ANNEX VI

ECONOMIC AND FINANCIAL ANALYSIS (EFA) GUIDANCE

INTRODUCTION

The GCF Programming Manual requests that Accredited Entities (AEs) submit an Economic and Financial Analysis (EFA) as part of the Proposal Approval Process (PAP)[1] in FP **Annex 3**. It is one of the optional annexes for Concept Note[2] (CN) submissions as well as for Simplified Approval Process (SAP) proposals (**Annex 10**).[3] "Financial structure, terms and conditions, and economic impact"[4] is one of the key elements of project and programme appraisal.

The EFA allows AEs to demonstrate the relative viability and efficiency of the climate interventions considered in the Funding Proposal. It helps GCF to understand how the project's financial and economic performance contribute to each of the six GCF investment criteria.[5]

The financial analysis evaluates the forecasted cash flows to the project sponsor or beneficiaries over the lifetime of the project or investment. It informs the consideration of alternative means of achieving project objectives based on financial indicators such as net present value using commercial discount rates, financial internal rate of return and simple payback period.

By exploring the financial performance of the activities considered in the FP with and without GCF support, the EFA can contribute to the additionality assessment conducted through the Innovation and Additionality Tool (IAT); as well as supporting the assessment of concessionality and of the appropriateness of the de-risking financial instruments in the proposal.[6] Examples of questions that could be answered through the financial analysis include:

- How do beneficiaries' cash flows change over time in the absence of GCF support?
- Is it profitable for beneficiaries to invest in mitigation or adaptation measures without GCF?
- How does GCF support of mitigation or adaptation measures affect the profitability of a project activity?
- How long does it take the activities to generate a positive financial return with and without GCF support?
- What are the financial incentives for continuing the mitigation or adaptation activity beyond the GCF funding period?

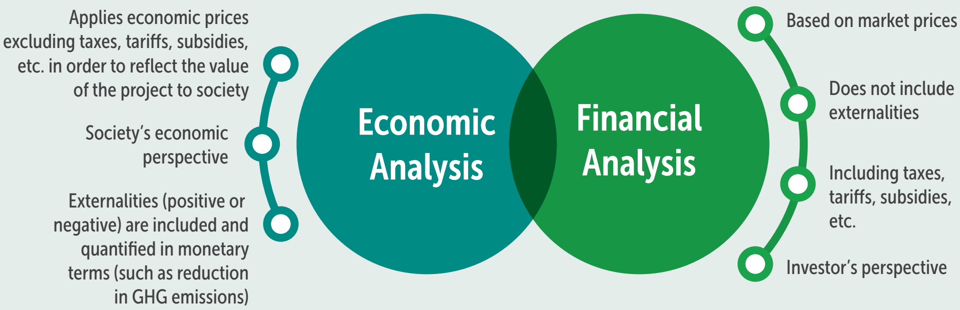
The economic analysis complements this view by evaluating the costs and benefits at a national, societal, or global level. It attempts to capture non-market externalities that are not easily monetized, such as the value of greenhouse gas (GHG) reductions, health benefits, social welfare, and ecosystem services. The economic analysis demonstrates

[1] *GCF Programming Manual, page 81.*
[2] *GCF Programming Manual, page 17.*
[3] *GCF Simplified Approval Process funding proposal preparation guidelines, page 1.*
[4] *GCF Programming Manual, page 45.*
[5] *GCF Programming Manual, page 113.*
[6] *GCF Programming Manual, page 32.*

the extent to which the GCF investment results in societal benefits. Examples of questions that could be answered through the economic analysis include:

- What are the project's benefits and costs including or excluding externalities?
- What are the sources of benefits and costs at a project or societal level?
- Is the intervention cost-effective? Are the economic returns above the social discount rate?

FIGURE 1. DIFFERENCE BETWEEN ECONOMIC AND FINANCIAL ANALYSIS



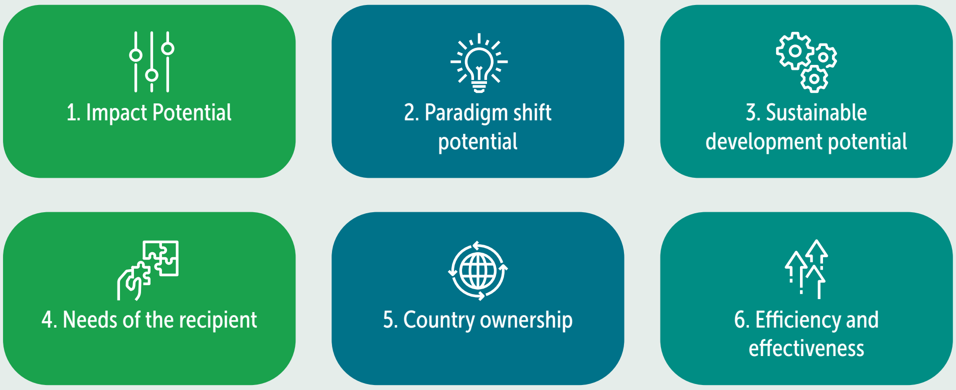
Source: Adapted from "Guide 3: Economic and Financial Analysis", Nielsen et al., Nordic Council of Ministers 2016.

This distinction is helpful because the positive and negative externalities associated with mitigation and adaptation projects are often not captured in market transactions. Economic Analysis allows to identify and quantify these externalities. The Financial Analysis allows to understand how concessional finance can be used to address these market failures and create incentives to finance similar projects at scale.

After a brief overview of the GCF Investment Criteria below, Section 1 of this document presents a summary of the steps of the Economic and Financial Analysis. Section 2 provides recommendations on Economic Analysis for the paradigm shifting pathways identified in each sector under the GCF Sector Guides. Section 3 provides guidance on how to use the results of the EFA to support the assessment of the six GCF investment criteria. Section 4 is a series of recommendations for Economic Analysis. Section 5 is a series of recommendations for Financial Analysis. Section 6 explores how EFA can be linked to other documents submitted as part of the GCF submission package (i.e. the Feasibility Study, Budget Annex, Implementation Timeline, GHG emissions calculations, and the Funding Proposal).

ECONOMIC AND FINANCIAL ANALYSIS AND THE GCF INVESTMENT CRITERIA

FIGURE 2. GCF INVESTMENT CRITERIA



CRITERION 1/6 IMPACT POTENTIAL

The GCF Initial Investment Framework defines impact potential as the “potential of the programme/project to contribute to the achievement of the Fund’s [mitigation and adaptation] objectives and results areas”.[7]

Wherever possible, the EFA should demonstrate a clear link between the GCF investment and the most likely impact assessment factors, including but not limited to:

- tCO_2eq to be reduced or avoided
- Avoiding lock-in of long-lived, high-emission infrastructure
- Number of households with access to low-emission energy
- Support for scale-up of low-emission energy by addressing key barriers
- Megawatts of low-emission energy capacity installed, generated and/or rehabilitated
- Increase in the number of small, medium, and large low-emission power suppliers and installed effective capacity
- Decrease in energy intensity of buildings, cities, industries, and appliances
- Increase in the use of low-carbon transport
- Expected improvement in management of land or forest areas (including change in area or type of cover)
- Improvement in waste management (e.g. the change in the share of waste managed using low-carbon strategies and/or the change in the share of waste that is recovered through recycling and composting).

For adaptation projects, the EFA should demonstrate, where possible, the contribution to climate-resilient development pathways based on the most likely indicative impact assessment factors, including but not limited to:

- Expected total number of direct and indirect beneficiaries experiencing reduced vulnerability or increased resilience and number of beneficiaries relative to the total population
- Degree to which the activity avoids lock-in of long-lived, climate-vulnerable infrastructure

[7] *GCF Programming Manual, page 36.*

- Enhancement of adaptive capacity and resilience for populations affected by the proposed activity
- Expected strengthening of institutional and regulatory systems for climate-responsive planning and development
- Expected increase in generation and use of climate information in decision-making
- Expected strengthening of adaptive capacity and reduced exposure to climate risks
- Expected strengthening of awareness of climate threats and risk reduction processes

For climate adaptation/resilience projects the expected impact potential is often based on a hypothetical scenario – weather events whose exact timing and severity are impossible to predict. The analysis therefore should specify the extent to which the scenario is built upon a credible evidence base, and then document linkages between the GCF investment and the impact assessment factors presented in the model.

CRITERION 2/6 PARADIGM SHIFT POTENTIAL

The GCF Initial Investment Framework defines "paradigm shift potential" as the "degree to which the proposed activity can catalyse impact beyond a one-off project or programme investment". Here, GCF wishes to understand the project's:

1. Potential for scaling up and replication, and, for mitigation projects, the overall contribution to global low-carbon development pathways consistent with the 2º Celsius target;
2. Potential for knowledge and learning through contribution to collective learning processes and institutions;
3. Contribution to the creation of an enabling environment that supports sustainable outcomes beyond project completion and/or market development and transformation;
4. Contribution to policies and a regulatory framework supportive of low-emission technologies and activities and/or climate-responsive planning and development; and
5. Overall contribution to climate-resilient development pathways consistent with a country's climate change adaptation strategies and plans (for adaptation projects).

Many of these assessment factors are likely to be presented only indirectly in the EFA. A possible way for the analysis to demonstrate potential for scaling up and replication, and for contribution to the creation of an enabling environment, might be consideration of the relative attractiveness and financial sustainability of the returns presented in the financial analysis, then using the Theory of Change to understand the extent to which the project has established an enabling environment that allows those returns for new entrants. Presentation of other assessment factors would depend on the specifics of each project and the effort made already by the AE to elaborate these factors in the Theory of Change and log-frame.

CRITERION 3/6 SUSTAINABLE DEVELOPMENT POTENTIAL

The GCF Initial Investment Framework defines "sustainable development potential" in terms of the project's wider benefits and priorities. These include environmental co-benefits, social co-benefits, economic co-benefits, and gender-sensitive development impact – none of which are captured easily by analysis of the project's direct costs and benefits.

It is possible to use stated or revealed preferences methods to estimate the value of positive environmental externalities such as air quality, soil quality, biodiversity, etc; for social co-benefits such as health and safety or cultural preservation; and for factors such as increased energy security. It is also possible to model the economic multiplier effects of job creation and increased private investment. It will be important to document clearly the assumptions used to generate these values.

CRITERION 4/6 NEEDS OF THE RECIPIENT

The GCF Initial Investment Framework defines "needs of the recipient"` in terms of the vulnerability and the financing needs of the beneficiary country and population. These needs are evaluated along several interrelated axes:

- For adaptation projects, need at the country level is indicated by the intensity of exposure to climate risks and degree of vulnerability, as well as by the size of the population and/or assets/economic sectors exposed to climate change risks and impacts.
- For adaptation projects, the need of beneficiary groups is indicated by the extent to which the project or programme supports groups that are identified as particularly vulnerable in national climate or development strategies, with relevant sex disaggregation.
- In all cases, the needs of the recipient must take into account the economic and social development level of the targeted country/region and the affected population.
- It is the geographic or spatial intersection of the exposure to climate-sensitive hazards and the socio/economic vulnerability of populations (i.e. variability within the population to prepare for, respond to, mitigate, and recover from a climatic hazard/latent risk) that would determine the needs of the recipients.
- The need for GCF support is also indicated by the absence of alternative sources of financing, coupled with a description of how the Fund can overcome specific barriers to financing.
- The need for GCF support to strengthen institutions and implementation capacity.

GCF is interested in understanding whether there are market failures that justify the need for public financing and whether any of the outputs have characteristics of public goods.

Many of these assessment factors are amenable to inclusion in the economic and financial analysis. The counterfactual scenario based on climate trends and expected impacts can quantify the extent to which GCF support will reduce the intensity of exposure to climate risks by project beneficiaries or accelerate the introduction of GHG mitigation measures. The Funding Proposal and Feasibility Study narrative can help to explain the absence of alternative sources of financing or else clarify how those alternatives are presented in the financial analysis (for example, showing financial returns based on commercial or informal loans at high interest rates).

CRITERION 5/6 COUNTRY OWNERSHIP

Economic and Financial Analysis (EFA) does not directly support the assessment of the GCF Country Ownership investment criteria. However, the EFA handbook explains how to integrate country-level climate policy considerations when relevant.

CRITERION 6/6 EFFICIENCY AND EFFECTIVENESS

The EFA directly informs the assessment of the project's efficiency and effectiveness. In fact, the GCF Initial Investment Framework defines "efficiency and effectiveness" as "economic and, if appropriate, financial soundness of the programme/project".[8]

Efficiency and effectiveness are two distinct assessments aiming at evaluating two distinct aspects:

- Efficiency: How well are our agents converting inputs into outputs? ("Spending well")
- Effectiveness: How well are the outputs produced by an intervention having the intended effect? ("Spending wisely")

Cost-effectiveness and efficiency can be benchmarked based on project outputs. For example, cost per tCO_2e of emission reduction or avoidance is a cost-effectiveness indicator, while cost per hectare of landscape rehabilitation, cost per MW of low-emission power generation, and cost per MWh of energy efficiency investment are cost-efficiency indicators.

Cost-effectiveness can be assessed further based on the proposed level of concessionality calculated according to the methodologies presented in GCF/B.21/24, GCF/B.23/19 or as indicated using the Grant Equivalent Calculator.[9]

GCF evaluates efficiency and effectiveness according to several assessment factors:

- Financial adequacy and appropriateness of concessionality
- Cost-effectiveness
- Long-run financial viability
- Application of best practices and degree of innovation

1. SUMMARY OF ECONOMIC AND FINANCIAL ASSESSMENT STEPS

This section summarizes the steps of the EFA and focuses on the differences between economic and financial analysis. More detailed inputs are available in sections 3 and 4 of this document.

[8] GCF Initial Investment Framework. *initial-investment-framework.pdf (greenclimate.fund)*

[9] *https://www.greenclimate.fund/document/grant-equivalent-calculator*

TABLE 1. ECONOMIC AND FINANCIAL ANALYSIS COMPARISON

	STEPS FOR ECONOMIC AND FINANCIAL ANALYSIS	CONTEXT	FINANCIAL ANALYSIS	ECONOMIC ANALYSIS
			Objective: To assess the financial profitability of the activities under consideration in the FP with and without GCF support.	**Objective:** To assess the overall economic returns of the activities under consideration in the FP including all the relevant externalities.
1.	**Define scope**	Financial and economic analyses do not adopt the same perspective.	The level of the beneficiary (project developer, farmer, farmer organization, households, etc.). Could assess a single unit, for instance, the profitability of an intervention on one hectare of land or one MW of renewable energy. Should be performed as much as possible on a relevant scope for a beneficiary. For instance, an entire forest concession or land owned by a farmer.	The level of the impacts of the project from a holistic economic perspective. The benefits and costs must be aggregated with the capital budgeting criteria such as EIRR or ENPV calculated for all the activities. For instance, if an energy project aims at installing 10 MW of renewable energy, the analysis should not be performed for a unit of 1 MW but for the entire scope. At a minimum, the entire budget (including co-financing and other financing to be mobilized) should be included on the costs side, and non-cash flow benefits (e.g. positive externalities) should be included on the benefits side along with cash flow analysis.
2.	**Assign costs and revenues to activities**	Some of the income, benefit and cost streams are different for the economic and the financial analysis.	Should include fixed and variable costs for products with market prices. For instance, the cost of a water input would only be included if the beneficiary is paying for the water. Should include revenues from the sales of project outputs (agricultural products, electricity output, forestry products, etc.).	Should include fixed and variable costs for both products with and without market prices. Taking the water example again, the cost of water would be included in the analysis even if the beneficiary is not paying for the water. The analyst could then use a shadow water price.
3.	**Determine baseline**	For both the financial and economic analysis, the project case should be considered in comparison with a baseline.	The focus here should be on modelling the FP's intervention with and without GCF financing. The baseline is the project "without GCF support" and the intervention is the project "with GCF support".	The baseline scenario can be either a "no project" scenario or, preferably, a plausible alternative scenario to the activity under consideration. The benefits and costs of the project need to be evaluated against this baseline.

	STEPS FOR ECONOMIC AND FINANCIAL ANALYSIS	CONTEXT	FINANCIAL ANALYSIS	ECONOMIC ANALYSIS
4.	**Estimate production functions**[10]	The formulas linking project inputs and outputs should be based on evidence from studies or market data.	Formulas linking marketable physical inputs of the project and outputs. This will only include inputs and outputs that have a market price.	Formulas linking physical inputs of the project and outputs including those without market prices. Production functions for non-marketable assets should be based on studies (using benefit transfers methods) that are clearly referenced either in the supporting documentation or in the calculation sheets.
5.	**Collect data on prices and unit costs**		Price and unit cost data should be based on projects previously implemented in the project location and sector to avoid distortions. The analysis should not include shadow prices and should only be based on prices observed in market context.	Prices and unit costs for marketable goods should be based on previous projects implemented in the project location and sector to avoid distortions. Prices should not include taxes and subsidies. Prices and unit costs for non-marketable goods should be included in the analysis using shadow values. Shadow prices should be based on environmental valuation methods discussed in the next section.
6.	**Calculate cashflow**		The difference between project costs and revenues over each period of the analysis. This calculation should include financial elements such as depreciation, interest payments, transfer payments, etc. Cashflows should be calculated separately for the "without GCF support" and "with GCF support" scenarios.	The difference between project costs and benefits over each period of the analysis for each scenario. This needs to include both marketable and non-marketable costs and benefits. The final net stream of benefits and costs figures to be discounted is the difference between the project scenario's cashflows and the baseline scenario cashflows. See also above under "Scope" related to what aspects to include.

[10] *Small changes in production functions can have large impacts on profitability metrics.*

	STEPS FOR ECONOMIC AND FINANCIAL ANALYSIS	CONTEXT	FINANCIAL ANALYSIS	ECONOMIC ANALYSIS
7.	**Determine Economic Profitability Indicators** **Determine Financial Profitability and Solvency Indicators**	The key indicators to assess the economic and financial relevance of GCF participation in the project.	Discounting of each scenario's cashflows using relevant cost of capital. In the case of project components with different types of beneficiaries, use different discount factors based on the beneficiary's cost of capital. Please refer to the rest of the document for discussion on the relevant discounting time-horizon. Calculate profitability indicators for each scenario. As a minimum include: Net Present Value (NPV), Internal Rate of Returns (IRR), and Payback period. For projects including a debt component, please include analysis on solvency of beneficiaries with and without GCF intervention. Examples of indicators can include Debt Service Coverage Ratios (DSCR) for companies and organizations, as well as debt service as a share of income for households and individuals.	Discounting of the net cashflows, difference between baseline and project scenario, using the relevant social discount rate. The social discount rate used should reflect the fact that the benefits of the project under consideration might occur over a long period of time. See next section for detailed discussion on social discount rate. The analysis should include a calculation of the Economic Net Present Value (ENPV) of the net difference between the project cashflows and the baseline scenario's cashflows. It should also include an Economic Internal Rate of Return (EIRR) as well as the Benefit and Cost Ratio for the project.
8.	**Perform Sensitivity Analysis**	Check the sensitivity of the assessment's results to the main parameters of the analysis.	As a minimum, the AE should include sensitivity analysis on the discount rate as well as the main drivers of costs and revenues. In absence of clarity over the trajectory of key costs and revenues drivers, the AE should explore simple upper and lower band values for the relevant variables.	The AE should include an analysis of how the ENPV varies based on changes in other variables known as input variables (as a minimum social discount rate as well as all shadow prices used to value non-marketable assets).

2. ECONOMIC AND FINANCIAL ANALYSIS AND THE GCF SECTOR GUIDES

The objective of section 2 is to summarize specific elements that AEs should consider when performing EFA in relation to the GCF sector guides. This is not an exhaustive guidance; it is intended to cover the most common issues identified during the review of GCF Funding Proposals. AEs should consider these sector-specific notes as a starting point and should feel free to add any relevant methodological or scope adjustments in line with their internal EFA guidance. Further notes on benefits and cost valuation, as well as financial analysis, are provided in the rest of the document.

2.1 Climate Information and Early Warning Systems (CIEWS)

The baseline for a CIEWS economic analysis should start with the determination of the relevant type of disasters in the project's spatial and temporal context. It should determine: (1) the typical accuracy of the forecast for each disaster; (2) the typical lead time of acute warnings; and (3) the resulting damage in lives and property value.

The AE should then assess the impact of the activities in the FP on the reliability and accuracy of the CIEWS and the three determinants mentioned.

The economic analysis will help to determine the optimal parameters of the warning system in addition to its overall benefits.

A key element of discussion in a CIEWS economic analysis is the trade-off between increased lead-time and warning reliability. Higher lead-times reduce damages but also decrease the reliability of forecasts and increased false alerts.[11]

CIEWS EFAs can include prediction-related factors such as the ones mentioned and **dissemination-related factors**.[12] The dissemination-related factors could be the likelihood that a person uses a communication channel or notices a warning message or that a communication channel is not operational.[13] These factors should be integrated into the economic analysis as much as possible.

Following Klafft and Meissen (2011), we recommend including the following costs at a minimum: the investment needed to establish the CIEWS, energy costs, training costs for operating the CIEWS, costs of operating and expendable materials, communication costs for receiving and sending alerts, and wages.

The economic impacts of disasters in lives and damages should be accounted for following an avoided-cost methodology.

2.2 Transport

2.2.1 PARADIGM SHIFTING PATHWAY: ACCELERATE THE SHIFT TO LOW EMISSIONS PUBLIC TRANSPORT

For urban mobility projects, a non-exhaustive list of benefits to be included in the analysis could be: GHG emissions reductions, passengers and freight traffic time savings, travel time reliability, noise reduction, air pollution reductions, soil and water

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[11] *"Costs and benefits of early warning systems", Rogers, D. and Tsirkunov, V.; Global Assessment Report on Disaster Risk Reduction, 2010.*

[12] *"Assessing the economic value of early warning Systems", Klafft, M. and Meissen, U., 2011.*

[13] *"Assessing the economic value of early warning Systems", Klafft, M. and Meissen, U., 2011.*

pollution reductions, accident reductions, and revenues from the charges applied to the users of the transport mode if relevant.[14]

The economic analysis should be fully consistent with any multimodal transport model used in the FP's feasibility study and the metric of Generalised Cost (GC) used to perform the integration [see Beria and Grimaldi (2012), Castigliano et al. (2003), and Jong et al. (2007)].

Following Beria and Grimaldi (2014), we recommend a careful analysis of the difference between the activities and policies when performing an EFA for urban transport plans. The activities or policies can differ: they may have costs and benefits attributed to public bodies or public users; they may be specially concentrated or diffused; they may be punctual in time or continuous. All these characteristics can lead to different activities within the same plan and generate very different mobility patterns. The synergies between the activities, policies,[15] or modes need to be carefully studied and the best methodology selected to calculate the welfare implications of mixed policies.[16]

On the cost side, the EFA should include investment costs such as infrastructure construction costs, noise protection, flood protection, etc. and recurrent costs such as operations and maintenance costs (O&M).

2.2.2 PARADIGM SHIFTING PATHWAY: RAPID ELECTRIFICATION OF THE TRANSPORT SYSTEM

The baseline fuel used for the GHG emissions reduction estimation should be the same as the one used in the estimation of the economic benefits of electrification. It should be differentiated by type of vehicle when relevant.

The quantification of the benefits should be based on estimations of the penetration of the electric transport technology under consideration. It should be consistent with the country's NDCs or other decarbonization roadmaps. This demand analysis should be consistent with estimations in the Feasibility Study and other parts of the proposal.

Benefits should be considered in terms of (i) operating cost savings for the vehicle owners; (ii) costs to the electricity utility; and (iii) monetization of GHG emissions reductions.[17]

In the case of charging infrastructure, the AE should also explore the benefits of electricity price incentives that would encourage the vehicle users to delay charging until off-peak hours and estimate the overall financial benefits for utilities and users.

In all cases, the impact of the electric vehicle charging load on the grid should be studied and monetized (generation cost, transmission cost, peak capacity cost, infrastructure cost, and revenues).

The analysis should be linked to the country's power sector strategy in terms of (i) using an appropriate grid emissions factor that considers a future decarbonization target for

[14] *"Detailed guidance on how to evaluate each benefit is available in the European Commission (EC) "Guide to Cost-Benefit Analysis of Investment Projects", 2014. cba_guide.pdf (europa.eu)*

[15] *"Cost-benefit analyses of policy tools to encourage the use of Plug-in electric vehicles", Lavee, D.; Parsha, A., 2021.*

[16] *"Cost benefit analysis to assess urban mobility plans. Consumers' surplus calculation and integration with transport models", Beria, P. and Grimaldi, R., 2014.*

[17] *"Electric Vehicle Cost-Benefit Analysis", Lowell, D.; Jones, B.; Seamonds, D.; MJB&A; 2016.*

the power sector; (ii) the impact of the charging load mentioned previously; and (iii) the impact on the government budget for State Owner utilities.

Cost should include investment costs with specific attention to the cost of batteries for options where it is possible to own a vehicle while leasing the battery. The AE should make explicit any VAT or registration tax examples for electric vehicles. Operations costs should include taxes and fuel consumption based on annual mileage. The maximum speed and battery range are important factors to make explicit in the analysis of operations costs for electric vehicles.[18]

In addition to GHG emissions reduction, the economic analysis should include a discussion of the differences between electric vehicles and internal combustion engine vehicles[19] in terms of the typical externalities such as accident consequences, air pollution, and noise exposure.[20]

Following Jochem et al. (2016) relevant characteristics to consider for each one of these costs are fuel type, vehicle size, population density, and the time of day (i.e. for noise and congestion).

In terms of assumptions, it is important to perform sensitivity analysis on the cost of fuel, the grid emissions factor, electricity tariffs, as well as vehicle mileage.

2.2.3 PARADIGM SHIFTING PATHWAY: NEW GENERATION ZERO-EMISSIONS FUELS

The economic analysis should include scenarios on demand for the new generation zero-emissions fuels based on integrated assessment and energy system models with competing decarbonization strategies.

The estimation of the benefits and costs should consider the entire new generation zero-emissions fuel value chain,[21] energy source availability, production method (gasification or electrolysis for hydrogen for example), transportation (pipeline, tanker, etc.), storage (liquid or compressed), and distribution in the fuelling stations.

The economic analysis should also include parameters on production, transportation, and storage constraints such as the number of units.

For biofuel generation projects,[22] the economic analysis should include a discussion on the impact of changes in land use on crop prices through the channel of increase in demand for energy crops and potential decrease in land surface for competing crops. It should also include a discussion on the GHG balance associated with the change in land use, but also soil carbon sequestration, and fertilizer use.

The availability of land being a key issue for biofuel generation, the economic analysis should reference the change in land use analysis included in the project's feasibility study and ensure that estimations in the EFA are fully consistent with the estimations in the feasibility study.

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[18] *"A cost benefit analysis of electric vehicles – a UK case Study", Piao, J.; McDonald, M.; Preston, J.; 2014.*

[19] *"External costs of electric vehicles", Jochem, P.; Doll, C.; Fichtner, W.; 2016.*

[20] *"Dynamic and acoustic behaviour of electric versus combustion vehicles", Mocanu, I.; Aichinger, C.; Czuka, M.; Gasparoni, S.; Saleh, P.; 2016.*

[21] *"Cost-benefit analysis of a hydrogen supply chain deployment case for fuel cell vehicles use in Midi-Pyrenees region", Martinez-Garcia, G., 2017.*

[22] *"The economic and environmental costs and benefits of the renewable fuel standard" Chen, L.; Environmental Research Letters; 2021.*

The economic analysis should also include an assessment of the impact on the transport sector in terms of decrease of demand on fuels (gasoline and diesel for instance) that would be replaced by the biofuel. For fossil-fuel exporting countries, the decrease in "domestic" demand in fuels can translate into an increase in export, which in turn will have an important impact on the outcomes of the economic analysis. Impact on exports and assumptions on demand for commodities and prices should be carefully discussed in the economic analysis.

Such an analysis would include a high level of uncertainty over the prices of the different commodities, land use, and the future demand for crops and fuel. All these elements need to be included in the sensitivity analysis.

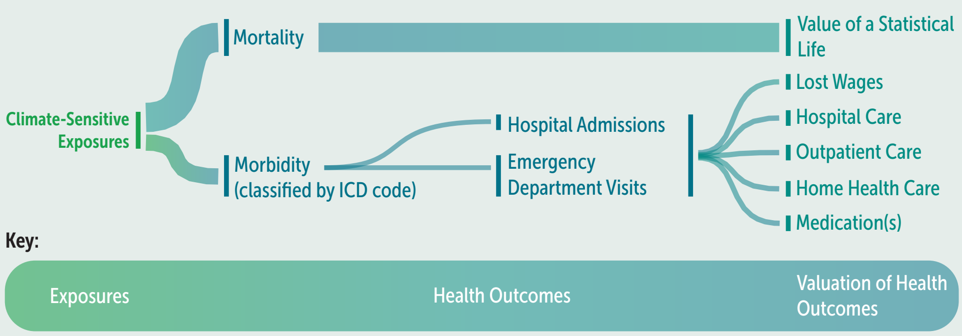
The analysis should explicitly discuss parameters of cost of energy sourcing, production, transportation, storage, and distribution (benefits section). The AE should adopt a total cost of ownership approach including the cost of the infrastructure as well as the cost of the end-user equipment that needs the new generation zero-emissions fuels and its operations and maintenance. The AE should also estimate the "embodied carbon" of infrastructure assets using life-cycle analysis.

2.3 Health and Well-Being

Limaye et al. (2020) defined climate health valuation as the "process for estimating the price tag of climate-sensitive health outcomes in terms of morbidity and mortality from climate-sensitive exposures".[23]

An economic analysis for health and well-being should start by identifying the climate-sensitive exposures of the health system under consideration. The AE should start by identifying the climate stressors with potential health impacts such as heatwaves, temperature changes, droughts, or floods, then link those to health impacts[24] in terms of mental illness, undernutrition, injuries, respiratory disease, allergies, cardiovascular diseases, infectious diseases, poisoning, water-borne diseases, and heat stroke.

FIGURE 3. CLIMATE-SENSITIVE EXPOSURES AND HEALTH IMPACTS



Source: Limaye et al. 2020.

The economic benefits of the interventions in the funding proposals should be estimated using an avoided cost method or averting behaviour/defensive expenditure

[23] *"Estimating the costs of inaction and the economic benefits of addressing the health harms of climate change", Limaye, V.; Max, W.; Constible, J.; Knowlton, K.; Environmental Health, 2020.*

[24] *"Health & Climate Change", World Health Organization (WHO), 2018.*

models,[25] estimating the costs of the health impact with and without intervention. For examples of costs to be considered see section 3.2 below (Main Steps: Estimation of benefits and costs).

Climate change can have implications on the operations of healthcare facilities in terms of physical damage in extreme events such as floods or hurricanes or increased operations costs due to cooling or heating needs in the case of change in temperature patterns. The AE should estimate the benefits of climate resilience for health facilities when they are part of the project scope.

Limaye et al. (2020) suggest the use of "Value of Statistical Life" (VSL) to estimate the cost of mortality from the climate health impacts. In addition, they suggest estimating morbidity costs linked to hospital admissions and emergency department visits in terms of lost wages during time in the hospital, hospital care, outpatient care, home health care, and prescribed medications.

2.4 Water Security

2.4.1 PARADIGM SHIFTING PATHWAY: ENHANCE WATER CONSERVATION, WATER EFFICIENCY AND WATER RE-USE

The estimation of the trends in demand and price for water is an important first step of the economic (and financial) analysis for water projects. The AE should include an assumption of the justification of demand based on the analysis of the socio-economic drivers of water demand in the project area. Such drivers could be demographic, but also sectoral when much of the demand is driven by irrigation or industrial use. The AE should be clear about the water user group(s) targeted by the activities in the proposal and include the relevant scope. For instance, if water conservation or re-use activities are targeting the agriculture sector in a country where agricultural commodities are exported, the scope for the demand analysis should also include trends in global commodity demand and prices.

The second point of attention is the coherence of all the assumptions in the economic analysis with the hydrological models submitted for the project. Hydrological models should serve as one of the primary inputs to economic and financial analysis for water conservation, re-use, and integrated water resource management projects alike.

For water conservation and efficiency projects, or project components, water savings analysis should be the starting input to the economic analysis. The AE needs to calculate the water savings associated with each conservation measure in the FP. The avoided water use or water savings should then be monetized using an avoided cost method in order to estimate the water savings benefits.

The AE should also estimate the GHG emissions reductions and energy savings resulting from "plumbing/appliance standards and planned active conservation measures".[26]

The AE baseline scenario[27] for the economic analysis should identify the sources, uses, treatment, re-use, and discharge of the water resources. For each step, the AE should identify the quantity, quality, and reliability standards, GHG emissions impacts, other environmental, health and economic impacts, as well as impact on ecosystem services

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[25] *"Cost-Benefit Analysis and the Environment – Chapter 3: revealed preference methods", OECD, 2018. Home | OECD iLibrary (oecd-ilibrary.org)*

[26] *"Water use efficiency cost-benefit analysis"; Riley, G.; City of Bellingham, Washington; 2019.*

[27] *"Cost-benefit analysis approach suited for water reuse schemes" De Paoli, G.; Mattheiss, V.; 2016.*

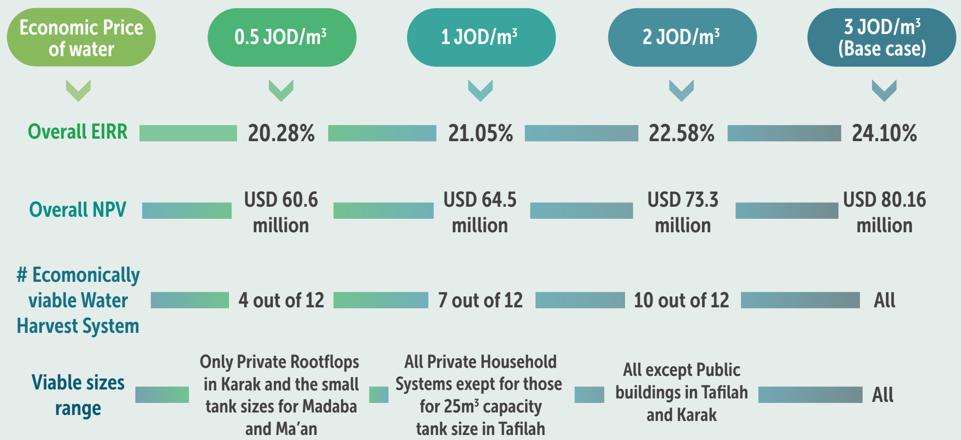
of the water flows. The AE should map the financial flows and payment at each stage of the process.

The AE should monetize the impact of the interventions or activities in the funding proposals on the water quality, quantity, GHG emissions, other environmental, health and economic impacts using the suggested methods described in the rest of this document.

For the economic analysis, the AE should use a shadow price of water[28] to monetize water savings and other benefits. This shadow price should be estimated in a way that considers the scarcity of the resources and competing use between sectors.[29] Water is often under-priced, and water tariffs do not usually reflect the true cost of the resource. For activities such as aquafer recharge,[30] water tariffs simply do not reflect the externalities associated with groundwater use. Water tariffs can be used as a second-best water pricing source.

For the financial analysis, the AE should use the water tariffs in place for each category of water use (and not the shadow price). The AE should differentiate between categories of users if necessary – single family households, multi-family households, commercial buildings, industry, agriculture, etc.

FIGURE 4. EXAMPLE OF THE LINK BETWEEN WATER TARIFF AND WATER PROJECT COMPONENT VIABILITY BASED ON FP155



Source: FP155 "Building resilience to cope with climate change in Jordan through improving water use efficiency in the agriculture sector (BRCCJ)", Project approved at B.28. Full EFA package available here: GCF/B.28/02/Add.02 : Consideration of funding proposals — Addendum II: Funding proposal package for FP155 | Green Climate Fund. Note: Economic Internal Rate of Returns (EIRR), Net Present Value (NPV), Jordanian Dinar (JOD).

Revenues for water conservation/re-use projects typically come from user payments. Users are often charged a fixed tariff and variable/volumetric tariff depending on the consumption level. If it is planned that water tariffs will also depend on the quality of the treated water, the differentiation should also be included in the financial analysis.

28 *"Water use, shadow prices and the Canadian business sector productive performance", Dachraoui, K.; Harchaoui, T.; 2004.*

29 *"Shadow price of water for irrigation – a case of the high plains", Ziolkowska, J.; 2015.*

30 *"An estimate of the shadow price of water in the Southern Ogallala aquifer" Williams, R.; Al-Hmoud, R.; Sgarra, E.; Mitchell-McCallister, D.; 2017.*

Revenue from subsidies and taxes should not be included in the economic analysis as these are neutral cashflows at the level of the entire society.

2.4.2 PARADIGM SHIFTING PATHWAY: STRENGTHEN INTEGRATED WATER RESOURCES MANAGEMENT AND WATER MANAGEMENT

Yoder et al. (2017) note that the difficulty in performing an EFA for integrated water resource management (IWRM) projects lay in that they entail the understanding of multiple facets "water systems, uses and stakeholders, and water management activities".[31] They qualify these multiple facets as "interrelated and non-separable".

The AE's challenge in such an economic analysis is therefore to identify the interdependence between the different components of the integrated water resource management project or system.

In practice, this means that we encourage AEs to aggregate economic analysis results both at the level of the entire IWRM project as well as present results by individual technical component. In addition to technical components, it is also a practice for IWRM economic analysis to aggregate results by stakeholder (i.e. developer, local community, water utility, council) given the importance of stakeholders in the IWRM approach.[32]

An IWRM project's economic analysis offers the possibility of including a wide range of benefits[25,] such as water savings, ground water recharge, reduction in flood impact and other climate-resilience benefits, GHG emissions reduction, water quality benefits, improved aesthetics (impact on property prices), and improved health (morbidity and mortality).

The cost of water can be categorized as use costs and opportunity costs.[33] Use costs are relative to construction and operation of infrastructure, storage, treatment, and distribution of water. Opportunity costs relate to the foregone benefits associated with using the water resources for one purpose rather than a competing one. For instance, "greater abstraction of water by a city might affect the quality and quantity of water available to downstream irrigators, thus imposing costs on these users".

For water treatment plants, use costs should include pumping systems, pipes, storage, infiltration, and reinjection investments,[34] man work units, land acquisition costs, and other administrative costs. Typical O&M costs are related to energy use or pipeline network.

The required quality of the re-used water will determine the cost and type of treatment considered for the economic and financial analysis. The cost assumptions need to be consistent with the technology choice assumptions in the project Budget and Feasibility Study.[35]

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31 *"Benefit-cost analysis of integrated water resource management: accounting for interdependence in the Yakima basin integrated plan"; Yoder et al.; Journal of the American Water Resources Association; 2017.*

32 *"INFFEWS Benefit cost analysis tool: Booklet of applied examples", Cooperative Research Centre for Water Sensitive Cities; Australian Government; 2020.*

33 *"Cost-Benefit Analysis and Water Resources Management: Water as an Economic Good" Briscoe, J.; Brower, R.; Pearce, D.; 2005.*

34 *"Socio-economic interest of treated wastewater reuse in agricultural irrigation and indirect potable water reuse: Clermont-Ferrand and Cannes case studies' cost-benefit analysis", Declercq, R.; Loubier, S.; Condom, N.; Molle, B.; Irrigation and Drainage; 2020.*

35 *"Cost-benefit analysis of wastewater reuse in Puglia, Southern Italy" Arborea, S.; Giannoccaro, G.; de Gennaro, V.; Ferruccio Piccinni, A.; Water, 2017.*

The assessment of opportunity cost[36] must account for the value of the use (high value vs low value), the quality and quantity issues that water extraction and use can cause on a basin, and the institutional mechanisms that exist (or do not exist) to manage the allocation of resources between users.

2.5 Energy Efficiency

The mix of technologies used for both the intervention and baseline scenarios should be based on least-cost analysis consistent with sector-level low-carbon development pathways, or national level least-cost analysis for the purpose of NDC or Long-Term Strategies (LTS). If such a decarbonization pathway is absent, the AE should consider developing one for the purpose of the FP.

Economic analysis for energy efficiency projects should include the benefits from GHG emissions reductions, energy savings and any savings on operating costs.

An important and often-overlooked benefit of energy efficiency is the "avoided need for generation and new Transmission and Distribution" or the capacity-avoided costs (related to equipment, system losses, T&D facilities, capacity market price reductions, land use, etc.).[37] The AE should include such elements in the analysis as much as possible.

Another overlooked aspect of energy efficiency is its potential adaptation benefits. Energy consumption can be associated with water consumption, especially in fossil-fuel-based energy systems. The AE should explore adaptation benefits in contexts with increased water stress due to climate change.

The AE, when possible, should apply a **deadweight adjustment**[38] to the benefits of energy-efficiency measures that takes into account the measures that households/commercial/industry beneficiaries would have taken without the project intervention. This is important in a context where other energy-efficiency policies and programmes are in place. A **regulatory and gap analysis** can help identify these energy-efficiency savings and calibrate the deadweight adjustment accordingly.

In addition to the social cost of carbon used to monetize GHG emissions reductions, the cost of energy (electricity, heat, or other fuels) will be an important determinant of the outcomes of economic analysis on energy efficiency projects. The AE should perform a specific sensitivity analysis on the cost of energy source used in the analysis.

Energy-efficiency measures can result in significant positive job impacts. The AE should aim at estimating these job impacts and integrating them into the FP in the economic co-benefits section.

Below are additional sector-specific considerations.

Industry

The baseline and intervention scenarios of energy efficiency in the industry sector should consider energy demand (electricity, heat, feedstock, or other fuels) based on the growth in demand for the industry.

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[36] *"Cost-Benefit Analysis and Water Resources Management: Water as an Economic Good" Briscoe, J.; Brower, R.; Pearce, D.; 2005.*

[37] *"Understanding Cost-Effectiveness of Energy Efficiency Programmes: Best practices, technical methods, and emerging issues for policy-makers" EPA, 2008.*

[38] *"Economic analysis of residential and small-business energy efficiency improvements", Sustainable Energy Authority of Ireland, 2011.*

To avoid over-inflation of energy-efficiency benefits, the economic analysis should consider decarbonization of the electricity sector in the country, if electricity is the main energy input for the industry under consideration, as well as any demand-side dynamics.

Buildings
The project intervention should be articulated in the context of any quantitative targets already in place in the country (energy consumption per square meters in Net Zero building regulations for instance).

For heating and cooling technologies, the assumptions of the economic analysis must be consistent with: (1) climatic trends identified in the FP's climate rationale, (2) any maximum demand or technology penetration assessments in the Feasibility Study.

Appliances and equipment
For economic analysis on high efficiency appliances/equipment projects, it should pay particular attention to the future trajectory of the energy costs that could be included in the sensitivity analysis. The deadweight adjustment mentioned earlier is also particularly important in the appliances and equipment context.

Benefits from energy savings should be compared with the costs of implementing energy-efficiency measures in terms of investment cost and O&M.

When possible, the AE should also include other costs such as data collection and Measurement, Reporting and Verification (MRV) costs, any permitting and certification costs,[39] and any legal costs linked to the negotiations of contractual issues when dealing with residential building energy efficiency.

For technology and equipment, the AE should provide an analysis of the cost of disposal/recycling of electronic waste and factor these costs into the economic analysis.

2.6 Forest and Land Use and Ecosystems and Ecosystem Services

The estimation of benefits and costs for forestry and land use, as well as for ecosystems and ecosystem services projects should be performed using the ecosystem services framework.

The United Nations System of Environmental Economic Accounting (SEEA) provides a list of ecosystem services generally categorized in provisioning services, regulating and maintenance services, cultural services, and supporting services. The economic analysis is therefore an estimation of the costs and benefits "associated with changes in assets and the services they provide".[40]

The AE should map project interventions with ecosystem services provided by the forestry, terrestrial and freshwater, or coastal and marine ecosystem. The total economic value of the service[41] is made up of:

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[39] *"Towards a more realistic cost-benefit analysis – Attempting to integrate transaction costs and energy efficiency services", Adisorn et al., 2020. Energies.*

[40] *"Towards a global map of natural capital: key ecosystem assets", UNEP, 2014. Towards a global map of natural capital: key ecosystem assets | UNEP - UN Environment Programme*

[41] *Ewards, L., 2013 based on "The economic value of Guam's coral reefs", van Beukering et al. 2007.*

1. *Use values:* direct use (drinking water, timber, tourism, etc.); indirect use (coastal protection, water purification, carbon sequestration, etc.); and optional use (biodiversity, clean soils, etc.); and
2. *Non-use values:* bequest value (avoided damage from climate change); or existence value (rare species, and indigenous rights).

Ecological interdependencies between ecosystems is a challenge in such analyses. Although it is difficult to understand how the ecosystem targeted by the AE's intervention is dependent on other ecosystems, it is important to identify critical interdependencies and include them in the analysis. Ecosystem services-related valuations should "explicitly seek to be as inclusive as possible in scope and coverage".

Another challenge when it comes to valuing ecosystem services through NPV is the analysis lifespan. Ecosystem assets tend to provide services for many decades, given the ability of ecosystems to regenerate, introducing issues of intergenerational wealth transfer. The AE should consider relevant time horizons that can go beyond the project period. Alternative approaches to Net Present Value (NPV) that better reflect long-term value, such as Land Expectation Value (LEV),[42] can be explored.

For restoration projects, the economic analysis should not estimate *the total economic value* of the restored land use, but rather the *change in total economic value* between the degraded and restored landscape.[43]

The baseline degradation scenario for restoration projects should be consistent with the assumptions in the FP. It should factor in socio-economic drivers such demographic and urbanization trends, as well the future demand for forest and ecosystem services-based products.

2.7 Energy Generation and Access

For energy generation and access, the use of least-cost optimization approaches is the industry standard when it comes to modelling low-emissions pathways for the energy sector. Such studies are sometimes referred to as "market studies". These "are used to calculate the cost optimal dispatch of generation units under the constraint that the demand for electricity is fulfilled (taking into account demand side responses, DSR) in each bidding area and in every modelled time step".[44]

We recommend that AEs perform economic analysis where the baseline, counterfactual, and project scenarios are developed based on a least-cost energy system modelling. When available, AEs should prioritize such modelling developed in the context of available Nationally Determined Contributions (NDCs), Long-Term Strategies (LTS), or energy sector low-carbon development pathways.

The estimation of benefits and costs for energy projects can rely on a high number of assumptions linked to the dynamic of demand for energy, fuel prices, energy tariffs, the price of carbon or investment cost for technologies. A thorough sensitivity analysis is often necessary to check the robustness of results.

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[42] *See "A profitability study for both timber and nuts in a Brazil nut forest concession: The case of Madre de Dios, Peru", Rodriguez, A., 2014.*

[43] *"A cost-benefit framework for analyzing forest landscape restoration decisions", IUCN, 2015.*

[44] *"3rd ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects", ENTSO-E, 2019.*

One important consideration for electricity-generation projects is the potential for sector coupling and in particular for demand-side flexibility[45] measures that can have an impact on the load profile and costs of generation. An electricity-generation project should include foreseeable developments in the industry, transport, commercial, or residential sector that would result in some level of demand-side flexibility. In practice, this means that when AEs set the baseline for the economic analysis of a generation project, they should also consider development plans in other sectors that include demand-side flexibility considerations.

The "ENTSO-E 3rd Guideline for Cost Benefit Analysis for Grid Projects" identifies three project-level benefits for transmission and distribution: "balancing energy exchange, avoidance of the renewable/replacement costs of infrastructure (...) reduction of necessary reserve for re-dispatch power plants".[46] For project scenarios with a high penetration of renewable energy, the estimation of the reduction in reserve requirements for re-dispatch is an often-overlooked element in economic analysis that AEs should try to include. For grid projects, we recommend including indicators on the project contribution to enhancing the transfer capabilities of the grid such as Net Transfer Capacity (NTC) or Grid Transfer Capability (GTC).[47]

In terms of benefits from GHG emissions reductions, transmission and distribution projects should clarify cross-border considerations and the geographic scope. If electricity export and import flows are to be expected, these should be factored into the analysis at all the relevant levels.

The economic benefits of storage connected to intermittent renewables can be estimated based mainly on avoided loss of load for peaking power above the network capacity and curtailment during peak production hours.[48]

A further economic benefit comes from reducing the cost of unserved energy (CoUE) to account for the impact of lost load on consumers. This can be estimated based on the marginal cost of running backup power units like diesel generators by customers to address network outages.

For further examples of cost and benefits to consider for smart transmission, distribution and storage projects, AEs can refer to the International Renewable Energy Agency (IRENA) guide "Smart Grids and Renewables: A Cost-Benefit Analysis Guide for Developing Countries".[49]

For energy access projects considering mini-grid technologies for off-grid beneficiaries,[50] the AE should consider a baseline scenario based on the current generation technology used by the communities in addition to a counterfactual scenario looking at the extension of the grid. The grid extension counterfactual should consider future development of the generation mix including potential increases in the share of renewable energy generation. This will result in different estimations in terms of GHG emissions reductions for the project and subsequent benefit estimations. Benefits should be calculated over the useful life of the technologies considered and if the timeframe of the analysis exceeds the useful life, it should include any replacement costs. For an accurate estimation of energy savings, the cost of fuels for the baseline

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[45] *"Demand-side flexibility for power sector transformation", IRENA, 2019.*

[46] *"3rd ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects", ENTSO-E, 2019.*

[47] *"3rd ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects", ENTSO-E, 2019.*

[48] *"Power System Flexibility for the Energy Transition, IRENA, 2018.*

[49] *"Smart Grids and Renewables: A Cost-Benefit Analysis Guide for Developing Countries", IRENA, 2015.*

[50] *"Cost-Benefit Analysis of Off-Grid Solar Investments in East Africa", USAID, 2017.*

or counterfactual scenario should include any transport costs. Similarly, the cost of the mini-grid alternative should factor in the capacity-building component, if included in the project.

For energy sector investment, the AE should aim at including estimation of embedded carbon emissions in infrastructure and equipment.

2.8 Agriculture and Food Security

For the adaptation component of projects in the agriculture and food security sector, the AE should make sure that the climate impact baseline scenario is fully in line with the climate rationale in the funding proposal. For instance, the percentage changes in crop yield, frequency, and severity of extreme climate events, should be based on the same climate modelling adopted in the Funding Proposal's climate rationale. The AE should include at least two different Representative Concentration Pathways (RCPs) when considering climate impacts on the agriculture sector. Economic analysis for agriculture and food security projects should include a sensitivity analysis on climate change impact assumptions.[51]

AEs should clearly explain and discuss the production functions[52] used to model "the physical response pattern of yield in response"[53] to funding proposals activities (such as Liebig or Mitscherlich functions[54]). The AE can consider using benefit transfer methodologies when there is a lack of data on the project's context. The economic analysis needs to explain the activities' relation to outcomes such as "improved soil fertility, improved crop water availability and reduced soil erosion" and the subsequent potential increase or stabilization of agriculture output.

Following Liu et al. (2016), when data is available, AEs should consider including a diffusion model[55] in the economic analysis that attempts to predict the adoption of the activities under consideration in the FP beyond the direct scope of the project. The AE can then calculate project benefits that are linked to the project's exit strategy.

For economic analysis, the AE should use agricultural commodity prices based on the market where these commodities are sold. For international commodities destined for export, international prices should be considered. For locally marketed commodities, local prices should be considered. In all cases, tax and subsidies should not be included in the prices used for the economic analysis

For the financial analysis, the AE should use local prices reflecting the income generated for the project's beneficiary.

[51] *"Cost-benefit analysis for climate change adaptation policies and investments in the agriculture sectors", FAO, 2018.*

[52] *"Reconciling the von Liebig and Differentiable Crop Production Functions", Berck and Helfand, American Journal of Agricultural Economics, 1990.*

[53] *"Cost and benefit analysis of adopting climate adaptation practices among smallholders: The case of five selected practices in Ghana", Williams et al., Climate Services, 2020.*

[54] *"Integrating the production functions of Liebig, Michaelis-Menten, Mitscherlich and Liebscher into one system dynamics models", Nijland, Schouls, and Goudriann, 2008.*

[55] *"Cost and benefit analysis of adopting climate adaptation practices among smallholders: The case of five selected practices in Ghana", Liu, at al., Climate Risk Management, 2016.*

3. ECONOMIC ANALYSIS

3.1 Purpose in the context of a GCF project

Economic analysis aims at capturing the benefits and costs of the activities undertaken in the Funding Proposal from society's perspective. Multiple methods are used to assess the costs and benefits of mitigation and adaptation projects. The three most common are: Cost-Benefit Analysis (CBA), Cost-Effectiveness Analysis (CEA), and Multi-Criteria Analysis (MCA).

The CBA is the most widely applied and influential method for policy analysis.[56] It requires all the benefits and costs of a project to be expressed in monetary terms, which can sometimes be difficult to achieve. In that case, CEA and MCA can be helpful.[57] Cost-effectiveness analysis (CEA) is used to determine the least costly way to achieve a specific mitigation or adaptation goal. Costs are measured in monetary terms, but benefits can be expressed in any other measures. Projects can be compared based on least cost and other relevant measures (GHG emissions for instance in the case of mitigation). Multi-Criteria Analysis (MCA) integrates financial and non-financial criteria and priorities of different stakeholders to arrive at a scoring and relative ranking of project. MCA often integrates results from CBA or CEA as one of the criteria. In the context of the GCF Project Cycle, the Secretariat assessment can already be considered a form of MCA.

Example of questions that could be answered through the economic analysis

- What are the project's benefits and costs including externalities?
- What are the sources of the benefits and costs: Mitigation? Adaptation? Health? Etc.
- Is the intervention cost effective? Are the economic returns above the social discount rate?

Example of results presentation

The analysis should include a calculation of the Economic Internal Rate of Return (EIRR), the Benefit to Cost Ratio, as well as the Economic Net Present Value (ENPV) of the Net Benefits of the projects.

The Net Benefits here refer to the difference between the benefits and the costs of the project in the case where the project is evaluated against a "no project/no action" baseline; or it refers to the difference between the net benefits of the projects and the net benefits of the baseline scenario in the case of a specific baseline (this case is often relevant for adaptation projects).

The Benefit to Cost Ratio provides information on the "value for money"[58] of the proposed activities and it should be greater than 1. ENPV (also a "value for money" measure) provides information on the net total amount of benefits in present value obtained and it should be positive. The EIRR reflects the returns on the mitigation or adaptation measures at society level and it should be above the discount rate used in the analysis.

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[56] *https://environment.yale.edu/kotchen/pubs/CBAchap.pdf*

[57] *"Conducting a cost-benefit analysis of adaptation measures", Urban Adaptation Support Tool, Covenant of Mayors for Climate & Energy. 4.2 Conducting a cost-benefit analysis of adaptation measures — Climate-ADAPT (europa.eu)*

[58] *"NSW Coastal Management Manual: Using Cost-Benefit Analysis to Assess Coastal Management Options: Guidance for Councils", NSW Australia Government, 2015.*

This table is an example of the way economic analysis results and indicators can be presented. Such a table should be included in the funding proposal in support of the discussion on the Efficiency and Effectiveness criteria.

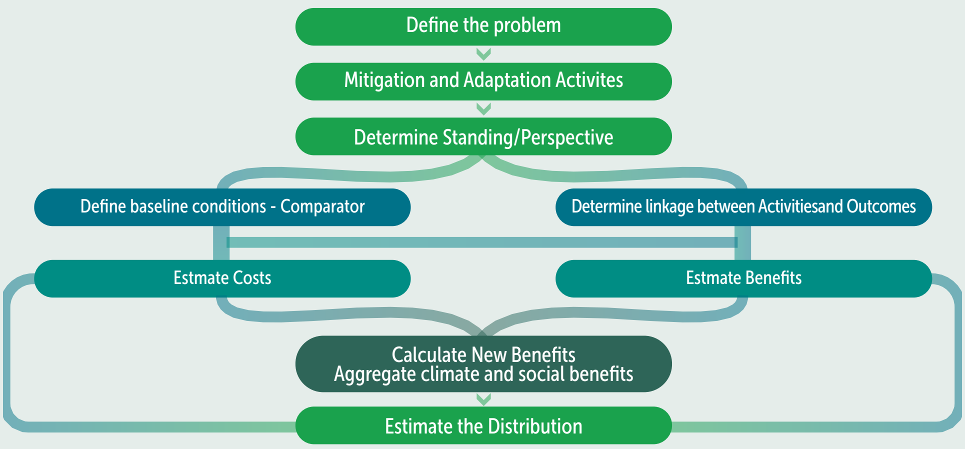
TABLE 2. PRESENTATION OF ECONOMIC ANALYSIS RESULTS (EXAMPLE)

	ECONOMIC COSTS IN PRESENT VALUE (USD)	ECONOMIC BENEFITS IN PRESENT VALUE (USD)	ECONOMIC IRR	ECONOMIC NPV	BENEFIT TO COST RATIO
Activity 1 or Portfolio of Measures 1					
Activity 2 or Portfolio of Measures 2					
Activity 3 or Portfolio of Measures 3					
...					
Total Funding Proposal					

3.2 Main steps

This section presents recommendations on elements to include in a CBA or CEA performed for a GCF Funding Proposal.

FIGURE 5. ENVIRONMENTAL COST-BENEFIT ANALYSIS



Source: Author, based on "Conducting Benefit-Cost Analysis in Low- and Middle-Income Countries: Introduction to the Special Issue", Robinson et al., Journal of Benefit-Cost Analysis, 2019.

Defining the problem: Consistency with the Theory of Change and climate rationale
The Funding Proposal's Theory of Change and Climate Rationale should be the starting point to identify the specific problem or policy goal the analysis is trying to address (i.e. investing in a low-carbon transport or adaptation of an urban transport infrastructure). The analysis should include all the significant outcomes considered in the Funding Proposal.

Determining the relevant perspective for the analysis and climate narrative
The AE should perform the economic analysis (CBA or CEA) at the spatial and temporal scope of the entire project.

Most of the time, intended climate impacts for adaptation projects are not linked to a specific climate scenario. The AE needs to clearly identify the Representative Concentration Pathway (RCP) it is using to formulate the climate impacts. We recommend the use of at least two climate scenarios and consider benefits and costs for short-term impacts as well as medium- and long-term impacts. This can be performed as well as a sensitivity analysis.[59]

Determining baseline conditions and linkages between activities and outcomes
The economic analysis requires comparing the activities included in the Funding Proposal against a baseline scenario. The baseline is the status quo or the alternative to the mitigation or adaptation project under consideration. A classic baseline is a "no action" scenario that reflects the future if the project is not implemented. Other policies that are already planned will be taking place in this scenario. Only the project is not taking place. Alternatives can be driven by considerations other than climate action. A counterfactual scenario of "minimum action" can also be developed in addition to the "no action" baseline. The number of counterfactual scenarios is not limited and should reflect the expected changes in status quo.

FIGURE 6. ANNUAL EXPECTED DAMAGES WITH AND WITHOUT MANGROVES FROM TROPICAL CYCLONES AND REGULAR CLIMATE

Source: Losada et al., The Nature Conservation,[60] 2018.Analysis, 2019.

[59] "Scope and limitations of the cost-benefit analysis (CBA) for the evaluation of climate change adaptation measures", Latino Adapta Policy Brief, Gutman, V.; 2019.

[60] "The global value of mangroves for risk reduction. Technical Report". Losada, I. J., P. Menéndez, A. Espejo, S. Torres, P. Díaz-Simal, S. Abad, M. W. Beck , S. Narayan, D. Trespalacios, K. Pfiegner, P. Mucke, L. Kirch. 2018. The Nature Conservancy, Berlin.

In the context of GCF Funding Proposals, the baseline considered for the GHG emissions reductions and the determination of the adaptation impact should be consistent with the baseline considered in the economic analysis.

Economic analysis baseline consistency with climate scenarios and low-carbon development roadmaps

For adaptation projects, the climate narrative considered for the estimation of climate change impacts needs to be in line with the climate scenarios mentioned in the Funding Proposal's climate rationale. The AE should clearly say which Representative Concentration Pathway (RCP) is considered for the climate impacts. We recommend the use of at least two RCPs for the climate impacts and include a sensitivity analysis on climate scenarios.

For mitigation projects, the baseline assumptions in terms of adoption of a mitigation activity or technology should be consistent with low-carbon pathways built using Integrated Assessment Models (IAM) when available. Ideally, such a sector or national roadmap can be referenced in the project country's Nationally Determined Contributions (NDCs), Long-Term Strategies (LTS), or other Low-carbon Development Strategies (LDS).

For the activities assessed in the economic analysis, it is important to clearly understand *the causal pathways*[61] between the Funding Proposal's activities and outcome. For instance, what is the exact contribution of the shift in transport mode to the reduction in GHG emissions? What is the exact way climate-resilient measures can reduce congestion and generate time savings for end-users?

Indicators such as Economic Net Present Value (ENPV) and Economic Internal Rate of Return (IRR) should be calculated on the benefit/cost difference between the baseline and project[62] scenarios. The AE should make sure this difference is solely attributable to the project activities under consideration.

An assessment of other projects and activities planned in the same sector, country, or area is necessary to evaluate what benefits and costs can be attributed to the project and **to avoid double counting**. If overlapping projects are identified, the AE should clarify the measurement, reporting and verification processes that will ensure a correct attribution of benefits.

A clear elaboration of the baseline scenario can compensate for limitations related to the estimations of costs and benefits discussed below. The baseline scenario is key to understanding the economic value of the interventions under consideration in the FP.

Estimation of Benefits and Costs

The distinction between benefits and costs is not always clear, especially when talking about climate economic analysis. For instance, GHG emissions are sometimes included as a cost using a social cost of carbon; but can also be included as benefits (or negative

[61] *"Conducting Benefit-Cost Analysis in Low- and Middle-Income Countries: Introduction to the Special Issue", Robinson et al., Journal of Benefit Cost Analysis, 2019.*

[62] *Also referred to as "factual" and "counterfactual" outcomes in the evaluation literature.*

costs) using the same social cost of carbon when quantifying the benefits of reducing emissions in comparison with a baseline.

It is important to categorize costs and benefits in a homogenous way. A useful framework to ensure consistency of benefits and costs is to separate inputs and outputs. Costs are the required investments to implement the mitigation or adaptation activity. Benefits are the outputs or outcomes of the activities. The project can result in some costs, but these can be categorised as negative benefits if it serves to improve the narrative. This framework is consistent with the way the Theory of Change is often presented in Funding Proposals.

Costs are the required investments and inputs to implement the mitigation or adaptation activity. The AE should include at least two categories of costs: (i) onetime investment costs such as infrastructure construction costs, noise protection, flood protection, etc.; and (ii) recurrent costs such as operation and maintenance costs (O&M), the progressive loss of jobs and production due to climate change.[63] During the initial GCF investment period, these costs are usually closely aligned with GCF and co-financing amounts presented in FP **Annex 4** – Detailed Budget Annex. For the remainder of the investment lifetime, these costs should reflect ongoing amounts necessary to ensure the project/programme continues to deliver the projected adaptation and/or mitigation benefits. Costs should also include any negative externalities generated by project activities such as air quality costs due to dust during the construction phase.

Alignment of the economic analysis cost assumptions with the Budget

The cost assumptions used for the economic and financial assessment need to be consistent with Funding Proposal **Annex 4** – Detailed Budget Annex.

Although we do acknowledge that some of the costs in the economic and financial analysis might not be included in the budget, for any investment or O&M cost that will be funded under the project, GCF expects full consistency with the budget.

The benefits to be considered in the analysis will depend on the perspective and the stakeholders. Stakeholders can directly or indirectly benefit from the activity under consideration.

Benefits are the outputs or outcomes of the activities. As mentioned previously, the benefits to be considered in the analysis will depend on the perspective and the stakeholders. Stakeholders can benefit from the activity under consideration directly. For instance, if the activity aims at recharging a depleting aquifer,[64] farmers will directly benefit as they use the water for irrigation. Direct benefits can then be subdivided into marketable and non-marketable benefits. For goods and services to be included in

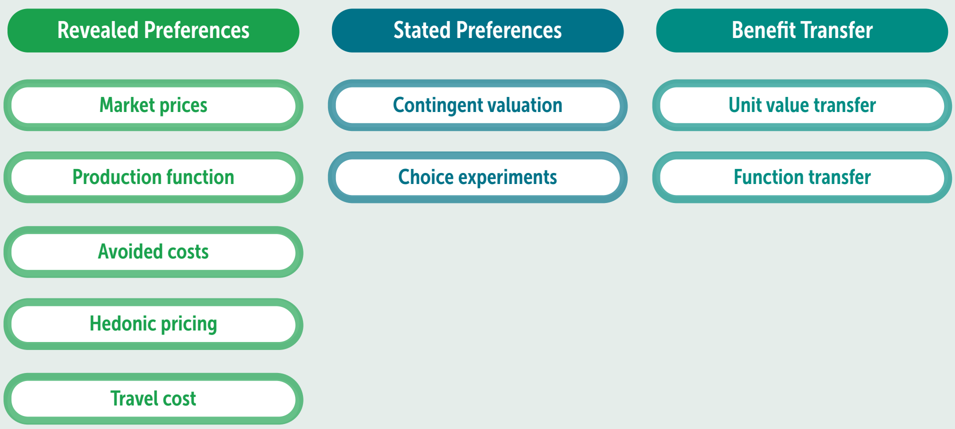
[63] *"Using ecosystem services to underpin cost-benefit analysis: Is it a way to protect finite soil resources?", Greenhalgh and al., Ecosystem Services Journal, 2017.*

[64] *"Assessing the Economic Viability of Alternative Water Resources in Water-Scarce Regions", Birol, Koundouri, and Kountouris, International Food Policy Research Institute, 2015.*

an economic analysis, they need to have a monetary value. In the case of the aquifer recharge example, the benefit farmers get from increased yield due to irrigation can be quantified directly as the harvest can be sold in a market and they are therefore marketable. Taking the example of a transportation project, potential benefits could be travel time, traffic safety, and reduction in noise and air pollution; yet non-market benefits need to be indirectly estimated as there is no market for travel time. These are then considered as non-marketable benefits that require estimation. Projects can also include indirect benefits. In the example of the aquifer recharge project, local communities might benefit indirectly by consuming locally produced food.

Valuing climate mitigation or adaptation benefits and costs requires the use of revealed-preference or stated-preference methods. As much as possible, AEs should use revealed-preference valuation methods. Revealed preference methods estimate the value of non-market outcomes based on the prices paid for related market goods. Stated-preference methods estimate these values based on survey data. For example, the value of water saving benefits can be calculated using the price of water. However, a survey can also be used to ask farmers how much they would value an increase in water quality in a context without a price on water. AEs should explore stated-preference methods as part of the Project Preparation Facility support. A party can also benefit when it does not have to bear a cost. This is the avoided-cost approach[65] to evaluating benefits. For instance, the owners of coastal properties that would be damaged due to coastal erosion would benefit from management options that would reduce the risk of erosion. It is important to also factor in the co-benefits of climate mitigation and adaptation such as changes in time-use valuation[66] and health benefits.[67]

FIGURE 7. ENVIRONMENTAL BENEFITS VALUATION METHODS



Source: Authors.

[65] *"NSW Coastal Management Manual: Using Cost-Benefit Analysis to Assess Coastal Management Options: Guidance for Councils", NSW Australia Government, 2015.*

[66] *"Valuating changes in time use in low- and middle-income countries", Whittington, Dale, and Joseph Cook; Journal of Benefit-Cost Analysis; 2019.*

[67] *A detailed presentation of the methodology for quantifying non-monetary costs and benefits using shadow pricing techniques like those described above is beyond the scope of this Handbook.*

Prices used to evaluate benefits and costs

For the estimates of the economic benefits, prices should not include taxes or subsidies. This is necessary to reflect the true costs and benefits to society. Economic benefits and costs usually include proxies of values for non-marketable goods called "shadow prices".[68] For instance, the social cost of carbon used to monetise the mitigation benefits under the project should be aligned with the recommendation of the High-Level Commission on Carbon Prices.[69] Please refer to the financial analysis section for information on elements that should not be included in the economic analysis.

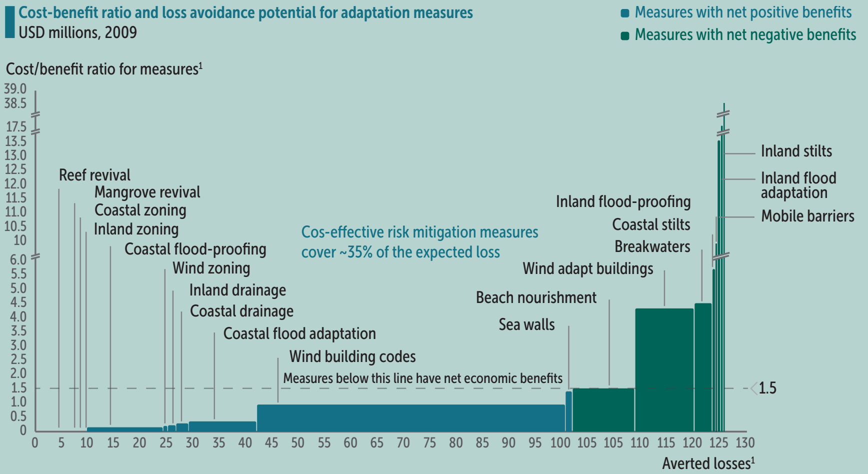
When an Integrated Assessment Model (IAM) was computed in the project's country as part of the Nationally Determined Contribution (NDC), Long-Term Strategy (LTS), or sector or national decarbonization roadmaps and strategies, the AE should use the social cost of carbon developed under these analyses.

The Value of Benchmarking

In the context of the GCF project approval cycle, Economic Analysis is fundamentally a tool to assess the cost effectiveness of the mitigation and adaptation measures considered in the funding proposal. The AE will compare the project primarily through the baseline and counterfactual scenarios. However, there could be situations where multiple counterfactuals are possible.

The Caribbean Catastrophe Risk Insurance Facility[70] (CCRIF) provides an example for the Caribbean countries using the concept of "Adaptation cost-benefit curves". The study compares adaptation measures based on their averted losses and cost-benefit ratios.

FIGURE 8. EXAMPLE OF ADAPTATION COST-BENEFIT CURVE FOR BARBADOS



1 Does not account for synergies and dis-synergies between measures (e.g. building seawalls behind a breakwater)

Source: CCRIF, 2010.

68 *Shadow Pricing - Overview, Varying Definitions, & Example (corporatefinanceinstitute.com)*

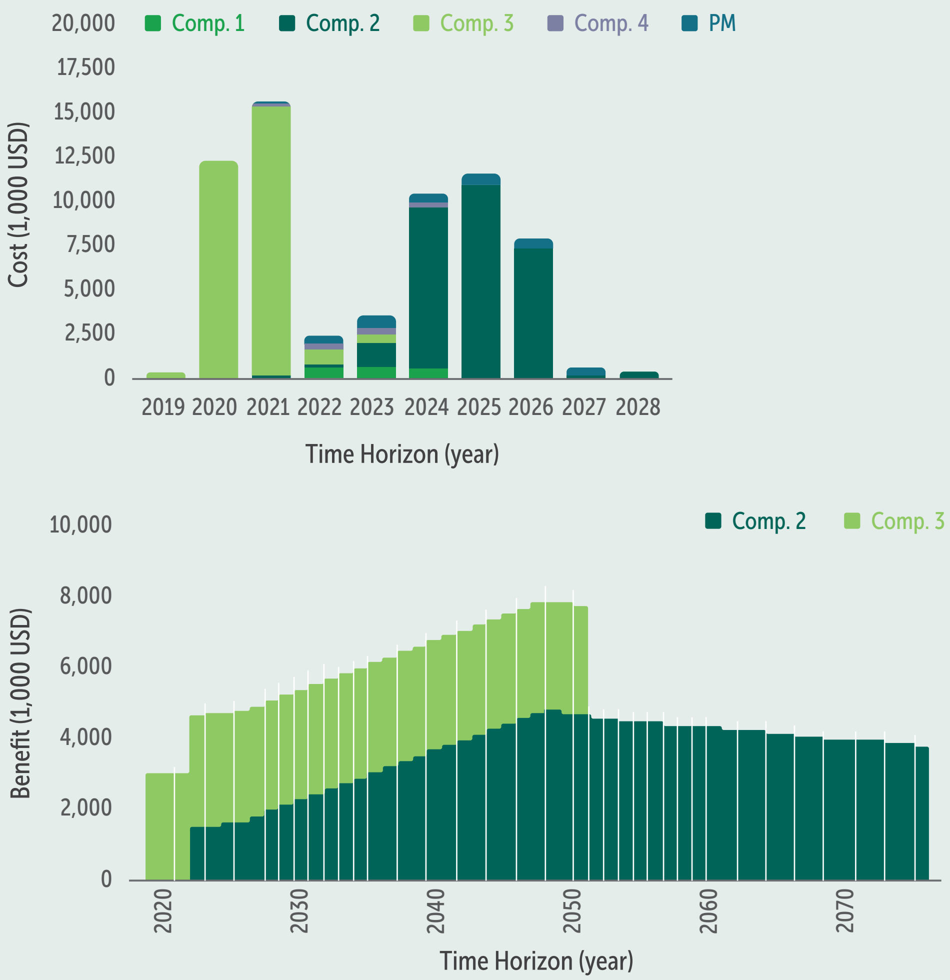
69 *https://static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/59b7f2409f8dce5316811916/1505227332748/CarbonPricing_FullReport.pdf*

70 *"Enhancing the climate risk and adaptation fact base for the Caribbean", CCRIF, 2010.*

Time horizon of the analysis

AEs should consider the lifespan of each activity based on its benefits and costs. The choice of the analysis indicators can be impacted by the nature of the project where cashflows occur over several decades. The AE should consider the timeline that is consistent with the useful life of the infrastructure or policy under consideration.

FIGURE 9. EXAMPLE OF REPRESENTATION OF BENEFITS AND COSTS TIMING BASED ON FP165 EFA SUBMISSION PACKAGE



Source: FP165 "Building Climate Resilient Safer Islands in the Maldives", JICA. Project approved at B.29. Full EFA package available here: GCF/B.29/02/Add.01 : Consideration of funding proposals - Addendum I Funding proposal package for FP165 | Green Climate Fund.

Social Discount Rates

Benefits and costs extend over long time periods. They are converted into present values using a measure of the social discount rate. The higher the discount rate, the more important the present is at the expense of the future.

There is no professional consensus on what social discount rate should be used for climate adaptation and mitigation projects. The appropriate response to this level of uncertainty is therefore to choose a discount rate, provide a justification for it, and conduct sensitivity analysis.

O'Mahony (2021) shows that the discounting guidance in many OECD[71] countries for projects is shifting towards: (i) the use of a lower discount rate over the short- to medium-term; and (ii) the use of declining discount rates over the long-term. The United Kingdom's Green Book (2018) recommends declining interest rates for projects with more than a 125-year life span.

The AE should use the social discount rate it deems relevant and provide references. However, the social discount rate can be different from the financial cost of capital as it reflects society's time preference and not only the activity. Public mitigation and adaptation projects are meant to maximize social and environmental benefits and therefore might not be directly comparable with for-profit investments. This explains why social discount rates are typically lower than financial discount rates in developing economies.

Tips and Good Practice

- Consider structuring the spreadsheet model with one tab for all the key parameters and assumptions, and then link to these in the formulae to reduce the potential for transcription errors in subsequent calculations.
- Be sure to include formulae in the cells rather than hard-coded values. This will make it easier for the GCF reviewer to follow the logic of the analysis and potentially reduce the number of follow-up questions
- Include references for all key parameters.
- Include all project costs presented in the budget – if these costs are not considered necessary to generate the project's benefits, then one could ask whether they should be part of the budget request.
- Ensure the projected benefits reflect the Theory of Change.

3.3 Additional Recommendations

Comparing values across countries and over time

To allow country comparison[72] in the case of Funding Proposals covering multiple countries over time, some conversions are recommended: (1) an inflation adjustment to account for economy-wide price changes; (2) an exchange rate adjustment to reflect the relative value of the different currencies; and (3) a discount rate adjustment to account for time preferences and GDP levels across countries.

Dealing with Uncertainty: Scenario and Sensitivity Analysis

Uncertainty poses a significant challenge in assessing climate mitigation and adaptation projects. One way to deal with uncertainty is scenario and sensitivity analysis.

A simple way to perform scenario analysis is to use a "maximum-minimum approach" or "optimistic-pessimistic" approach. Such an approach identifies upper and lower boundaries for the key parameters of the analysis. Other scenarios can also be identified by varying the degree of climate outcomes such as GHG emissions reductions or degrees of adaptation.

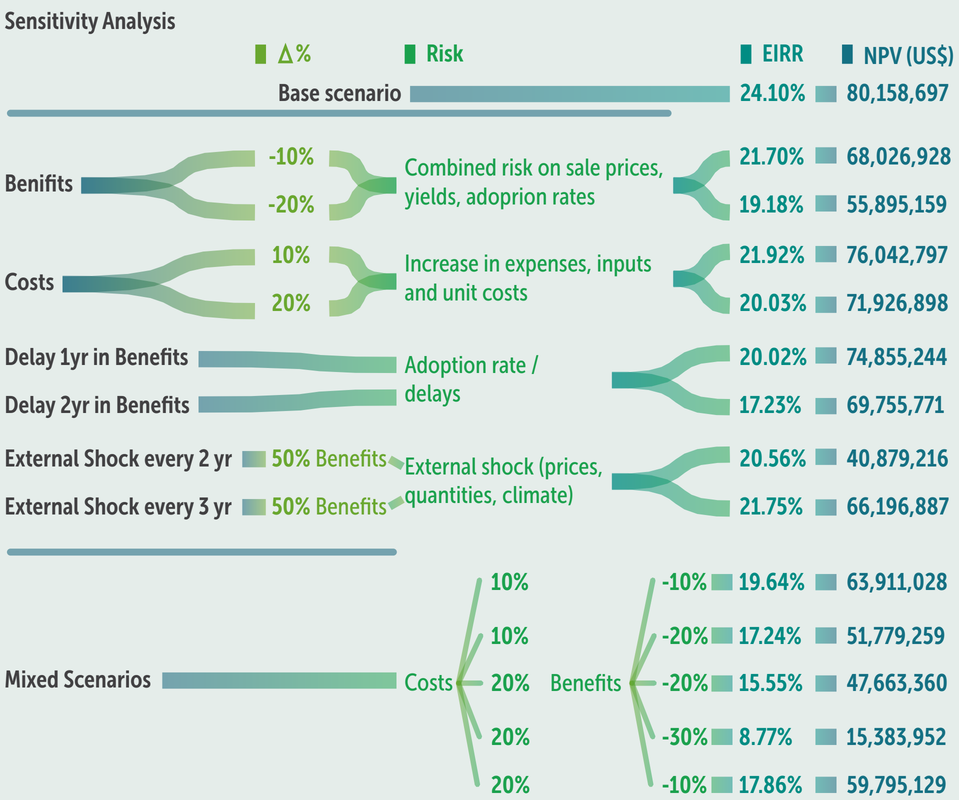
[71] *"Cost-Benefit Analysis and the Environment", the OECD, 2018.*

[72] *"Reference Case Guidelines for Benefit-Cost Analysis in Global Health and Development", Harvard T.H. Chan School of Public Health, 2019.*

Such scenarios can then provide input for sensitivity analysis of outcomes of the economic assessment such EIRR, ENPV, or BCR.[73]

The analysis should include a sensitivity analysis on main parameters such as: carbon prices, value of time, fares and tariffs, rate of increase of the demand for the services or goods in question in the project, over time,[74] and discount rate. As mentioned previously, one of the key parameters of economic analysis is the social discount rate. AEs are encouraged to perform sensitivity analysis at least on the social discount rate. We suggest performing a sensitivity analysis for a discount rate equal to twice the per capita growth rate of the country under consideration[75] in line with the recommendation of the *Journal of Benefit Cost Analysis* "2019 Special Edition on Benefit Cost Analysis in Middle and Low-income countries".[76]

FIGURE 10. EXAMPLE OF SENSITIVITY ANALYSIS WITH CLEAR JUSTIFICATION BASED ON FP155



Source: FP155 "Building resilience to cope with climate change in Jordan through improving water use efficiency in the agriculture sector (BRCCJ)", Project approved at B.28. Full EFA package available here: GCF/B.28/02/Add.02 : Consideration of funding proposals - Addendum II: Funding proposal package for FP155 | Green Climate Fund.

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[73] *"Economic approaches for assessing climate change options under uncertainty – Excel tools for Cost-Benefit and Multi-criteria Analysis", GIZ, 2013.*

[74] *Detailed guidance on how to evaluate each benefit is available in the European Commission (EC) "Guide to Cost-Benefit Analysis of Investment Projects", 2014. cba_guide.pdf (europa.eu)*

[75] *This value is a simplistic approximation of Ramsey's rule with a social rate of time preference of zero and an elasticity of the marginal utility of consumption of 2.*

[76] *"Standardized sensitivity analysis in BCA: An education case study", Pradhan and Jamison, Journal of Benefit-Cost Analysis, 2019.*

Understanding distributional impacts
Distributional impacts refer to how different income groups incur costs and receive benefits from the project. It is important to understand the interplay between project activities and "poverty alleviation or social inclusion strategies".[77]

Many GCF projects target vulnerable communities. Yet it is not easy to capture the effect of the activities under consideration on specific communities through the economic analysis.[78] It is therefore important to try to estimate the distribution of impact across the groups identified in the economic analysis (business size, income, age, region, etc.). These groups can include local communities, business, or government depending on the context. Ultimately the availability of information will dictate the ability of the AE to perform such analyses.[79]

The theoretical underpinnings of Cost-benefit analysis generally ignore which segments of a population may be on the receiving end of the costs and benefits, leading to an inequitable result. Using distributional weights can help avoid this problem, where weighting factors are applied to reflect the relative income levels of those affected by the costs or benefits of an investment.

4. FINANCIAL ANALYSIS

The financial analysis should evaluate the relative financial performance of activities under consideration in the Financial Proposal with and without the GCF contribution. For revenue-generating activities, the financial analysis informs the assessment of the following criteria:

LONG-RUN FINANCIAL VIABILITY (FIRR)

POTENTIAL TO CATALYSE INVESTMENT

FINANCIAL ADEQUACY AND APPROPRIATENESS OF CONCESSIONALITY

Example of questions that could be answered through the financial analysis

- Are the project activities profitable for the beneficiaries without GCF?
- Is GCF concessionality used appropriately? What happens if other financial instruments are used to finance the Funding Proposal's activities?
- What happens after the project is over? How does financial profitability impact the potential for scalability of the activities under the project?

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[77] *"Economic approaches for assessing climate change options under uncertainty – Excel tools for Cost-Benefit and Multi-criteria Analysis", GIZ, 2013.*

[78] *"Conducting Benefit-Cost Analysis in Low- and Middle-Income Countries: Introduction to the Special Issue", Robinson et al., Journal of Benefit Cost Analysis, 2019.*

[79] *"NSW Coastal Management Manual: Using Cost-Benefit Analysis to Assess Coastal Management Options: Guidance for Councils", NSW Australia Government, 2015.*

Example of results presentation

Below is an example of a simple presentation of financial analysis conducted at the level of beneficiaries:

TABLE 3. PRESENTATION OF FINANCIAL ANALYSIS RESULTS (EXAMPLE)

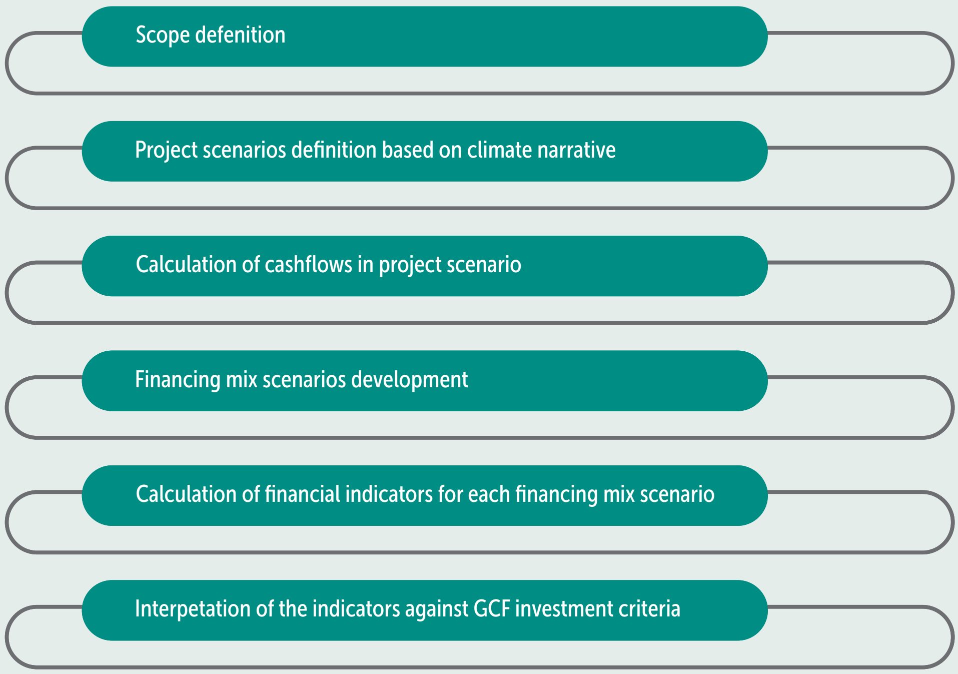
EXAMPLE OF ACTIVITY	EXAMPLE OF PERSPECTIVE	NPV		IRR		PAYBACK PERIOD		DEBT SERVICE COVERAGE RATIO	
		Without GCF	With GCF	Without GCF	With GCF	Without GCF	With GCF	Without GCF	With GCF
Solar PV	Farmer association								
Irrigation	Municipality								
Climate resilient seeds	Farmer family								
Etc.									

The results of the financial scenario analysis should be included in the funding proposal in Section D: Effectiveness and Efficiency. The results should be discussed with the objective of reaching a conclusion on appropriateness of instruments used in the FP to finance the activities as well as the sustainability of these activities in the long run.

4.1 Main steps

The AE is encouraged to perform the financial analysis following the steps described below.

FIGURE 11. FINANCIAL ANALYSIS SUGGESTED STEPS



Defining the scope

A financial analysis[80] considers the costs, revenues, and profits from the activities in the Funding Proposal (FP). The analysis is carried out based on available market prices only as opposed to the economic analysis that also includes non-market prices.

A financial analysis is carried out from the perspective of the main beneficiary as opposed to economic analysis that is carried out from the perspective of the entire economy.

The analysis should be performed at the relevant scope, or multiple scopes, depending on the FP's Theory of Change. Examples could be a municipality or a project developer. The AE should provide a financial analysis for each type of beneficiary.

Determining project cashflows and scenarios

The next step is to identify all the project activities and the associated costs and income streams and estimate cashflows for each project scenario. The cost is the sum of variable and fixed costs. Variable costs refer to the costs that change according to level of output of the activity and fixed costs to those that do not, such as interest repayment, taxes, etc.

The AE should collect data on unit cost of inputs and price of outputs. These prices may be obtained from many sources. We encourage the AE to include prices directly collected from the project area to avoid distortions.

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[80] *Based on the recommendation formulated by Cubbage et al. (2015) "financial and Economic Evaluation Guidelines for International Forestry Projects".*

The appropriateness of concessionality should be assessed on the cashflows of a project's activities, not on the incremental difference between the activities and the baseline alternative.

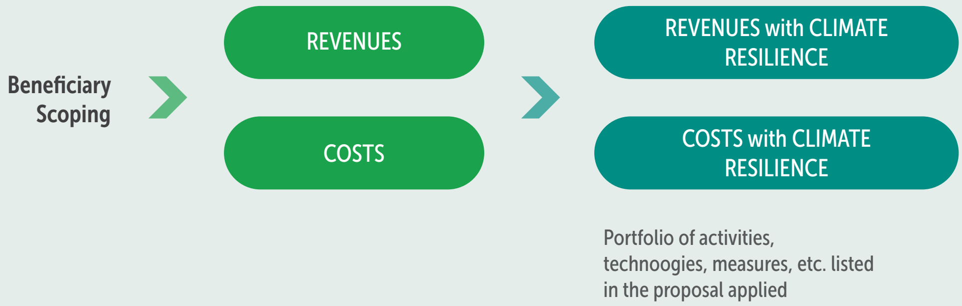
It can, however, be interesting to perform a financial analysis for the baseline or counterfactual activity. This is often the case when affordability questions are in play. In the case of fares, tariffs, or tolls, these could be calculated as outputs of the financial analysis and discussed in the funding proposal. For instance, the AE can present a fare of a public transport mode with and without GCF concessional funding.

For adaptation projects, or project components, the AE should consider two scenarios:

- A first scenario where the transport service is provided without the adaptation investment. In this case, climate change should affect its quality of service and result in lost income or decreasing cashflows as climate impacts worsen. The assumptions used in this section need to be fully aligned with the Theory of Change and climate narrative developed in the FP.
- A second scenario where the transport service is provided after the adaptation investment is implemented. In this case, the beneficiary takes advantage of the climate resilience investment with resulting stable or increasing cashflows.

The cashflows of the second scenario are the basis of the financial analysis.

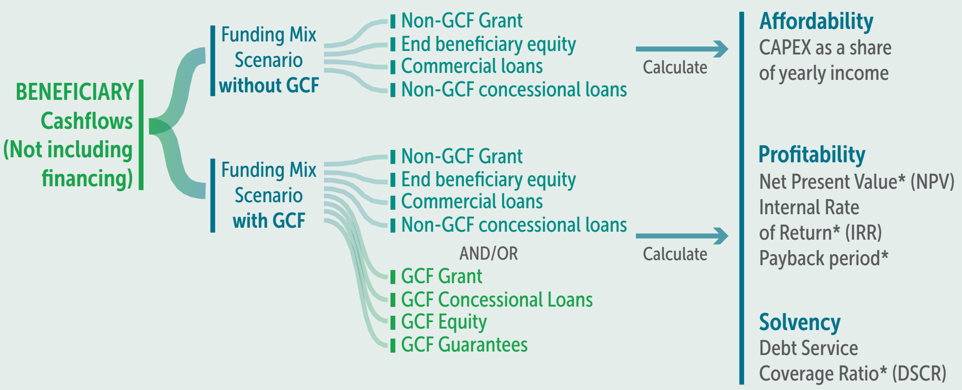
FIGURE 12. CASHFLOWS BUILDING AND ADAPTATION SCENARIOS



Calculating the financial indicators

The AE should calculate capital budgeting criteria for the activities under consideration. GCF requires the calculation of Net Present Value (NPV), Internal Rate of Return (IRR), and payback periods.

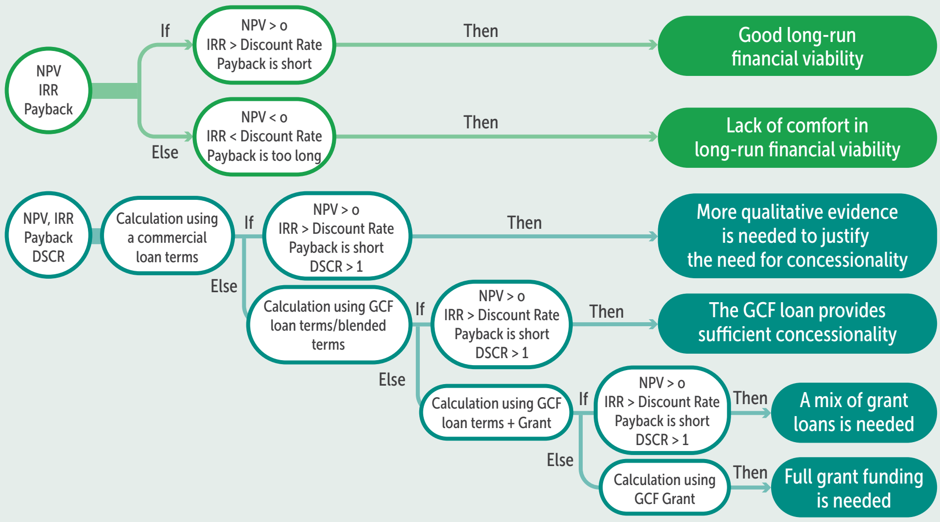
FIGURE 13. FINANCIAL SCENARIO ANALYSIS AND THE APPROPRIATENESS OF CONCESSIONALITY



Projects or activities are profitable if the NPV is positive and the IRR is above the discount rate used in the analysis. The AE should also calculate other relevant profitability[81] and solvency[82] indicators for each scenario such as the payback period for each activity. The analysis should demonstrate that the payback period is short enough to ensure the commitment of the end beneficiaries to the activities.

FPs involving debt financing should provide a calculation of the Debt Service Coverage Ratio (DSCR) under each scenario. The analysis should demonstrate that the DSCR is above 1. An interesting analysis would be to study the effect of GCF concessionality on the DSCR by calculating a DSCR with and without GCF. Below is an example of the interpretation of the results of the financial analysis.

FIGURE 14. INDICATIVE EXAMPLE OF FINANCIAL ANALYSIS RESULTS INTERPRETATION[83]



The discount rate in the context of the financial analysis refers to the cost of capital of the entity that will implement the activity. For instance, if the entity is a company, project sponsor, or municipality, the appropriate cost of capital is the Weighted Average Cost of Capital (WACC).

AEs should perform sensitivity analysis on key inputs costs, output prices, and discount rates. As the distribution probability of specific parameters is not available in most cases, AEs should consider introducing optimistic and pessimistic scenarios for key parameters. **Annex 3** of the FP package should also include a discussion on uncertainties over NPVs and IRRs.

[81] *The ability of a project to generate revenues in excess of its expenses.*

[82] *The ability of a project, company, or individual to meet its debt and other financial obligations.*

[83] *This flow chart is for illustration purposes only and does not reflect the actual decision-making process in the context of the GCF project approval cycle. The purpose of this illustration is to guide the AE in interpreting the outcome of the financial analysis in relation to the efficiency and effectiveness investment criteria.*

The following elements[84] should be factored into the financial analysis BUT NOT into the economic analysis:

- Interest payments
- Residual value (the value of the activity/investment at the end of the timeframe).
- Depreciation (an accounting item that represents the decline in the value of an asset).
- Transfer payments (if they do not have an impact on the overall welfare of society).
- Taxation and subsidies
- Sunk costs (not included in the economic analysis as they have already been incurred and should not affect new investments).

FIGURE 15. EXAMPLE OF FA RESULTS SUMMARY FOR ADAPTATION PROJECT TARGETING SUBSISTENCE FARMERS

		Commercial loan 18% p.a. 5yrs	50% Grant 50% Loan	100% Grant	100% Reimbursable Grants (5 years)
Package 1	IRR	18%	21.7%	24.2%	43.6%
	NVP	1.87	860	1.718	448
	Payback	7	6	5	3.5
Package 2	IRR	26.0%	24.8%	27.0%	N/A
	NVP	224	167	281	4,216
	Payback	5	4.3	4.3	3
Package 3	IRR	5.2%	11.5%	N/A	81.4%
	NVP	(6,841)	(4,308)	26,359	7,006
	Payback	7.5	6.8	-	5.0
Package 4	IRR	8.9%	14.8%	N/A	225.0%
	NVP	(1,313)	(589)	8,187	2,649
	Payback	7	6	-	2

Source: GCF Project Submission Package.

[84] *"NSW Coastal Management Manual: Using Cost-Benefit Analysis to Assess Coastal Management Options: Guidance for Councils", NSW, Australia Government, 2015.*

**: Qualitative evidence such as analysis on access to finance and availability of credit can help identify barriers to finance that do not relate to profitability. Financial incentives and concessionality can still be an effective tool to accelerate the adoption of an activity or technology in context where risk perception or other barrier are hindering adoption.*

,**Tips and Good Practice**

- Consider structuring the spreadsheet model with one tab for all the key parameters and assumptions, and then link to these in the formulae to reduce the potential for transcription errors in subsequent calculations
- Be sure to include formulae in the cells rather than hard-coded values. This will make it easier for the GCF reviewer to follow the logic of the analysis and potentially reduce the number of follow-up questions
- Include references for all key parameters

Elements that should be included in the spreadsheet and narrative document
GCF expects the financial analysis to include the following critical elements:

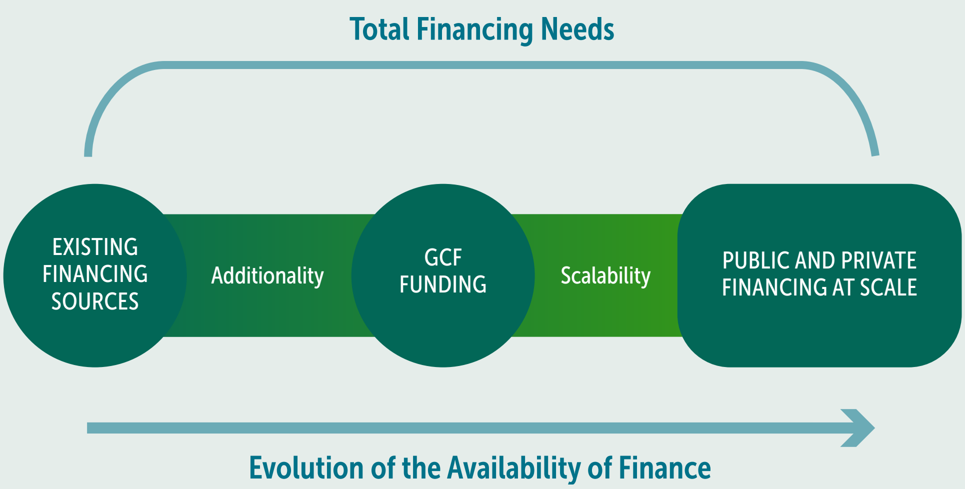
- The perspective of an identified beneficiary/investor perspective (i.e. farmer family, forest concession operator, cookstove users, PV minigrid operator, producer cooperative)
- The financing structure described in the Funding Proposal
- Estimations of incremental costs
- Calculations of the weighted average cost of capital for the beneficiary/investor
- Reasonable and justifiable assumptions
- Demonstration of viability/non-viability with and without GCF financing
- Sensitivity analysis
- Financial incentives of all parties aligned to the objectives of the project/programme
- Revenues sufficient to sustain investment

LINKAGES WITH OTHER ELEMENTS OF THE FUNDING PROPOSAL PACKAGE

FP **Annex 2** – Feasibility Study

A financing gap analysis improves understanding of the overall funding conditions in the FP's country and sector. It provides a context for EFA and contributes to assessing the proposal's paradigm shift potential from a financing perspective.

FIGURE 16. EVOLUTION OF THE AVAILABILITY OF FINANCE



AE should consider adding a financing gap analysis to the "**Annex 2** Feasibility Study" submission document including:

- An estimation of overall financing needs for the mitigation and adaptation activities under consideration in the proposal.
- The financing available to the climate mitigation and adaptation activities under consideration in the FP.
- The barriers (collateral requirements, bureaucracy, interest rates, tenors, etc.) and determinants of access to finance for the beneficiaries considered in the Financial Proposal (age, gender, size of the company, etc.).

For facilities addressing early stage companies, we recommend that the feasibility study include an analysis of the existing government support schemes for early-stage companies in the countries under consideration as well as venture capital market size.

For facilities with a bond component, we recommend that complementary analysis includes insights on bond markets (size, share of green bonds, existence of bond frameworks, etc.). This analysis would inform the sizing of the facility for bonds. We also recommend an estimation of the contribution of the bond market to the overall needs calculated for the activities under consideration.

The estimation of the overall needs for the activities in the proposal would inform the "scalability" potential of the activities implemented under the project.

Understanding the overall financing available in the country and the conditions/determinants of access to finance will help understand how the project enables further financing by other institutions.

See EFA ANNEX I for more details on how to develop such an analysis.

FP **Annex 4** – Detailed Budget Annex

The timing and amount of project costs and benefits in the economic and financial analyses (**Annex 3** of the FP package) should be aligned with the proposed annual budget costs presented in **Annex 4**. They should also take into account any lags in the expected expenditure and be able to observe/quantify the mitigation or adaptation benefit. Any subsequent change to the timing or amounts in FP **Annex 4** should be reflected in an updated FP **Annex 3**.

FP **Annex 5** – Implementation timetable

The quantity of project costs and benefits in the economic and financial analyses (**Annex 3**) should be aligned with the proposed implementation timeline in **Annex 4**. One would not expect to see mitigation benefits from a PV mini-grid in FP **Annex 3** while the implementation timetable says that construction activities are still underway.

FP **Annex 22** – GHG calculations

The calculation of GHG emissions/reductions in FP **Annex 22** directly informs the non-marketable benefits presented in **Annex 3** calculated using the social cost of carbon. Similarly, these calculations should be aligned with the potential value of any REDD+ or other GHG credit sales that occur as part of the project activities. Any revisions to the calculations in FP **Annex 22** should be reflected in FP **Annex 3**.

Funding Proposal sections

The results of the EFA should be included in sections B.5, B.6, D.4 and D.6 of the Funding Proposal.

EFA ANNEXES

EFA ANNEX I: Multi-Criteria Analysis

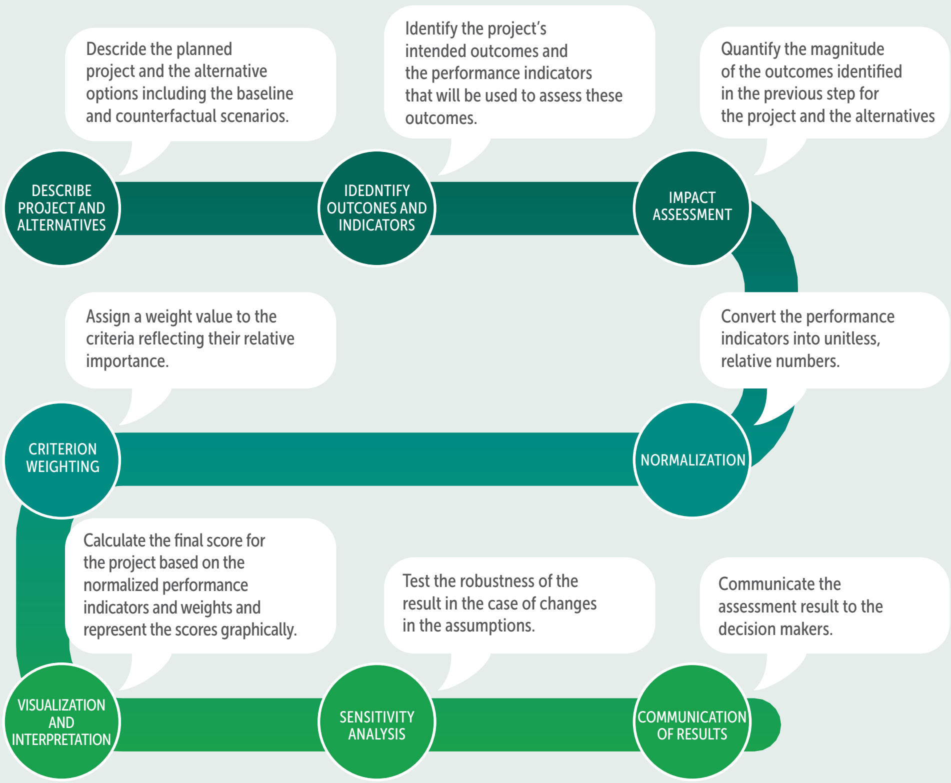
As mentioned in the previous sections of this document, the Cost Benefit Analysis (CBA) or Cost-Effectiveness Analysis (CEA) would not account for investment criteria that are difficult to monetize. This is the reason that GCF Funding Proposals are evaluated according to multiple investment criteria.

If they wish to, Accredited Entities (AE) could adopt a Multi-Criteria Analysis (MCA) in addition or in parallel to a CBA or a CEA.

The MCA is not a mandatory analysis under the GCF project cycle. The AE should only undertake an MCA if it considers that important decision elements not already captured in the GCF investment criteria are necessary for the investment decision.

Below, a figure extracted from Huging et al. 2014 summarizes possible steps for an MCA in the context of an urban mobility project.

FIGURE 17. AN APPROACH TO MCA STEPS FOR CITIES BY HUGING ET AL. 2014[85]



Source: Authors, based on Huging et al. 2014, page 8.

[85] *Huging, Glensor, and Lah "Need for holistic assessment of urban mobility measures – Review of existing methods and design of a simplified approach", Transportation Research Procedia 4, 2014.*

Huging et al. (2014) recommend including the CBA as one of the criteria of the MCA by allocating a score and weight to the CBA results similarly to the other criteria. This is also the way economic analysis is included in the GCF approval process. However, the AE is free to consider the MCA in parallel to economic analysis.

For GCF Funding Proposals, the economic analysis (CBA or CEA) has to be included separately and the results need to be discussed in detail in the FP main document as well as part of the Annex III submission. **An MCA cannot substitute the required economic analysis but would be supplementary to it.**

If the AE choses to perform a separate MCA, it should explain in detail the scoring methodology as well as the criteria weighting process. For more guidance, see Huging et al. (2014) as well as the Analytical Hierarchy Process (AHP) developed by Saaty (1977).

EFA ANNEX II: Facility Financial Modelling for Multi-Country Programmes

This section provides ideas and recommendations on financial analysis supporting multi-component, multi-financial instrument Funding Proposals (FPs). The financial analysis for such programmes should allow the review team to understand the overall functioning of the facility through the modelling of the Profit and Loss, Cashflow, and Balance Sheet statement of each facility and in aggregate.

For greater clarity, the FP should consider including the following elements in the analysis for the grant, loan, and bonds elements:

- **For the reimbursable grant component:** disbursement schedule, replenishment schedule (and cash flow statement if reimbursable grant).
- **For the loan facility:** business plan of the facility including profit and loss, cash flow, balance sheet and the relevant financial indicators.
- **For guarantee facility:** duration of the fund, guarantee volume, fee structure, coverage, interest income, and business plan of the guarantee facility.

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