

Annex 3b. Economic and Financial Valuation Summary

A. Financial Analysis

Both Components 1 and 2 will catalyze significant co-finance from the government, the private sector and project beneficiaries. GCF grants, by filling selected funding gaps while minimizing concessionality, will be crucial to the successful execution of the project. Specifically:

1. Rationale for GCF grants for Component 1

The following considerations justify the request of a GCF grant for the revenue-generating Activities 1.1 and 1.3 of Component 1. Please refer also to the “Component 1 – FIRR” sheet in the Excel model. The model is in real terms (i.e. it does not account for inflation). The assumed EUR/GEL exchange rate is 3.00.

a. Financial IRR and NPV considerations

To determine the FIRR, we have modeled the SFM’s revenues, capex and operations & maintenance (O&M) costs over 20 years, based on the following assumptions:

- Revenues are based on an estimate of volumes of timber and fuelwood sustainably produced and sold under the SFM. Timber production is also differentiated by timber grade.
- The SFM will be implemented in subsequent 10-year planning periods.
- During the first planning period, the SFM will reach its full sustainable production capacity by year 7, starting from a 30% production capacity in year 2. In year 2 the SFM is expected to yield approx. 2,000 m³ of category I timber (highest quality and price), 19,000 m³ of cat. II timber, 39,000 m³ of cat. III timber and 86,000 m³ of fuelwood (lowest quality and price). By year 7, such volumes will increase to 7,000, 62,000, 131,000 and 286,000 m³, respectively. In year 1, while the SFM preparatory activities are ongoing, the forest in the 8 districts will continue to produce at the current (pre-SFM) rate of 36,000 m³ of timber (total for the three categories) and 54,000 m³ of fuelwood.
- Prices for timber are assumed at GEL 273/m³ for cat. I, 225 for cat. II and 177 for cat. III. The model is in real terms (no inflation) and prices are assumed to remain constant throughout the forecast period. Conservatively, prices are assumed to be 5% below current market prices, to reflect the increased supply and possible downward pressure that this may put on prices. These are prices to the final buyer, assuming timber is collected by the NFA in-forest and deposited and sold from the business yards.
- The NFA expects to sell fuelwood including delivery to households at a cost covering price of GEL 81/m³, in line with current prices being paid by households purchasing fuelwood from intermediaries.
- Based on these assumptions, during the 7-year project period, the SFM will generate revenues of GEL 254 million (~EUR 84.7 million), starting from ~EUR 4 million in year 1 and increasing to over EUR 20 million in year 7.
- In the second 10-year period, production at full capacity increases to approx. 242,000 m³ of timber and 345,000 m³ of fuelwood.
- Capex is in the form of (i) equipment for forest restoration and regeneration activities, enrichment planting, harvesting, timber transport; (ii) construction of in-forest and skidding roads; and (iii) construction of 15 business yards and wood processing equipment for the processing and sale of timber and fuelwood.
- O&M costs arise both from the implementation of the SFM in-forest (e.g. for regeneration activities, tending, thinning, harvesting, timber transport and road maintenance) and from the operation of the business yards.

Without concessionality, the expected financial IRR (FIRR) of Component 1 (SFM) is 2.4% over 20 years, the time period conventionally used to evaluate the effectiveness of SFM projects. This is well below

Georgia's financial cost of capital of ~8.4%.¹ The financial NPV, using such cost of capital as the discount rate, is negative EUR 9 million.

A EUR 13.2 million GCF grant, covering approx. 25% of the SFM's capex over the first 7 years, would increase the FIRR to 9.7%. In order to minimize concessionality, the grant is sized so that the FIRR reaches just above the sovereign cost of capital and does not create a financial windfall for the government.

b. Cashflow considerations

The SFM model for forest measure implementation (Activity 1.1) and the NFA timber and fuelwood supply system (Activity 1.3) is meant to be financially sustainable in the long run, by generating revenues from timber and fuelwood sales that more than offset capex and operations and maintenance (O&M) costs. For the first 15 years, however, revenues will not be sufficient to cover capex and O&M, because of the timing required for SFM measures to reach maturity and timber/fuelwood sales volumes to increase accordingly. Without GCF support, the government would have to inject a total of EUR 32.8 million (GEL 98.4 million) to make up for negative cashflows in years 1-15 (see row 186 of "Component 1 – FIRR" sheet).

A EUR 13.2 million GCF grant for Activity 1.1 and 1.3 will contribute to alleviating this shortfall. The government has committed to step in, out of budget sources, to fill the SFM's remaining funding gap of EUR 19.6 million in years 1-15 (EUR 1.3 million p.a. on average). This is a significant commitment that exceeds the current funding injected by the government to support the current forest management system. In 2019, for instance, a budget support of GEL 11.9 million (~EUR 4 million) is expected for the NFA across the entire Georgia. The 8 districts targeted by the project represent 15% of the NFA forest area. Under the current system, they would therefore receive government support, on a pro rata basis, of approx. EUR 600,000 p.a.

Due to the prolonged period of negative cashflows, borrowing to cover the funding gap is not advisable, even at the concessional terms offered by GCF and development banks (grace periods typically do not exceed 5 years). In addition, the SFM approach represents a complete overhaul of Georgia's forest management system in the target districts. Information asymmetries deter commercial lenders from supporting the project, especially with the very long-dated loans that would be required due to cashflow profile described above.

Importantly, from year 16 onwards, the SFM will be consistently cashflow-positive, ensuring the long-term sustainability of the project without any additional concessional funding or budget support from the government. This long-term financial sustainability is indeed one of the reasons for the government to transition from the current system to the SFM.

2. Rationale for GCF grants for Component 2

The objective of GCF grants in Component 2 is to kickstart and bring to a meaningful scale two markets that are currently in their infancy in Georgia: Energy Efficient (EE) stoves and Upgraded Solid Biofuels (USB, such as briquettes). The following considerations justify the request of a GCF grant for Component 1. Please refer also to the "Component 2 – FIRR" sheet in the Excel model.

a. Barriers to the adoption of EE stoves

The project team has modeled the FIRR for a household that switches from a conventional to an EE stove, based on the following assumptions:

- Conventional stove price of GEL 70 and 2-year useful life
- EE stove price of GEL 1,000 and 10-year useful life
- Annual fuelwood consumption with a conventional stove of 8 m³. An EE stove requires half this amount

¹ Yield on Georgia's 10-year (longest-dated) sovereign bonds as of mid-June 2019.

- At the fuelwood price of GEL 81/m³, to be enforced by the NFA under the SFM system, this equates to a saving of GEL 324 p.a. for a household using an EE stove
- Without concessionality, households would finance the purchase of an EE stove with a micro-finance loan at 30% effective interest rate, repaid in 9 monthly instalments (assuming they have access to and qualify for MFI loans). These terms are in line with those applied by Chrystal, Georgia's largest MFI. The resulting monthly instalment of GEL 128 is, according to Chrystal, not affordable to most of the target households

Without concessionality, the switch from a conventional to an EE stove would generate a FIRR of 45% for a household. This FIRR, however, is largely theoretical. In practice, several barriers hinder the widespread adoption of EE stoves, including:

- The high price point of an EE stove, considering local income levels (GEL 1,000 EE stove price vs. GEL 50-70 for a conventional one)
- Product novelty, with only few units sold currently in Georgia and lack of industry certifications of product quality
- Lack of sizable domestic production of EE stoves or imports (and for the latter, particularly high prices)
- Lack of an easy-to-tap financing product specifically targeted at the purchase of EE stoves, to help consumers bridge the price gap between an EE and a conventional stove.

GCF grants will be used to incentivize the purchase of EE stoves in the form of a subsidy covering 30% of the purchase price (GEL 300 / EUR 100 per unit) via a voucher scheme. The incentive scheme will be put in place in partnership with local financial institutions (banks and MFIs) that will offer loans covering the remaining 70% of the purchase price. Importantly, such loans will bear full commercial interest rates, which are currently in the 30% range for MFIs. In other words, no concessionality will be offered by the financial institutions. Chrystal, for instance, will in effect realize its required 30% interest rate by negotiating a discount on the purchase price of EE stoves with suppliers, even if the loans offered to households will be formally at 0% rate. Households will have the option to apply for a consumer loan covering the EE stove purchase only, or the stove and the annual supply of USB. In addition, financial institutions will bear the risk of loan default (no government or other guarantees are attached to the EE stove loan program).

Similar consumer financing schemes, such as the EBRD's Sustainable Energy Financing Facility (SEFF), proved instrumental in stimulating demand of other household products, such as EE appliances.

b. Barriers to the scale-up of EE stove and USB production

Through the financial incentive scheme, the project will stimulate demand for up to 30,000 EE stoves and related USB supply, creating a market opportunity for entrepreneurs that wish to start EE/USB production businesses. GCF grants will not be used to provide financial support to such entrepreneurs, to minimize concessionality and market distortions. GCF support will be limited to funding technical assistance (via the Technical Assistance and Investment Support Facility, TAISF, based at the Agricultural and Rural Development Agency, ARDA), together with BMZ's co-finance.

Financial support to entrepreneurs will be supplied by ARDA under its existing support schemes, which include a combination of interest rate subsidies (applied to commercial loans offered to the entrepreneurs by ARDA partner banks), partial credit guarantees and contributions for the purchase of equipment. Such support schemes are provided by ARDA to a variety of sectors.

The concessionality of ARDA's support is minimized by the requirement that the entrepreneur also contributes equity (minimum 10% of the investment, actual level determined on a project-by-project basis by ARDA). Commercial lenders bear the risk of loan default for the portion of the loan that is not guaranteed by ARDA. The entrepreneurs bear the risk of losing their equity should the ventures fail. The project, in other words, does not create a risk-free profit opportunity for the private sector.

3. GoG budget constraints

The government's financing options are constrained by fiscal consolidation, to which the government has committed under an ongoing IMF program. Significant budget reforms were introduced in 2017 and no increase in current spending is envisaged in real terms in the coming 5-7 years. The budget deficit has been declining gradually since 2017/18 as envisaged by the IMF. The deficit is forecasted at 2.6% of GDP in 2019, has to be maintained under 3% in coming years and reduced gradually to 2.5% in the medium term starting from 2023. Maintaining the fiscal deficit within the above-mentioned limits is extremely important since this is the debt stabilizing level of fiscal deficit. Government debt is forecasted at 43.7% of GDP for 2019, which needs to be reduced gradually and maintained within 35%-40% of GDP in the medium term. Within this fiscal consolidation framework, the set limits of government debt and budget deficit allow only for increased spending in education and investments in infrastructure that maximizes the usage of Georgia's transit and tourism potential. At the same time, there are constraints on including new commitments in many other directions and no room for additional liabilities.

B. Economic Analysis

The economic analysis compares the project budget over 7 years (GCF grant + co-finance) to the expected societal benefits of the project over 20 years (the period conventionally used to evaluate the effectiveness of sustainable forest management project). Societal benefits fall in three categories:

- Value of emission savings
- Economic value added
- Value of restored ecosystem

The GIZ model captures quantitatively – in the form of an economic IRR and NPV – the first two factors. Please refer to “Whole project – EIRR” sheet in Excel model.

The value of the restored ecosystem is subject to arbitrary and hard-to-quantify methods and assumptions and is discussed qualitatively at the end.

1. Value of emission savings

The main impact of the project and its very *raison d'être* is the reduction in emissions. Over the 20-year project lifetime, the total emission reduction is estimated at over 16 million tons of CO₂-equivalent.

Estimates of carbon prices widely. As noted by the World Bank, when pricing emission reductions, “the use of a range of values (instead of a central estimate) is justified by the uncertainty and the need to consider the country context. Indeed, there is a significant uncertainty around the carbon value that is consistent with the Paris Agreement, linked to the unpredictability of future socioeconomic and technological trends”.² In line with the High-Level Commission on Carbon Prices, the World Bank recommends that the economic analyses of projects use an estimated range of carbon price of USD 40-80 (min-max) in 2020, shifting to USD 50-100 (min-max) by 2030.

The European Investment Bank (EIB) and European Commission (EC) recommend using a central value of EUR 25/tCO₂eq in 2010, raising gradually to EUR 45 by 2030.³

These figures are considerably higher than the (admittedly limited) evidence from emission allowances traded on exchanges. As of mid-June 2019, when the economic model was finalized, in the EU-ETS carbon exchange (the largest and most liquid), the price of CO₂ allowances was approximately EUR 24/ton. This is almost an all-time high. However, wide swings were experienced in the past, as shown in the chart below. For instance, between 2011 and 2017 the price hovered in the EUR 5-10 range.

² World Bank (12 November 2017). *Shadow Price of Carbon in Economic Analysis – Guidance Note*.

³ European Commission (December 2014). *Guide to Cost-Benefit Analysis of Investment Projects*. Link: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

Figure 1: EU-ETS emission allowance price (EUR)



Conservatively, this economic analysis uses as base case the mid-June 2019 EU-ETS emission allowance price of EUR 24, running sensitivities at lower prices.

2. Economic value added

The model estimates the economic value added of the project based on detailed bottom-up assumptions broken down by several components, namely:

- Incremental employment generated by the NFA and its contractors to operate the SFM system
- Incremental household income from replacement of conventional stoves with EE stoves (higher upfront cost of stove, but 50% fuelwood savings over stove life)
- Incremental pre-tax profits for EE stove manufacturers, partially offset by loss of profits from conventional stove manufacturing
- Incremental pre-tax profits for USB manufacturers, partially offset by loss of profits from fuelwood sales
- Incremental employment generated by USB manufacturers (new industry sector)

Below is a brief summary of the assumptions. All estimates are on a pre-tax basis (tax being a form of income redistribution, rather than a source of value added at societal level).

a. Incremental employment generated by the NFA and its contractors to operate the SFM system

By the end of the 20-year period, the SFM operations will require an additional 385 full-time staff (hired by the NFA and its contractors) and 471 seasonal workers. The model assumes that 30% of new full-time staff and 50% of new seasonal staff were previously unemployed – in other words, incremental employment generated by the project over the baseline. Salaries are estimated at GEL 20,400-30,000 p.a. depending on seniority.

b. Incremental household income from replacement of conventional stoves with EE stoves

The model assumes EE stove sales ramping up to an annual volume of 7,500 by year 6 of the project and remaining at that level thereafter. Each EE stove purchase generates, for the ten-year stove life, the incremental cashflows vs. conventional stove presented in the financial analysis.

c. Incremental pre-tax profits for EE stove manufacturers

The model assumes a pre-tax profit margin of 20% for both EE and conventional stove sales. Based on the volume of EE stoves sold (and conventional stoves therefore not sold), the model computes the difference in industry pre-tax profit.

d. Incremental pre-tax profits for USB manufacturers

The model assumes USB sales ramping up to approx. 28,600 tons p.a. by year 8 and remaining at that level thereafter. USB price is estimated at GEL 350/ton. The pre-tax profit margin of USB sales is set at 21%, based on an industry study produced by Chrystal (the MFI). Each ton of USB is assumed to replace 4 m³ of fuelwood, which sells in the market currently at a price of GEL 90/m³. A pre-tax profit margin of 20% is assumed for current fuelwood sales.

e. Incremental employment generated by USB manufacturers

The model assumes the average production capacity of a USB plant at 1,000 tons p.a., in line with Chrystal's estimates. Chrystal's study assumes GEL 200,000 labor costs per plant p.a. To estimate the incremental employment vs. baseline, the model assumes that 50% of the newly hired USB employees were previously unemployed.

Results:

Based on the above assumptions, the societal benefits estimated over the 20-year period are summarized in rows 164-176 of the EIRR sheet. The resulting EIRR at the base case emission price of EUR 24 is a positive 34%. The economic NPV, using a 10% discount rate conventionally used in similar economic analyses, is a positive EUR 83 million.

Emission savings are the primary driver of value, generating a positive NPV of EUR 167 million. The NPV of the economic value added is a smaller EUR 38 million. Subtracting the negative NPV of the project budget, the overall project NPV is the previously stated EUR 83 million.

NPV breakdown by component (EURm)		
Project budget		(122)
Value of emission savings		167
Economic value added:		38
	Incremental employment created by SFM and its contractors	9
	Incremental household income from EE stove adoption	22
	Incremental pre-tax profits for EE stove producers	4
	Profit decrease for conventional stove manufacturers	(1)
	Incremental pre-tax profits for USB producers	4
	Profit decrease from fuelwood sales replaced by USB	(4)
	Incremental employment created by USB producers	4
Total		83

Conservatively, sensitivities are run at lower CO2 prices. A +/- 20% sensitivity is run for the economic value added. As shown in the sensitivity table below, the EIRR is greater than 10% and the economic NPV is positive even with emissions priced at EUR 15 (~60% down from base case level) and the economic value added is 20% below base case.

EIRR sensitivity								NPV sensitivity (EURm)						
		% change in economic value added							% change in economic value added					
		-20%	-10%	0%	10%	20%			-20%	-10%	0%	10%	20%	
CO2 allowance price (EUR)	5.0	0%	1%	2%	3%	4%		CO2 allowance price (EUR)	5.0	(56)	(53)	(49)	(45)	(41)
	10.0	6%	7%	8%	8%	9%			10.0	(22)	(18)	(14)	(10)	(6)
	15.0	13%	13%	14%	15%	15%			15.0	13	17	21	25	28
	20.0	21%	22%	23%	23%	24%			20.0	48	52	55	59	63
	24.0	32%	33%	34%	35%	35%			24.0	76	79	83	87	91

3. Value of restored forest ecosystem

Significant research efforts have attempted to estimate the value of a restored ecosystem and forests in particular. Such value arises from multiple factors such as: avoided erosion, watershed protection, flood protection and associated insurance savings, availability of water resources, biodiversity habitat, pollination and tourism revenues. These are in addition to the value of carbon sequestration captured in the previous component of the economic analysis.

Estimates of the value of restored ecosystems are subject to a wide range of variables and are highly country-specific.⁴ Due to the wide range and arbitrary nature of the assumptions required, the project team has opted not to quantify the value of the restored ecosystem in the economic analysis. Since emission savings and economic value added already produce positive EIRR and NPV, the picture would only improve if the value of the restored ecosystem were also added.

TEEB conducted a study on *The Economics of Ecosystems and Biodiversity for the Forestry Sector of Adjara Autonomous Republic, Georgia*.⁵ Such study, while specific to one area of Georgia, offers insights on the potential value of restored forest ecosystem in the country.

TEEB's restoration scenario for year 2035 (20 years from the date of the study) assumes that 33% of pasture and scrub and sparse vegetation areas in Adjara will be reforested, focusing on areas within a 5km radius from villages. This would result in a 16% increase in forest woodland. In addition to carbon sequestration and the supply of timber and fuelwood, TEEB recognized the following sources of economic value for the Adjara forest:

- Recreation and tourism, in particular due to the increasing trend in eco-tourism. TEEB did not provide a quantitative estimate of this effect
- Non-timber forest products. A TEEB survey in the region found that 30% of households collect blueberries, 26% mushrooms, 16% blackberries and 7% chestnuts. TEEB estimated at ~USD 750,000 the total value of increased NTFP availability in the sustainably managed Adjara forest over 20 years
- Regulation of natural hazards. TEEB noted that 2/3 of the Adjara forest area contributed to soil protection from erosion and water regulation. In particular, landslides in Adjara occur 4-5 times a year, causing significant damage to infrastructure and housing, displacement of population and need for compensation from the government. TEEB estimated at ~USD 1,350,000 the landslide protection value of the restored forest over 20 years

⁴ On this topic, see TEEB, *The Economics of Ecosystems and Biodiversity for National and International Policy Makers* (2009).

⁵ TEEB (2016). *The Economics of Ecosystems and Biodiversity for the Forestry Sector of Adjara Autonomous Republic, Georgia*.