional loans	5,733,744	4.0%
Total	**57,337,442**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the

recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 5.3%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Fiji.

Table 92 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	5.3%
NPV of annual cash flow	185,100,518
IRR	29.0%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 29% and an NPV of the cash flow of $185 million based on a real discount rate of 5.3%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is reasonable.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings

2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 93 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	34,500,129	2,947,122
NPV of avoided cost of CO_2 through recycling	18,960,214	1,619,648
NPV of avoided CO_2 at the landfill	9,617,380	821,550
NPV of reduced leachate production	346,977	29,640
NPV of additional wages	59,143,890	5,052,278
Total NPV of economic benefits	**122,568,589**	**10,470,238**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $10.5 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.43 for the Fiji recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement	Fiji Hub								
	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fractions	USD				58,251,295	61,892,001	65,532,707	69,173,413	72,814,119
Gate fees and subsidies	USD				4,049,649	4,302,752	4,555,855	4,808,958	5,062,061
Total revenues	USD				62,300,944	66,194,753	70,088,562	73,982,371	77,876,180
Operational and maintenance costs									
Cost of waste	USD				17,704,234	18,810,749	19,917,264	21,023,778	22,130,293
Maintenance costs of the facility	USD				2,752,197	2,924,210	3,096,222	3,268,234	3,440,247
Transportation costs to the facility	USD				7,070,703	7,512,622	7,954,541	8,396,460	8,838,379
Operational costs of the facility	USD				6,421,794	6,823,156	7,224,518	7,625,880	8,027,242
Transportation costs from the facility	USD				8,197,314	8,709,646	9,221,978	9,734,311	10,246,643
Cost of depositing non-recycled waste fractions					283,356	301,066	318,776	336,486	354,195
Total operational and maintenance costs					42,429,598	45,081,448	47,733,298	50,385,148	53,036,998
EBITDA	USD				19,871,345	21,113,304	22,355,264	23,597,223	24,839,182
Depreciation and amortization	USD				4,242,971	4,242,971	4,242,971	4,242,971	4,242,971
EBIT	USD				15,628,375	16,870,334	18,112,293	19,354,252	20,596,211
Interest payment	USD				1,949,473	1,949,473	1,855,822	1,762,171	1,668,520
Profit or loss - before tax	USD				13,678,902	14,920,861	16,256,471	17,592,081	18,927,691
Tax	USD				2,735,780	2,984,172	3,251,294	3,518,416	3,785,538
Profit or loss - after tax	USD				10,943,121	11,936,689	13,005,177	14,073,665	15,142,153
Dividend payments	USD				0	1,990,539	3,055,962	4,121,630	5,187,524
Profit or loss after dividends	USD				10,943,121	9,946,149	9,949,215	9,952,035	9,954,629

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Fiji Hub								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD				10,995,579	22,671,501	35,017,514	47,366,348	59,717,775
Inventory	USD				5,191,745	5,516,229	5,840,713	6,165,198	6,489,682
DSRA	USD				1,949,473	2,522,847	2,429,196	2,335,545	2,241,894
Total short term assets	USD				18,136,798	30,710,578	43,287,424	55,867,090	68,449,351
Long term assets									
Tangible long term assets	USD	16,627,858	33,255,716	49,883,575	47,131,377	44,379,180	41,626,983	38,874,786	36,122,588
Intangible assets amortization	USD	2,484,622	4,969,245	7,453,867	5,963,094	4,472,320	2,981,547	1,490,773	0
Other long term assets	USD								
Total long term assets	USD	19,112,481	38,224,961	57,337,442	53,094,471	48,851,501	44,608,530	40,365,559	36,122,588
TOTAL ASSETS (I + II)	USD	19,112,481	38,224,961	57,337,442	71,231,269	79,562,079	87,895,954	96,232,650	104,571,940
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD				2,950,706	3,135,125	3,319,544	3,503,963	3,688,382
Total short term liabilities	USD				2,950,706	3,135,125	3,319,544	3,503,963	3,688,382
Long Term Liabilities									
Domestic government or commercial loans	USD	1,911,248	3,822,496	5,733,744	5,733,744	5,160,370	4,586,995	4,013,621	3,440,247
International loans	USD	7,644,992	15,289,985	22,934,977	22,934,977	22,425,311	21,915,644	21,405,978	20,896,312
Promotional loans	USD	1,911,248	3,822,496	5,733,744	5,733,744	5,017,026	4,300,308	3,583,590	2,866,872
Total long term loans	USD	11,467,488	22,934,977	34,402,465	34,402,465	32,602,707	30,802,948	29,003,189	27,203,431
TOTAL LIABILITIES (I+II)	USD	11,467,488	22,934,977	34,402,465	37,353,171	35,737,831	34,122,492	32,507,152	30,891,813
EQUITY									
Equity	USD	7,644,992	15,289,985	22,934,977	22,934,977	22,934,977	22,934,977	22,934,977	22,934,977
Retained earning	USD	0	0	0	0	10,943,121	20,889,271	30,838,485	40,790,520
Profit (Loss) for the current financial period	USD	0	0	0	10,943,121	9,946,149	9,949,215	9,952,035	9,954,629
Total Equity	USD	7,644,992	15,289,985	22,934,977	33,878,098	43,824,247	53,773,462	63,725,497	73,680,127
TOTAL LIABILITIES AND EQUITY (I+II+III)	USD	19,112,481	38,224,961	57,337,442	71,231,269	79,562,079	87,895,954	96,232,650	104,571,940

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	Fiji Hub								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	0	10,943,121	9,946,149	9,949,215	9,952,035	9,954,629
Depreciations	USD	0	0	0	4,242,971	4,242,971	4,242,971	4,242,971	4,242,971
Operating profit before working capital changes	USD	0	0	0	15,186,092	14,189,120	14,192,185	14,195,006	14,197,600
Investing activities									
Investments	USD	19,112,481	19,112,481	19,112,481	0	0	0	0	0
Net cash flow used for investing activities	USD	19,112,481	19,112,481	19,112,481	0	0	0	0	0
Financing activities									
Domestic government grants	USD	3,822,496	3,822,496	3,822,496					
Domestic government or commercial loans	USD	1,911,248	1,911,248	1,911,248	0	-573,374	-573,374	-573,374	-573,374
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	7,644,992	7,644,992	7,644,992	0	-509,666	-509,666	-509,666	-509,666
Equity from owners	USD	3,822,496	3,822,496	3,822,496	0	0	0	0	0
Promotional loans	USD	1,911,248	1,911,248	1,911,248	0	-716,718	-716,718	-716,718	-716,718
Net cash generated from financing activities	USD	19,112,481	19,112,481	19,112,481	0	-1,799,759	-1,799,759	-1,799,759	-1,799,759
Changes in working capital	USD				-2,241,040	-140,065	-140,065	-140,065	-140,065
Net annual increase in Cash and Cash Equivalents	USD				12,945,052	12,249,296	12,252,362	12,255,182	12,257,777
Cash and Cash equivalents (Start of year)	USD				0	12,945,052	25,194,349	37,446,711	49,701,893
Cash and Cash Equivalents (End of year)	USD				12,945,052	25,194,349	37,446,711	49,701,893	61,959,669

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators Fiji Hub		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			0%	32%	32%	32%	32%	32%
- EBITDA	USD			-	19,871,345	21,113,304	22,355,264	23,597,223	24,839,182
- EBITDA margin	%			0%	32%	32%	32%	32%	32%
- Debt-equity ratio	%			150%	102%	74%	57%	46%	37%
- DSCR	%			0%	904%	559%	608%	659%	712%
- Solvency ratio	%			0%	41%	45%	51%	56%	63%
Profitability									
- Return on total assets	%			0%	15%	15%	15%	15%	14%
- Return on equity	%			0%	32%	27%	24%	22%	21%
- Gross profit margin	%			0%	32%	32%	32%	32%	32%
- Net profit margin	%			0%	18%	18%	19%	19%	19%
- Return on investment	%			0%	47%	47%	47%	47%	47%
Asset management									
- Asset turnover	%			0%	87%	83%	80%	77%	74%
Financial solvency									
- Debt to equity ratio	%			150%	102%	74%	57%	46%	37%
- Total long term debt to total asset ratio	%			60%	48%	41%	35%	30%	26%
Liquidity ratios									
- Current ratios				-	6.1	9.8	13.0	15.9	18.6
- Acid ratio				-	4.4	8.0	11.3	14.2	16.8
- Cash coverage ratio	%			n/a	661%	712%	801%	899%	1008%
- Working capital	USD			-	15,186,092	27,575,453	39,967,880	52,363,127	64,760,969

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix D Financial and Economic Analysis – Federated States of Micronesia

This Appendix on FSM recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for FSM and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on FSM, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 94 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	857,952	30
Mechanical parts	17%	291,704	15
Electrical parts	20%	343,181	10
Legal	5%	85,795	
Planning	8%	137,272	
Total investments	**100%**	**1,715,905**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs for Federated States of Micronesia are estimated to be $1.7 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 95 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	580	348
Waste fraction 2 – ULAB	376	282
Waste fraction 3 – PET	581	291
Waste fraction 4 - Scrap Steel	13,699	9,589
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	-	-
Waste fraction 7 - Glass Bottles	273	82
Waste fraction 8 - Plastic Bags (Plastic Film)	-	-
Total waste	**15,510**	**10,592**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total, 15,510 tons of annual waste have been identified and delivered to the recycling facility and 10,592 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 96 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	580	0	0
Waste fraction 2 – ULAB	376	0	0

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 3 – PET	581	0	0
Waste fraction 4 - Scrap Steel	13,699	0	0
Waste fraction 5 - Steel Cans	-	0	0
Waste fraction 6 - Paper & Cardboard	-	0	0
Waste fraction 7 - Glass Bottles	273	0	0
Waste fraction 8 - Plastic Bags (Plastic Film)	-	0	0
Total	**15,510**	**0**	**0**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 97 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	580	30	17,408
Waste fraction 2 – ULAB	376	30	11,277
Waste fraction 3 – PET	581	30	17,431
Waste fraction 4 - Scrap Steel	13,699	30	410,976
Waste fraction 5 - Steel Cans	-	30	-
Waste fraction 6 - Paper & Cardboard	-	30	-
Waste fraction 7 - Glass Bottles	273	30	8,200
Waste fraction 8 - Plastic Bags (Plastic Film)	-	30	-
Total	**15,510**	**-**	**465,293**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 98 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	348	139	48,356
Waste fraction 2 – ULAB	282	104	29,367

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 3 – PET	291	227	66,027
Waste fraction 4 - Scrap Steel	9,589	125	1,198,681
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	-	167	-
Waste fraction 7 - Glass Bottles	82	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	-	167	-
Total	**10,592**		**1,342,430**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 99 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	-	0%
Maintenance costs of the facility	102,954	4%
Transportation costs to the facility	465,293	19%
Operational costs of the facility	240,227	10%
Transportation costs from the facility	1,342,430	56%
Cost of depositing non-recycled waste fractions	245,885	10%
Total operational and maintenance costs	**2,396,789**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $2.4 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 100 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	260,768

Expected revenues from sales of waste fractions	2,543,220
Total revenue	**2,803,987**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $2.8 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 101 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,500
Waste fraction 2 – ULAB	800
Waste fraction 3 – PET	650
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	125
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	188

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 102 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	343,181	
Domestic government or commercial loans	686,362	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	343,181	8.0%
Promotional loans	343,181	4.0%
Total	**1,715,905**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands'

recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on FSM.

Table 103 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	2,239,094
IRR	18.7%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 18.7% and an NPV of the cash flow of $2.2 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 104 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	5,862,629	500,806
NPV of avoided cost of CO_2 through recycling	7,363,311	629,000
NPV of avoided CO_2 at the landfill	-	-
NPV of reduced leachate production	64,489	5,509
NPV of additional wages	721,328	61,618
Total NPV of economic benefits	14,011,757	1,196,933

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $1.2 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.46 for FSM recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement	FSM								
	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fractions	USD			2,034,576	2,161,737	2,288,898	2,416,059	2,543,220	2,543,220
Gate fees and subsidies	USD			208,614	221,652	234,691	247,729	260,768	260,768
Total revenues	USD			2,243,190	2,383,389	2,523,589	2,663,788	2,803,987	2,803,987
Operational and maintenance costs									
Cost of waste	USD			0	0	0	0	0	0
Maintenance costs of the facility	USD			82,363	87,511	92,659	97,807	102,954	102,954
Transportation costs to the facility	USD			372,234	395,499	418,763	442,028	465,293	465,293
Operational costs of the facility	USD			192,181	204,193	216,204	228,215	240,227	240,227
Transportation costs from the facility	USD			1,073,944	1,141,066	1,208,187	1,275,309	1,342,430	1,342,430
Cost of depositing non-recycled waste fractions				196,708	209,002	221,297	233,591	245,885	245,885
Total operational and maintenance costs				1,917,431	2,037,271	2,157,110	2,276,950	2,396,789	2,396,789
EBITDA	USD			325,759	346,119	366,478	386,838	407,198	407,198
Depreciation and amortization	USD			126,977	126,977	126,977	126,977	126,977	82,363
EBIT	USD			198,782	219,142	239,502	259,861	280,221	324,835
Interest payment	USD			54,909	54,909	49,075	43,241	37,407	31,573
Profit or loss - before tax	USD			143,873	164,233	190,427	216,621	242,815	293,262
Tax	USD			28,775	32,847	38,085	43,324	48,563	58,652
Profit or loss - after tax	USD			115,098	131,386	152,341	173,297	194,252	234,610
Dividend payments	USD			0	14,922	26,217	38,284	51,062	66,047
Profit or loss after dividends	USD			115,098	116,464	126,125	135,013	143,190	168,563

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet FSM

ASSETS	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Short term assets									
Cash	USD			234	51,821	187,540	332,147	484,930	630,157
Inventory	USD			186,932	198,616	210,299	221,982	233,666	233,666
DSRA	USD			54,909	123,545	117,711	111,877	106,043	100,209
Total short term assets	USD			242,075	373,982	515,550	666,006	824,639	964,031
Long term assets									
Tangible long term assets	USD	746,419	1,492,837	1,410,474	1,328,110	1,245,747	1,163,383	1,081,020	998,657
Intangible assets amortization	USD	111,534	223,068	178,454	133,841	89,227	44,614	0	
Other long term assets	USD								
Total long term assets	USD	857,952	1,715,905	1,588,928	1,461,951	1,334,974	1,207,997	1,081,020	998,657
TOTAL ASSETS (I + II)	USD	857,952	1,715,905	1,831,003	1,835,933	1,850,524	1,874,003	1,905,659	1,962,688
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	0	0	0	0	0	0
Total short term liabilities	USD	0	0	0	0	0	0	0	0
Long Term Liabilities									
Domestic government or commercial loans	USD	343,181	686,362	686,362	617,726	549,090	480,453	411,817	343,181
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	171,590	343,181	343,181	300,283	257,386	214,488	171,590	128,693
Total long term loans	USD	514,771	1,029,543	1,029,543	918,009	806,475	694,941	583,408	471,874
TOTAL LIABILITIES (I+II)	USD	514,771	1,029,543	1,029,543	918,009	806,475	694,941	583,408	471,874
EQUITY									
Equity	USD	343,181	686,362	686,362	686,362	686,362	686,362	686,362	686,362
Retained earning	USD	0	0	0	115,098	231,562	357,687	492,699	635,889
Profit (Loss) for the current financial period	USD	0	0	115,098	116,464	126,125	135,013	143,190	168,563
Total Equity	USD	343,181	686,362	801,460	917,924	1,044,049	1,179,061	1,322,251	1,490,814
TOTAL LIABILITIES AND EQUITY (I+II+III)	USD	857,952	1,715,905	1,831,003	1,835,933	1,850,524	1,874,003	1,905,659	1,962,688

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	FSM								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD			115,098	116,464	126,125	135,013	143,190	168,563
Depreciations	USD			126,977	126,977	126,977	126,977	126,977	82,363
Operating profit before working capital changes	USD			242,075	243,441	253,102	261,990	270,167	250,927
Investing activities									
Investments	USD	857,952	857,952	0	0	0	0	0	0
Net cash flow used for investing activities	USD	857,952	857,952	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	171,590	171,590	0	0	0	0	0	0
Domestic government or commercial loans	USD	343,181	343,181	0	-68,636	-68,636	-68,636	-68,636	-68,636
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	171,590	171,590	0	0	0	0	0	0
Promotional loans	USD	171,590	171,590	0	-42,898	-42,898	-42,898	-42,898	-42,898
Net cash generated from financing activities	USD	857,952	857,952	0	-111,534	-111,534	-111,534	-111,534	-111,534
Changes in working capital	USD		0	-186,932	-11,683	-11,683	-11,683	-11,683	0
Net annual increase in Cash and Cash Equivalents	USD	0	0	55,143	120,224	129,885	138,773	146,950	139,393
Cash and Cash equivalents (Start of year)	USD		0	0	55,143	175,366	305,251	444,024	590,973
Cash and Cash Equivalents (End of year)	USD	0	0	55,143	175,366	305,251	444,024	590,973	730,366

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators FSM		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			15%	15%	15%	15%	15%	15%
- EBITDA	USD			325,759	346,119	366,478	386,838	407,198	407,198
- EBITDA margin	%			15%	15%	15%	15%	15%	15%
- Debt-equity ratio	%			128%	100%	77%	59%	44%	32%
- DSCR	%			253%	201%	221%	242%	266%	285%
- Solvency ratio	%			24%	28%	35%	43%	55%	67%
Profitability									
- Return on total assets	%			6%	7%	8%	9%	10%	12%
- Return on equity	%			14%	14%	15%	15%	15%	16%
- Gross profit margin	%			15%	15%	15%	15%	15%	15%
- Net profit margin	%			5%	6%	6%	7%	7%	8%
- Return on investment	%			17%	17%	17%	17%	17%	17%
Asset management									
- Asset turnover	%			123%	130%	136%	142%	147%	143%
Financial solvency									
- Debt to equity ratio	%			128%	100%	77%	59%	44%	32%
- Total long term debt to total asset ratio	%			56%	50%	44%	37%	31%	24%
Liquidity ratios									
- Current ratios				-	-	-	-	-	-
- Acid ratio				-	-	-	-	-	-
- Cash coverage ratio	%			310%	339%	410%	501%	619%	843%
- Working capital	USD			242,075	373,982	515,550	666,006	824,639	964,031

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix E Financial and Economic Analysis – Kiribati

This Appendix on the Kiribati recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Kiribati and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Kiribati, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 105 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	1,861,928	30
Mechanical parts	17%	633,056	15
Electrical parts	20%	744,771	10
Legal	5%	186,193	
Planning	8%	297,909	
Total investments	**100%**	**3,723,857**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Kiribati are estimated to be $3.7 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 106 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	538	511
Waste fraction 2 – ULAB	376	358
Waste fraction 3 – PET	519	493
Waste fraction 4 - Scrap Steel	13,720	7,546
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	7,584	4,171
Waste fraction 7 - Glass Bottles	332	116
Waste fraction 8 - Plastic Bags (Plastic Film)	353	124
Total waste	**23,423**	**13,319**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total, 23,423 tons of annual waste have been identified and delivered to the recycling facility and 13,319 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 107 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	538	0	0
Waste fraction 2 – ULAB	376	0	0
Waste fraction 3 – PET	519	0	0

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 4 - Scrap Steel	13,720	0	0
Waste fraction 5 - Steel Cans	-	0	0
Waste fraction 6 - Paper & Cardboard	7,584	0	0
Waste fraction 7 - Glass Bottles	332	0	0
Waste fraction 8 - Plastic Bags (Plastic Film)	353	0	0
Total	**23,423**	**0**	**0**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 108 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	538	5	2,690
Waste fraction 2 – ULAB	376	5	1,882
Waste fraction 3 – PET	519	5	2,594
Waste fraction 4 - Scrap Steel	13,720	5	68,600
Waste fraction 5 - Steel Cans	-	5	-
Waste fraction 6 - Paper & Cardboard	7,584	5	37,921
Waste fraction 7 - Glass Bottles	332	5	1,659
Waste fraction 8 - Plastic Bags (Plastic Film)	353	5	1,767
Total	**23,423**	-	**117,114**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 109 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	511	139	70,973
Waste fraction 2 – ULAB	358	104	37,255
Waste fraction 3 – PET	493	91	44,806
Waste fraction 4 - Scrap Steel	7,546	125	943,256
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	4,171	67	278,090
Waste fraction 7 - Glass Bottles	116	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	124	67	8,246
Total	**13,319**		**1,382,625**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 110 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	-	0%
Maintenance costs of the facility	223,431	8%
Transportation costs to the facility	117,114	4%
Operational costs of the facility	521,340	19%
Transportation costs from the facility	1,382,625	50%
Cost of depositing non-recycled waste fractions	505,200	18%
Total operational and maintenance costs	**2,749,710**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $2.7 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 111 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	1,117,949
Expected revenues from sales of waste fractions	2,897,519
Total revenue	**4,015,468**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $4 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 112 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 113 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	1,489,543	
Domestic government or commercial loans	2,979,085	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	1,489,543	8.0%
Promotional loans	1,489,543	4.0%
Total	7,447,713	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Kiribati.

Table 114 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	8,501,793
IRR	26.5%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 26.5% and an NPV of the cash flow of $8.5 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 115 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	7,371,826	629,727
NPV of avoided cost of CO_2 through recycling	7,271,423	621,150
NPV of avoided CO_2 at the landfill	791,627	67,624
NPV of reduced leachate production	81,090	6,927
NPV of additional wages	2,476,585	211,559
Total NPV of economic benefits	**17,992,551**	**1,536,987**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $1.5 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.43 for the Kiribati recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement	Kiribati								
	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fractions	USD			2,318,015	2,462,891	2,607,767	2,752,643	2,897,519	2,897,519
Gate fees and subsidies	USD			894,359	950,257	1,006,154	1,062,052	1,117,949	1,117,949
Total revenues	USD			3,212,374	3,413,148	3,613,921	3,814,695	4,015,468	4,015,468
Operational and maintenance costs									
Cost of waste	USD			0	0	0	0	0	0
Maintenance costs of the facility	USD			178,745	189,917	201,088	212,260	223,431	223,431
Transportation costs to the facility	USD			93,691	99,547	105,402	111,258	117,114	117,114
Operational costs of the facility	USD			417,072	443,139	469,206	495,273	521,340	521,340
Transportation costs from the facility	USD			1,106,100	1,175,232	1,244,363	1,313,494	1,382,625	1,382,625
Cost of depositing non-recycled waste fractions				404,160	429,420	454,680	479,940	505,200	505,200
Total operational and maintenance costs				2,199,768	2,337,254	2,474,739	2,612,225	2,749,710	2,749,710
EBITDA	USD			1,012,606	1,075,894	1,139,182	1,202,470	1,265,758	1,265,758
Depreciation and amortization	USD			275,565	275,565	275,565	275,565	275,565	178,745
EBIT	USD			737,041	800,329	863,617	926,905	990,192	1,087,013
Interest payment	USD			119,163	119,163	106,502	93,841	81,180	68,519
Profit or loss - before tax	USD			617,877	681,165	757,114	833,063	909,012	1,018,494
Tax	USD			123,575	136,233	151,423	166,613	181,802	203,699
Profit or loss - after tax	USD			494,302	544,932	605,691	666,451	727,210	814,795
Dividend payments	USD			0	83,768	126,865	171,374	217,184	266,335
Profit or loss after dividends	USD			494,302	461,164	478,827	495,076	510,026	548,460

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Kiribati									
ASSETS		**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets										
Cash		USD			383,006	712,000	1,220,271	1,744,792	2,284,263	2,782,078
Inventory		USD			267,698	284,429	301,160	317,891	334,622	334,622
DSRA		USD			119,163	268,118	255,457	242,795	230,134	217,473
Total short term assets		USD			769,867	1,264,546	1,776,888	2,305,479	2,849,020	3,334,174
Long term assets										
Tangible long term assets		USD	1,619,878	3,239,755	3,061,010	2,882,265	2,703,520	2,524,775	2,346,030	2,167,285
Intangible assets amortization		USD	242,051	484,101	387,281	290,461	193,641	96,820	0	
Other long term assets		USD								
Total long term assets		USD	1,861,928	3,723,857	3,448,291	3,172,726	2,897,160	2,621,595	2,346,030	2,167,285
TOTAL ASSETS (I + II)		USD	1,861,928	3,723,857	4,218,159	4,437,272	4,674,048	4,927,074	5,195,049	5,501,458
LIABILITIES AND EQUITY		**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities										
Short term liability		USD	0	0	0	0	0	0	0	0
Total short term liabilities		USD	0	0	0	0	0	0	0	0
Long Term Liabilities										
Domestic government or commercial loans		USD	744,771	1,489,543	1,489,543	1,340,588	1,191,634	1,042,680	893,726	744,771
International loans		USD	0	0	0	0	0	0	0	0
Promotional loans		USD	372,386	744,771	744,771	651,675	558,579	465,482	372,386	279,289
Total long term loans		USD	1,117,157	2,234,314	2,234,314	1,992,263	1,750,213	1,508,162	1,266,111	1,024,061
TOTAL LIABILITIES (I+II)		USD	1,117,157	2,234,314	2,234,314	1,992,263	1,750,213	1,508,162	1,266,111	1,024,061

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	Kiribati								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	494,302	461,164	478,827	495,076	510,026	548,460
Depreciations	USD	0	0	275,565	275,565	275,565	275,565	275,565	178,745
Operating profit before working capital changes	USD	0	0	769,867	736,730	754,392	770,642	785,591	727,205
Investing activities									
Investments	USD	1,861,928	1,861,928	0	0	0	0	0	0
Net cash flow used for investing activities	USD	1,861,928	1,861,928	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	372,386	372,386	0	0	0	0	0	0
Domestic government or commercial loans	USD	744,771	744,771	0	-148,954	-148,954	-148,954	-148,954	-148,954
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	372,386	372,386	0	0	0	0	0	0
Promotional loans	USD	372,386	372,386	0	-93,096	-93,096	-93,096	-93,096	-93,096
Net cash generated from financing activities	USD	1,861,928	1,861,928	0	-242,051	-242,051	-242,051	-242,051	-242,051
Changes in working capital	USD		0	-267,698	-16,731	-16,731	-16,731	-16,731	0
Net annual increase in Cash and Cash Equivalents	USD	0	0	502,170	477,948	495,610	511,860	526,810	485,154
Cash and Cash equivalents (Start of year)	USD		0	0	502,170	980,117	1,475,728	1,987,588	2,514,397
Cash and Cash Equivalents (End of year)	USD	0	0	502,170	980,117	1,475,728	1,987,588	2,514,397	2,999,551

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators Kiribati		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			32%	32%	32%	32%	32%	32%
- EBITDA	USD			1,012,606	1,075,894	1,139,182	1,202,470	1,265,758	1,265,758
- EBITDA margin	%			32%	32%	32%	32%	32%	32%
- Debt-equity ratio	%			113%	81%	60%	44%	32%	23%
- DSCR	%			625%	293%	322%	353%	386%	408%
- Solvency ratio	%			34%	41%	50%	62%	79%	97%
Profitability									
- Return on total assets	%			12%	12%	13%	14%	14%	15%
- Return on equity	%			25%	22%	21%	19%	19%	18%
- Gross profit margin	%			32%	32%	32%	32%	32%	32%
- Net profit margin	%			15%	16%	17%	17%	18%	20%
- Return on investment	%			46%	46%	46%	46%	46%	46%
Asset management									
- Asset turnover	%			76%	77%	77%	77%	77%	73%
Financial solvency									
- Debt to equity ratio	%			113%	81%	60%	44%	32%	23%
- Total long term debt to total asset ratio	%			53%	45%	37%	31%	24%	19%
Liquidity ratios									
- Current ratios				-	-	-	-	-	-
- Acid ratio				-	-	-	-	-	-
- Cash coverage ratio	%			515%	557%	669%	810%	996%	1289%
- Working capital	USD			769,867	1,264,546	1,776,888	2,305,479	2,849,020	3,334,174

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix F Financial and Economic Analysis – Republic of the Marshall Islands

This Appendix on the Republic of the Marshall Islands (RMI) recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for RMI, and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on RMI, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 116 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	651,886	30
Mechanical parts	17%	221,641	15
Electrical parts	20%	260,754	10
Legal	5%	65,189	
Planning	8%	104,302	
Total investments	**100%**	**1,303,772**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on RMI are estimated to be $1.3 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 117 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	308	154
Waste fraction 2 – ULAB	195	117
Waste fraction 3 – PET	311	156
Waste fraction 4 - Scrap Steel	7,124	5,343
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	3,938	2,166
Waste fraction 7 - Glass Bottles	280	98
Waste fraction 8 - Plastic Bags (Plastic Film)	212	106
Total waste	**12,369**	**8,140**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 12,369 tons of annual waste have been identified and delivered to the recycling facility and 8,140 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 118 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	308	-	-
Waste fraction 2 – ULAB	195	300	58,645
Waste fraction 3 – PET	311	-	-
Waste fraction 4 - Scrap Steel	7,124	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	3,938	-	-
Waste fraction 7 - Glass Bottles	280	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	212	-	-
Total	**12,369**		**58,645**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 119 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	308	16	4,930
Waste fraction 2 – ULAB	195	16	3,128
Waste fraction 3 – PET	311	16	4,982
Waste fraction 4 - Scrap Steel	7,124	16	113,987
Waste fraction 5 - Steel Cans	-	16	-
Waste fraction 6 - Paper & Cardboard	3,938	16	63,010
Waste fraction 7 - Glass Bottles	280	16	4,478
Waste fraction 8 - Plastic Bags (Plastic Film)	212	16	3,394
Total	**12,369**	**-**	**197,909**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 120 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	154	139	21,395
Waste fraction 2 – ULAB	117	104	12,218
Waste fraction 3 – PET	156	91	14,155
Waste fraction 4 - Scrap Steel	5,343	125	667,893
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	2,166	67	144,399

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 7 - Glass Bottles	98	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	106	67	7,070
Total	**8,140**		**867,130**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 121 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	58,645	4%
Maintenance costs of the facility	78,226	5%
Transportation costs to the facility	197,909	12%
Operational costs of the facility	182,528	11%
Transportation costs from the facility	867,130	54%
Cost of depositing non-recycled waste fractions	211,457	13%
Total operational and maintenance costs	**1,595,896**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $1.6 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 122 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	410,488
Expected revenues from sales of waste fractions	1,507,752
Total revenue	**1,918,240**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $1.9 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 123 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 124 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	521,509	
Domestic government or commercial loans	1,043,018	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	521,509	8.0%
Promotional loans	521,509	4.0%
Total	**2,607,545**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on RMI.

Table 125 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	1,824,750
IRR	19.5%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 18.8% and an NPV of the cash flow of $1.8 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.

5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 126 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	4,505,535	384,879
NPV of avoided cost of CO_2 through recycling	4,236,384	361,887
NPV of avoided CO_2 at the landfill	411,054	35,114
NPV of reduced leachate production	49,561	4,234
NPV of additional wages	2,871,564	245,299
Total NPV of economic benefits	**12,074,098**	**1,031,412**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $1 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.48 for the RMI recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen RMI

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			1,206,201	1,281,589	1,356,977	1,432,364	1,507,752	1,507,752
Gate fees and subsidies	USD			328,390	348,915	369,439	389,964	410,488	410,488
Total revenues	USD			1,534,592	1,630,504	1,726,416	1,822,328	1,918,240	1,918,240
Operational and maintenance costs									
Cost of waste	USD			46,916	49,848	52,780	55,713	58,645	58,645
Maintenance costs of the facility	USD			62,581	66,492	70,404	74,315	78,226	78,226
Transportation costs to the facility	USD			158,327	168,223	178,118	188,014	197,909	197,909
Operational costs of the facility	USD			146,023	155,149	164,275	173,402	182,528	182,528
Transportation costs from the facility	USD			693,704	737,060	780,417	823,773	867,130	867,130
Cost of depositing non-recycled waste fractions				169,166	179,739	190,311	200,884	211,457	211,457
Total operational and maintenance costs				1,276,716	1,356,511	1,436,306	1,516,101	1,595,896	1,595,896
EBITDA	USD			257,875	273,993	290,110	306,227	322,344	322,344
Depreciation and amortization	USD			96,479	96,479	96,479	96,479	96,479	62,581
EBIT	USD			161,396	177,514	193,631	209,748	225,865	259,763
Interest payment	USD			41,721	41,721	37,288	32,855	28,422	23,989
Profit or loss - before tax	USD			119,676	135,793	156,343	176,893	197,443	235,774
Tax	USD			23,935	27,159	31,269	35,379	39,489	47,155
Profit or loss - after tax	USD			95,740	108,634	125,074	141,514	157,954	188,619
Dividend payments	USD			0	14,463	23,651	33,418	43,719	55,650
Profit or loss after dividends	USD			95,740	94,171	101,424	108,096	114,235	132,969

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	RMI								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	30,436	76,686	186,772	303,531	426,429	541,667
Inventory	USD	-	0	127,883	135,875	143,868	151,861	159,853	159,853
DSRA	USD		0	41,721	93,872	89,439	85,006	80,573	76,140
Total short term assets	USD	0	0	200,039	306,433	420,079	540,398	666,856	777,661
Long term assets									
Tangible long term assets	USD	567,141	1,134,282	1,071,701	1,009,120	946,539	883,958	821,377	758,796
Intangible assets amortization	USD	84,745	169,490	135,592	101,694	67,796	33,898	0	
Other long term assets	USD								
Total long term assets	USD	651,886	1,303,772	1,207,293	1,110,814	1,014,335	917,856	821,377	758,796
TOTAL ASSETS (I + II)	USD	651,886	1,303,772	1,407,332	1,417,247	1,434,414	1,458,254	1,488,232	1,536,456
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	7,819	8,308	8,797	9,285	9,774	9,774
Total short term liabilities	USD	0	0	7,819	8,308	8,797	9,285	9,774	9,774
Long Term Liabilities									
Domestic government or commercial loa	USD	260,754	521,509	521,509	469,358	417,207	365,056	312,905	260,754
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	130,377	260,754	260,754	228,160	195,566	162,972	130,377	97,783
Total long term loans	USD	391,132	782,263	782,263	697,518	612,773	528,028	443,283	358,537
TOTAL LIABILITIES (I+II)	USD	391,132	782,263	790,083	705,826	621,570	537,313	453,057	368,312
EQUITY									
Equity	USD	260,754	521,509	521,509	521,509	521,509	521,509	521,509	521,509
Retained earning	USD	0	0	0	95,740	189,911	291,335	399,431	513,666
Profit (Loss) for the current financial peri	USD	0	0	95,740	94,171	101,424	108,096	114,235	132,969
Total Equity	USD	260,754	521,509	617,249	711,420	812,844	920,940	1,035,175	1,168,145
TOTAL LIABILITIES AND EQUITY (I+II+	USD	651,886	1,303,772	1,407,332	1,417,247	1,434,414	1,458,254	1,488,232	1,536,456

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement RMI

Operating activities	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Operating profits	USD	0	0	95,740	94,171	101,424	108,096	114,235	132,969
Depreciations	USD	0	0	96,479	96,479	96,479	96,479	96,479	62,581
Operating profit before working capital cl	USD	0	0	192,220	190,650	197,903	204,575	210,714	195,550
Investing activities									
Investments	USD	651,886	651,886	0	0	0	0	0	0
Net cash flow used for investing activities	USD	651,886	651,886	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	130,377	130,377	0	0	0	0	0	0
Domestic government or commercial loa	USD	260,754	260,754	0	-52,151	-52,151	-52,151	-52,151	-52,151
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	130,377	130,377	0	0	0	0	0	0
Promotional loans	USD	130,377	130,377	0	-32,594	-32,594	-32,594	-32,594	-32,594
Net cash generated from financing activit	USD	651,886	651,886	0	-84,745	-84,745	-84,745	-84,745	-84,745
Changes in working capital	USD		0	-120,063	-7,504	-7,504	-7,504	-7,504	0
Net annual increase in Cash and Cash Eq	USD	0	0	72,156	98,401	105,654	112,326	118,465	110,805
Cash and Cash equivalents (Start of year	USD		0	0	72,156	170,557	276,211	388,537	507,002
Cash and Cash Equivalents (End of year)	USD	0	0	72,156	170,557	276,211	388,537	507,002	617,807

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators RMI		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			17%	17%	17%	17%	17%	17%
- EBITDA	USD			257,875	273,993	290,110	306,227	322,344	322,344
- EBITDA margin	%			17%	17%	17%	17%	17%	17%
- Debt-equity ratio	%			127%	98%	75%	57%	43%	31%
- DSCR	%			330%	211%	232%	254%	278%	296%
- Solvency ratio	%			24%	29%	36%	44%	56%	68%
Profitability									
- Return on total assets	%			7%	8%	9%	10%	11%	12%
- Return on equity	%			16%	15%	15%	15%	15%	16%
- Gross profit margin	%			17%	17%	17%	17%	17%	17%
- Net profit margin	%			6%	7%	7%	8%	8%	10%
- Return on investment	%			20%	20%	20%	20%	20%	20%
Asset management									
- Asset turnover	%			109%	115%	120%	125%	129%	125%
Financial solvency									
- Debt to equity ratio	%			127%	98%	75%	57%	43%	31%
- Total long term debt to total asset rati	%			56%	49%	43%	36%	30%	23%
Liquidity ratios									
- Current ratios				25.6	36.9	47.8	58.2	68.2	79.6
- Acid ratio				9.2	20.5	31.4	41.8	51.9	63.2
- Cash coverage ratio	%			329%	360%	435%	531%	656%	886%
- Working capital	USD			192,220	298,125	411,282	531,112	657,081	767,887

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix G Financial and Economic Analysis – Nauru

This Appendix on the Nauru recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Nauru and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Nauru, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 127 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	100,000	30
Mechanical parts	17%	34,000	15
Electrical parts	20%	40,000	10
Legal	5%	10,000	
Planning	8%	16,000	
Total investments	**100%**	**200,000**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Nauru are estimated to be $200,000.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 128 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	76	69
Waste fraction 2 – ULAB	40	36
Waste fraction 3 – PET	83	46
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	-	-
Waste fraction 7 - Glass Bottles	197	29
Waste fraction 8 - Plastic Bags (Plastic Film)	56	20
Total waste	**452**	**199**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total, 452 tons of annual waste have been identified and delivered to the recycling facility and 199 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 129 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	76	0	0
Waste fraction 2 – ULAB	40	0	0
Waste fraction 3 – PET	83	0	0
Waste fraction 4 - Scrap Steel	-	0	0
Waste fraction 5 - Steel Cans	-	0	0
Waste fraction 6 - Paper & Cardboard	-	0	0
Waste fraction 7 - Glass Bottles	197	0	0
Waste fraction 8 - Plastic Bags (Plastic Film)	56	0	0
Total	**452**	**0**	**0**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 130 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	76	11	838
Waste fraction 2 – ULAB	40	11	440
Waste fraction 3 – PET	83	11	912
Waste fraction 4 - Scrap Steel	-	11	-
Waste fraction 5 - Steel Cans	-	11	-
Waste fraction 6 - Paper & Cardboard	-	11	-
Waste fraction 7 - Glass Bottles	197	11	2,163
Waste fraction 8 - Plastic Bags (Plastic Film)	56	11	621
Total	**452**	**-**	**4,974**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 131 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	69	278	19,046
Waste fraction 2 – ULAB	36	208	7,505
Waste fraction 3 – PET	46	455	20,720
Waste fraction 4 - Scrap Steel	-	250	-
Waste fraction 5 - Steel Cans	-	250	-
Waste fraction 6 - Paper & Cardboard	-	333	-
Waste fraction 7 - Glass Bottles	29	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	20	333	6,586
Total	**199**		**53,858**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 132 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	-	0%
Maintenance costs of the facility	12,000	11%
Transportation costs to the facility	4,974	4%
Operational costs of the facility	28,000	25%
Transportation costs from the facility	53,858	48%
Cost of depositing non-recycled waste fractions	12,636	11%
Total operational and maintenance costs	**111,467**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $111,467.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 133 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	-
Expected revenues from sales of waste fractions	142,121
Total revenue	**142,121**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $142,121. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 134 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 135 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	80,000	
Domestic government or commercial loans	160,000	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	80,000	8.0%
Promotional loans	80,000	4.0%
Total	400,000	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Nauru.

Table 136 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	92,885
IRR	11.1%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 11.1% and an NPV of the cash flow of $92,885 based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is reasonable.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 137 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	110,380	9,429
NPV of avoided cost of CO_2 through recycling	264,855	22,625
NPV of avoided CO_2 at the landfill	-	-
NPV of reduced leachate production	1,214	104
NPV of additional wages	407,306	34,793
Total NPV of economic benefits	783,755	66,951

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $66,951 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.60 for Nauru recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement Nauru

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fra	USD			113,696	120,802	127,908	135,015	142,121	142,121
Gate fee	USD			0	0	0	0	0	0
Total revenues	USD			113,696	120,802	127,908	135,015	142,121	142,121
Operational and maintenance costs									
Cost of waste	USD			0	0	0	0	0	0
Maintenance costs of the facility	USD			9,600	10,200	10,800	11,400	12,000	12,000
Transportation costs to the facility	USD			3,979	4,228	4,476	4,725	4,974	4,974
Operational costs of the facility	USD			22,400	23,800	25,200	26,600	28,000	28,000
Transportation costs from the facility	USD			43,086	45,779	48,472	51,165	53,858	53,858
Cost of depositing non-recycled waste fractions				10,109	10,741	11,372	12,004	12,636	12,636
Total operational and maintenance costs				89,174	94,747	100,321	105,894	111,467	111,467
EBITDA	USD			24,522	26,055	27,588	29,120	30,653	30,653
Depreciation and amortization	USD			13,467	13,467	13,467	13,467	13,467	8,267
EBIT	USD			11,056	12,588	14,121	15,654	17,186	22,386
Interest payment	USD			6,400	6,400	5,720	5,040	4,360	3,680
Profit or loss - before tax	USD			4,656	6,188	8,401	10,614	12,826	18,706
Tax	USD			931	1,238	1,680	2,123	2,565	3,741
Profit or loss - after tax	USD			3,725	4,951	6,721	8,491	10,261	14,965
Dividend payments	USD			0	1,013	1,460	2,012	2,662	3,636
Profit or loss after dividends	USD			3,725	3,937	5,261	6,479	7,599	11,329

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Nauru								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	1,317	-2,872	2,944	9,977	18,130	25,406
Inventory	USD	-	0	9,475	10,067	10,659	11,251	11,843	11,843
DSRA	USD		0	6,400	14,400	13,720	13,040	12,360	11,680
Total short term assets	USD	0	0	17,191	21,595	27,323	34,268	42,334	48,929
Long term assets									
Tangible long term assets	USD	87,000	174,000	165,733	157,467	149,200	140,933	132,667	124,400
Intangible assets amortization	USD	13,000	26,000	20,800	15,600	10,400	5,200	0	
Other long term assets	USD								
Total long term assets	USD	100,000	200,000	186,533	173,067	159,600	146,133	132,667	124,400
TOTAL ASSETS (I + II)	USD	100,000	200,000	203,725	194,662	186,923	180,402	175,000	173,329
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	0	0	0	0	0	0
Total short term liabilities	USD	0	0	0	0	0	0	0	0
Long Term Liabilities									
Domestic government or commercial loans	USD	40,000	80,000	80,000	72,000	64,000	56,000	48,000	40,000
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	20,000	40,000	40,000	35,000	30,000	25,000	20,000	15,000
Total long term loans	USD	60,000	120,000	120,000	107,000	94,000	81,000	68,000	55,000
TOTAL LIABILITIES (I+II)	USD	60,000	120,000	120,000	107,000	94,000	81,000	68,000	55,000
EQUITY									
Equity	USD	40,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
Retained earning	USD	0	0	0	3,725	7,662	12,923	19,402	27,000
Profit (Loss) for the current financial perioc	USD	0	0	3,725	3,937	5,261	6,479	7,599	11,329
Total Equity	USD	40,000	80,000	83,725	87,662	92,923	99,402	107,000	118,329
TOTAL LIABILITIES AND EQUITY (I+II+III)	USD	100,000	200,000	203,725	194,662	186,923	180,402	175,000	173,329

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	Nauru								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	3,725	3,937	5,261	6,479	7,599	11,329
Depreciations	USD	0	0	13,467	13,467	13,467	13,467	13,467	8,267
Operating profit before working capital cha	USD	0	0	17,191	17,404	18,728	19,945	21,066	19,595
Investing activities									
Investments	USD	100,000	100,000	0	0	0	0	0	0
Net cash flow used for investing activities	USD	100,000	100,000	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	20,000	20,000	0	0	0	0	0	0
Domestic government or commercial loans	USD	40,000	40,000	0	-8,000	-8,000	-8,000	-8,000	-8,000
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	20,000	20,000	0	0	0	0	0	0
Promotional loans	USD	20,000	20,000	0	-5,000	-5,000	-5,000	-5,000	-5,000
Net cash generated from financing activitie	USD	100,000	100,000	0	-13,000	-13,000	-13,000	-13,000	-13,000
Changes in working capital	USD		0	-9,475	-592	-592	-592	-592	0
Net annual increase in Cash and Cash Equ	USD	0	0	7,717	3,812	5,135	6,353	7,473	6,595
Cash and Cash equivalents (Start of year)	USD		0	0	7,717	11,528	16,664	23,017	30,490
Cash and Cash Equivalents (End of year)	USD	0	0	7,717	11,528	16,664	23,017	30,490	37,086

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators	Nauru		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators										
- Gross margin		%			22%	22%	22%	22%	22%	22%
- EBITDA		USD			24,522	26,055	27,588	29,120	30,653	30,653
- EBITDA margin		%			22%	22%	22%	22%	22%	22%
- Debt-equity ratio		%			143%	122%	101%	81%	64%	46%
- DSCR		%			235%	131%	144%	158%	173%	184%
- Solvency ratio		%			14%	17%	21%	27%	35%	42%
Profitability										
- Return on total assets		%			2%	3%	4%	5%	6%	9%
- Return on equity		%			4%	6%	7%	9%	10%	13%
- Gross profit margin		%			22%	22%	22%	22%	22%	22%
- Net profit margin		%			3%	4%	5%	6%	7%	11%
- Return on investment		%			27%	27%	27%	27%	27%	27%
Asset management										
- Asset turnover		%			56%	62%	68%	75%	81%	82%
Financial solvency										
- Debt to equity ratio		%			143%	122%	101%	81%	64%	46%
- Total long term debt to total asset ratio		%			59%	55%	50%	45%	39%	32%
Liquidity ratios										
- Current ratios					-	-	-	-	-	-
- Acid ratio					-	-	-	-	-	-
- Cash coverage ratio		%			158%	177%	217%	268%	335%	507%
- Working capital		USD			17,191	21,595	27,323	34,268	42,334	48,929

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix H Financial and Economic Analysis – Niue

This Appendix on the Niue recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Niue and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Niue, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 138 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	30,000	30
Mechanical parts	17%	10,200	15
Electrical parts	20%	12,000	10
Legal	5%	3,000	
Planning	8%	4,800	
Total investments	**100%**	**60,000**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Niue are estimated to be $60,000.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 139 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	26	21
Waste fraction 2 – ULAB	8	6
Waste fraction 3 – PET	25	12
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	-	-
Waste fraction 7 - Glass Bottles	29	3
Waste fraction 8 - Plastic Bags (Plastic Film)	17	5
Total waste	**105**	**47**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 105 tons of annual waste have been identified and delivered to the recycling facility and 47 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 140 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	26	0	0
Waste fraction 2 – ULAB	8	0	0
Waste fraction 3 – PET	25	0	0
Waste fraction 4 - Scrap Steel	-	0	0
Waste fraction 5 - Steel Cans	-	0	0
Waste fraction 6 - Paper & Cardboard	-	0	0
Waste fraction 7 - Glass Bottles	29	0	0
Waste fraction 8 - Plastic Bags (Plastic Film)	17	0	0
Total	**105**	**0**	**0**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 141 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	26	16	417
Waste fraction 2 – ULAB	8	16	121
Waste fraction 3 – PET	25	16	397
Waste fraction 4 - Scrap Steel	-	16	-
Waste fraction 5 - Steel Cans	-	16	-
Waste fraction 6 - Paper & Cardboard	-	16	-
Waste fraction 7 - Glass Bottles	29	16	468
Waste fraction 8 - Plastic Bags (Plastic Film)	17	16	271
Total	**105**	**-**	**1,675**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 142 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	21	278	5,795
Waste fraction 2 – ULAB	6	208	1,265
Waste fraction 3 – PET	12	455	5,644
Waste fraction 4 - Scrap Steel	-	250	-
Waste fraction 5 - Steel Cans	-	250	-
Waste fraction 6 - Paper & Cardboard	-	333	-
Waste fraction 7 - Glass Bottles	3	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	5	333	1,692
Total	**47**		**14,395**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 143 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	-	0%
Maintenance costs of the facility	3,600	12%
Transportation costs to the facility	1,675	5%
Operational costs of the facility	8,400	27%
Transportation costs from the facility	14,395	47%
Cost of depositing non-recycled waste fractions	2,867	9%
Total operational and maintenance costs	**30,937**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $30,937.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 144 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	-
Expected revenues from sales of waste fractions	45,359
Total revenue	**45,359**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $45,359. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 145 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,500
Waste fraction 2 – ULAB	800
Waste fraction 3 – PET	650
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	125
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	188

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 146 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	12,000	
Domestic government or commercial loans	24,000	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	12,000	8.0%
Promotional loans	12,000	4.0%
Total	**60,000**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Niue.

Table 147 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	77,691
IRR	18.9%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 18.9% and an NPV of the cash flow of $77,691 based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 148 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	26,209	2,239
NPV of avoided cost of CO_2 through recycling	77,610	6,630
NPV of avoided CO_2 at the landfill	-	-
NPV of reduced leachate production	288	25
NPV of additional wages	61,499	5,253
Total NPV of economic benefits	165,607	14,147

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $14,147 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.62 for Niue recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement Niue

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fra	USD			36,287	38,555	40,823	43,091	45,359	45,359
Gate fee	USD			0	0	0	0	0	0
Total revenues	USD			36,287	38,555	40,823	43,091	45,359	45,359
Operational and maintenance costs									
Cost of waste	USD			0	0	0	0	0	0
Maintenance costs of the facility	USD			2,880	3,060	3,240	3,420	3,600	3,600
Transportation costs to the facility	USD			1,340	1,424	1,508	1,591	1,675	1,675
Operational costs of the facility	USD			6,720	7,140	7,560	7,980	8,400	8,400
Transportation costs from the facility	USD			11,516	12,236	12,956	13,675	14,395	14,395
Cost of depositing non-recycled waste fractions				2,294	2,437	2,580	2,724	2,867	2,867
Total operational and maintenance costs				24,750	26,297	27,843	29,390	30,937	30,937
EBITDA	USD			11,538	12,259	12,980	13,701	14,422	14,422
Depreciation and amortization	USD			4,040	4,040	4,040	4,040	4,040	2,480
EBIT	USD			7,498	8,219	8,940	9,661	10,382	11,942
Interest payment	USD			1,920	1,920	1,716	1,512	1,308	1,104
Profit or loss - before tax	USD			5,578	6,299	7,224	8,149	9,074	10,838
Tax	USD			1,116	1,260	1,445	1,630	1,815	2,168
Profit or loss - after tax	USD			4,462	5,039	5,779	6,519	7,259	8,670
Dividend payments	USD			0	841	1,232	1,651	2,096	2,618
Profit or loss after dividends	USD			4,462	4,198	4,547	4,868	5,163	6,052

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Niue								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD			3,558	5,307	10,008	15,031	20,349	25,185
Inventory	USD			3,024	3,213	3,402	3,591	3,780	3,780
DSRA	USD			1,920	4,320	4,116	3,912	3,708	3,504
Total short term assets	USD			8,502	12,840	17,526	22,534	27,837	32,469
Long term assets									
Tangible long term assets	USD	26,100	52,200	49,720	47,240	44,760	42,280	39,800	37,320
Intangible assets amortization	USD	3,900	7,800	6,240	4,680	3,120	1,560	0	
Other long term assets	USD								
Total long term assets	USD	30,000	60,000	55,960	51,920	47,880	43,840	39,800	37,320
TOTAL ASSETS (I + II)	USD	30,000	60,000	64,462	64,760	65,406	66,374	67,637	69,789
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	0	0	0	0	0	0
Total short term liabilities	USD	0	0	0	0	0	0	0	0
Long Term Liabilities									
Domestic government or commercial loans	USD	12,000	24,000	24,000	21,600	19,200	16,800	14,400	12,000
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	6,000	12,000	12,000	10,500	9,000	7,500	6,000	4,500
Total long term loans	USD	18,000	36,000	36,000	32,100	28,200	24,300	20,400	16,500
TOTAL LIABILITIES (I+II)	USD	18,000	36,000	36,000	32,100	28,200	24,300	20,400	16,500
EQUITY									
Equity	USD	12,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Retained earning	USD	0	0	0	4,462	8,660	13,206	18,074	23,237
Profit (Loss) for the current financial perioc	USD	0	0	4,462	4,198	4,547	4,868	5,163	6,052
Total Equity	USD	12,000	24,000	28,462	32,660	37,206	42,074	47,237	53,289
TOTAL LIABILITIES AND EQUITY (I+II+III)	USD	30,000	60,000	64,462	64,760	65,406	66,374	67,637	69,789

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	Niue								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	4,462	4,198	4,547	4,868	5,163	6,052
Depreciations	USD	0	0	4,040	4,040	4,040	4,040	4,040	2,480
Operating profit before working capital cha	USD	0	0	8,502	8,238	8,587	8,908	9,203	8,532
Investing activities									
Investments	USD	30,000	30,000	0	0	0	0	0	0
Net cash flow used for investing activities	USD	30,000	30,000	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	6,000	6,000	0	0	0	0	0	0
Domestic government or commercial loans	USD	12,000	12,000	0	-2,400	-2,400	-2,400	-2,400	-2,400
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	6,000	6,000	0	0	0	0	0	0
Promotional loans	USD	6,000	6,000	0	-1,500	-1,500	-1,500	-1,500	-1,500
Net cash generated from financing activitie	USD	30,000	30,000	0	-3,900	-3,900	-3,900	-3,900	-3,900
Changes in working capital	USD		0	-3,024	-189	-189	-189	-189	0
Net annual increase in Cash and Cash Equ	USD	0	0	5,478	4,149	4,498	4,819	5,114	4,632
Cash and Cash equivalents (Start of year)	USD		0	0	5,478	9,627	14,124	18,943	24,057
Cash and Cash Equivalents (End of year)	USD	0	0	5,478	9,627	14,124	18,943	24,057	28,689

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators	Niue		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators										
- Gross margin		%			32%	32%	32%	32%	32%	32%
- EBITDA		USD			11,538	12,259	12,980	13,701	14,422	14,422
- EBITDA margin		%			32%	32%	32%	32%	32%	32%
- Debt-equity ratio		%			126%	98%	76%	58%	43%	31%
- DSCR		%			443%	207%	228%	250%	273%	288%
- Solvency ratio		%			24%	28%	35%	43%	55%	68%
Profitability										
- Return on total assets		%			7%	8%	9%	10%	11%	12%
- Return on equity		%			16%	15%	16%	15%	15%	16%
- Gross profit margin		%			32%	32%	32%	32%	32%	32%
- Net profit margin		%			12%	13%	14%	15%	16%	19%
- Return on investment		%			47%	47%	47%	47%	47%	47%
Asset management										
- Asset turnover		%			56%	60%	62%	65%	67%	65%
Financial solvency										
- Debt to equity ratio		%			126%	98%	76%	58%	43%	31%
- Total long term debt to total asset ratio		%			56%	50%	43%	37%	30%	24%
Liquidity ratios										
- Current ratios					-	-	-	-	-	-
- Acid ratio					-	-	-	-	-	-
- Cash coverage ratio		%			332%	362%	437%	531%	655%	885%
- Working capital		USD			8,502	12,840	17,526	22,534	27,837	32,469

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix I Financial and Economic Analysis – Palau

This Appendix on the Palau recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Palau and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Palau, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 149 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	253,392	30
Mechanical parts	17%	86,153	15
Electrical parts	20%	101,357	10
Legal	5%	25,339	
Planning	8%	40,543	
Total investments	**100%**	**506,783**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Palau are estimated to be $506,783.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 150 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	146	131
Waste fraction 2 – ULAB	71	57
Waste fraction 3 – PET	163	130
Waste fraction 4 - Scrap Steel	2,583	1,808
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	1,428	714
Waste fraction 7 - Glass Bottles	318	191
Waste fraction 8 - Plastic Bags (Plastic Film)	-	-
Total waste	**4,709**	**3,031**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 4,709 tons of annual waste has been identified and delivered to the recycling facility and 3,031 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 151 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	146	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 2 – ULAB	71	300	21,263
Waste fraction 3 – PET	163	-	-
Waste fraction 4 - Scrap Steel	2,583	-	-
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	1,428	-	-
Waste fraction 7 - Glass Bottles	318	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	-	-	-
Total	**4,709**		**21,263**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 152 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	146	42	6,132
Waste fraction 2 – ULAB	71	42	2,977
Waste fraction 3 – PET	163	42	6,844
Waste fraction 4 - Scrap Steel	2,583	42	108,486
Waste fraction 5 - Steel Cans	-	42	-
Waste fraction 6 - Paper & Cardboard	1,428	42	59,970
Waste fraction 7 - Glass Bottles	318	42	13,355
Waste fraction 8 - Plastic Bags (Plastic Film)	-	42	-
Total	**4,709**	-	**197,764**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 153 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	131	139	18,250

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 2 – ULAB	57	104	5,906
Waste fraction 3 – PET	130	227	29,628
Waste fraction 4 - Scrap Steel	1,808	125	226,013
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	714	167	118,988
Waste fraction 7 - Glass Bottles	191	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	-	167	-
Total	**3,031**		**398,786**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 154 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	21,263	3%
Maintenance costs of the facility	30,407	4%
Transportation costs to the facility	197,764	25%
Operational costs of the facility	70,950	9%
Transportation costs from the facility	398,786	50%
Cost of depositing non-recycled waste fractions	83,869	10%
Total operational and maintenance costs	**803,038**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $803,038.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 155 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	568,342
Expected revenues from sales of waste fractions	730,411
Total revenue	**1,298,753**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $1.3 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 156 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,500
Waste fraction 2 – ULAB	800
Waste fraction 3 – PET	650
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	125
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	188

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 157 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	101,357	
Domestic government or commercial loans	202,713	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	101,357	8.0%
Promotional loans	101,357	4.0%
Total	**506,783**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Palau.

Table 158 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	4,240,840
IRR	64.1%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 64.1% and an NPV of the cash flow of $4.2 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is very good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 159 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	1,677,794	143,323
NPV of avoided cost of CO_2 through recycling	1,755,998	150,003
NPV of avoided CO_2 at the landfill	135,487	11,574
NPV of reduced leachate production	18,456	1,577
NPV of additional wages	1,302,213	111,240
Total NPV of economic benefits	**4,889,948**	**417,716**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $417,716 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost

Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.35 for the Palau recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen Palau

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			584,329	620,849	657,370	693,891	730,411	730,411
Gate fees and subsidies	USD			454,673	483,090	511,507	539,925	568,342	568,342
Total revenues	USD	0	0	1,039,002	1,103,940	1,168,878	1,233,815	1,298,753	1,298,753
Operational and maintenance costs									
Cost of waste	USD			17,010	18,073	19,137	20,200	21,263	21,263
Maintenance costs of the facility	USD			24,326	25,846	27,366	28,887	30,407	30,407
Transportation costs to the facility	USD			158,211	168,099	177,988	187,876	197,764	197,764
Operational costs of the facility	USD			56,760	60,307	63,855	67,402	70,950	70,950
Transportation costs from the facility	USD			319,028	338,968	358,907	378,846	398,786	398,786
Cost of depositing non-recycled waste fractions				67,095	71,289	75,482	79,676	83,869	83,869
Total operational and maintenance costs			0	642,431	682,583	722,735	762,886	803,038	803,038
EBITDA	USD		0	396,572	421,357	446,143	470,929	495,714	495,714
Depreciation and amortization	USD			37,502	37,502	37,502	37,502	37,502	24,326
EBIT	USD		0	359,070	383,855	408,641	433,427	458,213	471,389
Interest payment	USD		0	16,217	16,217	14,494	12,771	11,048	9,325
Profit or loss - before tax	USD		0	342,853	367,638	394,147	420,656	447,165	462,064
Tax	USD		0	68,571	73,528	78,829	84,131	89,433	92,413
Profit or loss - after tax	USD		0	274,282	294,111	315,318	336,525	357,732	369,651
Dividend payments	USD		0	0	41,772	63,602	85,382	107,116	128,065
Profit or loss after dividends	USD	0	0	274,282	252,339	251,716	251,143	250,616	241,587

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Palau								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	211,818	443,213	695,979	948,172	1,199,838	1,434,532
Inventory	USD	-	0	86,584	91,995	97,406	102,818	108,229	108,229
DSRA	USD		0	16,217	36,488	34,765	33,042	31,319	29,596
Total short term assets	USD	0	0	314,619	571,696	828,151	1,084,032	1,339,386	1,572,358
Long term assets									
Tangible long term assets	USD	220,451	440,902	416,576	392,250	367,925	343,599	319,274	294,948
Intangible assets amortization	USD	32,941	65,882	52,705	39,529	26,353	13,176	0	
Other long term assets	USD								
Total long term assets	USD	253,392	506,783	469,281	431,779	394,277	356,776	319,274	294,948
TOTAL ASSETS (I + II)	USD	253,392	506,783	783,900	1,003,476	1,222,428	1,440,808	1,658,660	1,867,306
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	2,835	3,012	3,189	3,367	3,544	3,544
Total short term liabilities	USD	0	0	2,835	3,012	3,189	3,367	3,544	3,544
Long Term Liabilities									
Domestic government or commercial loa	USD	101,357	202,713	202,713	182,442	162,171	141,899	121,628	101,357
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	50,678	101,357	101,357	88,687	76,018	63,348	50,678	38,009
Total long term loans	USD	152,035	304,070	304,070	271,129	238,188	205,247	172,306	139,365
TOTAL LIABILITIES (I+II)	USD	152,035	304,070	306,905	274,141	241,378	208,614	175,850	142,909
EQUITY									
Equity	USD	101,357	202,713	202,713	202,713	202,713	202,713	202,713	202,713
Retained earning	USD	0	0	0	274,282	526,621	778,337	1,029,480	1,280,096
Profit (Loss) for the current financial peri	USD	0	0	274,282	252,339	251,716	251,143	250,616	241,587
Total Equity	USD	101,357	202,713	476,995	729,334	981,050	1,232,194	1,482,810	1,724,396
TOTAL LIABILITIES AND EQUITY (I+II+	USD	253,392	506,783	783,900	1,003,476	1,222,428	1,440,808	1,658,660	1,867,306

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement — Palau

Operating activities	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Operating profits	USD	0	0	274,282	252,339	251,716	251,143	250,616	241,587
Depreciations	USD	0	0	37,502	37,502	37,502	37,502	37,502	24,326
Operating profit before working capital c	USD	0	0	311,784	289,841	289,218	288,645	288,118	265,912
Investing activities									
Investments	USD	253,392	253,392	0	0	0	0	0	0
Net cash flow used for investing activitie	USD	253,392	253,392	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	50,678	50,678	0	0	0	0	0	0
Domestic government or commercial loa	USD	101,357	101,357	0	-20,271	-20,271	-20,271	-20,271	-20,271
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	50,678	50,678	0	0	0	0	0	0
Promotional loans	USD	50,678	50,678	0	-12,670	-12,670	-12,670	-12,670	-12,670
Net cash generated from financing activi	USD	253,392	253,392	0	-32,941	-32,941	-32,941	-32,941	-32,941
Changes in working capital	USD		0	-83,748	-5,234	-5,234	-5,234	-5,234	0
Net annual increase in Cash and Cash Eq	USD	0	0	228,036	251,666	251,043	250,470	249,943	232,971
Cash and Cash equivalents (Start of yea	USD		0	0	228,036	479,701	730,744	981,214	1,231,157
Cash and Cash Equivalents (End of year)	USD	0	0	228,036	479,701	730,744	981,214	1,231,157	1,464,128

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators Palau		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			38%	38%	38%	38%	38%	38%
- EBITDA	USD			396,572	421,357	446,143	470,929	495,714	495,714
- EBITDA margin	%			38%	38%	38%	38%	38%	38%
- Debt-equity ratio	%			64%	37%	24%	17%	12%	8%
- DSCR	%			1929%	847%	930%	1019%	1115%	1173%
- Solvency ratio	%			102%	121%	146%	179%	225%	276%
Profitability									
- Return on total assets	%			35%	29%	26%	23%	22%	20%
- Return on equity	%			58%	40%	32%	27%	24%	21%
- Gross profit margin	%			38%	38%	38%	38%	38%	38%
- Net profit margin	%			26%	27%	27%	27%	28%	28%
- Return on investment	%			62%	62%	62%	62%	62%	62%
Asset management									
- Asset turnover	%			133%	110%	96%	86%	78%	70%
Financial solvency									
- Debt to equity ratio	%			64%	37%	24%	17%	12%	8%
- Total long term debt to total asset rati	%			39%	27%	19%	14%	10%	7%
Liquidity ratios									
- Current ratios				111.0	189.8	259.7	322.0	378.0	443.7
- Acid ratio				80.4	159.3	229.1	291.5	347.4	413.2
- Cash coverage ratio	%			1791%	1914%	2276%	2735%	3338%	4064%
- Working capital	USD			311,784	568,684	824,961	1,080,665	1,335,843	1,568,814

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix J Financial and Economic Analysis – Papua New Guinea

This Appendix on the Papua New Guinea (PNG) hub project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for PNG and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take three years to plan, construct, and implement the recycling facility on PNG, i.e., from 2023 to 2025 and commercial operations will commence in 2026.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 160 Investment Costs in the Recycling Hub and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	73,858,820	30
Mechanical parts	17%	25,111,999	15
Electrical parts	20%	29,543,528	10
Legal	5%	7,385,882	
Planning	8%	11,817,411	
Total investments	**100%**	**147,717,640**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on PNG are estimated to be $148 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical

equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 161 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	43,089	25,853
Waste fraction 2 – ULAB	28,800	21,600
Waste fraction 3 – PET	42,518	21,259
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	580,194	290,097
Waste fraction 7 - Glass Bottles	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	28,962	2,896
Total waste	**723,562**	**361,705**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 723,562 tons of annual waste have been identified and delivered to the recycling facility and 361,705 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 162 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	43,089	600	25,853,205
Waste fraction 2 – ULAB	28,800	350	10,079,922
Waste fraction 3 – PET	42,518	200	8,503,651
Waste fraction 4 - Scrap Steel	-	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	580,194	-	-
Waste fraction 7 - Glass Bottles	-	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	28,962	-	-
Total	**723,562**		**44,436,778**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 163 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	43,089	57	2,456,054
Waste fraction 2 – ULAB	28,800	57	1,641,587
Waste fraction 3 – PET	42,518	57	2,423,540
Waste fraction 4 - Scrap Steel	-	57	-
Waste fraction 5 - Steel Cans	-	57	-
Waste fraction 6 - Paper & Cardboard	580,194	57	33,071,050
Waste fraction 7 - Glass Bottles	-	57	-
Waste fraction 8 - Plastic Bags (Plastic Film)	28,962	57	1,650,817
Total	**723,562**	-	**41,243,050**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 164 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	25,853	52	1,346,521
Waste fraction 2 – ULAB	21,600	52	1,124,991
Waste fraction 3 – PET	21,259	91	1,932,648
Waste fraction 4 - Scrap Steel	-	63	-
Waste fraction 5 - Steel Cans	-	63	-
Waste fraction 6 - Paper & Cardboard	290,097	67	19,339,796

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 7 - Glass Bottles	-	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	2,896	67	193,078
Total	**361,705**		**23,937,034**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 165 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	44,436,778	28%
Maintenance costs of the facility	8,863,058	6%
Transportation costs to the facility	41,243,050	26%
Operational costs of the facility	20,680,470	13%
Transportation costs from the facility	23,937,034	15%
Cost of depositing non-recycled waste fractions	18,092,851	12%
Total operational and maintenance costs	**157,253,240**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $157 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 166 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	19,436,495
Expected revenues from sales of waste fractions	201,385,357
Total revenue	**220,821,852**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $221 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 167 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	2,000
Waste fraction 2 – ULAB	1,800
Waste fraction 3 – PET	1,050
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	300
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	500

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 168 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	14,771,764	
Domestic government or commercial loans	29,543,528	6.0%
International grants	-	
International loans	73,858,820	4.0%
Equity from owners	29,543,528	8.0%
Promotional loans	-	4.0%
Total	**147,717,640**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 5.3%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on PNG.

Table 169 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	5.3%
NPV of annual cash flow	456,334,915
IRR	28.8%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 28.8% and an NPV of the cash flow of $456 million based on a real discount rate of 5.3%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.

5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 170 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	200,201,399	17,101,904
NPV of avoided cost of CO_2 through recycling	135,695,040	11,591,545
NPV of avoided CO_2 at the landfill	55,053,815	4,702,890
NPV of reduced leachate production	2,202,215	188,121
NPV of additional wages	99,360,768	8,487,744
Total NPV of economic benefits	492,513,237	42,072,204

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $42 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.42 for the PNG hub project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statement	PNG Hub								
	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste fractions	USD				161,108,286	171,177,554	181,246,822	191,316,089	201,385,357
Gate fee	USD				15,549,196	16,521,020	17,492,845	18,464,670	19,436,495
Total revenues	USD				176,657,482	187,698,574	198,739,667	209,780,759	220,821,852
Operational and maintenance costs									
Cost of waste	USD				35,549,422	37,771,261	39,993,100	42,214,939	44,436,778
Maintenance costs of the facility	USD				7,090,447	7,533,600	7,976,753	8,419,905	8,863,058
Transportation costs to the facility	USD				32,994,440	35,056,593	37,118,745	39,180,898	41,243,050
Operational costs of the facility	USD				16,544,376	17,578,399	18,612,423	19,646,446	20,680,470
Transportation costs from the facility	USD				19,149,627	20,346,479	21,543,331	22,740,182	23,937,034
Cost of depositing non-recycled waste fractions					14,474,281	15,378,923	16,283,566	17,188,208	18,092,851
Total operational and maintenance costs					125,802,592	133,665,254	141,527,916	149,390,578	157,253,240
EBITDA	USD				50,854,889	54,033,320	57,211,751	60,390,181	63,568,612
Depreciation and amortization	USD				10,931,105	10,931,105	10,931,105	10,931,105	10,931,105
EBIT	USD				39,923,784	43,102,215	46,280,645	49,459,076	52,637,506
Interest payment	USD				6,204,141	6,204,141	5,928,401	5,652,662	5,376,922
Profit or loss - before tax	USD				33,719,643	36,898,074	40,352,244	43,806,414	47,260,584
Tax	USD				6,743,929	7,379,615	8,070,449	8,761,283	9,452,117
Profit or loss - after tax	USD				26,975,715	29,518,459	32,281,795	35,045,131	37,808,468
Dividend payments	USD				0	4,690,298	7,360,471	10,038,096	12,722,579
Profit or loss after dividends	USD				26,975,715	24,828,161	24,921,325	25,007,035	25,085,889

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	PNG Hub								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD				22,906,126	50,565,595	81,548,320	112,616,755	143,764,044
Inventory	USD				14,721,457	15,641,548	16,561,639	17,481,730	18,401,821
DSRA	USD				6,204,141	9,158,494	8,882,754	8,607,014	8,331,275
Total short term assets	USD				43,831,724	75,365,637	106,992,713	138,705,500	170,497,140
Long term assets									
Tangible long term assets	USD	42,838,115	85,676,231	128,514,346	121,423,900	114,333,453	107,243,006	100,152,560	93,062,113
Intangible assets amortization	USD	6,401,098	12,802,195	19,203,293	15,362,635	11,521,976	7,681,317	3,840,659	0
Other long term assets	USD								
Total long term assets	USD	49,239,213	98,478,426	147,717,640	136,786,534	125,855,429	114,924,324	103,993,218	93,062,113
TOTAL ASSETS (I + II)	USD	49,239,213	98,478,426	147,717,640	180,618,258	201,221,065	221,917,037	242,698,718	263,559,253
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	0	5,924,904	6,295,210	6,665,517	7,035,823	7,406,130
Total short term liabilities	USD	0	0	0	5,924,904	6,295,210	6,665,517	7,035,823	7,406,130
Long Term Liabilities									
Domestic government or commercial loans	USD	9,847,843	19,695,685	29,543,528	29,543,528	26,589,175	23,634,822	20,680,470	17,726,117
International loans	USD	24,619,607	49,239,213	73,858,820	73,858,820	72,217,513	70,576,206	68,934,898	67,293,591
Promotional loans	USD	0	0	0	0	0	0	0	0
Total long term loans	USD	34,467,449	68,934,898	103,402,348	103,402,348	98,806,688	94,211,028	89,615,368	85,019,708
TOTAL LIABILITIES (I+II)	USD	34,467,449	68,934,898	103,402,348	109,327,251	105,101,898	100,876,545	96,651,191	92,425,838
EQUITY									
Equity	USD	14,771,764	29,543,528	44,315,292	44,315,292	44,315,292	44,315,292	44,315,292	44,315,292
Retained earning	USD	0	0	0	0	26,975,715	51,803,876	76,725,200	101,732,235
Profit (Loss) for the current financial period	USD	0	0	0	26,975,715	24,828,161	24,921,325	25,007,035	25,085,889
Total Equity	USD	14,771,764	29,543,528	44,315,292	71,291,006	96,119,167	121,040,492	146,047,527	171,133,415
TOTAL LIABILITIES AND EQUITY (I+II+III)	USD	49,239,213	98,478,426	147,717,640	180,618,258	201,221,065	221,917,037	242,698,718	263,559,253

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	PNG Hub								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	0	26,975,715	24,828,161	24,921,325	25,007,035	25,085,889
Depreciations	USD	0	0	0	10,931,105	10,931,105	10,931,105	10,931,105	10,931,105
Operating profit before working capital changes	USD	0	0	0	37,906,820	35,759,266	35,852,430	35,938,140	36,016,994
Investing activities									
Investments	USD	49,239,213	49,239,213	49,239,213	0	0	0	0	0
Net cash flow used for investing activities	USD	49,239,213	49,239,213	49,239,213	0	0	0	0	0
Financing activities									
Domestic government grants	USD	4,923,921	4,923,921	4,923,921	0	0	0	0	0
Domestic government or commercial loans	USD	9,847,843	9,847,843	9,847,843	0	-2,954,353	-2,954,353	-2,954,353	-2,954,353
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	24,619,607	24,619,607	24,619,607	0	-1,641,307	-1,641,307	-1,641,307	-1,641,307
Equity from owners	USD	9,847,843	9,847,843	9,847,843	0	0	0	0	0
Promotional loans	USD	0	0	0	0	0	0	0	0
Net cash generated from financing activities	USD	49,239,213	49,239,213	49,239,213	0	-4,595,660	-4,595,660	-4,595,660	-4,595,660
Changes in working capital	USD		0	0	-8,796,553	-549,785	-549,785	-549,785	-549,785
Net annual increase in Cash and Cash Equivalents	USD	0	0	0	29,110,267	30,613,822	30,706,985	30,792,696	30,871,549
Cash and Cash equivalents (Start of year)	USD		0	0	0	29,110,267	59,724,089	90,431,074	121,223,770
Cash and Cash Equivalents (End of year)	USD	0	0	0	29,110,267	59,724,089	90,431,074	121,223,770	152,095,319

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators	PNG Hub		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators										
- Gross margin		%			0%	29%	29%	29%	29%	29%
- EBITDA		USD			-	50,854,889	54,033,320	57,211,751	60,390,181	63,568,612
- EBITDA margin		%			0%	29%	29%	29%	29%	29%
- Debt-equity ratio		%			233%	145%	103%	78%	61%	50%
- DSCR		%			0%	678%	495%	538%	584%	632%
- Solvency ratio		%			0%	35%	38%	43%	48%	53%
Profitability										
- Return on total assets		%			0%	15%	15%	15%	14%	14%
- Return on equity		%			0%	38%	31%	27%	24%	22%
- Gross profit margin		%			0%	29%	29%	29%	29%	29%
- Net profit margin		%			0%	15%	16%	16%	17%	17%
- Return on investment		%			0%	40%	40%	40%	40%	40%
Asset management										
- Asset turnover		%			0%	98%	93%	90%	86%	84%
Financial solvency										
- Debt to equity ratio		%			233%	145%	103%	78%	61%	50%
- Total long term debt to total asset ratio		%			70%	57%	49%	42%	37%	32%
Liquidity ratios										
- Current ratios					-	7.4	12.0	16.1	19.7	23.0
- Acid ratio					-	4.9	9.5	13.6	17.2	20.5
- Cash coverage ratio		%			n/a	535%	576%	645%	720%	803%
- Working capital		USD			-	37,906,820	69,070,426	100,327,196	131,669,677	163,091,011

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix K Financial and Economic Analysis – Samoa

This Appendix on the Samoa recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Samoa and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Samoa, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 171 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	838,788	30
Mechanical parts	17%	285,188	15
Electrical parts	20%	335,515	10
Legal	5%	83,879	
Planning	8%	134,206	
Total investments	**100%**	**1,677,577**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Samoa are estimated to be $1.7 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 172 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	1,029	618
Waste fraction 2 – ULAB	654	589
Waste fraction 3 – PET	1,039	572
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	13,185	7,252
Waste fraction 7 - Glass Bottles	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	708	248
Total waste	**16,616**	**9,278**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 16,616 tons of annual waste has been identified and delivered to the recycling facility and 9,278 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 173 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	1,029	362	372,200
Waste fraction 2 – ULAB	654	150	98,172
Waste fraction 3 – PET	1,039	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 4 - Scrap Steel	-	-	-
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	13,185	-	-
Waste fraction 7 - Glass Bottles	-	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	708	-	-
Total	**16,616**		**470,372**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 174 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	1,029	30	30,876
Waste fraction 2 – ULAB	654	30	19,634
Waste fraction 3 – PET	1,039	30	31,176
Waste fraction 4 - Scrap Steel	-	30	-
Waste fraction 5 - Steel Cans	-	30	-
Waste fraction 6 - Paper & Cardboard	13,185	30	395,551
Waste fraction 7 - Glass Bottles	-	30	-
Waste fraction 8 - Plastic Bags (Plastic Film)	708	30	21,236
Total	**16,616**	-	**498,474**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 175 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	618	139	85,767
Waste fraction 2 – ULAB	589	104	61,358
Waste fraction 3 – PET	572	91	51,960
Waste fraction 4 - Scrap Steel	-	125	-
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	7,252	67	483,451
Waste fraction 7 - Glass Bottles	-	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	248	67	16,517
Total	**9,278**		**699,053**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 176 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	470,372	20%
Maintenance costs of the facility	100,655	4%
Transportation costs to the facility	498,474	21%
Operational costs of the facility	234,861	10%
Transportation costs from the facility	699,053	29%
Cost of depositing non-recycled waste fractions	366,908	15%
Total operational and maintenance costs	**2,370,321**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $2.4 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 177 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	485,869
Expected revenues from sales of waste fractions	2,313,761
Total revenue	**2,799,630**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $2.8 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 178 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 179 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	335,515	
Domestic government or commercial loans	671,031	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	335,515	8.0%
Promotional loans	335,515	4.0%
Total	**1,677,577**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Samoa.

Table 180 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	2,486,592
IRR	20.2%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 20.2% and an NPV of the cash flow of $2.5 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 181 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	5,135,110	438,659
NPV of avoided cost of CO_2 through recycling	3,365,302	287,476
NPV of avoided CO_2 at the landfill	1,376,221	117,562
NPV of reduced leachate production	56,486	4,825
NPV of additional wages	888,976	75,939
Total NPV of economic benefits	**10,822,096**	**924,461**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $924,461 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.28 for the Samoa recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen Samoa

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			1,851,009	1,966,697	2,082,385	2,198,073	2,313,761	2,313,761
Gate fees and subsidies	USD			388,695	412,988	437,282	461,575	485,869	485,869
Total revenues	USD	0	0	2,239,704	2,379,685	2,519,667	2,659,648	2,799,630	2,799,630
Operational and maintenance costs									
Cost of waste	USD			376,298	399,816	423,335	446,853	470,372	470,372
Maintenance costs of the facility	USD			80,524	85,556	90,589	95,622	100,655	100,655
Transportation costs to the facility	USD			398,779	423,703	448,626	473,550	498,474	498,474
Operational costs of the facility	USD			187,889	199,632	211,375	223,118	234,861	234,861
Transportation costs from the facility	USD			559,242	594,195	629,148	664,100	699,053	699,053
Cost of depositing non-recycled waste fractions				293,526	311,871	330,217	348,562	366,908	366,908
Total operational and maintenance costs			0	1,896,257	2,014,773	2,133,289	2,251,805	2,370,321	2,370,321
EBITDA	USD		0	343,447	364,912	386,377	407,843	429,308	429,308
Depreciation and amortization	USD			124,141	124,141	124,141	124,141	124,141	80,524
EBIT	USD		0	219,306	240,771	262,237	283,702	305,168	348,785
Interest payment	USD		0	53,682	53,682	47,979	42,275	36,571	30,867
Profit or loss - before tax	USD		0	165,623	187,089	214,258	241,427	268,596	317,917
Tax	USD		0	33,125	37,418	42,852	48,285	53,719	63,583
Profit or loss - after tax	USD		0	132,499	149,671	171,406	193,142	214,877	254,334
Dividend payments	USD		0	0	22,591	35,084	48,317	62,230	78,187
Profit or loss after dividends	USD	0	0	132,499	127,080	136,322	144,825	152,647	176,147

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Samoa								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	79,031	146,361	295,740	453,621	619,325	772,657
Inventory	USD	-	0	186,642	198,307	209,972	221,637	233,302	233,302
DSRA	USD		0	53,682	120,786	115,082	109,378	103,674	97,970
Total short term assets	USD	0	0	319,356	465,454	620,794	784,637	956,302	1,103,930
Long term assets									
Tangible long term assets	USD	729,746	1,459,492	1,378,968	1,298,444	1,217,921	1,137,397	1,056,873	976,350
Intangible assets amortization	USD	109,042	218,085	174,468	130,851	87,234	43,617	0	
Other long term assets	USD								
Total long term assets	USD	838,788	1,677,577	1,553,436	1,429,295	1,305,155	1,181,014	1,056,873	976,350
TOTAL ASSETS (I + II)	USD	838,788	1,677,577	1,872,792	1,894,749	1,925,949	1,965,651	2,013,175	2,080,280
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	62,716	66,636	70,556	74,476	78,395	78,395
Total short term liabilities	USD	0	0	62,716	66,636	70,556	74,476	78,395	78,395
Long Term Liabilities									
Domestic government or commercial loa	USD	335,515	671,031	671,031	603,928	536,825	469,721	402,618	335,515
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	167,758	335,515	335,515	293,576	251,636	209,697	167,758	125,818
Total long term loans	USD	503,273	1,006,546	1,006,546	897,503	788,461	679,419	570,376	461,334
TOTAL LIABILITIES (I+II)	USD	503,273	1,006,546	1,069,262	964,139	859,017	753,894	648,771	539,729
EQUITY									
Equity	USD	335,515	671,031	671,031	671,031	671,031	671,031	671,031	671,031
Retained earning	USD	0	0	0	132,499	259,579	395,901	540,726	693,373
Profit (Loss) for the current financial peri	USD	0	0	132,499	127,080	136,322	144,825	152,647	176,147
Total Equity	USD	335,515	671,031	803,529	930,610	1,066,932	1,211,757	1,364,404	1,540,551
TOTAL LIABILITIES AND EQUITY (I+II+	USD	838,788	1,677,577	1,872,792	1,894,749	1,925,949	1,965,651	2,013,175	2,080,280

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement — Samoa

Operating activities	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Operating profits	USD	0	0	132,499	127,080	136,322	144,825	152,647	176,147
Depreciations	USD	0	0	124,141	124,141	124,141	124,141	124,141	80,524
Operating profit before working capital c	USD	0	0	256,639	251,221	260,463	268,965	276,788	256,671
Investing activities									
Investments	USD	838,788	838,788	0	0	0	0	0	0
Net cash flow used for investing activitie	USD	838,788	838,788	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	167,758	167,758	0	0	0	0	0	0
Domestic government or commercial loa	USD	335,515	335,515	0	-67,103	-67,103	-67,103	-67,103	-67,103
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	167,758	167,758	0	0	0	0	0	0
Promotional loans	USD	167,758	167,758	0	-41,939	-41,939	-41,939	-41,939	-41,939
Net cash generated from financing activi	USD	838,788	838,788	0	-109,042	-109,042	-109,042	-109,042	-109,042
Changes in working capital	USD		0	-123,926	-7,745	-7,745	-7,745	-7,745	0
Net annual increase in Cash and Cash Eq	USD	0	0	132,714	134,433	143,675	152,178	160,000	147,628
Cash and Cash equivalents (Start of yea	USD		0	0	132,714	267,147	410,822	562,999	722,999
Cash and Cash Equivalents (End of year)	USD	0	0	132,714	267,147	410,822	562,999	722,999	870,628

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators Samoa		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			15%	15%	15%	15%	15%	15%
- EBITDA	USD			343,447	364,912	386,377	407,843	429,308	429,308
- EBITDA margin	%			15%	15%	15%	15%	15%	15%
- Debt-equity ratio	%			125%	96%	74%	56%	42%	30%
- DSCR	%			409%	219%	241%	264%	290%	307%
- Solvency ratio	%			24%	28%	34%	42%	52%	62%
Profitability									
- Return on total assets	%			7%	8%	9%	10%	11%	12%
- Return on equity	%			16%	16%	16%	16%	16%	17%
- Gross profit margin	%			15%	15%	15%	15%	15%	15%
- Net profit margin	%			6%	6%	7%	7%	8%	9%
- Return on investment	%			18%	18%	18%	18%	18%	18%
Asset management									
- Asset turnover	%			120%	126%	131%	135%	139%	135%
Financial solvency									
- Debt to equity ratio	%			125%	96%	74%	56%	42%	30%
- Total long term debt to total asset rati	%			54%	47%	41%	35%	28%	22%
Liquidity ratios									
- Current ratios				5.1	7.0	8.8	10.5	12.2	14.1
- Acid ratio				2.1	4.0	5.8	7.6	9.2	11.1
- Cash coverage ratio	%			347%	379%	457%	557%	688%	924%
- Working capital	USD			256,639	398,818	550,238	710,161	877,906	1,025,535

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix L Financial and Economic Analysis – Solomon Islands

This Appendix on the Solomon Islands recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for the Solomon Islands and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on the Solomon Islands, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 182 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	3,258,737	30
Mechanical parts	17%	1,107,971	15
Electrical parts	20%	1,303,495	10
Legal	5%	325,874	
Planning	8%	521,398	
Total investments	**100%**	**6,517,474**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on the Solomon Islands are estimated to be $6.5 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 183 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	3,209	2,247
Waste fraction 2 – ULAB	2,190	1,204
Waste fraction 3 – PET	3,135	1,724
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	44,116	30,881
Waste fraction 7 - Glass Bottles	2,572	386
Waste fraction 8 - Plastic Bags (Plastic Film)	2,136	747
Total waste	**57,358**	**37,190**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 57,358 tons of annual waste has been identified and delivered to the recycling facility and 37,190 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 184 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	3,209	623	1,999,467
Waste fraction 2 – ULAB	2,190	223	488,335
Waste fraction 3 – PET	3,135	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 4 - Scrap Steel	-	123	-
Waste fraction 5 - Steel Cans	-	123	-
Waste fraction 6 - Paper & Cardboard	44,116	-	-
Waste fraction 7 - Glass Bottles	2,572	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	2,136	-	-
Total	**57,358**		**2,487,802**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 185 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	3,209	19	60,979
Waste fraction 2 – ULAB	2,190	19	41,607
Waste fraction 3 – PET	3,135	19	59,571
Waste fraction 4 - Scrap Steel	-	19	-
Waste fraction 5 - Steel Cans	-	19	-
Waste fraction 6 - Paper & Cardboard	44,116	19	838,206
Waste fraction 7 - Glass Bottles	2,572	19	48,870
Waste fraction 8 - Plastic Bags (Plastic Film)	2,136	19	40,577
Total	**57,358**	-	**1,089,809**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 186 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	2,247	139	312,027
Waste fraction 2 – ULAB	1,204	104	125,460
Waste fraction 3 – PET	1,724	91	156,765
Waste fraction 4 - Scrap Steel	-	125	-
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	30,881	67	2,058,751
Waste fraction 7 - Glass Bottles	386	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	747	67	49,832
Total	**37,190**		**2,702,834**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 187 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	2,487,802	29%
Maintenance costs of the facility	391,048	5%
Transportation costs to the facility	1,089,809	13%
Operational costs of the facility	912,446	11%
Transportation costs from the facility	2,702,834	31%
Cost of depositing non-recycled waste fractions	1,008,421	12%
Total operational and maintenance costs	**8,592,361**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $8.6 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 188 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	2,069,044
Expected revenues from sales of waste fractions	8,061,033
Total revenue	**10,130,078**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $10 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 189 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 190 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	1,303,495	
Domestic government or commercial loans	2,606,990	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	1,303,495	8.0%
Promotional loans	1,303,495	4.0%
Total	**6,517,474**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on the Solomon Islands.

Table 191 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	8,419,518
IRR	18.6%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 18.6% and an NPV of the cash flow of $8.4 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 192 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	20,584,396	1,758,391
NPV of avoided cost of CO_2 through recycling	12,374,384	1,057,063
NPV of avoided CO_2 at the landfill	5,860,563	500,630
NPV of reduced leachate production	226,428	19,342
NPV of additional wages	4,266,200	364,434
Total NPV of economic benefits	**43,311,971**	**3,699,860**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $3.7 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.28 for the Solomon Islands recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen Solomon Islands

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			6,448,827	6,851,878	7,254,930	7,657,982	8,061,033	8,061,033
Gate fees and subsidies	USD			1,655,236	1,758,688	1,862,140	1,965,592	2,069,044	2,069,044
Total revenues	USD	0	0	8,104,062	8,610,566	9,117,070	9,623,574	10,130,078	10,130,078
Operational and maintenance costs									
Cost of waste	USD			1,990,241	2,114,631	2,239,022	2,363,412	2,487,802	2,487,802
Maintenance costs of the facility	USD			312,839	332,391	351,944	371,496	391,048	391,048
Transportation costs to the facility	USD			871,848	926,338	980,828	1,035,319	1,089,809	1,089,809
Operational costs of the facility	USD			729,957	775,579	821,202	866,824	912,446	912,446
Transportation costs from the facility	USD			2,162,267	2,297,409	2,432,551	2,567,692	2,702,834	2,702,834
Cost of depositing non-recycled waste fractions				806,737	857,158	907,579	958,000	1,008,421	1,008,421
Total operational and maintenance costs			0	6,873,889	7,303,507	7,733,125	8,162,743	8,592,361	8,592,361
EBITDA	USD		0	1,230,173	1,307,059	1,383,945	1,460,831	1,537,717	1,537,717
Depreciation and amortization	USD			482,293	482,293	482,293	482,293	482,293	312,839
EBIT	USD		0	747,880	824,766	901,652	978,538	1,055,424	1,224,878
Interest payment	USD		0	208,559	208,559	186,400	164,240	142,081	119,922
Profit or loss - before tax	USD		0	539,321	616,207	715,252	814,298	913,343	1,104,957
Tax	USD		0	107,864	123,241	143,050	162,860	182,669	220,991
Profit or loss - after tax	USD		0	431,457	492,966	572,202	651,438	730,674	883,965
Dividend payments	USD		0	0	85,047	126,994	171,924	219,598	275,722
Profit or loss after dividends	USD	0	0	431,457	407,919	445,208	479,514	511,076	608,243

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Solomon Islands								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	361,559	545,959	1,050,507	1,589,362	2,159,778	2,679,383
Inventory	USD	-	0	675,339	717,547	759,756	801,964	844,173	844,173
DSRA	USD		0	208,559	469,258	447,099	424,939	402,780	380,620
Total short term assets	USD	0	0	1,245,457	1,732,765	2,257,362	2,816,265	3,406,731	3,904,177
Long term assets									
Tangible long term assets	USD	2,835,101	5,670,203	5,357,364	5,044,525	4,731,686	4,418,848	4,106,009	3,793,170
Intangible assets amortization	USD	423,636	847,272	677,817	508,363	338,909	169,454	0	
Other long term assets	USD								
Total long term assets	USD	3,258,737	6,517,474	6,035,181	5,552,888	5,070,595	4,588,302	4,106,009	3,793,170
TOTAL ASSETS (I + II)	USD	3,258,737	6,517,474	7,280,638	7,285,653	7,327,957	7,404,567	7,512,739	7,697,347
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	331,707	352,439	373,170	393,902	414,634	414,634
Total short term liabilities	USD	0	0	331,707	352,439	373,170	393,902	414,634	414,634
Long Term Liabilities									
Domestic government or commercial loa	USD	1,303,495	2,606,990	2,606,990	2,346,291	2,085,592	1,824,893	1,564,194	1,303,495
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	651,747	1,303,495	1,303,495	1,140,558	977,621	814,684	651,747	488,811
Total long term loans	USD	1,955,242	3,910,485	3,910,485	3,486,849	3,063,213	2,639,577	2,215,941	1,792,305
TOTAL LIABILITIES (I+II)	USD	1,955,242	3,910,485	4,242,191	3,839,287	3,436,383	3,033,479	2,630,575	2,206,939
EQUITY									
Equity	USD	1,303,495	2,606,990	2,606,990	2,606,990	2,606,990	2,606,990	2,606,990	2,606,990
Retained earning	USD	0	0	0	431,457	839,376	1,284,584	1,764,099	2,275,175
Profit (Loss) for the current financial peri	USD	0	0	431,457	407,919	445,208	479,514	511,076	608,243
Total Equity	USD	1,303,495	2,606,990	3,038,447	3,446,366	3,891,574	4,371,088	4,882,165	5,490,408
TOTAL LIABILITIES AND EQUITY (I+II+	USD	3,258,737	6,517,474	7,280,638	7,285,653	7,327,957	7,404,567	7,512,739	7,697,347

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement — Solomon Islands

Operating activities	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Operating profits	USD	0	0	431,457	407,919	445,208	479,514	511,076	608,243
Depreciations	USD	0	0	482,293	482,293	482,293	482,293	482,293	312,839
Operating profit before working capital c	USD	0	0	913,750	890,212	927,501	961,808	993,369	921,082
Investing activities									
Investments	USD	3,258,737	3,258,737	0	0	0	0	0	0
Net cash flow used for investing activitie	USD	3,258,737	3,258,737	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	651,747	651,747	0	0	0	0	0	0
Domestic government or commercial loa	USD	1,303,495	1,303,495	0	-260,699	-260,699	-260,699	-260,699	-260,699
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	651,747	651,747	0	0	0	0	0	0
Promotional loans	USD	651,747	651,747	0	-162,937	-162,937	-162,937	-162,937	-162,937
Net cash generated from financing activi	USD	3,258,737	3,258,737	0	-423,636	-423,636	-423,636	-423,636	-423,636
Changes in working capital	USD		0	-343,632	-21,477	-21,477	-21,477	-21,477	0
Net annual increase in Cash and Cash Eq	USD	0	0	570,118	445,099	482,389	516,695	548,257	497,446
Cash and Cash equivalents (Start of yea	USD		0	0	570,118	1,015,218	1,497,606	2,014,301	2,562,557
Cash and Cash Equivalents (End of year)	USD	0	0	570,118	1,015,218	1,497,606	2,014,301	2,562,557	3,060,004

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators	Solomon Islands	2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			15%	15%	15%	15%	15%	15%
- EBITDA	USD			1,230,173	1,307,059	1,383,945	1,460,831	1,537,717	1,537,717
- EBITDA margin	%			15%	15%	15%	15%	15%	15%
- Debt-equity ratio	%			129%	101%	79%	60%	45%	33%
- DSCR	%			425%	203%	223%	245%	268%	283%
- Solvency ratio	%			22%	25%	31%	37%	46%	54%
Profitability									
- Return on total assets	%			6%	7%	8%	9%	10%	11%
- Return on equity	%			14%	14%	15%	15%	15%	16%
- Gross profit margin	%			15%	15%	15%	15%	15%	15%
- Net profit margin	%			5%	6%	6%	7%	7%	9%
- Return on investment	%			18%	18%	18%	18%	18%	18%
Asset management									
- Asset turnover	%			111%	118%	124%	130%	135%	132%
Financial solvency									
- Debt to equity ratio	%			129%	101%	79%	60%	45%	33%
- Total long term debt to total asset rati	%			54%	48%	42%	36%	29%	23%
Liquidity ratios									
- Current ratios				3.8	4.9	6.0	7.1	8.2	9.4
- Acid ratio				1.7	2.9	4.0	5.1	6.2	7.4
- Cash coverage ratio	%			307%	336%	407%	497%	614%	837%
- Working capital	USD			913,750	1,380,326	1,884,192	2,422,364	2,992,097	3,489,543

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix M Financial and Economic Analysis – Tonga

This Appendix on the Tonga recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Tonga and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Tonga, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 193 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	457,194	30
Mechanical parts	17%	155,446	15
Electrical parts	20%	182,878	10
Legal	5%	45,719	
Planning	8%	73,151	
Total investments	**100%**	**914,388**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Tonga are estimated to be $0.91 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 194 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	565	339
Waste fraction 2 – ULAB	352	264
Waste fraction 3 – PET	575	316
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	7,096	3,903
Waste fraction 7 - Glass Bottles	565	85
Waste fraction 8 - Plastic Bags (Plastic Film)	392	137
Total waste	**9,545**	**5,044**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 9,545 tons of annual waste has been identified and delivered to the recycling facility and 5,044 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 195 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	565	361	203,948
Waste fraction 2 – ULAB	352	85	29,940

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 3 – PET	575	-	-
Waste fraction 4 - Scrap Steel	-	-	-
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	7,096	-	-
Waste fraction 7 - Glass Bottles	565	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	392	-	-
Total	**9,545**		**233,888**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 196 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	565	30	16,949
Waste fraction 2 – ULAB	352	30	10,567
Waste fraction 3 – PET	575	30	17,262
Waste fraction 4 - Scrap Steel	-	30	-
Waste fraction 5 - Steel Cans	-	30	-
Waste fraction 6 - Paper & Cardboard	7,096	30	212,882
Waste fraction 7 - Glass Bottles	565	30	16,943
Waste fraction 8 - Plastic Bags (Plastic Film)	392	30	11,758
Total	**9,545**	-	**286,362**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 197 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	339	139	47,079
Waste fraction 2 – ULAB	264	104	27,518
Waste fraction 3 – PET	316	91	28,771
Waste fraction 4 - Scrap Steel	-	125	-
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	3,903	67	260,189
Waste fraction 7 - Glass Bottles	85	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	137	67	9,145
Total	**5,044**		**372,703**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 198 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	233,888	18%
Maintenance costs of the facility	54,863	4%
Transportation costs to the facility	286,362	22%
Operational costs of the facility	128,014	10%
Transportation costs from the facility	372,703	29%
Cost of depositing non-recycled waste fractions	225,052	17%
Total operational and maintenance costs	**1,300,883**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $1.3 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 199 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	261,490
Expected revenues from sales of waste fractions	1,228,618
Total revenue	**1,490,109**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $1.5 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 200 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 201 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	182,878	
Domestic government or commercial loans	365,755	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	182,878	8.0%
Promotional loans	182,878	4.0%
Total	**914,388**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Tonga.

Table 202 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	928,469
IRR	16.2%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 16.2% and an NPV of the cash flow of $928,469 based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 203 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	2,792,021	238,504
NPV of avoided cost of CO_2 through recycling	1,843,035	157,438
NPV of avoided CO_2 at the landfill	740,670	63,271
NPV of reduced leachate production	30,712	2,624
NPV of additional wages	206,969	17,680
Total NPV of economic benefits	**5,613,406**	**479,517**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $479,517 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.23 for the Tonga recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen Tonga

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			982,895	1,044,326	1,105,757	1,167,187	1,228,618	1,228,618
Gate fees and subsidies	USD			209,192	222,267	235,341	248,416	261,490	261,490
Total revenues	USD	0	0	1,192,087	1,266,592	1,341,098	1,415,603	1,490,109	1,490,109
Operational and maintenance costs									
Cost of waste	USD			187,110	198,805	210,499	222,194	233,888	233,888
Maintenance costs of the facility	USD			43,891	46,634	49,377	52,120	54,863	54,863
Transportation costs to the facility	USD			229,090	243,408	257,726	272,044	286,362	286,362
Operational costs of the facility	USD			102,411	108,812	115,213	121,614	128,014	128,014
Transportation costs from the facility	USD			298,163	316,798	335,433	354,068	372,703	372,703
Cost of depositing non-recycled waste fractions				180,042	191,294	202,547	213,799	225,052	225,052
Total operational and maintenance costs			0	1,040,706	1,105,750	1,170,794	1,235,839	1,300,883	1,300,883
EBITDA	USD		0	151,381	160,842	170,303	179,764	189,226	189,226
Depreciation and amortization	USD			67,665	67,665	67,665	67,665	67,665	43,891
EBIT	USD		0	83,716	93,177	102,638	112,100	121,561	145,335
Interest payment	USD		0	29,260	29,260	26,151	23,043	19,934	16,825
Profit or loss - before tax	USD		0	54,455	63,917	76,487	89,057	101,627	128,510
Tax	USD		0	10,891	12,783	15,297	17,811	20,325	25,702
Profit or loss - after tax	USD		0	43,564	51,133	61,190	71,246	81,302	102,808
Dividend payments	USD		0	0	7,537	12,146	17,192	22,638	29,369
Profit or loss after dividends	USD	0	0	43,564	43,597	49,043	54,054	58,664	73,439

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet Tonga

ASSETS	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Short term assets									
Cash	USD	0	0	13,813	24,804	80,926	142,059	207,801	268,804
Inventory	USD	-	0	99,341	105,549	111,758	117,967	124,176	124,176
DSRA	USD		0	29,260	65,836	62,727	59,618	56,509	53,400
Total short term assets	USD	0	0	142,414	196,190	255,411	319,644	388,486	446,380
Long term assets									
Tangible long term assets	USD	397,759	795,518	751,627	707,736	663,846	619,955	576,065	532,174
Intangible assets amortization	USD	59,435	118,870	95,096	71,322	47,548	23,774	0	
Other long term assets	USD								
Total long term assets	USD	457,194	914,388	846,723	779,059	711,394	643,729	576,065	532,174
TOTAL ASSETS (I + II)	USD	457,194	914,388	989,138	975,248	966,805	963,373	964,550	978,554
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	31,185	33,134	35,083	37,032	38,981	38,981
Total short term liabilities	USD	0	0	31,185	33,134	35,083	37,032	38,981	38,981
Long Term Liabilities									
Domestic government or commercial loa	USD	182,878	365,755	365,755	329,180	292,604	256,029	219,453	182,878
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	91,439	182,878	182,878	160,018	137,158	114,299	91,439	68,579
Total long term loans	USD	274,316	548,633	548,633	489,198	429,762	370,327	310,892	251,457
TOTAL LIABILITIES (I+II)	USD	274,316	548,633	579,818	522,332	464,846	407,359	349,873	290,438
EQUITY									
Equity	USD	182,878	365,755	365,755	365,755	365,755	365,755	365,755	365,755
Retained earning	USD	0	0	0	43,564	87,161	136,204	190,258	248,922
Profit (Loss) for the current financial peri	USD	0	0	43,564	43,597	49,043	54,054	58,664	73,439
Total Equity	USD	182,878	365,755	409,320	452,916	501,960	556,013	614,677	688,116
TOTAL LIABILITIES AND EQUITY (I+II+	USD	457,194	914,388	989,138	975,248	966,805	963,373	964,550	978,554

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement — Tonga

Operating activities	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Operating profits	USD	0	0	43,564	43,597	49,043	54,054	58,664	73,439
Depreciations	USD	0	0	67,665	67,665	67,665	67,665	67,665	43,891
Operating profit before working capital c	USD	0	0	111,229	111,262	116,708	121,719	126,328	117,329
Investing activities									
Investments	USD	457,194	457,194	0	0	0	0	0	0
Net cash flow used for investing activitie	USD	457,194	457,194	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	91,439	91,439	0	0	0	0	0	0
Domestic government or commercial loa	USD	182,878	182,878	0	-36,576	-36,576	-36,576	-36,576	-36,576
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	91,439	91,439	0	0	0	0	0	0
Promotional loans	USD	91,439	91,439	0	-22,860	-22,860	-22,860	-22,860	-22,860
Net cash generated from financing activi	USD	457,194	457,194	0	-59,435	-59,435	-59,435	-59,435	-59,435
Changes in working capital	USD		0	-68,156	-4,260	-4,260	-4,260	-4,260	0
Net annual increase in Cash and Cash Eq	USD	0	0	43,074	47,567	53,013	58,024	62,633	57,894
Cash and Cash equivalents (Start of yea	USD		0	0	43,074	90,640	143,653	201,677	264,310
Cash and Cash Equivalents (End of year)	USD	0	0	43,074	90,640	143,653	201,677	264,310	322,204

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators Tonga		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			13%	13%	13%	13%	13%	13%
- EBITDA	USD			151,381	160,842	170,303	179,764	189,226	189,226
- EBITDA margin	%			13%	13%	13%	13%	13%	13%
- Debt-equity ratio	%			134%	108%	86%	67%	51%	37%
- DSCR	%			284%	177%	194%	213%	233%	248%
- Solvency ratio	%			19%	23%	28%	34%	43%	51%
Profitability									
- Return on total assets	%			4%	5%	6%	7%	8%	11%
- Return on equity	%			11%	11%	12%	13%	13%	15%
- Gross profit margin	%			13%	13%	13%	13%	13%	13%
- Net profit margin	%			4%	4%	5%	5%	5%	7%
- Return on investment	%			15%	15%	15%	15%	15%	15%
Asset management									
- Asset turnover	%			121%	130%	139%	147%	154%	152%
Financial solvency									
- Debt to equity ratio	%			134%	108%	86%	67%	51%	37%
- Total long term debt to total asset rati	%			55%	50%	44%	38%	32%	26%
Liquidity ratios									
- Current ratios				4.6	5.9	7.3	8.6	10.0	11.5
- Acid ratio				1.4	2.7	4.1	5.4	6.8	8.3
- Cash coverage ratio	%			249%	275%	334%	409%	508%	711%
- Working capital	USD			111,229	163,055	220,328	282,611	349,505	407,399

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix N Financial and Economic Analysis – Tuvalu

This Appendix on the Tuvalu recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Tuvalu and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Tuvalu, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 204 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	330,284	30
Mechanical parts	17%	112,297	15
Electrical parts	20%	132,114	10
Legal	5%	33,028	
Planning	8%	52,846	
Total investments	**100%**	**660,569**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Tuvalu are estimated to be $660,569.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 205 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	61	55
Waste fraction 2 – ULAB	39	35
Waste fraction 3 – PET	62	53
Waste fraction 4 - Scrap Steel	1,420	1,207
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	785	432
Waste fraction 7 - Glass Bottles	234	59
Waste fraction 8 - Plastic Bags (Plastic Film)	42	15
Total waste	**2,643**	**1,855**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 2,643 tons of annual waste has been identified and delivered to the recycling facility and 1,855 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 206 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	61	0	0
Waste fraction 2 – ULAB	39	0	0
Waste fraction 3 – PET	62	0	0

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 4 - Scrap Steel	1,420	0	0
Waste fraction 5 - Steel Cans	-	0	0
Waste fraction 6 - Paper & Cardboard	785	0	0
Waste fraction 7 - Glass Bottles	234	0	0
Waste fraction 8 - Plastic Bags (Plastic Film)	42	0	0
Total	**2,643**	**0**	**0**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 207 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	61	22	1,351
Waste fraction 2 – ULAB	39	22	857
Waste fraction 3 – PET	62	22	1,366
Waste fraction 4 - Scrap Steel	1,420	22	31,230
Waste fraction 5 - Steel Cans	-	22	-
Waste fraction 6 - Paper & Cardboard	785	22	17,264
Waste fraction 7 - Glass Bottles	234	22	5,150
Waste fraction 8 - Plastic Bags (Plastic Film)	42	22	930
Total	**2,643**	**-**	**58,148**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 208 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	55	278	15,355
Waste fraction 2 – ULAB	35	208	7,303
Waste fraction 3 – PET	53	455	23,990
Waste fraction 4 - Scrap Steel	1,207	250	301,655
Waste fraction 5 - Steel Cans	-	250	-
Waste fraction 6 - Paper & Cardboard	432	333	143,863
Waste fraction 7 - Glass Bottles	59	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	15	333	4,934
Total	**1,855**		**497,100**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 209 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	-	0%
Maintenance costs of the facility	39,634	5%
Transportation costs to the facility	58,148	8%
Operational costs of the facility	92,480	13%
Transportation costs from the facility	497,100	68%
Cost of depositing non-recycled waste fractions	39,423	5%
Total operational and maintenance costs	**726,785**	**100%**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $726,785.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 210 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	1,188,362
Expected revenues from sales of waste fractions	376,891
Total revenue	**1,565,253**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $1.6 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 211 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 212 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	132,114	
Domestic government or commercial loans	264,228	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	132,114	8.0%
Promotional loans	132,114	4.0%
Total	**660,569**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Tuvalu.

Table 213 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	7,361,376
IRR	78.2%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 78% and an NPV of the cash flow of $7.4 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 214 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	1,026,533	87,690
NPV of avoided cost of CO_2 through recycling	1,031,262	88,094
NPV of avoided CO_2 at the landfill	81,906	6,997
NPV of reduced leachate production	11,292	965
NPV of additional wages	586,092	50,066
Total NPV of economic benefits	**2,737,084**	**233,811**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $233,811 during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 0.78 for the Tuvalu recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen Tuvalu

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			301,513	320,357	339,202	358,046	376,891	376,891
Gate fees and subsidies	USD			950,689	1,010,108	1,069,526	1,128,944	1,188,362	1,188,362
Total revenues	USD	0	0	1,252,202	1,330,465	1,408,727	1,486,990	1,565,253	1,565,253
Operational and maintenance costs									
Cost of waste	USD			0	0	0	0	0	0
Maintenance costs of the facility	USD			31,707	33,689	35,671	37,652	39,634	39,634
Transportation costs to the facility	USD			46,519	49,426	52,333	55,241	58,148	58,148
Operational costs of the facility	USD			73,984	78,608	83,232	87,856	92,480	92,480
Transportation costs from the facility	USD			397,680	422,535	447,390	472,245	497,100	497,100
Cost of depositing non-recycled waste fractions				31,538	33,510	35,481	37,452	39,423	39,423
Total operational and maintenance costs			0	581,428	617,767	654,107	690,446	726,785	726,785
EBITDA	USD		0	670,774	712,697	754,621	796,544	838,468	838,468
Depreciation and amortization	USD			48,882	48,882	48,882	48,882	48,882	31,707
EBIT	USD		0	621,892	663,815	705,739	747,662	789,585	806,760
Interest payment	USD		0	21,138	21,138	18,892	16,646	14,400	12,154
Profit or loss - before tax	USD		0	600,754	642,677	686,846	731,016	775,185	794,606
Tax	USD		0	120,151	128,535	137,369	146,203	155,037	158,921
Profit or loss - after tax	USD		0	480,603	514,142	549,477	584,813	620,148	635,685
Dividend payments	USD		0	0	75,142	113,043	150,738	188,245	223,994
Profit or loss after dividends	USD	0	0	480,603	439,000	436,434	434,074	431,903	411,691

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Tuvalu								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	403,997	815,997	1,254,100	1,689,844	2,123,416	2,526,123
Inventory	USD	-	0	104,350	110,872	117,394	123,916	130,438	130,438
DSRA	USD		0	21,138	47,561	45,315	43,069	40,823	38,577
Total short term assets	USD	0	0	529,485	974,430	1,416,809	1,856,829	2,294,677	2,695,138
Long term assets									
Tangible long term assets	USD	287,347	574,695	542,988	511,280	479,573	447,866	416,158	384,451
Intangible assets amortization	USD	42,937	85,874	68,699	51,524	34,350	17,175	0	
Other long term assets	USD								
Total long term assets	USD	330,284	660,569	611,687	562,805	513,923	465,040	416,158	384,451
TOTAL ASSETS (I + II)	USD	330,284	660,569	1,141,172	1,537,234	1,930,732	2,321,869	2,710,835	3,079,589
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	0	0	0	0	0	0
Total short term liabilities	USD	0	0	0	0	0	0	0	0
Long Term Liabilities									
Domestic government or commercial loa	USD	132,114	264,228	264,228	237,805	211,382	184,959	158,537	132,114
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	66,057	132,114	132,114	115,600	99,085	82,571	66,057	49,543
Total long term loans	USD	198,171	396,341	396,341	353,404	310,467	267,530	224,593	181,656
TOTAL LIABILITIES (I+II)	USD	198,171	396,341	396,341	353,404	310,467	267,530	224,593	181,656
EQUITY									
Equity	USD	132,114	264,228	264,228	264,228	264,228	264,228	264,228	264,228
Retained earning	USD	0	0	0	480,603	919,603	1,356,037	1,790,111	2,222,014
Profit (Loss) for the current financial peri	USD	0	0	480,603	439,000	436,434	434,074	431,903	411,691
Total Equity	USD	132,114	264,228	744,831	1,183,830	1,620,264	2,054,339	2,486,242	2,897,933
TOTAL LIABILITIES AND EQUITY (I+II+	USD	330,284	660,569	1,141,172	1,537,234	1,930,732	2,321,869	2,710,835	3,079,589

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement — Tuvalu

Operating activities	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Operating profits	USD	0	0	480,603	439,000	436,434	434,074	431,903	411,691
Depreciations	USD	0	0	48,882	48,882	48,882	48,882	48,882	31,707
Operating profit before working capital c	USD	0	0	529,485	487,882	485,316	482,956	480,785	443,398
Investing activities									
Investments	USD	330,284	330,284	0	0	0	0	0	0
Net cash flow used for investing activitie	USD	330,284	330,284	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	66,057	66,057	0	0	0	0	0	0
Domestic government or commercial loa	USD	132,114	132,114	0	-26,423	-26,423	-26,423	-26,423	-26,423
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	66,057	66,057	0	0	0	0	0	0
Promotional loans	USD	66,057	66,057	0	-16,514	-16,514	-16,514	-16,514	-16,514
Net cash generated from financing activi	USD	330,284	330,284	0	-42,937	-42,937	-42,937	-42,937	-42,937
Changes in working capital	USD		0	-104,350	-6,522	-6,522	-6,522	-6,522	0
Net annual increase in Cash and Cash Eq	USD	0	0	425,135	438,423	435,858	433,498	431,326	400,461
Cash and Cash equivalents (Start of yea	USD		0	0	425,135	863,558	1,299,415	1,732,913	2,164,239
Cash and Cash Equivalents (End of year)	USD	0	0	425,135	863,558	1,299,415	1,732,913	2,164,239	2,564,700

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators Tuvalu		2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			54%	54%	54%	54%	54%	54%
- EBITDA	USD			670,774	712,697	754,621	796,544	838,468	838,468
- EBITDA margin	%			54%	54%	54%	54%	54%	54%
- Debt-equity ratio	%			53%	30%	19%	13%	9%	6%
- DSCR	%			2680%	1102%	1210%	1326%	1451%	1522%
- Solvency ratio	%			134%	159%	193%	237%	298%	367%
Profitability									
- Return on total assets	%			42%	33%	28%	25%	23%	21%
- Return on equity	%			65%	43%	34%	28%	25%	22%
- Gross profit margin	%			54%	54%	54%	54%	54%	54%
- Net profit margin	%			38%	39%	39%	39%	40%	41%
- Return on investment	%			115%	115%	115%	115%	115%	115%
Asset management									
- Asset turnover	%			110%	87%	73%	64%	58%	51%
Financial solvency									
- Debt to equity ratio	%			53%	30%	19%	13%	9%	6%
- Total long term debt to total asset rati	%			35%	23%	16%	12%	8%	6%
Liquidity ratios									
- Current ratios				-	-	-	-	-	-
- Acid ratio				-	-	-	-	-	-
- Cash coverage ratio	%			2374%	2532%	3008%	3613%	4406%	5330%
- Working capital	USD			529,485	974,430	1,416,809	1,856,829	2,294,677	2,695,138

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix O Financial and Economic Analysis – Vanuatu

This Appendix on the Vanuatu recycling project identifies the costs and benefits associated with the installation and operation of the recommended recycling option. The Benefit-Cost Ratio divides the present value of the expected benefit by the present value of the costs, which determines the viability and value of the project.

The recycling facility is assessed in a two-step approach. First is calculating the financial profitability and the sustainability. The financial profitability is assessed by the project's Net Present Value (NPV) and the Internal Rate of Interest (IRI) of the cash flow, whereas the financial sustainability is assessed by the annual cash flow in the financial statements. In the second step, the economic costs and benefits of the recycling facility are identified and outlined, along with the adjustments made to the financial calculations to arrive at the Benefit-Cost Ratio calculations. All assumptions made for Vanuatu and the resulting financial and economic results are presented in this Appendix.

1. Financial Profitability and Sustainability of the Recycling Facility

The financial and economic profitability of the recycling facility is calculated based on the standard methodology. The analysis period has been assumed to be 20 years. All calculations are done in US dollars.

Investment costs in the recycling facility

Capital expenditure is the total investment cost required to procure the recycling facility, the land, the buildings, the equipment, and the machinery. The investment costs of the recycling facility are assessed based on similar facilities implemented elsewhere.

It is assumed that it will take 2 years to plan, construct, and implement the recycling facility on Vanuatu, i.e., in 2023 and 2024 and operations will commence in 2025.

The investment costs are divided into civil works, mechanical, and electrical parts, with different economic lifetimes. These assumptions are shown in the Table below.

Table 215 Investment Costs in the Recycling Facility and the Economic Lifetime of the Assets

Investment cost component	% Structure	Investment cost breakdown	Lifetime of asset in years
Civil works	50%	947,179	30
Mechanical parts	17%	322,041	15
Electrical parts	20%	378,872	10
Legal	5%	94,718	
Planning	8%	151,549	
Total investments	**100%**	**1,894,358**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In addition to the above physical investments, it has been assumed that legal and planning costs constitute 13% of the total investment and these costs are assumed amortized over a 5-year period. The total investment costs on Vanuatu are estimated to be $1.9 million.

To continue recycling the waste requires that the capital equipment of the recycling facility is up-to-date and properly maintained and rehabilitated. Hence, whenever an asset such as the electrical equipment reaches the end of its economic lifetime, it is assumed replaced. For example, if the life expectancy of electrical equipment is 10 years, the calculation assumes that, after 10 years, it is worn out and is replaced by new electrical equipment. These rehabilitation costs are assumed financed from the revenue generated from the operations of the recycling facility.

The information on the economic lifetime of the assets in the above Table is used to calculate their annual depreciation and the required rehabilitation/reinvestments over the 20-year analysis period. A straight-line depreciation is assumed for each asset in line with its life expectancy. At the end of the analysis period, the scrap value of the assets has been included in the cash flow calculations. The scrap value is calculated based on the investment costs less the accumulated depreciation.

Waste streams

The annual amount of waste has previously been assessed in this report. The different waste fractions and streams going to the recycling facility, together with the total materials recycled, are summarized in the Table below.

Table 216 Annual Amount of Waste Fractions and Streams to the Recycling Facility

Waste fraction	Annual waste (tons)	Total materials recycled (tons)
Waste fraction 1 - Aluminum Cans	1,489	893
Waste fraction 2 – ULAB	991	594
Waste fraction 3 – PET	1,472	810
Waste fraction 4 - Scrap Steel	-	-
Waste fraction 5 - Steel Cans	-	-
Waste fraction 6 - Paper & Cardboard	19,960	9,980
Waste fraction 7 - Glass Bottles	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	1,003	351
Total waste	**24,916**	**12,629**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

In total 24,916 tons of annual waste has been identified and delivered to the recycling facility and 12,629 tons of waste are recycled. The difference is deposited at the landfill.

Cost of waste

The recycling facility must procure part of the waste. The unit procurement cost of the waste and the total cost for acquiring the waste is presented in the Table below.

Table 217 Procurement Cost of Waste to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	1,489	362	539,036
Waste fraction 2 – ULAB	991	85	84,218
Waste fraction 3 – PET	1,472	-	-

Waste fraction	Annual waste (tons)	Unit cost of waste (USD/ton)	Costs to the facility (USD)
Waste fraction 4 - Scrap Steel	-	-	-
Waste fraction 5 - Steel Cans	-	-	-
Waste fraction 6 - Paper & Cardboard	19,960	-	-
Waste fraction 7 - Glass Bottles	-	-	-
Waste fraction 8 - Plastic Bags (Plastic Film)	1,003	-	-
Total	24,916		623,254

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Transportation cost

The total transportation cost to the recycling facility has been assessed based on the amount of waste and the unit transportation cost to the recycling facility. These figures are presented in the Table below.

Table 218 Transportation Cost to the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs to the facility (USD)
Waste fraction 1 - Aluminum Cans	1,489	27	40,204
Waste fraction 2 – ULAB	991	27	26,752
Waste fraction 3 – PET	1,472	27	39,757
Waste fraction 4 - Scrap Steel	-	27	-
Waste fraction 5 - Steel Cans	-	27	-
Waste fraction 6 - Paper & Cardboard	19,960	27	538,932
Waste fraction 7 - Glass Bottles	-	27	-
Waste fraction 8 - Plastic Bags (Plastic Film)	1,003	27	27,081
Total	**24,916**	-	**672,726**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total transportation cost to the potential off-taker has been assessed based on the amount of waste and the unit transportation cost. These figures are presented in the Table below.

Table 219 Transportation Cost from the Recycling Facility

Waste fraction	Annual waste (tons)	Unit transportation cost (USD/ton)	Transportation costs from the facility (USD)
Waste fraction 1 - Aluminum Cans	893	139	124,088
Waste fraction 2 – ULAB	594	104	61,925
Waste fraction 3 – PET	810	91	73,624
Waste fraction 4 - Scrap Steel	-	125	-
Waste fraction 5 - Steel Cans	-	125	-
Waste fraction 6 - Paper & Cardboard	9,980	67	665,348
Waste fraction 7 - Glass Bottles	-	0	-
Waste fraction 8 - Plastic Bags (Plastic Film)	351	67	23,403
Total	**12,629**		**948,389**

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of depositing non-recycled waste fractions

The waste that is not recycled is deposited at the landfill at a unit cost of $50/ton.

Annual operational and maintenance costs

The annual operation and maintenance costs at the recycling facility have been assessed based on experience from similar facilities in the area, as well as from comparable recycling facilities. It has been assumed that operation and maintenance costs constitute 20% of the investment. The following annual operational and maintenance costs have been assumed.

Table 220 Operational and Maintenance Costs

Operational and maintenance costs	Annual costs (USD)	Percentage distribution
Cost of waste	623,254	19%
Maintenance costs of the facility	113,661	4%
Transportation costs to the facility	672,726	21%
Operational costs of the facility	265,210	8%
Transportation costs from the facility	948,389	29%
Cost of depositing non-recycled waste fractions	614,337	19%
Total operational and maintenance costs	3,237,578	100%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annual operation and maintenance costs amount to $3.2 million.

Revenues

The recycling facility revenues are either from a subsidy or gate fees, or sales of recycled waste fractions. The revenues from the two sources are outlined in the Table below.

Table 221 Revenues

Revenues	Annual revenues (USD)
Gate fees or subsidies	668,675
Expected revenues from sales of waste fractions	3,107,320
Total revenue	**3,775,995**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Annual revenues amount to $3.8 million. This annual revenue is based on the following unit sales prices outlined in the Table below.

However, it has been assumed that the revenues and costs gradually will approach the above costs and revenues in year 5 after commissioning of the recycling facility. It has been assumed that a gradual ramp-up of revenues and costs is going from 80% in the first year of operation to 100% in the fifth year of operation.

Table 222 Unit Sales Price

Waste fraction	Unit sales price (USD/tons)
Waste fraction 1 - Aluminum Cans	1,275
Waste fraction 2 – ULAB	680
Waste fraction 3 – PET	553
Waste fraction 4 - Scrap Steel	167
Waste fraction 5 - Steel Cans	167
Waste fraction 6 - Paper & Cardboard	106
Waste fraction 7 - Glass Bottles	63
Waste fraction 8 - Plastic Bags (Plastic Film)	160

PET = polyethylene, ULAB = used lead-acid battery.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Financing structure, assumptions and the WACC

The following financing structure assumptions have been made:

Table 223 Financing Assumptions

Financing structure	USD	Required return or interest rate
Domestic government grants	378,872	
Domestic government or commercial loans	757,743	6.0%
International grants	-	
International loans	-	4.0%
Equity from owners	378,872	8.0%
Promotional loans	378,872	4.0%
Total	**1,894,358**	

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

It has not been possible to outline a specific financing structure at this pre-feasibility stage. But given that many of the smaller islands' debt management strategies only allow for external borrowing operations, with a large grant element and significant grace periods, the specific islands' recycling facility will not be attractive as a stand-alone project financed by any International Financing Institution (IFI). Further, the size of most of the recycling projects is also not attractive for an IFI. IFI financing may only be attracted if several recycling facilities are bundled. Hence, only domestic grant and loan financing, as well as potential promotional financing, has been assumed for the recycling facilities on 12 of the islands. The size of the recycling hub investment on Fiji and PNG allows, however, for international financing.

The promotional loans are assumed to be for 8 years with a 4% real interest rate and a 1-year grace period, whereas the domestic or commercial loans are assumed to have a 10-year repayment period and carry a 6% real interest rate. The international loans are assumed to be 15 years with a 4% real interest rate and a 1-year grace period. For the time being, no additional fees, such as commitment fees, upfront fees, or agency fees, are assumed on the loans. The required real return on the equity from the Project Sponsor has been assumed to be 8%. The Project Sponsor or equity provider is assumed to receive dividends if there is a positive annual net result and there is a positive cash balance in the previous years.

All the different revenue and cost items are summarized in the annual cash flow. The annual cash flow comprises the initial investments, the reinvestments/rehabilitation, the fixed and variable operational and maintenance costs, and the scrap value at the end of the analysis period. This cash flow is discounted to an NPV with the weighted average cost of capital (WACC). The WACC is calculated as the weighted average of the above financing structure and attains a real value of 6%.

This discounted cash flow generates the NPV of the specific recycling facility. The same cash flow is used to calculate the IRR of the recycling facility.

2. Financial Profitability Analysis

The Table below shows the financial profitability of the recycling facility on Vanuatu.

Table 224 Profitability of the Recycling Facility

Profitability of the recycling facility	
WACC	6.0%
NPV of annual cash flow	3,496,458
IRR	23.0%

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The recycling facility gives an IRR of 23% and an NPV of the cash flow of $3.5 million based on a real discount rate of 6.0%. Hence, based on the assumptions outlined above, the profitability of the recycling facility is good.

3. Economic Benefit-Cost Analysis

To calculate the economic costs and benefits of the recycling facility project, different corrections to the cash flow must be made. In addition, the economic cost and benefits must—to the extent

possible—be quantified and monetized. The methodology for doing this is explained in detail in chapter 6.

Economic benefits

The following economic benefits have been identified and quantified:

1. Resource savings
2. Avoided cost of CO_2 through recycling
3. Reduction in GHG emissions
4. Reduced leachate generated due to reduced amount of waste deposited at the landfill.
5. Employment effects

The recycling facility's annual economic benefits are summarized in the Table below.

Table 225 Economic Benefits Quantified

Economic benefit	2023 (USD)	Annualized economic benefits
NPV of resource savings	6,990,096	597,118
NPV of avoided cost of CO_2 through recycling	4,763,052	406,877
NPV of avoided CO_2 at the landfill	1,894,020	161,794
NPV of reduced leachate production	76,891	6,568
NPV of additional wages	2,537,717	216,781
Total NPV of economic benefits	**16,261,777**	**1,389,138**

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

The total annualized economic benefits are calculated to be $1.4 million during the 20-year analysis period of the recycling facility.

It has not been possible to monetize negative externalities like noise, and odors following continuous use of the landfill. In addition, health and environmental hazards (variations in air contamination) have likewise not been possible to monetize. However, if quantified, it would have benefitted the project to a larger extent. Only contamination of water (not drinking water) and soil has been quantified.

Economic results

Correcting for the fiscal transfers in the cash flow and including the economic cash flow provides the basis for calculating the total benefit of the recycling project. This economic cash flow is discounted to an Economic NPV. Dividing the Economic NPV of the financial and economic benefits by the NPV of the financial and economic costs gives the Benefit-Cost Ratio of the recycling project. A ratio above 1 indicates that the economic benefits are higher than the economic costs of the recycling facility and vice versa. However, when the NPV of the recycling facility is positive, the Benefit-Cost Ratio is above 1 before adding the economic effects. When adding the economic benefits to the adjusted financial cash flow, we obtain a Benefit-Cost Ratio of 1.32 for the Vanuatu recycling project.

4. Financial Sustainability Analysis

Financial forecast

The financial statements are summarized for the Project Sponsor of the recycling facility until 2030.

With the given assumptions, the recycling facility project is financially sustainable as there are positive cash flows every year, and the Project Sponsor can repay loans, as well as pay dividends. Given the size of the annual profit, the Project Sponsor will accumulate equity after having serviced the annual loan obligations.

Profit and loss statemen Vanuatu

	Unit	2023	2024	2025	2026	2027	2028	2029	2030
Expected revenues from sales of waste f	USD			2,485,856	2,641,222	2,796,588	2,951,954	3,107,320	3,107,320
Gate fees and subsidies	USD			534,940	568,374	601,808	635,241	668,675	668,675
Total revenues	USD	0	0	3,020,796	3,209,596	3,398,395	3,587,195	3,775,995	3,775,995
Operational and maintenance costs									
Cost of waste	USD			498,603	529,766	560,929	592,092	623,254	623,254
Maintenance costs of the facility	USD			90,929	96,612	102,295	107,978	113,661	113,661
Transportation costs to the facility	USD			538,181	571,817	605,454	639,090	672,726	672,726
Operational costs of the facility	USD			212,168	225,429	238,689	251,950	265,210	265,210
Transportation costs from the facility	USD			758,711	806,130	853,550	900,969	948,389	948,389
Cost of depositing non-recycled waste fractions				491,469	522,186	552,903	583,620	614,337	614,337
Total operational and maintenance costs			0	2,590,062	2,751,941	2,913,820	3,075,699	3,237,578	3,237,578
EBITDA	USD		0	430,734	457,654	484,575	511,496	538,417	538,417
Depreciation and amortization	USD			140,183	140,183	140,183	140,183	140,183	90,929
EBIT	USD		0	290,551	317,472	344,393	371,314	398,234	447,488
Interest payment	USD		0	60,619	60,619	54,179	47,738	41,297	34,856
Profit or loss - before tax	USD		0	229,932	256,852	290,214	323,576	356,937	412,632
Tax	USD		0	45,986	51,370	58,043	64,715	71,387	82,526
Profit or loss - after tax	USD		0	183,945	205,482	232,171	258,861	285,550	330,105
Dividend payments	USD		0	0	28,878	45,662	63,239	81,545	101,950
Profit or loss after dividends	USD	0	0	183,945	176,604	186,509	195,622	204,005	228,155

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Balance sheet	Vanuatu								
ASSETS	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short term assets									
Cash	USD	0	0	94,876	202,215	401,674	610,247	827,202	1,029,594
Inventory	USD	-	0	251,733	267,466	283,200	298,933	314,666	314,666
DSRA	USD		0	60,619	136,394	129,953	123,512	117,071	110,631
Total short term assets	USD	0	0	407,228	606,075	814,827	1,032,692	1,258,940	1,454,891
Long term assets									
Tangible long term assets	USD	824,046	1,648,092	1,557,163	1,466,233	1,375,304	1,284,375	1,193,446	1,102,517
Intangible assets amortization	USD	123,133	246,267	197,013	147,760	98,507	49,253	0	
Other long term assets	USD								
Total long term assets	USD	947,179	1,894,358	1,754,176	1,613,993	1,473,811	1,333,628	1,193,446	1,102,517
TOTAL ASSETS (I + II)	USD	947,179	1,894,358	2,161,404	2,220,068	2,288,638	2,366,320	2,452,386	2,557,407
LIABILITIES AND EQUITY	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Short Term Liabilities									
Short term liability	USD	0	0	83,101	88,294	93,488	98,682	103,876	103,876
Total short term liabilities	USD	0	0	83,101	88,294	93,488	98,682	103,876	103,876
Long Term Liabilities									
Domestic government or commercial loa	USD	378,872	757,743	757,743	681,969	606,195	530,420	454,646	378,872
International loans	USD	0	0	0	0	0	0	0	0
Promotional loans	USD	189,436	378,872	378,872	331,513	284,154	236,795	189,436	142,077
Total long term loans	USD	568,307	1,136,615	1,136,615	1,013,482	890,348	767,215	644,082	520,949
TOTAL LIABILITIES (I+II)	USD	568,307	1,136,615	1,219,716	1,101,776	983,837	865,897	747,958	624,824
EQUITY									
Equity	USD	378,872	757,743	757,743	757,743	757,743	757,743	757,743	757,743
Retained earning	USD	0	0	0	183,945	360,549	547,058	742,680	946,685
Profit (Loss) for the current financial peri	USD	0	0	183,945	176,604	186,509	195,622	204,005	228,155
Total Equity	USD	378,872	757,743	941,689	1,118,292	1,304,801	1,500,423	1,704,428	1,932,583
TOTAL LIABILITIES AND EQUITY (I+II+	USD	947,179	1,894,358	2,161,404	2,220,068	2,288,638	2,366,320	2,452,386	2,557,407

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cash flow statement	Vanuatu								
Operating activities	**Unit**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Operating profits	USD	0	0	183,945	176,604	186,509	195,622	204,005	228,155
Depreciations	USD	0	0	140,183	140,183	140,183	140,183	140,183	90,929
Operating profit before working capital c	USD	0	0	324,128	316,786	326,691	335,804	344,188	319,084
Investing activities									
Investments	USD	947,179	947,179	0	0	0	0	0	0
Net cash flow used for investing activitie	USD	947,179	947,179	0	0	0	0	0	0
Financing activities									
Domestic government grants	USD	189,436	189,436	0	0	0	0	0	0
Domestic government or commercial loa	USD	378,872	378,872	0	-75,774	-75,774	-75,774	-75,774	-75,774
International grants	USD	0	0	0	0	0	0	0	0
International loans	USD	0	0	0	0	0	0	0	0
Equity from owners	USD	189,436	189,436	0	0	0	0	0	0
Promotional loans	USD	189,436	189,436	0	-47,359	-47,359	-47,359	-47,359	-47,359
Net cash generated from financing activi	USD	947,179	947,179	0	-123,133	-123,133	-123,133	-123,133	-123,133
Changes in working capital	USD		0	-168,632	-10,540	-10,540	-10,540	-10,540	0
Net annual increase in Cash and Cash Eq	USD	0	0	155,495	183,113	193,019	202,131	210,515	195,951
Cash and Cash equivalents (Start of yea	USD		0	0	155,495	338,609	531,627	733,759	944,274
Cash and Cash Equivalents (End of year)	USD	0	0	155,495	338,609	531,627	733,759	944,274	1,140,225

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key performance indicators	Vanuatu	2023	2024	2025	2026	2027	2028	2029	2030
Financial indicators									
- Gross margin	%			14%	14%	14%	14%	14%	14%
- EBITDA	USD			430,734	457,654	484,575	511,496	538,417	538,417
- EBITDA margin	%			14%	14%	14%	14%	14%	14%
- Debt-equity ratio	%			121%	91%	68%	51%	38%	27%
- DSCR	%			432%	243%	267%	293%	321%	341%
- Solvency ratio	%			27%	31%	38%	46%	57%	67%
Profitability									
- Return on total assets	%			9%	9%	10%	11%	12%	13%
- Return on equity	%			20%	18%	18%	17%	17%	17%
- Gross profit margin	%			14%	14%	14%	14%	14%	14%
- Net profit margin	%			6%	6%	7%	7%	8%	9%
- Return on investment	%			17%	17%	17%	17%	17%	17%
Asset management									
- Asset turnover	%			140%	145%	148%	152%	154%	148%
Financial solvency									
- Debt to equity ratio	%			121%	91%	68%	51%	38%	27%
- Total long term debt to total asset rati	%			53%	46%	39%	32%	26%	20%
Liquidity ratios									
- Current ratios				4.9	6.9	8.7	10.5	12.1	14.0
- Acid ratio				1.9	3.8	5.7	7.4	9.1	11.0
- Cash coverage ratio	%			403%	439%	529%	642%	791%	1047%
- Working capital	USD			324,128	517,781	721,339	934,010	1,155,064	1,351,015

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Appendix P Report Limitations

1. Basis of Estimate Limitations and Response

The Association for the Advancement of Cost Estimation (ACE) has provided a cost estimation tool that has been specifically developed to guide practitioner and audiences on the precision of project cost estimates at different stages of a project from screening to concept, to budget development and finalization.

The ACE cost estimation matrix is presented in Figure 38 to share this information with the PRIF and its members on reasonable and expected accuracy ranges for estimation for this Options Report and the project information contained within it in accordance with industry best practice.

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical +/- range relative to index of 1 (i.e. Class 1 estimate) [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Screening or feasibility	Stochastic (factors and/or models) or judgment	4 to 20	1
Class 4	1% to 15%	Concept study or feasibility	Primarily stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget authorization or control	Mixed but primarily stochastic	2 to 6	3 to 10
Class 2	30% to 75%	Control or bid/tender	Primarily deterministic	1 to 3	5 to 20
Class 1	65% to 100%	Check estimate or bid/tender	Deterministic	1	10 to 100

Notes:
[a] If the range index value of "1" represents +10/-5%, then an index value of 10 represents +100/-50% (at an 80% confidence interval).
[b] If the cost index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%.

Figure 38 Generic Cost Estimate Classification Matrix (AACE 2020)

Note: AACE International Recommended Practice No. 17R-97. Cost Estimation Classification System

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

This report (Network Options Report) comprises the screening stage of the project with the objective to produce a pre-feasibility assessment of the most favorable option in the following report. Additionally, as this project has a heavy process equipment-centric focus, the maturity level of project definition and subsequent estimate definition is significantly determined by how well the equipment and process flow is defined. This deliverable does not specifically identify the exact equipment and machinery required by type or brand; rather, it focuses on the differences in conceptualization of the recycled waste product and the high-level investment requirements for those operations.

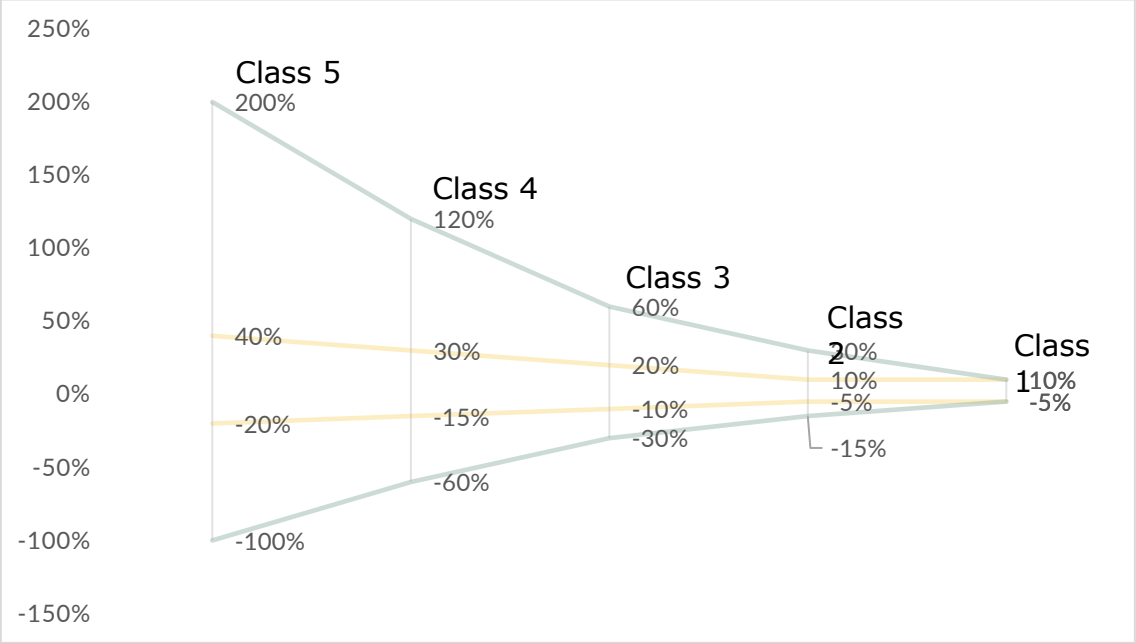

Figure 39 Cone of Uncertainty – Expected Estimation

Note: Constructed using the AACE Cost Estimate Classification Matrix data 'Expected accuracy ranges' for all Estimation Classes.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Both perspectives align to indicate that the project is within the early stages of estimation (Class 5) where cost estimation methodology is largely a mix of stochastic and judgement, expected cost accuracy range is between –20% to +40% (lower) and –100% to 200% (upper) (Figure 39 above), and the preparation effort of 0.005% of the project's entire cost progresses through all classes 5 to 1.

While greater precision in estimation is expected and reasonable as the project moves from the Network Options Report screening stage into the full pre-feasibility report, it is important to note that the estimation precision in accordance with the industry standard would be expected to remain in a Class 5 Estimation but at the lower end.

2. A Note on Waste Audits

In general, waste audits conducted globally have focused on the quantitative collection of information on municipal solid waste,[32] meaning that the information provided for commercial waste, industrial waste, agricultural waste is much lower quality and often not accounted for quantitatively. This can result in an underestimation of the volumes of wastes in total and for specific waste streams.

The Consultant's review of the waste audits mirrors this situation in that it found that household or municipal waste was the main focus of the audits, with quantitative data provided for 48% of the 16 waste streams this analysis has focused on.

[32] Intosai. Undated. Mooc; Auditing Waste Management. Estonia. https://sisu.ut.ee/waste/book/12-global-generation-waste.

But commercial sources of waste are not fully quantified, with only incomplete self-reporting data and qualitative description. Industrial (including mining, manufacture and construction), agricultural and utility (electricity, gas, water, wastewater) waste have not been accounted for in data provided to this report, nor are they readily available from any other source.

To provide some idea of how much waste may be unaccounted for, quantified information from the Australian Bureau of Statistics (ABS)[33] has been provided from a full waste inventory conducted for 2018 and 2019 to provide a comparison.

The ABS report found that households generated 16.3% of all waste, manufacturing 16.9%, construction 16.8%, and utilities 14.4%, which is of direct relevance to this study when we are considering the business case of a specific waste stream and how much material may be available.

In relation to the contribution of household waste to different waste streams, the ABS study found that it contributed to 20% of metal waste streams (approx. 1 million tons out of 6 million tons), 40% of paper and cardboard waste (approx. 2 million tons out of 5 million tons) and 50% of plastic waste (approx. 1 million tons out of 2 million tons).

[33] Australian Bureau of Statistics. November 2020. Waste Account, Australia, Experimental Estimates. Australia. https://www.abs.gov.au/statistics/environment/environmental-management/waste-account-australia-experimental-estimates/latest-release

Appendix Q Waste Audit Data Limitations and Response

This study has to a large extent been conducted as a desktop-based consultancy since, due to the wide geographical scope, the Consultant's principal members did not travel to the Pacific Island Countries (PICs). However, local partners in some countries (Tuvalu, Vanuatu, Fiji, and the Solomon Islands) have provided some on-the-ground support.

Therefore, the Consultant was heavily reliant on the waste audit data and reporting, which has been collected by three different consultancies using large field teams across 15 PICs to collect in country data over several years.

While the Consultant has used approaches it has identified and alternate sources of information to address any gaps, this is not a substitute for robust, accurate, and quantitative field and country data.

Identified limitations are in Table 215, as well as in 0, 0 and 0.

Table 217 Summary of Waste Audit Limitations Impacting Analysis

Information Source	Limitation	TA Response
Waste Audits	Volumetric Data Gaps (Only 48% quantitative)	Alternative Material Flow Analysis (WW2.0 World Bank (Benchmarked), https://documents.worldbank.org/en/publication/documents-reports/documentdetail/697271544470229584/what-a-waste-2-0-a-global-snapshot-of-solid-waste-management-to-2050
Waste Audits	Waste Characterization (40% aggregated metals/ plastics)	Benchmarked Against Characterized Waste Audits (PRIF 1998/IUCN PWFI)
Waste Audits/Recycler Interviews	Commercial Waste (Limited quantitative data)	Note limitation in Report (no benchmarking tool available)
Waste Audits/Customs Reporting	Recyclable Export Volumes (Limited quantitative data missing) *	Benchmark against Palau data for CDL countries Estimate from self-reported and anecdotal information from recyclers
Waste Audit/Recycler Interviews	Description of Waste Facilities (Limited quantitative data)	Benchmark against known facilities (Fiji, Vanuatu, Solomon Islands, Palau, RMI, Kiribati)
Waste Audit/Recycler Interviews	CAPEX/OPEX (Limited quantitative/data missing)	Benchmark against known facilities (Australia, Solomon Islands, Vanuatu, Southeast Asia)

**Palau was an exception for materials collected under their CDL*
WW2.0 = What a Waste 2 World Bank Report, IUCN PWFI = International Union for Conservation of Nature's Pacific Waste Free Islands Project, CDL = container deposit legislation, CAPEX = capital expenditure, OPEX = operational expenditure.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

1. Waste Audit Limitations

Volumetric Data Gaps

- As presented in the Market Assessment Report, data gaps were identified in 16 waste audit reports. The Consultant found that waste audit approaches and reporting format varied substantially across different auditors in different countries, potentially contributing to this issue.

- Only five out of 16 waste audit reports included national annual generation weights for more than 50% of the 16 original target waste streams. Six of the reports covered between 25%–50% of target waste streams, and four reports covered less than 25% of target waste streams. This collectively resulted in a total gap of 52% of the waste stream data points.

- "Sense checking" of the data gaps' impacts on waste volume data generated through the audits alone compared to country population and gross domestic product (GDP) data showed significant potential underestimation of waste volumes.

- Where national-level generation rates are not summarized, the sum of landfill tonnage or the sum of total waste disposed and recycled is used.

- To address this the Consultant conducted an additional Material Flow Analysis using an alternate methodology. This approach follows the World Bank "What a Waste 2.0" report methods.

- Use of this approach has resulted in estimated waste volume increasing to 2,213,384 tons per annum for the 16 waste streams and 15 PICs, which is more than 4.5 times higher than the original adjusted waste audit data of 484,677 tons per annum.

- For the eight target waste streams, the estimated waste volume based on the same approach is 1,012,869 tons.

Waste Characterization Gaps

- As presented in the Market Assessment Report, the Consultant found there was a lack of detailed characterization of metals and plastics waste streams in 40% of the country waste audits. Moreover, many waste streams were only qualitatively assessed through visual audits or country self-reporting.

- To address differences in waste characterization of certain waste streams such as metals and plastics, as well as gaps in quantitative waste data for some countries and some waste streams, efforts have been made to improve the relevance of the data to this report

- Where not reported, the proportion of PET is calculated from aggregated 'Plastic' at 25%, based on Fiji household and commercial sector averages from the Plastic Waste Free Islands plastic ratios as previously discussed in the Market Assessment Report.

- Where not reported, the proportion of Aluminum, Steel Cans, and Steel Other (Scrap) items are disaggregated from 'Metals' in the ratio 0.33:0.27:0.4, respectively, based on 2018 PRIF Solid Waste Management and Recycling reported proportions.

- Where not reported, LDPE is used as a proxy for Plastic Bags and was calculated at 9.8% of the total aggregated 'Plastic' reported tonnage, based on Fiji household and commercial sector averages from the PWFI plastic ratios.

3. Commercial Waste Quantities

- Review of the national waste audits for the 14 countries and eight waste streams of focus has found insufficient quantitative data to accurately estimate waste volumes and characterization from the commercial sector.

- Anecdotal information from recycler interviews indicates that most scrap steel, aluminum scrap (except beverage cans) and cardboard would be derived from the commercial and is expected to exceed the amounts found through the household waste surveys.

- Unlike for household waste the Consultant has no commercial waste benchmarking tool to estimate the missing contribution from commercial waste and can only note the lack of information.

4. Export Volumes/Values of Recyclables

- Review of the national waste audits for the 14 countries and eight waste streams of focus has found insufficient quantitative data to accurately estimate the total volumes and values of recyclables estimated. This could be attributable to unsuitable customs export data and a lack of standardized national reporting on waste exports.

- An attempt has therefore been made by the Consultant to estimate potential volumes of recyclables exported by benchmarking from other countries with data (i.e. Palau for countries with CDLs) or anecdotal and self-reported information from recycler interviews.

5. Waste Facility Description

- Review of the national waste audits for the 14 countries and eight waste streams of focus has found insufficient quantitative data to accurately estimate waste volume processing capability in each country of the target waste streams.

- The Consultant is therefore only able to give a qualitative description of processing capability and estimate of waste volume processing currently practiced as presented in the existing situation.

6. CAPEX/OPEX

- Review of the national waste audits for the 14 countries and eight waste streams of focus found limited quantitative data for waste facility CAPEX/OPEX.

- In the absence of detailed information, the accuracy of the estimated CAPEX/OPEX could be significantly different than actual value but this is normal for a project that is only at the screening stage of a prefeasibility study.

- To address this, the Consultant has gathered anonymized information estimating CAPEX/OPEX for Vanuatu and the Solomon Islands for superior compactions, supported by

anecdotal information from Kiribati and RMI as well as market information on waste equipment in Australia, New Zealand and Asia, https://www.mil-tek.com/balers-and-compactors, https://www.miltek.co.nz/balers-and-compactors, and https://www.enerpatrecycling.com

- CAPEX from these sources have been used to estimate values for Option 1 and part of Option 3 while OPEX has been used as the basis for all three Options and has been estimated at 20% with 6% for maintenance and 14% which is benchmarked from recycler interview information in Solomons and Vanuatu.

- High level Information estimating CAPEX for the value adding scenarios has been based on publications from UNEP, anonymized information from Australian, Southeast Asian and Asian based industries and market-based information, https://www.mil-tek.com/balers-and-compactors, https://www.miltek.co.nz/balers-and-compactors, and https://www.enerpatrecycling.com

- This includes a mid-level range of metal/plastic endpoints with a range of purities/value end points (various aluminum ingots/lead ingots, hot washed plastic granules & pellets, cardboard/paper pulp) as well as a highest value adding range (finished rPET/plastic film products, finished aluminum products, finished cardboard/paper products).

Table 226 Waste Audit Data Gaps and the Consultant's Response

Country	Aluminum Cans					Glass Bottles					Paper and Cardboard					PET				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Cook Islands	N	N	N	N	L	N	N	N	N	N	N	N	N	N	L	N	N	N	N	L
Fiji	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N	N	N	L	N	L
FSM	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Kiribati	N	N	N	L	L	N	N	N	N	N	N	N	N	N	N	N	N	N	L	L
Marshall Islands	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	N	N
Nauru	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Niue	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Palau	N	L	N	L	L	N	N	N	L	N	N	N	N	L	N	N	N	N	L	L
PNG	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N
Samoa	N	N	N	N	L	N	N	N	N	N	N	N	N	N	L	N	N	N	N	L
Solomon Islands	N	N	L	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Tonga	N	N	N	N	L	N	N	N	N	N	N	N	N	N	L	N	N	N	N	L
Tuvalu	N	N	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Vanuatu	N	N	L	N	L	N	N	N	N	N	N	N	N	N	N	N	N	L	N	N

Country	Plastic Bags					Scrap Steel					Steel Cans					ULAB				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Cook Islands	N	N	N	N	N	N	N	N	N	L	N	N	N	N	N	N	N	N	N	N

Fiji	N	N	L	N	L	N	N	L	N	L	N	N	L	N	L	N	N	L	N	N
FSM	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Kiribati	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	L
Marshall Islands	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Nauru	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Niue	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Palau	N	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N	N	N	N	L
PNG	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N
Samoa	N	N	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N	N	N	L
Solomon Islands	N	N	N	N	N	N	N	L	N	L	N	N	N	N	N	N	N	N	N	N
Tonga	N	N	N	N	L	N	N	N	N	L	N	N	N	N	L	N	N	L	N	L
Tuvalu	N	N	N	N	N	N	N	N	N	L	N	N	N	N	N	N	N	N	N	L
Vanuatu	N	N	N	N	N	N	N	L	N	L	N	N	N	N	N	N	N	L	N	L

ULAB = used lead acid battery, PET = polyethylene, FSM = Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Key:

Q1	Is there a section on Operational expenditure for recycling for the 8 waste streams (e.g., paying people, rent, tax, consumables, repairs)?
Q2	Is there a section on Capital Expenditure for recycling for the 8 waste streams (facility, land, equipment)?
Q3	Is there a section on how much of the 8 waste streams (tons and values) is from commercial sources?

Q4	Is there a section on the capacity (tons and values) to process each of the 8 waste steams?
Q5	Is there a section on how much (tons and values) of the 8 waste streams is exported?

Y	Yes
N	No
L	Limited

OPEX for landfills: Cooks, Fiji, Federated States of Micronesia, Marshall Islands, Nauru, Niue, Palau, Samoa (not recycling specific)

OPEX for Environmental division for Kiribati (not recycling specific)

Capex for some parts of Koror Recycling Centre - Palau (Qualitative only)

OPEX for WAL for Tonga (not recycling specific)

Appendix

Appendix R Basis of Estimate

Table 227 CAPEX Estimation Assumptions

CAPEX Facility Estimate Range	Estimate in USD Per Ton Processed	Equipment/Technology in Facility Option
High Level Compaction[34]	$150 to $349	Receival/processing location(s), storage/receival bays, equipment buildings, compactors, bailers, plasma cutters, forklifts, pallet scales, collection vehicles, collection bins (cardboard, plastic bags/film especially), equipment spares, power supplies, administrative equipment.
Mid-Level Value Add Facilities[35]	$350 to $649	Receival/processing location(s), storage/receival bays, equipment buildings, battery recycling plant, metal furnaces, ingot castors, commination/grinders, pulpers, molds, cardboard roller, box, maker, compactors, bailers, plasma cutters, forklifts, pallet scales, collection vehicles, collection bins (cardboard, plastic bags/film especially), equipment spares, power supplies, administrative equipment.
High Level Value Add Facilities[36]	$650 to $1,250	Receival/processing location(s), storage/receival bays, equipment buildings, battery recycling plant, metal furnaces, ingot castors, commination/grinders, pulpers, molds, cardboard roller, box, maker, compactors, bailers, plasma cutters, forklifts, pallet scales, collection vehicles, collection bins (cardboard, plastic bags/film especially), equipment spares, power supplies, administrative equipment.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 228 Waste CDL Prices

CDL for Waste (USD/Ton)	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass Bottles	Plastic Bags (Plastic Film)

[34] Telford Smith, 2022; ORWAK, 2022; Mil-tek, 2021

[35] GIZ e-Waste Programme Ghana: Recycling chains, business models, and capacity development November 2019; Pragmatic Metal Group, 2022; Coca-Cola EuroPacific Partners, 2022; Hughson, 2022; Chemiplas, 2022; Yunda Paper Machinery, 2022; Anyang General International Co., LTD., 2022; https://www.batteryrescue.com.au/news/wa-lead-acid-battery-recycling-facility

[36] Upshall, 2022; Van, 2020; Upshall, E. 2021; https://www.petnology.com/online/news-detail/ecoblue-tackling-plastic-waste-problem-in-thailand-with-starlinger-pet-bottle-to-bottle-recycling-line; https://www.advantageaustria.org/vn/news/20210524_Success_Story_Starlinger.en.html; https://pactgroup.com/news/world-class-recycling-plant-opens-in-albury-wodonga

Cook Islands								
Fiji*	229		69					
FSM	670						50	
Kiribati	469		707					
Marshall Islands	670		1,010				50	
Nauru								
Niue								
Palau	1,675		2,525		300		100	
PNG								
Samoa								
Solomon Islands								
Tonga								
Tuvalu	2,350		3,540	700				
Vanuatu								

**Fiji is a return system through Mission Pacific for Coca-Cola products only.*

CDL = container deposit legislation, ULAB = used lead acid battery, PET = polyethylene, FSM – Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 229 Subsidies for Waste

Subsidies for Waste (USD/Ton)	Alumi-num Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Glass Bottles	Plastic Bags (Plastic Film)
Cook Islands								
Fiji*						67		

Subsidies for Waste (USD/Ton)	Alumi-num Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Glass Bottles	Plastic Bags (Plastic Film)
FSM		83						
Kiribati		700				67		
Marshall Islands						67		
Nauru								
Niue								
Palau								
PNG						67		
Samoa						67		
Solomon Islands						67		
Tonga						67		
Tuvalu		770						
Vanuatu						67		

Note: Paper and Cardboard values are the proposed payments to recyclers to collect paper and cardboard. ULAB values are currently existing subsidies.

ULAB = used lead acid battery, PET = polyethylene, FSM – Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 230 Proposed Option – Cost of Waste

Unit cost of the waste (USD/Ton)	Alumi-num Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Glass	Plastic Bags
Cook Islands	361	300	-	-	-	-	-	-
Internal Fiji	610	300	200	-	-	-	-	-

External Feed-in	1,275	680	553	-	-	106	-	160
FSM	-	-	-	-	-	-	-	-
Kiribati	-	-	-	-	-	-	-	-
Marshall Islands	-	300	-	-	-	-	-	-
Nauru	-	-	-	-	-	-	-	-
Niue	-	-	-	-	-	-	-	-
Palau	-	300	-	-	-	-	-	-
PNG	600	350	200	-	-	-	-	-
Samoa	362	150	-	-	-	-	-	-
Solomon Islands	623	223	-	123	123	-	-	-
Tonga	361	85	-	-	-	-	-	-
Tuvalu	-	-	-	-	-	-	-	-
Vanuatu	362	85	-	-	-	-	-	-

ULAB = used lead acid battery, PET = polyethylene, FSM – Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Cost of waste is measured in $/ton. Materials are compared against themselves across each PIC. A red, amber, green (RAG) system is applied to assign relative magnitude for a given material. Red indicates a more expensive cost of waste and green indicates the least expensive cost of waste. For example, in aluminum cans, Solomon Islands is the most expensive PIC to obtain aluminum and countries like FSM or Nauru (and several others) receive their aluminum free of charge.

Assumptions of Tons per TEU are derived from the typical weights for 20 Foot Container Load. Not exported (glass) in all options. Density values were applied to tons of wastes recycled to estimate the number of TEUs needed to managed waste.

Table 231 Existing Situation Tons per TEU

Assumed Tons per TEU	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Plastic Bags
Cook Islands	14	24	8	18	18	10	10
Fiji	14	24	8	18	18	10	10
FSM	14	24	8	18	18	10	10
Kiribati	14	24	8	18	18	10	10
Marshall Islands	14	24	8	18	18	10	10
Nauru	14	24	8	18	18	10	10
Niue	14	24	8	18	18	10	10
Palau	14	24	8	18	18	10	10
PNG	14	24	8	18	18	10	10
Samoa	14	24	8	18	18	10	10
Solomon Islands	14	24	8	18	18	10	10
Tonga	14	24	8	18	18	10	10
Tuvalu	14	24	8	18	18	10	10
Vanuatu	14	24	8	18	18	10	10

TEU = 20-foot equivaluent container unit, ULAB = used lead acid battery, PET = polyethylene, FSM – Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 232 - Tons per TEU

Assumed Tons per TEU	Alumi-num Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Plastic Bags
Cook Islands	18	24	11	20	20	15	15

Fiji	24	24	11	20	20	15	15
FSM	18	24	11	20	20	15	15
Kiribati	18	24	11	20	20	15	15
Marshall Islands	18	24	11	20	20	15	15
Nauru	18	24	11	20	20	15	15
Niue	18	24	11	20	20	15	15
Palau	18	24	11	20	20	15	15
PNG	24	24	11	20	20	15	15
Samoa	18	24	11	20	20	15	15
Solomon Islands	18	24	11	20	20	15	15
Tonga	18	24	11	20	20	15	15
Tuvalu	18	24	11	20	20	15	15
Vanuatu	18	24	11	20	20	15	15

TEU = 20-foot equivaluent container unit, ULAB = used lead acid battery, PET = polyethylene, FSM – Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 233 - Unit Transportation Cost (USD/Ton)

Unit transportation cost (USD/Tonne)	Alumi-num Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Glass	Plastic Bags
Cook Islands	278	208	455	250	250	333		333
Fiji	104	104	91	125	125	67		67
FSM	139	104	227	125	125	167		167
Kiribati	139	104	91	125	125	67		67

Unit transportation cost (USD/Tonne)	Alumi-num Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Card-board	Glass	Plastic Bags
Marshall Islands	139	104	91	125	125	67		67
Nauru	278	208	455	250	250	333		333
Niue	278	208	455	250	250	333		333
Palau	139	104	227	125	125	167		167
PNG	52	52	91	63	63	67		67
Samoa	139	104	91	125	125	67		67
Solomon Islands	139	104	91	125	125	67		67
Tonga	139	104	91	125	125	67		67
Tuvalu	278	208	455	250	250	333		333
Vanuatu	139	104	91	125	125	67		67

**No viable international market was identified for glass.*

ULAB = used lead acid battery, PET = polyethylene, FSM – Federated States of Micronesia, PNG = Papua New Guinea.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Unit transportation cost is measured in US dollars per ton. Materials are compared against themselves across each PIC. A red, amber, green (RAG) system is applied to assign relative magnitude for a given material. Red indicates a more expensive unit transportation cost and green indicates the least expensive unit transportation cost. For example, Cook Islands, Nauru, Niue, and Tuvalu have the most expensive unit transportation cost for aluminum and PNG is the least expensive. Glass is not exported and therefore not considered.

Table 234 Wage Values for Jobs Created Estimation

2.23 x Minimum Wages (Gross Annual)	ILO 2021	Salary Explorer
Cook Islands		$12,000
Fiji	$8,472	
FSM		$3,122

2.23 x Minimum Wages (Gross Annual)	ILO 2021	Salary Explorer
Kiribati		$5,927
Marshall Islands	$16,729	
Nauru		$14,481
Niue		$6,851
Palau	$19,517	
PNG	$5,764	
Samoa	$4,852	
Solomon Islands	$5,469	
Tonga		$1,681
Tuvalu	$8,472	
Vanuatu	$8,954	

ILO = International Labour Organization, PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Source: ILO 2021 and Salary Explorer 2022.

Job creation was calculated as a function of the capital investment. It was assumed that a new operational job is created for every $100,000 invested and employment due to CAPEX (first year only) was one job for every $50,000. The following salaries were used to calculate the NPV of additional wages. New wages used a multiplier of 2.23 against minimum wage[37] for all countries. NPV took into consideration net salary after personal taxes.

Table 235 Personal Income Tax for Jobs Created Estimation

Personal Income Tax	%
Cook Islands	27%
Fiji	20%
FSM	10%

[37] Multiplier based on actual salary of waste workers in Vanuatu compared to minimum wage.

Personal Income Tax	%
Kiribati	25%
Marshall Islands	12%
Nauru	6%
Niue	0%
Palau	12%
PNG	22%
Samoa	27%
Solomon Islands	20%
Tonga	10%
Tuvalu	30%
Vanuatu	0%

PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Source: PWC 2022.

GHGs avoided due to recycling are calculated as the difference between tons of CO_2 produced through primary and secondary production.[38]

Table 236 Primary vs Secondary (recycling) Production of GHGs

	Primary Production (Ton CO_2/ton material) GHG	Secondary Production (Ton CO_2/ton material) GHG	GHG Avoided
Paper & Cardboard	1.1	0.7	0.4
Glass	0.9	0.5	0.4
Plastics Mixed	2.1	1.3	0.8

[38] Climate Benefits of Material Recycling Inventory of Average Greenhouse Gas Emissions for Denmark, Norway and Sweden

	Primary Production (Ton CO_2/ton material) GHG	Secondary Production (Ton CO_2/ton material) GHG	GHG Avoided
Aluminum	11	0.4	10.6
Steel	2.4	0.3	2.1
PET Plastic	3.71	1.4	2.3
ULAB	2.07	1.4	0.7

GHG = greenhouse gas, ULAB = used lead acid battery, PET = polyethylene,.

Source: Hillman et al., 2015.

Tons of **CO_2 produced** due to shipping activities was calculated as: ***Tons CO_2 emissions = tons x km x 3g CO_2 per ton-km / 1,000,000***. It is reported that the average of very large container vessels is 3g CO_2/ton-km[39]. Tons of waste unique to each option were multiplied by the distance (converted from nautical km to km using conversion factor 1.85) to the most likely market (outlined below) then multiplied by the CO_2 constant 3g. Glass is NA as it not envisaged as exported.

Table 237 Option 3 - Likely Destinations for Recyclables (Destination)

	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass	Plastic Bags
Cook Islands	NZ	NZ	NZ	NZ	NZ	NZ	N/A	NZ
Fiji	Korea	N/A	Australia	Australia	Australia	Australia	N/A	Australia
FSM	Korea	Korea	Korea	Korea	Korea	Korea	N/A	Korea
Kiribati	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Marshall Islands	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Nauru	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Niue	NZ	NZ	NZ	NZ	NZ	NZ	N/A	NZ

[39] IMO GHG Study (2009)

	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass	Plastic Bags
Palau	Taipei, China	Taipei, China	Taipei, China	Taipei, China	Taipei, China	Taipei, China	N/A	Taipei, China
PNG	Korea	Korea	Australia	Australia	Australia	Australia	N/A	Australia
Samoa	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Solomon Islands	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Tonga	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Tuvalu	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji
Vanuatu	Fiji	Fiji	Fiji	Australia	Australia	Fiji	N/A	Fiji

ULAB = used lead acid battery, PET = polyethylene, PNG = Papua New Guinea, FSM = Federated States of Micronesia

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 238 Option 3 - Likely Destinations for Recyclables (NM)

	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass	Plastic Bags
Cook Islands	1,744	1,744	1,744	1,744	1,744	1,744	N/A	1,744
Fiji	5,780	5,780	2,114	2,114	2,114	2,114	N/A	2,114
FSM	2,082	2,082	2,082	2,082	2,082	2,082	N/A	2,082
Kiribati	1,585	1,585	1,585	2,895	2,895	1,585	N/A	1,585
Marshall Islands	1,888	1,888	1,888	3,222	3,222	1,888	N/A	1,888
Nauru	1,706	1,706	1,706	2,582	2,582	1,706	N/A	1,706
Niue	1,334	1,334	1,334	1,334	1,334	1,334	N/A	1,334
Palau	1,634	1,634	1,634	1,634	1,634	1,634	N/A	1,634
PNG	3,700	3,700	1,704	1,704	1,704	1,704	N/A	1,704

	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass	Plastic Bags
Samoa	4,480	4,480	2,697	2,697	2,697	2,697	N/A	2,697
Solomon Islands	4,001	4,001	1,936	1,936	1,936	1,936	N/A	1,936
Tonga	5,459	5,459	1,934	1,934	1,934	1,934	N/A	1,934
Tuvalu	5,040	5,040	2,637	2,637	2,637	2,637	N/A	2,637
Vanuatu	5,026	5,026	1,567	1,567	1,567	1,567	N/A	1,567

ULAB = used lead acid battery, PET = polyethylene, PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 239 Option 3 - Likely Destinations for Recyclables (Tons of CO_2 per year)

	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass	Plastic Bags
Cook Islands	1.09	0.58	0.88	-	-	-	-	0.36
Fiji	295.23	198.06	91.16	-	-	1,442.21	-	36.12
FSM	4.20	3.40	3.51	115.80	-	-	-	-
Kiribati	4.70	3.29	4.53	126.71	-	38.35	-	1.14
Marshall Islands	1.69	1.28	1.70	99.85	-	23.72	-	1.16
Nauru	0.68	0.36	0.45	-	-	-	-	0.20
Niue	0.16	0.05	0.10	-	-	-	-	0.04
Palau	1.25	0.54	1.24	17.14	-	6.77	-	-
PNG	554.81	463.53	210.11	-	-	2,867.09	-	28.62
Samoa	16.05	15.31	8.94	-	-	113.44	-	3.88
Solomon Islands	52.13	27.95	19.36	-	-	346.76	-	8.39
Tonga	10.73	8.36	3.55	-	-	43.78	-	1.54

	Aluminum Cans	ULAB	PET	Scrap Steel	Steel Cans	Paper & Cardboard	Glass	Plastic Bags
Tuvalu	1.62	1.02	0.81	18.45	-	6.60	-	0.23
Vanuatu	26.04	17.33	7.36	-	-	90.71	-	3.19
Total	**970.38**	**741.06**	**353.70**	**377.95**	**-**	**4,979.41**		**84.86**

ULAB = used lead acid battery, PET = polyethylene, PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.

Table 240 Cost of Electricity (VUV) per 10,000 KwH and Percentage Renewable

Country	VUV	USD	% Renewable Energy
Cook Islands	686,528	6,865	26%
Fiji	155,863	1,559	60%
FSM	231,344	2,313	5%
Kiribati	642,392	6,424	17%
Marshall Islands	439,573	4,396	2%
Nauru	610,986	6,110	2%
Niue	540,421	5,404	14%
Palau	320,188	3,202	2%
PNG	375,157	3,752	62%
Samoa	393,993	3,940	42%
Solomon Islands	801,017	8,010	6%
Tonga	392,222	3,922	10%
Tuvalu	479,652	4,797	23%
Vanuatu	485,831	4,858	22%

PNG = Papua New Guinea, FSM = Federated States of Micronesia

Equation Used: $sum(cost\ of\ 10{,}000\ kwh\ x\ tonnes\ of\ waste)/sum\ of\ total\ tonnes\ of\ waste$ *= average cost of 10,000 kwh/t*

Source: Utilities Regulatory Authority (URA) 2017 and Secretariat of the Pacific Regional Environment Programme (SPREP) 2020.

Table 241 Estimate of Recyclables Collected under the Existing Situation

Recyclable	Estimated %
Aluminum Cans	51%
ULAB	42%
PET	<1%
Scrap Steel	31%
Steel Cans	<1%
Paper & Cardboard	<1%
Glass Bottles	<1%
Plastic Bags	0%
Total	**20%**

ULAB = used lead acid battery, PET = polyethylene.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.Appendix

Appendix S Shipping and Ports Data

Table 242 Port Calls, Diversity, and Reach by Country

Country	Port Calls	Diversity of Potential Pacific Feed-in Countries	Reach to Non-Pacific Countries
Cook Islands	25	Nuku'alofa (Tonga), Lautoka (Fiji), Suva (Fiji), Apia (Samoa)	ANZ (5), US (1)
FSM	60	Internally [Yap (Micronesia), Kosrae (Micronesia), Chuuk (Micronesia)]	East Asia/US (1)
Fiji	1,973	Majuro (Marshall), Nuku'alofa (Tonga), Port Vila (Vanuatu), Tarawa (Kiribati), Honiara (Solomon Islands), Apia (Samoa)	ANZ (16), East Asia (4), Southeast Asia (1)
Kiribati	445	Honiara (Solomon), Port Vila (Vanuatu), Lautoka (Fiji), Suva (Fiji), Nuku'alofa (Tonga), Apia (Samoa), Majuro (Marshall), Funafuti (Tuvalu)	ANZ (1), East Asia (4),
Marshall Islands	60	Yap (Micronesia) -Kosrae (Micronesia) -Chuuk (Micronesia) -Pohnpei (Micronesia)- Kosrae (Micronesia)	East Asia (2)
Nauru	20	-	-
Niue	20	Nuku'alofa (Tonga), Lautoka (Fiji), Suva (Fiji), Apia (Samoa), Rarotonga (Cooks)	ANZ (2)
Palau	100	-	-
PNG	2,863	Lautoka (Fiji), Suva (Fiji), Honiara (Solomon)	ANZ (3), East Asia (3), Southeast Asia (4)
Samoa	532	Nuku'alofa (Tonga), Lautoka (Fiji), Suva (Fiji), Honiara (Solomon), Port Vila (Vanuatu), Majuro (Marshall), Tarawa (Kiribati)	ANZ (11), East Asia (4), US (3)
Solomon Islands	999	PNG [Motukea (Papua New Guinea) -Lae (Papua New Guinea)], Tarawa (Kiribati)	ANZ (2), East Asia (4), US (3), Southeast Asia (1)
Tonga	161	Apia (Samoa)	ANZ (12), East Asia (4), US (1)
Tuvalu	20	Suva (Fiji), Lautoka (Fiji)	ANZ (1)

Vanuatu	148	Suva (Fiji)2, Lautoka (Fiji)2, Honiara (Solomon)2, Tarawa (Kiribati)2, Majuro (Marshall)	ANZ (5), East Asia (4)

PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Routes published by ANL, Hamburg Sud, Hapag-Llyod, Kyowa Shipping, Matson, NYK, PDL, PFL, and SWIRE Shipping.

Source: Kokusai Kogyo Co., Ltd. & Yachiyo Engineering Co., Ltd. 2021 and UNCTAD 2020).

Table 243 Sufficiency of Port Equipment by Country

Country	Port Equipment
Cook Islands	Capacity to move 40 foot and 20-foot containers Reach stacker (1 x12t maintained) Forklifts (4x3t, 1x12t, 1x35t, 1x40t maintained)
FSM	Yap Containers must all be unloaded by gantry crane as no container cranes are available at the dock. Port-handling equipment was in poor condition, with only a small amount available with major equipment undergoing repairs Reach stacker (under repairs) Forklifts (1 X 25 MT, 2 X 3 MT) Chuuk All vessels must be compatible and equipped with the ability to load and unload. There are no container cranes are available at the dock. Reach stacker 30MT Forklifts (1 X 2 MT, 1 X 5 MT, 1 X 6 MT) Pohnpei Containers must all be unloaded by vessel gantry crane as no container cranes or equipment are available at the dock. Containers can generally be unloaded at 6-10 per hour. Land-based port equipment is capable of moving 20-foot and 40-foot containers. Reach stacker (35MT) Forklifts (1 X 25 MT, 2 X 5 MT, 1 X 6 MT) Kosrae Containers must all be unloaded by gantry crane as no container cranes are available at the

Country	Port Equipment
	dock. Reach stacker (1 X 35 MT) Forklifts (1 X 35 MT, 2 X 5 MT, 1 X 3 MT)
Fiji	Fiji ports capable of handling 20-foot and 40-foot containers and breakbulk cargo via mobile harbour crane. Forklifts, omega spreaders. Mobile crane has lifting capacity up to 50 ton. All wharfs in Suva are multipurpose and all types of cargo can be handled at the port 2 x 50-ton Mobile cranes 7 x Reach stacker (40-ton x 4 cranes, 38-ton x 2 cranes, and 12 ton (1 crane). 8 x Forklifts (6 x 3-to-8-ton forklifts, and 2 x 12-ton fork trucks) 7 x Tractors 7 x Trailers
Kiribati	Vessels can berth at the quays, but larger vessels are worked offshore by lighters. Port facility is essentially a general terminal, and all vessels must be compatible and equipped with the ability to load and unload. Land-based port equipment is capable of moving 20-foot and 40-foot Containers. Mobile cranes (50 mt). Used for stacking in storage area. Reach stacker (40 mt). Used for stacking and movements storage Forklifts (1 x 30 mt, 4 x 7 mt, 2 x 2 mt). All good to fair condition.
Marshall Islands	Vessels can berth at the quays, but larger vessels are worked offshore by lighters. Port handling equipment is provided by the stevedore MISCO. Equipment is limited with only 1-2 Reach stacker with a capacity pf 40MT onsite Reach stacker (1-2 x 40MT). Forklifts (4-6 x 2-7 MT capacity)
Nauru	Containers are delivered via lighter from ocean vessels. Port Facility can handle 20-foot and 40-foot containers. Mobile crane available to lift both containers and break-bulk cargo.
Niue	Cargo transferred from wharf to vessel by lighters. Limited capability to handle volume cargo, /vessels required to have lifting equipment

Country	Port Equipment
Palau	Vessels must be compatible and equipped with the ability to load and unload. Reach stacker (1 x 42 mt, 1 x 36 mt) Transtainer - Fuel transtainers handled the same as containers Forklifts (2 x 2 mt, 1 x 3 mt, 2 x 3.5 mt, 1 x 5 mt, 1 x 20 mt)
PNG	There are no wharf mounted cranes; however, mobile cranes are available and capable of lifting up to 20-ton containers. 4x Bulk Handling - RoRo Tugmaster (w/ Trailer) (30-60 m) 4 x Tractor (30-60 mt) 6 x Forklifts (30-60 mt)
Samoa	Port facility is essentially a general terminal, and all vessels must be compatible and equipped with the ability to load and unload. Land-based port equipment is capable of moving 20-foot and 40-foot Containers. Mobile Cranes (1 x 50 mt) Forklifts (4 x 15 mt, 7 x 30 mt)
Solomon Islands	Honiara Port Port facility is essentially a general terminal, and all vessels must be compatible and equipped with the ability to load and unload. Land-based port equipment is capable of moving 20-foot and 40-foot Containers Reach stacker (3 x 45 MT, 5 x 45 MT) (new) All operative and in reasonable condition Transtainer - Due to large quantities of fuel imported and vegetable oil exported port handles 200 transtainers / month Forklifts (8 x range 3 –16MT) Noro Port Port facility is essentially a general terminal, and all vessels must be compatible and equipped with the ability to load and unload. Land-based port equipment is capable of moving 20-foot and 40-foot Containers Reach stacker (1 x 45 MT) Forklifts (1 x 45 MT, 1 x 7 MT, 1 x 3 MT)

Country	Port Equipment
Tonga	Nuku'alofa is the principal port of Tonga and handles breakbulk, containers, liquid and Ro-Ro cargoes Vessels required to use own equipment to offload and load containers Reach stacker (3 x 45T) Good condition, new. Capable of stacking containers full to 2 high, empty to 6 high. Forklifts (18 x ranging 3T – 26T Good condition)
Tuvalu	All vessels must be compatible and equipped with the ability to load and unload. There is a mobile crane at the dock
Vanuatu	All vessels must be compatible and equipped with the ability to load and unload. Reach stacker x 4 (2x 45 ton reach stackers- 5 high over 3 rows. For 20- and 40-foot containers. 2 x 10 ton reach stackers for empties that can stack 6 high). Forklifts (8 x forklifts various SWL - 3 ton maximum)

PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Source: World Food Programme (WFP) 2022.

Table 244 Sufficiency of Service Agents and Shipping Lines – National Hubs

Country	Sufficiency of service agents and shipping lines	Minimum No. Routes Connecting PRIF PICs
Cook Islands	MATSON - EXCIL SHIPPING LTD, Neptune Pacific Direct Line - TRANSAM COOK ISLANDS, TAIO SHIPPING LTD Cook Islands General Transport Ltd Capability to ship direct or via transhipment to Australia, Asia, Europe and USA	3
FSM	Mariana Express Lines Kyowa Shipping Matson Line Swire Shipping Services	4
Fiji	Matson	18+

Country	Sufficiency of service agents and shipping lines	Minimum No. Routes Connecting PRIF PICs
	NPDL - NPT Agency Swire Shipping Kyowa Shipping - c/-Carpenters Shipping (Suva) Stevedoring: Providing by FPCL's subsidiary, Ports Terminal Limited	
Kiribati	Swire Shipping NPDL Kyowa Capability to ship direct or via transhipment to Australia, Asia, Europe and USA	5
Marshall Islands	Mariana Express Lines c/- PACIFIC SHIPPING INC (MAJURO) Matson c/- Majuro Marine Inc. Kyowa Shipping c/- Central Pacific Maritime Agency (Majuro) Swire Shipping Services c/- Central Pacific Maritime Agency (Majuro) Capability to ship direct or via transhipment to Australia, Asia, Europe and USA	4
Nauru	Sea freight service to Nauru is a collaboration between Nauru Shipping Line and Swire Shipping	2
Niue	Matson Lines C/-Frank & Partner	2
Palau	Kyowa, Matson Navigation PIL/ Mariana Line Capability to ship direct or via transhipment to Australia, Asia, Europe and USA	3
PNG	Consort Express Lines Swire Shipping Services - Chief Container Service - New	5+

Country	Sufficiency of service agents and shipping lines	Minimum No. Routes Connecting PRIF PICs
	Guinea Pacific Line, Kyowa Shipping c/- Carpenters Ships Agency PORT MORESBY, Cosco Shipping Lines c/-Inchcape Shipping Services Capability to ship direct or via transhipment to Australia, Asia, Europe and USA	
Samoa	Transam Head Office, Matson Shipping C/-MOLIDA SHIPPING AGENCY LIMITED Swire Shipping (Agencies) Ltd. Kyowa c/-Betham Brothers Enterprises Ltd (Apia)	16
Solomon Islands	CMA/CGM c/- Tradco New Guinea Pacific Line/ Swire Shipping C/- BJS Matson South Pacific C/- BJS NPDL c/- EXPRESS FREIGHT MANAGEMENT (SI) Ltd Kyowa Shipping c/- Carpenters Shipping Agency Solomon Islands Ltd (Honiara) Maersk c/- National Fisheries Developments LTD. National Fisheries Developments Limited	7
Tonga	Matson c/-Mataliki Shipping Services Kyowa c/- Mataliki Shipping Services NPDL Swire Shipping Services	17
Tuvalu	Kyowa Shipping c/-Transam Tuvalu NPDL c/-Transam Tuvalu	2
Vanuatu	Swire Shipping c/- Tropical Agency Ltd NPDL c/- Transam Matson Lines c/- Pacific Shipping Agencies	9

Country	Sufficiency of service agents and shipping lines	Minimum No. Routes Connecting PRIF PICs
	Capability to ship direct or via transhipment to Australia, Asia, Europe and USA	

PNG = Papua New Guinea, FSM = Federated States of Micronesia, PIC = Pacfic Island Country.

Source: Kokusai Kogyo Co., Ltd. & Yachiyo Engineering Co., Ltd. 2021.

Table 245 TEUs Yearly Throughput

Country	TEUs/Year
Cook Islands	3,632
FSM	22,954
Fiji	234,064
Kiribati	52,712
Marshall Islands	58,350
Nauru	6,157
Niue	<3,000
Palau	18,823
Papua New Guinea	338,300
Samoa	27,444
Solomon Islands	161,163
Tonga	96,475
Tuvalu	5,946
Vanuatu	99,556
Total TEUs	**1,128,577**

TEU – 20-foot equivalent unit, FSM = Federated States of Micronesia.

Source: World Bank, 2020.

Table 246 Shipping Lines Assessed

Shipping Company	Ship Name	Route
ANL	CAPITAINE TASMAN (PDL), MAERSK NEWHAVEN, SEA-SPAN HANNOVER	Tauranga (New Zealand) -Auckland (New Zealand) -Suva (Fiji) -Lautoka (Fiji) -Tauranga (New Zealand)

Shipping Company	Ship Name	Route
ANL	CAPITAINE WALLIS (PDL)	Suva (Fiji) -Lautoka (Fiji) -Port Vila (Vanuatu) - Suva (Fiji) - Matautu (Wallis and Futuna) -Sigave (Wallis and Futuna) - Suva (Fiji)
ANL	KOKOPO CHIEF (PDL), SOUTHERN MOANA (PDL)	Melbourne (Australia) -Sydney (Australia) - Brisbane (Australia) -Noumea (New Caledonia) - Port Vila (Vanuatu) -Lautoka (Fiji) -Suva (Fiji) - Apia (Samoa) -Pago Pago (American Samoa) – Nuku'alofa (Tonga) -Melbourne (Australia)
ANL	SOUTHERN TRADER (PDL)	Auckland (New Zealand) -Nuku'alofa (Tonga) - Apia (Samoa) - Pago Pago (American Samoa) - Auckland (New Zealand)
ANL	CAPITAINE MAGELLAN (PDL)	Tauranga (New Zealand) -Auckland (New Zealand) -Noumea (New Caledonia) -Port Vila (Vanuatu) -Papeete (French Polynesia) - Tauranga (New Zealand)
ANL	SOFRANA SURVILLE (ANL), SOFRANA TOURVILLE (ANL)	Tauranga (New Zealand) -Auckland (New Zealand) -Noumea (New Caledonia) -Brisbane (Australia) -Townsville (Australia) -Motukea (Papua New Guinea) -Lae (Papua New Guinea) - Honiara (Solomon) -Brisbane (Australia) - Tauranga (New Zealand)
ANL	FLORA DELMAS, HANSA REGENSBURG	Port Klang (Malaysia) -Singapore (Singapore) - Jakarta (Indonesia) -Madan (Papua New Guinea) -Lae (Papua New Guinea) -Motukea (Papua New Guinea) - Townsville (Australia) -Port Klang (Malaysia)
Hamburg Sud	N/A	Auckland (New Zealand) -Nelson (New Zealand) -Timaru (New Zealand) -Littleton (New Zealand) - Tauranga (New Zealand) -Suva (Fiji) -Lautoka (Fiji) -Tauranga (New Zealand) -Auckland (New Zealand)
Hamburg Sud	Ditto	Long Beach (USA) -Oakland (USA) -Papeete (French Polynesia) -Apia (Samoa) -Pago Pago (American Samoa) -Long Beach (USA)
Hapag- Lloyd	N/A	Sydney (Australia) -Melbourne (Australia) - Adelaide (Australia) -Auckland (New Zealand) - Suva (Fiji) -Honolulu (USA)

Shipping Company	Ship Name	Route
Hapag- Lloyd	N/A	Melbourne (Australia) -Sydney (Australia) - Tauranga (New Zealand) -Papeete (French Polynesia) -Melbourne (Australia)
Kyowa Shipping	KYOWA ORCHID KYOWA FALCON KYOWA STORK KYOWA ROSE	Busan (ROK) -Kobe (Japan) -Nagoya (Japan) - Yokohama (Japan) -Saipan (USA) -Guam (USA) -Yap (Micronesia) -Kosrae (Micronesia) -Chuuk (Micronesia) - Pohnpei (Micronesia)- Kosrae (Micronesia) -Majuro (Marshall) -Ebeye (Marshall) - Kwajalein (Marshall)
Kyowa Shipping	PACIFIC CONDOR KYOWA ROSE	Busan (ROK) -Chofu / Moji (Japan) -Kobe (Japan) -Nagoya (Japan) -Yokohama (Japan) - Lae (Papua New Guinea) -Rabaul (Papua New Guinea) -Port Moresby (Papua New Guinea) - Townsville (Australia)
Kyowa Shipping	PAPUAN CHIEF TROPICAL ISLANDER HIGHLAND CHIEF PACIFIC ISLANDER II CORAL ISLANDER II NEW GUINEA CHIEF	Busan (ROK) -Kobe (Japan) -Nagoya (Japan) - Yokohama (Japan) -Tarawa (Kiribati) -Honiara (Solomon) -Santo (Vanuatu) - Port Vila (Vanuatu) -Noumea (New Caledonia) -Lautoka (Fiji) -Suva (Fiji) - Nuku'alofa (Tonga) -Apia (Samoa) -Pago Pago (American Samoa) -Papeete (French Polynesia) -Tarawa (Kiribati) -Santo (Vanuatu) - Busan (ROK)
Matson	LIORA II	Auckland (New Zealand) -Nuku'alofa (Tonga) - Suva (Fiji) - Apia (Samoa) -Rarotonga (Cook) - Aitutaki (Cook) -Auckland (New Zealand)
Matson	OLOMANA	Auckland (New Zealand) -Nuku'alofa (Tonga) - Suva (Fiji) - Pago Pago (American Samoa) -Apia (Samoa) -Rarotonga (Tonga) -Aitutaki (Cook) - Niue (Niue) -Nuku'alofa (Tonga) – Vava'u (Tonga) -Oakland (New Zealand)
NYK	CORAL ISLANDED II PACIFIC ISLANDED II TROPICAL ISLANDER SOUTH ISLANDER	Busan (ROK) -Kobe (Japan) -Nagoya (Japan) - Yokohama (Japan) -Honiara (Solomon) -Santo (Vanuatu) -Port Vila (Vanuatu) -Noumea (New Caledonia) -Lautoka (Fiji) -Suva (Fiji) - Nuku'alofa (Tonga) -Apia (Samoa) -Pago Pago (American Samoa) -Papeete (French Polynesia) -Tarawa (Kiribati) -Busan (ROK)

Shipping Company	Ship Name	Route
PDL	SOUTHERN LILY	Auckland (New Zealand) –Nuku'alofa (Tonga) - Apia (Samoa) -Pago Pago (American Samoa) - Auckland (New Zealand)
PDL	SOUTHERN MOANA	Tauranga (New Zealand) -Auckland (New Zealand) -Noumea (New Caledonia) -Lautoka (Fiji) -Suva (Fiji) - Port Vila (Vanuatu) -Santo (Vanuatu) -Tauranga (New Zealand)
PDL	CAPITAINE TASMAN, CAPITAINE DAMPIER	Tauranga (New Zealand) -Auckland (New Zealand) -Suva (Fiji) -Lautoka (Fiji) -Tauranga (New Zealand)
PDL	SOUTHERN PEARL	Suva (Fiji) -Lautoka (Fiji) -Wallis (Wallis and Futuna) -Futuna (Wallis and Futuna) -Funafuti (Tuvalu) -Tarawa (Kiribati) - Christmas Island (Australia) -Suva (Fiji)
PDL	IMUA II & LILOA	Auckland (New Zealand) -Rarotonga (Cook) - Aitutaki (Cook) -Vava'u (Tonga) -Auckland (New Zealand)
PDL	FORUM SAMOA, MELANESIAN PRIDE	Melbourne (Australia) -Sydney (Australia) - Brisbane (Australia) -Noumea (New Caledonia) - Port Vila (Vanuatu) -Lautoka (Fiji) -Suva (Fiji) - Apia (Samoa) -Pago Pago (American Samoa) - Nuku'alofa (Tonga) -Melbourne (Australia)
PFL	N/A	Melbourne (Australia) -Sydney (Australia) - Brisbane (Australia) -Lautoka (Fiji) -Suva (Fiji) - Apia (Samoa) -Pago Pago (Samoa) -Nuku'alofa (Tonga) -Melbourne (Australia)
PFL	N/A	Tauranga (New Zealand) -Auckland (New Zealand) -Rarotonga (Cook) -Aitutaki (Cook) – Vava'u (Tonga) -Tauranga (New Zealand)
PFL	N/A	Tauranga (New Zealand) -Auckland (New Zealand) - Nuku'alofa (Tonga) -Suva (Fiji) - Lautoka (Fiji) -Tauranga (New Zealand)
PFL	N/A	Tauranga (New Zealand) -Auckland (New Zealand) -Suva (Fiji) -Lautoka (Fiji) -Tauranga (New Zealand)

Shipping Company	Ship Name	Route
PFL	N/A	Lautoka (Fiji) -Suva (Fiji) -Apia (Samoa) -Pago Pago (American Samoa) -Nuku'alofa (Tonga) - Melbourne (Australia) -Sydney (Australia) - Brisbane (Australia) -Lautoka (Fiji)
PFL	N/A	Auckland (New Zealand) -Tauranga (New Zealand) -Port Moresby (Papua New Guinea) - Lae (Papua New Guinea) -Auckland (New Zealand)
PFL	N/A	Auckland (New Zealand) -Nuku'alofa (Tonga) - Apia (Samoa) - Pago Pago (American Samoa) - Auckland (New Zealand)
PFL	N/A	Oakland (USA) -Long Beach (USA) -Auckland (NZ) - Nuku'alofa (Tonga) -Pago Pago (American Samoa) -Apia (Samoa)
PFL	N/A	Oakland (USA) -Long Beach (USA) -Auckland (NZ) -Rarotonga (Cook) -Aitutaki (Cook)
Swire	LIORA II, OLOMANA, ISLAND CHIEF	Auckland (New Zealand) -Nuku'alofa (Tonga) - Lautoka (Fiji) - Suva (Fiji) -Apia (Samoa) - Rarotonga (Cook) -Aitutaki (Cook) -Niue (Niue) - Vava'u (Tonga) -Nuku'alofa (Tonga) -Auckland (New Zealand)
Swire	SOUTHERN MOANA, KOKOPO CHIEF	Melbourne (Australia) -Sydney (Australia) - Brisbane (Australia) -Prony Bay (New Caledonia) -Noumea (New Caledonia) -Port Vila (Vanuatu) - Lautoka (Fiji) -Suva (Fiji) -Apia (Samoa) -Pago Pago (American Samoa) -Nuku'alofa (Tonga) - Melbourne (Australia)
Swire	MOROBE CHIEF, NICKIE B	Melbourne (Australia) -Sydney (Australia) - Brisbane (Australia) -Motukea (Papua New Guinea) -Lae (Papua New Guinea) -Lihir (Papua New Guinea) -Honiara (Solomon) - Prony Bay (New Caledonia) -Melbourne (Australia)
Swire	LAE CHIEF, NOUMEA CHIEF, SUVA CHIEF	Shanghai (PRC) -Ningbo (PRC) -Nansha (PRC) -Hong Kong (Hong Kong) -Lae (Papua New Guinea) -Port Moresby / Motukea (Papua New Guinea) -Townsville (Australia) -Shanghai (PRC)

Shipping Company	Ship Name	Route
Swire	SOOCHOW, SIANG-TAN, SHENGKING, SHUNTIEN	Kaohsiung (Taipei,China) -Hatsukaichi (Japan) - Yokohama (Japan) -Osaka (Japan) -Busan (ROK) -Ningbo (PRC) -Nansha (PRC) -Lae (Papua New Guinea) -Rabaul (Papua New Guinea) -Motukea (Papua New Guinea)-Honiara (Solomon) -Noumea (New Caledonia) -Oakland (New Zealand) -Timaru (New Zea-land) - Tauranga (New Zealand) -Marsden Point (New Zea-land) -Noumea (New Caledonia) -Vavouto (New Caledonia) - Kaohsiung (Taipei,China)
Swire	CORAL CHIEF, HIGHLAND CHIEF, NEW GUINEA CHIEF, PAPUAN CHIEF, SOUTH IS-LANDER (NYK), CORAL ISLANDER II (KYOWA), PACIFIC ISLANDER II (NYK), TROPICAL IS-LANDER	Busan (ROK) -Kobe (Japan) -Nagoya (Japan) - Yokohama (Ja-pan) -Honiara (Solomon) -Santo (Vanuatu) -Port Vila (Vanu-atu) -Noumea (New Caledonia) -Lautoka (Fiji) -Suva (Fiji) - Nuku'alofa (Tonga) -Apia (Samoa) -Pago Pago (American Sa-moa) -Papeete (French Polynesia) -Tarawa (Kiribati) -Busan (ROK)
Swire	Ditto	Kaohsiung (Taipei,China) -Tianjin (PRC) -Qingdao (PRC) - Busan (ROK) -Yokohama (Japan) - Majuro (Marshall) -Tarawa (Kiribati) -Port Vila (Vanuatu) -Noumea (New Caledonia) - Lautoka (Fiji) -Suva (Fiji) -Nuku'alofa (Tonga) -Apia (Samoa) - Pago Pago (American Samoa) - Noumea (New Caledonia) - Santo (Vanuatu) - Kaohsiung (Taipei,China)
Swire	FESCO ASKOLD (Hamburg Sud)	Long Beach (USA) -Oakland (USA) -Papeete (French Polyne-sia) -Apia (Samoa) -Pago Pago (American Samoa) -Long Beach (USA)
Swire	SHANSI, SZECHUAN, KWANGSI	Sriracha (Thailand) -Singapore (Singapore) - Noumea (New Caledonia) -Lautoka (Fiji) -Suva (Fiji) -Auckland (New Zea-land) -Brisbane (Australia) -Motukea (Papua New Guinea) - Lae (Papua New Guinea) -Lihir (Papua New Guinea) - Srira-cha (Thailand)

Shipping Company	Ship Name	Route
Swire	CARPENTERS SIRIUS, CHANGSHA, CHEFOO, MIA SCHULTE	Port Klang (Malaysia) -Singapore (Singapore) - Jakarta (Indonesia) -Motukea (Papua New Guinea) -Lae (Papua New Guinea) -Lihir (Papua New Guinea) -Rabaul (Papua New Guinea) - Madan (Papua New Guinea) -Port Klang (Malaysia)
Swire	Ditto	Port Klang (Malaysia) -Singapore (Singapore) - Motukea (Papua New Guinea) -Lae (Papua New Guinea) -Orobay (Papua New Guinea) -Alotau (Papua New Guinea) -Honiara (Solomon) -Lihir (Papua New Guinea) -Kimbe (Papua New Guinea) -Port Klang (Malaysia)

PRC = People's Republic of China, ROK = Republic of Korea.

Source: Kokusai Kogyo Co., Ltd. & Yachiyo Engineering Co., Ltd. 2021

Appendix T Technical Data

Table 247 Recyclers Throughout the Pacific

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Cook Islands	Aitutaki Waste Facility	Aitutaki	N/A	unknown	unknown									
Cook Islands	Cook Islands Trading Corporation Limited	Rarotonga	N/A	shop@citc.co.ck	682 22000									
Cook Islands	General Transport	Rarotonga	N/A	movers@cigt.co.ck	682 24441									
Cook Islands	Rarotonga Waste Facility	Rarotonga	N/A	ICI.info@cookislands.gov.ck infrastructure@cookislands.gov.ck	682 20321									
Fiji	Coca-Cola Amatil "Mission Pacific Fiji"	Labasa, Lautoka & Suva	N/A	N/A	(679) 339 6497 (Nasinu) (679) 666 1188 (Lautoka) (679) 881 2266 (Labasa)									
Fiji	Waste Recyclers Fiji Ltd	Suva, Lautoka & Lami	Khalid Ahmed	wasterecsales@connect.com.fj	679 992 1056									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Fiji	Ba Town Council Office	Ba	N/A	info@ba-towncouncil.com.fj	679 667 4277									
Fiji	Pacific Batteries	Lami, Suva	N/A	info@pacificbatteries.com.fj	(679) 336-2708									
Fiji	Foundation for Rural Integrated Enterprises & Development (FRIENDS FIJI LTD)	Lautoka, Labasa	N/A	friend@connect.com.fj	679 666 3181									
Fiji	Pacific Scarp Metal Buyers	Lami	Sunil Singh	pacific_scrap@yahoo.com	336 2757									
Fiji	Asia Pacific Engineering Ltd.	Suva & Lautoka	Elizabeth Jacinta	apelfijino1@gmail.com	3310102									
Fiji	J.P.T Enterprise Ltd.	Lautoka	Moutasim Islam	jptenterprise121@gmail.com	8311766									
Fiji	Dayals Steel Pte Limited	Ba	Manpreet Kaur	manpreet@dayalssteels.com	6675605									
Fiji	South Pacific Waste Recyclers	Suva	Sanjay Kirpal	sanjay.k@cjsgroup.com.fj spwr@cjsgroup.com.fj info@cjsgroup.com.fj	679 334 1115									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Fiji	Zee Steel Recycling	Lautoka	Anil Chand	zeeclean@yahoo.com	9998087									
FSM	Island Paradise Metal Company	Yap	Jesse Faimaw	jesse-faimaw@hotmail.com	(691)350-8272									
FSM	Micronesia Eco. Corp.	Kosrae	Richard M. Stephens	pacifictree-lodge@gmail.com	(691)370-7856									
FSM	KTG Recycling Centre	Kolonia	N/A	N/A	N/A									
FSM	Madolenihmw Redemption Centre	Madolenihmw	N/A	N/A	N/A									
Kiribati	Kaoki Maange	South Tarawa	Alice Leney Uarai Koneteti	kaokimange@tskl.net.ki fsp@tskl.net.ki	(686) 25296									
Kiribati	Macaulay Metals Ltd. NZ	New Zealand	Jeff Harris (MD)	jeff.harris@macaulaymetals.co.nz scrap@macaulaymetals.co.nz	021 245 8408 0800 72 72 79									
Kiribati	Kiribati Material Recycling Facility	Batio Port, South Tarawa	N/A	N/A	N/A									
Marshall Islands	RMI Recycling Company	Majuro	Yen T Sheng	kmifva@yahoo.com.tw	(692)455-1358									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Marshall Islands	Majuro Atoll Waste Company (MAWC)	Majuro	Halston deBrum	mawc.gm@gmail.com	(692) 247-2700									
Marshall Islands	Marshall Islands Energy Company	Majuro	Damien Milne	publicinfo@mecrimi.net mec-corp@ntamar.net da-mien@mecrmi.net	692 625 3827									
Nauru	Nauru Waste Facility (Nauru Rehabilitation Corporation (NRC))	South-West Nauru	N/A	nrc.enquiry@gmail.com	674 557 3200									
Nauru	Government Warehouse (Nauru Government)	Meneng	N/A	N/A	674 557 3133 ext. 307									
Niue	Catholic Church	Alofi North	Father Anaua Finau	anauafinau@niue.nu	(683) 4164									
Niue	Niue Waste Management (The Department of Environment)	Alofi	N/A	info@wastemanagementniue.com	6934026									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Palau	Belau Garbage and Scrap Company	Koror	Sam Masang	peci@palautelecoms.com	680 488 2628									
Palau	Chao Tai CT Shop	Koror	Jimmy & Shella	N/A	N/A									
Palau	Koror State Recycling Centre	Koror	Katsuo Fuji/Selby Etibek	ksg.swm@gmail.com ksg-swm@palaunet.com	680-488-8076/8077									
Palau	Palau Waste Company	Koror	Michael Yiao	yafeng_kelly@hotmail.com	680 587 3680									
Palau	Airai State Government Public Works	Airai	N/A	airaigov@palaunet.com	(680) 587-2694									
Palau	GF Automative Enterprises	Koror	Ching Hua Lin	gfealin@yahoo.com	680 488 4065									
Palau	Melekeok Disposal Site	Melekeok	N/A	N/A	(680) 654-2967									
Palau	Palau Metal Company/JC Auto Shop	Koror	Joe Chen	N/A	N/A									
PNG	Nuovo International	West New Britain Province	N/A	info@nuovopng.com	675 70554440									
PNG	PNG Recycling	Port Moresby	Geroge Doonan	gwdoonan@gmail.com	N/A									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	UL AB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
PNG	National Capital District Commission (Baruni Landfill)	Port Moresby	N/A	info@ncdc.gov.pg	6753240700									
PNG	Sims Metal Management	Lae Port Moresby Western Province	N/A	https://www.simsmm.com.au/locations/morobe-lae/	675 472 6144									
PNG	Huon Gulf Metal Industries	Lae	Michale Beirne	N/A	675 472 6852									
PNG	Lihir Recycling Ltd	Lihir	N/A	N/A	675 986 4600									
PNG	Southern Scrap Metal	Boroko	Jacob Aksua Chinchinkru	N/A	675 328 1046									
PNG	Branis Recycling Ltd	Port Moresby	N/A	branis@daltron.com.pg	675 323 2764 675 325 0667									
PNG	Goldchin (PNG) Ltd	Lae	Stephanie Chan	goldchin_png@datec.net.pg	675 472 8369									
PNG	Kalapi Scrap Metals and Empty Bottle Buyers	Lae	N/A	N/A	675 475 7086									
PNG	Hythes Limited	Port Moresby	Duma Wilson	hytheslimited@gmail.com	(675) 7600 9374									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
PNG	Milaheve Scrap Trading	Boroko	Harry Rohoro	N/A	675 323 0680									
Samoa	Pacific Recyclers	Apia	John Sio	precycle@lesamoa.net	22117, 752 2117									
Samoa	Waste Management Co. Ltd	Vaitele	Marina Keil	wastemanagementapia@gmail.com	685 24939									
Samoa	Samoa Pure Water (Manino Waters)	Vaitele	N/A	info@samoapurewater.com	685-24516									
Samoa	Taula Breweries	Apia	N/A	info@taulabeverages.com	685 20236									
Samoa	Vailima Breweries	Apia	Tulia Losefa	Tulia.losefea@paradisebeverages.ws	L: +685 68000 M: 685 774 0107									
Samoa	One Scrap	Vailoa Faleata	Potoi Peteli	potoi1972@gmail.com	(685) 7201922									
Samoa	Metal Man	Vaitele	Rudy Nauer	n.nritytrell@gmail.com	(685) 7730316									
Solomon Islands	Alpha Metals	*Unclear	N/A											
Solomon	BJS Recycling	Honiara	Sebastian Ilala	bjsrecycling@live.com	1 253-839-7114									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	UL AB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Islands														
Solomon Islands	Top Environmental	*Unclear	N/A	N/A	N/A									
Solomon Islands	Catholic Church Gizo	Gizo	N/A	N/A	(677) 60130									
Solomon Islands	Solpower	Honiara	Michael Mafiti	mikeymaefiti@yahoo.com	677 7482918									
Solomon Islands	Lindsey Teobasi (Individual)	Honiara	Lindsey Teobasi	Lindsay.Teobasi@gmail.com	N/A									
Solomon Islands	PlasticWise GIZO	Gizo	Rendy Solomon	plasticwise-gizo@gmail.com	677 746 6256									
Solomon Islands	Honiara City Council (Landfill Site)	Honiara	N/A	diba.alu@gmail.com	677 21133									
Solomon	Patrick (Individual)	Honiara	Patrick	N/A	N/A									

Country	Waste Operator	Site Location	Contact Person	Contact Email	Contact no.	Aluminum	ULAB	PET	Scrap Steel	Scrap Metal	Steel Cans	EOL	P & C	Glass
Islands														
Solomon Islands	Solomon Brewers Ltd.	Honiara	N/A	info@solbrew.com.sb	677 677 30257									
Tonga	Gio Recycling Company	Tongatapu	Ms 'Ofa Tu'ikolovatu	Uihanson.gio@gmail.com	N/A									
Tonga	Sustainable Resources Management	Tongatapu	N/A	tongasustainabledevelopment@gmail.com	676 772 8510									
Tonga	Tapuhia Landfill (WAL)	Nuku'alofa	N/A	it@wasteauthoritylimited.com	(676) 27826									
Tuvalu	Department of Waste Management (DWM)	Funafuti Transfer Station	N/A	dwmmhard@gmail.com	688 201 164									
Vanuatu	Recycle Corp	Port Vila & Luganville	Andrew Hibgame	andrewhigame@gmail.com	678 554 1748									
Vanuatu	Kava Bars/Markets	Vanuatu	N/A	N/A	678 592 6976									
Vanuatu	Kava bars/markets/Azure pure water	Vanuatu & Bauefield Airport (Azure)	Yael Sakker	recycling@azure.vu	+678 27461									
Vanuatu	Vanuatu Beverage Ltd.	Port Vila	N/A	info@vanbev.vu	678 22964									

PNG = Papua New Guinea, FSM = Federated States of Micronesia.

Source: Regional Recycling Centre Pre-Feasibility Study Report project team, Secretariate of the Pacific Regional Environment Programme (SPREP) n.d., and Ministry of Commerce, Tourism, Trade & Transport 2021.

Appendix U Contact and Stakeholder List

Table 248 Contact and Stakeholder List

Name	Country	Position	Organization	Contact
Jotishna Reddy	Fiji		Ministry of Tourism	jotishna.reddy@govnet.gov.fj
Salote Waiwalu	Fiji		Ministry of Tourism	sariah.best-joseph@massygroup.com
Joseph Inoke-Deo	Fiji		Waste Recyclers Fiji Ltd	admin@wasterecylers.com.fiji
Clint Christerfer	Fiji		Waste Recyclers Fiji Ltd	sales1@wasterecylers.com.fiji
Sandeep Singh	Fiji		Department of Environment (DOE)	singhsk@govnet.gov.fj
Rajeshni Lata	Fiji		Department of Environment (DOE)	rajeshni.lata@govnet.gov.fj
Dorine Singh	Fiji		Department of Environment (DOE)	dorine.singh@govnet.gov.fj
Khalid Ahmed	Fiji		Waste Recyclers Fiji Ltd	wasterecsales@connect.com.fj / 6799921056
Sunil Singh	Fiji		Pacific Scrap Metal Buyers	pacific_scrap@yahoo.com / 6796663181
Elizabeth Jacinta	Fiji		Asia Pacific Engineering Ltd.	apelfijino1@gmail.com / 3310102
Moutasim Islam	Fiji		J.P.T Enterprise Ltd.	jptenterprise121@gmail.com / 8311766

Name	Country	Position	Organization	Contact
Manpreet Kaur	Fiji		Dayals Steel Pte Limited	manpreet@dayalssteels.com / 6675605
Bala Sami	Fiji	Production Manager	South Pacific Waste Recyclers	production.spwr@cjsgroup.com.fj
Sanjay Kirpal	Fiji		South Pacific Waste Recyclers	sanjay.k@cjsgroup.com.fj / 679 334 1115 spwr@cjsgroup.com.fj info@cjsgroup.com.fj
Anil Chand	Fiji		Zee Steel Recycling	zeeclean@yahoo.com / 9998087
Vinay Narsey	Fiji	Managing Director	Narseys Plastic	
Warwick Pleass	Fiji	Managing Director	Pleass Global	warwick@pleass.com
Errol Sumaru	Fiji		Dominion batteries	dommusic@connect.com.fj
Bandag	Fiji		Bandag/P.A. Lal	info@palalgroup.com.fj
Kailash Naidu	Fiji	Property Manager	Punjas Group	kailashm@punjas.com
Navneet Prasad	Fiji	Distribution Center	Punjas Group	navneetp@punjas.com
Navin Prasad	Fiji		Punjas Group	navinp@punjas.com
Patrick Kumar	Fiji		Punjas Group	patrick@punjas.com
Golden Manufacturing	Fiji		Golden Manufacturing	enquiries@golden.com.fj
Bruce Clay	Fiji	General Manager	Clay Energy	bruce@clayenergy.com.fj
Amit Singh	Fiji	General Manager	CBS Power Solutions	amit@cbspowersolutions.com

Name	Country	Position	Organization	Contact
Roger Hare	Fiji	General Manager	Coca Cola EuroPacific Partners Fiji	(679) 339 6497 (679) 666 1188 (679) 881 2266
Trevor Fisher	Fiji	General Manager	Fiji Chemicals Ltd.	info@fijichemicals.com.fj
Daventi & Priya	Fiji	Quality Assurance office	FMF	info@fmf.com.fj
Central Pacific Chemicals	Fiji		Central Pacific Chemicals	sales@ixom.com.fj
Sunrise Batteries	Fiji		Sunrise Batteries	338 4247
Ministry for Commerce, Trade, Tourism and Transport	Fiji		MCTTT	info@mcttt.gov.fj
Diwakar Dubey	Fiji	General Manager	Pacific Batteries	dubey@pacificbatteries.com.fj
Hemant Mahyavanshi	Fiji	Former General Manager Pacific Batters	Axis Fiji	hemant@axisfiji.com.fj
Brian Wilson	Fiji	Expert	ILA Lead	BWilson@ila-lead.org
Amitesh Deo	Fiji	Director	Recycling Foundation Waste Recyclers Fiji Ltd	amitesh@recyclingfoundation.org amitesh@wasterecyclers.com.fj
John	Fiji		Recycling Foundation	John@recyclingfoundation.org
Rohit Chand	Fiji		Waste Recyclers Fiji Ltd	fc@wasterecyclers.com.fj
Joseph	Fiji		Recycling Foundation	joseph@recyclingfoundation.org
Tanya Yanuyanurua	Fiji		Recycling Foundation	research@recyclingfoundation.org

Name	Country	Position	Organization	Contact
John Wilson	Fiji	Project Manager	Recycling Foundation	John@recyclingfoundation.org
Dhanjay Deo	Fiji	Communications Manager	Recycling Foundation	comms@recyclingfoundation.org
Vishal Chand	Fiji	General Manager	Waste Clear	waste.clear@yahoo.com
Sanjeev Chand	Fiji	Sales and Engineering Manager	Waste Clear	waste.clear@yahoo.com
Subhas Chand	Fiji	Managing Director	Waste Clear	waste.clear@yahoo.com
Jodi Smith	Fiji	Partner	Matanataki	jodi@matanataki.com
Alok Mishra	Fiji	General Manager	Carpenters Fiji Pte Limited	info@carpenters.com.fj
Michael Spencer	Fiji	General Manager	Paradise Beverages	enquiries@paradisebeverages.com.fj
Sudha Deo	Fiji	General Manager of Operations	Paradise Beverages	enquiries@paradisebeverages.com.fj
Fiji Water	Fiji		Fiji Water	delivery@fijiwater.com
Tappoo	Fiji	Pepsi Distributor	Tappoo	info@tappoo.com.fj
Vikesh Chauhan	Fiji	Managing Director	Star Printery	admin@starprintery.net.fj
Sandeep Chauhan	Fiji	Managing Director	Star Printery	admin@starprintery.net.fj
BlueScope Lysaght (Fiji) Limited	Fiji		Bluescope	info.fiji@bluescopesteel.com.fj
Quality Print	Fiji		Quality Print Pte Ltd	info@qualityprint.com.fj
Andrew Irvin	Fiji	Project Officer	University of the South Pacific (USP)	andrew.irvin@usp.ac.fj

Name	Country	Position	Organization	Contact
Jesse Faimaw	FSM		Island Paradise Metal Company	jessefaimaw@hotmail.com / (691)350-8272
Richard M. Stephens	FSM		Micronesia Eco. Corp.	pacifictreelodge@gmail.com / (691)370-7856
Alice Leney, Uarai Koneteti	Kiribati		Kaoki Maange	kaokimange@tskl.net.ki / (686) 25296 fsp@tskl.net.ki
Jeff Haris (MD)	Kiribati		Macaulay Metals Ltd. NZ	jeff.harris@macaulaymetals.co.nz / 021 245 8408 scrap@macaulaymetals.co.nz
Yen T Sheng	Marshal Islands		RMI Recycling Company	kmifva@yahoo.com.tw / (692)455-1358
Halston deBrum	Marshal Islands		Majuro Atoll Waste Company (MAWC)	mawc.gm@gmail.com / (692) 247-2700
Damien Milne	Marshal Islands		Marshall Islands Energy Company	publicinfo@mecrimi.net / 692 625 3827 meccorp@ntamar.net damien@mecrmi.net
Father Anaua Finau	Niue		Catholic Church	anauafinau@niue.nu / (683) 4164
Sam Masang	Palau		Belau Garbage and Scrap Company	peci@palautelecoms.com / 680 488 2628
Jimmy & Shella	Palau		Chao Tai CT Shop	

Name	Country	Position	Organization	Contact
Katsuo Fuji/Selby Etibek	Palau		Koror State Recycling Centre	ksg.swm@gmail.com / 680-488-8076/8077 ksg-swm@palaunet.com
Michael Yiao	Palau		Palau Waste Company	yafeng_kelly@hotmail.com / 680 587 3680 680 779 3680
Ching Hua Lin	Palau		GF Automative Enterprises	gfealin@yahoo.com / 680 488 4065 680 488 8196
Joe Chen	Palau		Palau Metal Company/JC Auto Shop	
Geroge Doonan	PNG		PNG Recycling	gwdoonan@gmail.com
Michale Beirne	PNG		Huon Gulf Metal Industries	675 472 6852
Jacob Aksua Chinchinkru	PNG		Southern Scrap Metal	675 328 1046
Stephanie Chan	PNG		Goldchin (PNG) Ltd	goldchin_png@datec.net.pg / 675 472 8369
Duma Wilson	PNG		Hythes Limited	hytheslimited@gmail.com / (675) 7600 9374 (675) 7219 9482
Harry Rohoro	PNG		Milaheve Scrap Trading	675 323 0680
Frances Debra Brown-Reupena	Samoa	New CEO	Ministry of Natural Resources & Environment	Fran.reupena@mnre.gov.ws
Fiasoso Siaosi	Samoa		Ministry of Natural Resources & Environment	fiasoso.siaosi@mnre.gov.ws

Name	Country	Position	Organization	Contact
Setoa Apo	Samoa		Ministry of Natural Resources & Environment	Setao.apo@mnre.gov.ws
Seumalo Afele Faiilagi	Samoa		Ministry of Natural Resources & Environment	afele.faiilagi@mnre.gov.ws
Faamatuainu Soifua	Samoa		Samoa Tourism Authority	faamatuainu@samoa.travel
Alvin Onesemo	Samoa		Ministry of Revenue (Customs)	aonesemo@revenue.gov.ws
Taiaopo Faumina	Samoa		Samoa Bureau of Statistics	Taiaopo.faumuina@sbs.gov.ws
Marina Keil	Samoa		Recyclers Association	wastemanagementapia@gmail.com
Abigail Lee Hang	Samoa		Ministry of Finance	Abigail.leehang@mof.gov.ws
John Sio	Samoa		Pacific Recyclers	precycle@lesamoa.net / 22117, 752 2117
Tulia Losefa	Samoa		Vailima Breweries	Tulia.losefea@paradisebeverages.ws / L: +685 68000 M: 685 774 0107
Potoi Peteli	Samoa		One Scrap	potoi1972@gmail.com / (685) 7201922
Rudy Nauer	Samoa		Metal Man	n.nrityrell@gmail.com / (685) 7730316
Dr Melchior Mataki	Solomon Islands	Permanent Secretary	Ministry of Environment, Climate Change, Disaster Management and Meteorology	MMataki@mecm.gov.sb

Name	Country	Position	Organization	Contact
Debra Kereseka	Solomon Islands	Chief Environment Officer	Environment and Conservation Division	26036 Dkereseka@mecm.gov.sb
Rosemary Apa	Solomon Islands	Deputy Director, Environment	Environment and Conservation Division	rapa@mecm.gov.sb
Hon. Snyder Rini	Solomon Islands		Min. Finance	24102
Nathan Kama	Solomon Islands	Controller Customs and Exercise	Min. Customs	24377
Hon. Willie B Marau	Solomon Islands		Min. Commerce	22856
Hon. Bartholomew Parapolo	Solomon Islands		Min. Tourism	28603
John Dean Kuku	Solomon Islands		Min. Education	28803 dhaa@hotmail.com
Freda Tuki Soriocomua	Solomon		Min. Women, Youth, Children	23544

Name	Country	Position	Organization	Contact
	Islands			
Hugo Baulo	Solomon Islands	Operations Manager	Solomon Islands Port Authority	hbaulo@sipa.com.sb
Glynn Joshua	Solomon Islands	Operations Manager	Solomon Islands Port Authority	gjoshua@sipa.com.sb
Christian Nieng	Solomon Islands	CEO	National Hosting Authority, 2023 Pacific Games	
Ken Grossmith	Solomon Islands	Architect	National Hosting Authority, 2023 Pacific Games	
Clint Flood	Solomon Islands		National Hosting Authority, 2023 Pacific Games	
Nelson Manepura	Solomon Islands	Marketing Officer	Tourism Solomons	
Roselyn Leua	Solomon Islands	Executive Personal Secretary	Guadalcanal Provincial Government	8856727

Name	Country	Position	Organization	Contact
Timothy Ngele	Solomon Islands	Provincial Secretary	Guadalcanal Provincial Government	7107622
Maesac Suia	Solomon Islands	Deputy Provincial Secretary - Guadalcanal Province	Guadalcanal Provincial Government	
Albert Kua	Solomon Islands	Senior Commerce Officer - Guadalcanal Province	Guadalcanal Provincial Government	
Katie Williams	Solomon Islands	Tourism Development advisor - Guadalcanal Province	Guadalcanal Provincial Government	
Jacinta K. Vagha	Solomon Islands	Tourism Officer - Guadalcanal Province	Guadalcanal Provincial Government	
Rence Sore	Solomon Islands	City Clerk	Honiara City Council	
George Titiulu	Solomon Islands	Chief Health Inspector	Honiara City Council	gtitiulu@gmail.com
George Bogese	Solomon	Director of Waste Management and Control	Honiara City Council	georgebgs59@gmail.com

Name	Country	Position	Organization	Contact
	Islands			
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**Includes contacts and relevant information provided for this and related studies.*

Source: Regional Recycling Centre Pre-Feasibility Study Report project team.