

## Annex 3: Detailed Financial and Economic Analysis

Please read this annex in conjunction with the Excel model “3a. Economic and financial valuation model”, sheets: “FIRR Agriculture”, “FIRR Forestry”, “EIRR” and “Outputs 2-3 Scale”.

### 1. Financial Analysis

The financial analysis focuses on the two outputs that are amenable to the generation of financial reflows, namely Outputs 2 and 3. The activities of Output 1 are of public good nature and will not generate financial reflows. Output 4 is devoted to programme management.

#### Output 2

Output 2 promotes the transition to sustainable agricultural practices that do not put additional strain on existing forest resources.

Most of GCF funding for Output 2 is concentrated in Activity 2.1, “Promotion of deforestation-free agricultural practices and technologies”.

The objective of Activity 2.1 is to shift 60,900 hectares of land away from two unsustainable agricultural practices: (i) shifting cultivation of upland rice (“rice baseline”) and (ii) unsustainable maize cultivation (“maize baseline”).

See “Outputs 2-3 Scale” sheet for size of the areas targeted. See “FIRR Agriculture” for per-hectare NPV and IRR calculations. When IRR calculations show an error, it is because the cashflow is already positive starting in year 1 of the IRR calculation period.

The rice baseline involves an estimated 36,540 ha of land (60% of total targeted). In this scenario, a farmer cultivates one hectare of land for 3 years, until all resources are depleted. The land then goes into fallow for the following 7 years, when it generates no economic value. Upland rice yields (during the cultivation period) are much lower than paddy rice yields in lowlands. Farmers engage in this activity primarily for self-consumption and subsistence. In the rice baseline, it is estimated that 1 ha of land generates USD 455 of revenues in each of the three production years (1.3 tons of rice sold at USD 0.35/kg). From a purely financial standpoint, farmers struggle to cover their own labor costs (estimated at USD 3/day, with 180 days of work p.a., or USD 540 p.a.). In practice, farmers have no choice but to engage in this activity for subsistence, even if the theoretical NPV is negative (-USD 439 over the 20-year programme lifetime, at a 10% discount rate).<sup>1</sup>

Activity 2.1 promotes the transition from the rice baseline to a sustainable model of sequential cropping, in which rice farming is sequenced with sesame/ginger and soybean/peanuts in different years. By eliminating soil degradation, farmers have no incentive to abandon the hectare of land and move on to a new one, at the expense of forest land. This model is financially attractive. Farmers would more than cover their labor costs, generating a positive NPV of USD 276 and financial IRR of 47% over the 20-year programme lifetime.

The maize baseline involves an estimated 24,360 ha of land (40% of total targeted). In this scenario, a farmer cultivates one hectare of land exclusively with maize for an extended period of time and without rotation. Farmers are often lured by purchase contracts from foreign buyers, especially Vietnamese who use maize to feed pigs. This activity is profitable, but highly damaging to soil quality. In the maize baseline, it is estimated that 1 ha of land generates USD 752 of revenues per year (4.7 tons of maize sold at USD 160/t, subject to market conditions). This more than covers an estimated USD 420 in annual labor costs and other costs for

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<sup>1</sup> In line with other development agencies and to facilitate comparability among projects, GIZ applies a real discount rate of 10% in all its projects. All forecasts are in real terms (i.e. assuming zero inflation) and on a pre-tax basis.

purchase of seeds and small equipment. The NPV of baseline maize cultivation on one hectare of land over 20 years is USD 870.

Activity 2.1 promotes the transition from the maize baseline to one of two sustainable models: (i) intercropping (maize, soybean, peanuts or other cash crops) and (ii) sequential cropping on 2-year rotations (maize, soybean, peanuts or other cash crops). Both models generate a significantly higher NPV than the maize baseline, estimated at USD 2,338 for intercropping and USD 1,513 for sequential cropping over 20 years.

While, in theory, the sustainable rice and maize farming models promoted by Activity 2.1 are financially more attractive than the baseline agricultural practices, a GCF grant is still deemed as the most efficient and effective financial instrument. This is because subsistence farmers in the target areas face, in practice, much more substantial barriers that prevent them from capturing any financial upside from sustainable farming altogether. In particular, farmers lack knowledge, awareness and expertise on sustainable farming, and lack access to downstream markets for any crops other than rice and maize.

The GCF grant for Activity 2.1 will address capacity barriers, primarily through the set-up of farmer field schools to provide technical assistance, capacity building and training of trainers.

Activity 2.2, to which a portion of the GCF grant is also dedicated, will contribute to value chain and private sector engagement in agriculture through technical assistance. For instance, it aims to create a platform to attract additional development and private sector finance to agriculture.

Crucially, neither activities 2.1 nor 2.2 involve any direct transfer of cash to any private sector participant, including subsistence farmers.

Activity 2.3 (Sustainable rural infrastructure for watershed management) is entirely managed and financed by the ADB/EU, IFAD and GoL (through a combination of highly concessional loans and grants). This activity will focus on lowland areas where agricultural yields are higher and farmers earn more than subsistence income. For this reason, beneficiaries will be able to support part of the irrigation infrastructure cost by paying water user tariffs. This in turn will enable the government to repay the ADB loan over time. (This set-up is impossible for Activity 2.1, where beneficiaries, due to widespread poverty, would not be able to contribute to the funding other than with their labor, recorded as co-finance).

### **Output 3**

Output 3 aims at the large-scale adoption of sustainable forest management practices across all forest types as per GoL's categorization. Specifically, it aims to:

1. Restore 25,300 ha of completely depleted forest to production forest. In the baseline, this forest area is completely unproductive. The programme will implement sustainable forest management and harvesting of firewood, construction timber and large-diameter timber. Sustainable management and harvesting is estimated to have a positive NPV of USD 155 per ha over 20 years. This compares positively to the baseline situation where no economic value whatsoever is extracted from the forest.
2. Promote sustainable forest management and non-timber forest product (NTFP) utilization in three categories of forest: (i) 24,000 ha of protection forest, (ii) 640,000 ha of national protected areas (up from a baseline of 360,000 ha to a target of 1,000,000 ha by 2027) and (iii) 463,000 ha managed under the enhanced village forest management system (up from a baseline of 67,000 ha to a target of 530,000 ha in 2027). In total, by 2027, ~1.1 million ha of forest will be transitioned to sustainable management and NTFP utilization. In the current baseline, unsustainable practices on a hectare of forest results in the gradual, complete depletion of economic value over an estimated period of 10-years. The NPV of such unsustainable practices is mildly negative (-USD 73/ha) – although in practice this is a subsistence practice done regardless of textbook financial considerations. Sustainable forest management and utilization of NTFPs promoted by the programme ensure that the forest is never depleted, extending the

period over which economic value can be extracted; as a result, the NPV of sustainable management is positive (~USD 451/ha over 20 years).

See “Outputs 2-3 Scale” sheet for size of the areas targeted. See “FIRR Forestry” for per-hectare NPV and IRR calculations. When IRR calculations show an error, it is because the cashflow is already positive starting in year 1 of the IRR calculation period.

Similar to Output 2, while in theory the SFM models promoted by the programme are financially more attractive than the baseline practices, a GCF grant is still deemed as the most efficient and effective financial instrument. This is because beneficiaries in the target areas face, in practice, much more substantial barriers that prevent them from capturing any financial upside from SFM altogether. In particular, they lack knowledge, awareness and expertise – barriers that the GCF grant will help address.

None of activities of Output 3 involve any direct transfer of cash to any beneficiary and private sector participant.

## Outputs 1 and 4

As previously mentioned, these outputs are of public good nature and are not amenable to the generation of financial reflows. A GCF grant is therefore deemed as the most appropriate instrument.

In addition, significant co-finance will be provided by BMZ, JICA, IFAD and GoL.

## Fiscal and debt considerations

In general, the ability of GoL to assume additional debt obligations is severely constrained by the Laos’ fiscal and debt situation. Laos has recorded budget deficits in the range of approx. 3-5% of GDP each year since 2013. The IMF projects a budget deficit of 4.3% in 2018 and 4.1% in 2019. Despite positive GDP growth, the debt/GDP ratio has increased from 56% in 2013 to a projected 66% in 2019. The IMF recommends, as a priority, the reduction of debt/GDP to 50%, through a reduction of budget deficit.<sup>2</sup>

## 2. Economic Analysis

The economic analysis applies to the entire programme, as all the phases of the programme are integral to the achievement of the climate mitigation objectives. The analysis therefore assumes – on a hypothetical basis – that funding for phases 2 and 3 is obtained, and uses the entire programme budget in economic NPV and IRR calculations.

The total programme budget over the 9.5-year period 2020-2029 is approximately EUR 160m. The lifetime of the programme (period over which the programme will bear its entire environmental benefits and socioeconomic co-benefits) is estimated at 20 years, as is customary in sustainable forest management projects.

EUR mln	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10
Project budget										
GCF grant	3.5	3.5	9.8	9.5	7.6	6.9	6.8	6.3	6.3	3.5
GoL co-finance	1.9	1.9	2.6	2.6	2.6	2.6	2.6	2.6	2.6	1.3
Other co-finance	10.2	10.2	10.0	10.1	10.3	10.8	3.5	3.5	3.5	1.5
Total budget	15.6	15.6	22.4	22.2	20.6	20.3	12.9	12.4	12.4	6.3

As a result of this significant investments, the following environmental and socio-economic benefits can be expected:

<sup>2</sup> IMF Art. IV Consultation on Laos, 2018.

1. Reduction in CO2 emissions
2. Economic value added captured by programme beneficiaries
3. Value of restored forest ecosystem

## Reduction in CO2 emissions

The main impact of the programme and its very *raison d'être* is the reduction in emissions. Over the 20-year lifetime, the total emission reduction is estimated at over 144 million tons of CO<sub>2</sub>-equivalent, or an average of 7.2 million tons per year.

Estimates of carbon prices vary 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”.<sup>3</sup>

In line with the High-Level Commission on Carbon Prices, the World Bank recommends that economic analyses use a low and high estimate of carbon price starting at USD 40 and 80, respectively, in 2020 and increasing to US 50 and 100 by 2030 (and increasing further thereafter at a fixed annual rate).

The European Investment Bank (EIB) and European Commission (EC) recommend using a central value of EUR 25/tCO<sub>2</sub>eq in 2010, raising gradually to EUR 45 by 2030.<sup>4</sup>

Evidence from carbon traded on exchanges or emission trading schemes is also not homogeneous and quite country-specific. Currently, in the EU-ETS (the largest and most liquid carbon market) the price per ton is approximately EUR 25 – an almost all-time high. Wide swings were experienced in the past, as shown in the chart below. EU emission allowances hovered between EUR 5 and 10 for a long period between 2011 and 2017. Interestingly, the EIB/EC guidance to use EUR 25 in economic analyses was issued when EU-ETS prices were close to the bottom of their trading range.



<sup>3</sup> World Bank (12 November 2017). *Shadow Price of Carbon in Economic Analysis – Guidance Note*.

<sup>4</sup> 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](https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf)

In light of the above considerations, this economic analysis uses as base case a price of EUR 25, which coincides with both the EIB/EC recommendation and the current level in the EU-ETS. Conservatively, sensitivities are run at lower prices.

### **Economic value added**

This component of the IRR calculation accounts for the financial benefits that accrue to all direct beneficiaries across the entire target area of intervention of Outputs 2 and 3. The incremental financial benefits per hectare associated with a switch from the unsustainable to sustainable deforestation-free agriculture and forest management (discussed above) are multiplied by the total number of hectares targeted by the programme.

Since the incremental financial benefit calculation above is pre-tax, there is no need to account separately for tax income received by the government.

Conservatively, we ran sensitivities assuming that the incremental financial benefit is up to 60% lower than the base case discussed in the financial analysis.

### **Value of restored forest ecosystem**

Significant research efforts have attempted to estimate the value of a restored ecosystem and tropical forest 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 values of carbon sequestration and sustainable NTFP, timber and agricultural production – captured in the previous two components of the economic analysis.

Estimates of ecosystem services value are subject to a wide range of variables and highly country-specific. On this topic, see for instance TEEB, *The Economics of Ecosystems and Biodiversity for National and International Policy Makers* (2009).

Due to the wide range of estimates, we have opted not to include these factors in the economic analysis. As noted in the summary conclusion below, the economic analysis shows a very NPV for the programme just taking into account emission reduction and economic value added. Any ecosystem value would add to an already positive economic return.

### **Summary conclusions**

Assuming as a base case carbon price of EUR 5/t and the economic value added derived from applying the per-hectare findings of the financial analysis to the entire target area of Outputs 2 and 3, the programme produces a very high NPV of EUR 1,485 million (20-year, 10% discount rate). Since the programme would produce a positive economic value from year 1, the IRR appears as not meaningful in the spreadsheet.

Below are sensitivity tables assuming (i) lower carbon prices (down to the ultraconservative and unrealistic scenario of 0 carbon price) and (ii) lower economic value added (% reduction applied to each year in the programme period). The bottom-right corner of the table represents the base case calculation described above.

Even at carbon prices of Euro 5/tCO<sub>2</sub>eq (approximately the lowest reached in the EU-ETS in recent years), the programme has a positive economic NPV, ranging from Euro 277 million to Euro 464 million. Only by disregarding emission reductions altogether (i.e. assuming a carbon price of 0) and reducing the economic value-added by 60% versus base-case estimates, does the economic NPV move closer to zero (but still positive), with the programme yielding an EIRR of 13%.

These findings are supportive of the very high relevance and positive cost/benefit analysis of the programme from an economic standpoint. As previously mentioned, adding the value of restored ecosystems would further improve the picture.

Sensitivity table NPV @ 10% discount rate		% change in economic value added						
Carbon price (EUR/t)		-60%	-50%	-40%	-30%	-20%	-10%	0%
	--	21	52	84	115	146	177	208
	5.0	277	308	339	370	401	433	464
	10.0	532	563	594	626	657	688	719
	15.0	787	819	850	881	912	943	974
	25.0	1,298	1,329	1,360	1,392	1,423	1,454	1,485

  

Sensitivity table EIRR		% change in economic value added						
Carbon price (EUR/t)		-60%	-50%	-40%	-30%	-20%	-10%	0%
	--	13%	16%	20%	22%	25%	27%	29%
	5.0	48%	51%	53%	55%	57%	59%	60%
	10.0	106%	108%	109%	111%	112%	114%	115%
	15.0	277%	278%	278%	278%	279%	279%	280%
	25.0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!