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MANUAL FOR CALCULATING GREENHOUSE GAS BENEFITS FOR GLOBAL ENVIRONMENT FACILITY TRANSPORTATION PROJECTS

Manual for Calculating Greenhouse Gas Benefits of Global Environmental Facility Transportation Projects

Prepared on behalf of the Scientific and Technical Advisory Panel of the Global Environment Facility by

The Institute for Transportation and Development Policy

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EXECUTIVE SUMMARY

1. For GEF it is essential to be able to have reliable information on the greenhouse gas (GHG) emission reductions of the programs/projects it supports. Measurement, estimation and monitoring of GHG emissions reduction in transportation sector projects is quite complex, especially for projects aimed at technical assistance and capacity development. The Manual for calculating GHG benefits of GEF transportation projects [1] is introduced in parallel with the STAP Advisory Document “Advancing sustainable low-carbon transport through the GEF” (GEF/C.39/Inf.17).

2. The lack of robust GHG emissions accounting including monitoring and reporting of transportation projects is one of the key barriers in supporting sustainable low-carbon transport globally. This has also been a challenging task for the GEF as the reliable and scientifically valid methodology and guidance to project managers and often the lack of capacity at the project level impeded the development and impact assessment of many transport projects submitted for GEF funding.

3. Developed GHG assessment methodology for GEF transportation projects is structured and remains consistent with the general framework, terminology, and principles of the existing energy efficiency/renewable energy methodology[2] with some important adjustments tailored for projects in the transportation sector. The GEF methodologies are less rigorous and data-intensive compared to other schemes for CO_2eq accounting such as for projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol. They are more accessible to project managers and more flexible to accommodate diverse array of transportation project types.

4. An adequate methodology to assess of the effects of GEF investments in transport projects needs to take into account both the direct mitigation impact of GEF grants and co-financing as well as the impacts which come from replication in other places and market expansion which result from these investments. The proposed methodology accounts explicitly for this situation. The methodologies provide some guidance and calculations for selected local co-benefits of transport projects. While co-benefits are not requirements for obtaining GEF funds, they increase the engagement of local stakeholders in project success and replication potential of

[1] This Information Document presented for the GEF Council is a shortened version of the Manual and does not include step-by-step guides for specific project categories such as projects dealing transportation efficiency, mass rapid transit projects (BRT and rail), non-motorized transportation (bicycle and pedestrian), transportation management (transport demand management), and comprehensive regional transport projects. It also does not include appendices with TEEMP model data defaults and sources. STAP is planning to publish the entire Manual and TEEMP models online and in the print form within the next couple months to be available for the GEF partnership.

[2] GEF/C.33/Inf.18

projects – both of which result in the increased generation of global benefit (reduced GHG emissions).

5. The Manual provides step-by-step guide for development of baseline, impact estimation and calibration of transport projects across a wide range of interventions including transport efficiency improvement, public transport, non-motorized transport, transport demand management, and comprehensive transport strategies. At the heart of methodologies included in the Manual are a series of models that streamline and provide a consistent framework for calculating GHG impact called the Transportation Emissions Evaluation Model for Projects (TEEMP). Eleven specific TEEMP models are included with the manual: bikes sharing, bikeways, bus rapid transit, employer based commute strategies, eco-driving, expressways, metro, "pay as you drive", walkability improvement, parking, and railway.

6. The models provide an ex-ante estimation of the direct GHG impact of a project in a consistent way with very little local data and use conservative default values - based on research, observed results from similar projects, and expert opinion. Whenever local data is available, it can easily be inputted into the models to provide a more accurate direct GHG impact ex-ante estimation. The models have limitations to be used for ex-post impact analysis. The Manual also provides guidance on estimating direct post-project and indirect GHG emission reductions.

7. Whether a traditional comprehensive baseline is calculated or TEEMP models using a market-shed analysis are employed, it is imperative that a "dynamic" no-project baseline scenario is considered (defined in terms of growth trends of transport behavior, different technologies, mode shares, carbon-intensity of fuels, and fuel economy of vehicles, etc.) for the specific market without the GEF or co-financing over the period of the intervention. The manual calls for the establishment of a dynamic baseline emissions inventory to be collected in the project preparation phase. A potential source of funding to accomplish the creation of a baseline inventory and/or the data required by TEEMP models for further GHG impact analysis could come from project or program preparation activities.

8. GEF transport projects should incentivize the development of detailed plans for gathering current observation-based data to replace the sketch analysis baseline used in the project preparation phase and to better inform planning and regulation, help secure funds from other climate-related sources, and for project monitoring and evaluation. The manual should help to supply data for tracking tools currently being established across the GEF focal areas to ensure project monitoring and ex-post impact assessment is based on accurate information. Furthermore, projects have to include components for monitoring and evaluation of GHG impacts.

9. The GEF should also encourage the use of enhanced modeling methodologies, when possible, that include sensitivity to induced demand impacts of changes in travel time and cost of different modes, and some effort to estimate longer-term impacts on land development patterns.

10. The purpose of the methodologies goes beyond GHG impact estimation: they are designed to encourage high quality project design, increase consistency and objectivity in impact estimation, and make it easier to estimate impacts and therefore invest in mitigation in places where there is little local data.

11. STAP advises GEF partners including recipient countries, GEF agencies and GEF Secretariat to use the proposed manual and methodologies consistently in preparing, submitting and evaluating GEF transport projects. Consistent use of the proposed methodologies will help to harmonize transport GHG data generation and reporting and contribute to global knowledge generation and better formulation of transport policies.

12. As GEF is evolving, the methodology needs to be updated regularly to account for additional types of interventions (i.e., for freight and logistics, or urban planning) and updating and improving model parameters (i.e., default values). There is a strong need to continue development of ex-post models in the transport sector and strengthen GEF's support for collecting data during project implementation. STAP is committed to assisting further GEF partners in improving the accountability of transport projects and thus proposes to convene a workshop reviewing the implementation and updating the proposed Manual and TEEMP methodologies during GEF-5 mid-term phase.

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ABBREVIATIONS

ADB	Asian Development Bank
BRT	Bus rapid transit
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
CO_2eq	Carbon dioxide equivalent
GEF	Global Environment Facility
GEF-STAP	Scientific and Technical Advisory Panel of the Global Environment Facility
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
kt or ktonnes	kilo-tonnes or 10^3 metric tonnes
PPG GEF	Project Preparation Grant
PIF GEF	Project Information Form
TAR IPCC	Third Assessment Report of the Intergovernmental Panel on Climate Change
TDM	Transportation demand management
TEEMP	Transportation Emissions Evaluation Model for Projects
t or tonnes	10^3 kg or one metric tonne
VKT	Vehicle kilometers traveled

I. INTRODUCTION, CONCEPTS, AND DEFINITIONS

Why this Manual?

Every Global Environment Facility (GEF) project requires a Project Document (PAD) that gives an assessment of the greenhouse gas (GHG) emissions (in CO_2 equivalence or CO_2eq) that the projects are expected to reduce. In 2008, the GEF developed a manual detailing specific methodologies for calculating the GHG impacts of energy efficiency, renewable energy, and clean energy technology projects. This manual represents the first transportation-specific methodology. It is structured by and remains consistent with the general framework, terminology, and principles of existing GEF methodologies for other sectors, but has also incorporated lessons learned from past experience and made appropriate adjustments and elaborations to tailor these methodologies specifically for projects in the transportation sector.

These methodologies are designed to give ex-ante estimations of the GHG impacts of transport interventions as accurately as possible without having data requirements so demanding that discourage investment in the sector. The methodologies are also designed to provide consistency in the approach and assumptions used to estimate the GHG impact of a very diverse array of transportation projects: initiatives that improve the efficiency of transportation vehicles and fuels, improve public and non-motorized transportation modes, price and manage transport systems more efficiently, train drivers in eco-driving, and employ multiple strategies as holistic, integrated implementation packages. The purpose of the methodologies, however, goes beyond just impact estimation: they are designed to encourage high quality project design, increase consistency and objectivity in impact estimation, and make it easier to estimate impacts and therefore invest in mitigation activities where there is little local data.

The main purpose of all GEF projects is to generate global environmental benefit(s). However, transportation projects also produce significant local co-benefits that, in many cases, could be the primary justification for the host country to pursue project activities. Therefore, this document also seeks to highlight the related co-benefits, appropriate to the unique nature of GEF projects. While co-benefits do not directly create global benefit, they increase the engagement and secure investments of local stakeholders in project success and they increase the replication potential of projects – both of which result in increased global benefit. GEF project proposals are asked to consider co-benefits in all proposals.

What is Different about this Scheme Compared to Standard Schemes for CO_2eq Accounting?

Most of the methodologies for measuring the GHG impacts of projects focus on the emissions savings from a specific investment. Projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol, for example, have to specify the technical characteristics of the hardware, location, ownership, and operating hours, in order to accurately calculate the amount of emissions reductions produced from an investment. The methodologies for assessing the baselines and additional impacts of CDM projects are constantly under review by the relevant bodies of the United Nations Framework Convention on Climate Change. They can serve as helpful tools to analyze GEF projects' impacts.

Nevertheless, GEF projects differ from CDM projects in important ways, which need to be reflected in the impact calculations. Firstly, CDM projects differ in their funding and project cycles. With the CDM, proponents receive the funding for CO_2eq emissions reductions only upon delivery of a Certified Emission Reductions analysis based on observed results after the project is implemented. Because the financing is directly tied to the GHG impact figure, accuracy is highly important. The CDM also relies on observed data collected in the post-implementation phase. GEF financing, on the other hand, happens before project implementation and funding is not revoked if targets are not attained or certified. Thus the GEF must create a projection of the expected impact of a project in an early phase of project planning, when advanced data is not available and the future impact is more difficult to predict accurately. As such, it is as important that the GEF methodology be able to assess projects in a consistent way, encourage good project design, and not impede investment in the sector with overly data-intensive methodologies, as it is for the GHG impact to be estimated with acceptable level of confidence.

The GEF also differs in its approach to investing in GHG reductions, focusing on strategic market development aimed at long-term impacts by reducing barriers to finance and markets, capacity-building, and improving the quality of proposed projects. In many of the developing countries where the GEF operates, transportation data is often incomplete, unreliable, or all-together non-existent. Therefore the GEF's ex-ante project impact calculations must not be overly data-intensive. Compared to the CDM, GEF projects are intentionally and necessarily riskier, their outcomes less certain, and subject to greater variation in the degree of uncertainty both between and within projects. In addition, a GEF method for GHG accounting needs to take into account the investments that can happen after the actual GEF intervention.

Another difference lies in the types of project activities supported by the GEF as compared to the CDM. While most GEF projects are grounded in specific demonstration projects and direct investments, many projects also include additional elements such as establishing financing mechanisms that leverage local private sector financing, capacity building and technical assistance, the development and implementation of government policies supporting climate-friendly investments. These elements do not have direct GHG impacts, yet are necessary for effectively avoiding emissions in the long run and calculated separately under GEF methodologies as "indirect" impacts.

Thus, the GEF methodologies are less rigorous and data-intensive in order to be more accessible to project managers with fewer data resources and more flexible to accommodate more diverse array of project types. An evolving set of sketch models with extensive default factors, as represented by the Transportation Emissions Evaluation Model for Projects (TEEMP), is most helpful towards this end.

An adequate methodology to assess of the effects of GEF investment in transport projects needs to take into account both the direct mitigation impact of GEF and co-financing investments, as well as the impacts which come from replication in other places and market expansion which results from these investments. The proposed methodology accounts explicitly for this situation. As the estimates for direct and indirect impacts are fundamentally different in their accuracy and degree of certainty, the methodology used here reports separately on direct and indirect impacts.

It is important to note that no single, general-purpose methodology can be used to quantify GHG emission reduction effects for GEF projects. Further, a methodology that results in only one aggregate number for the portfolio does not provide meaningful and comparable values for GHG abatement costs (US$/tons) because of the following:

(a) The GHG emission reductions are achieved using many different strategies in GEF projects.

(b) The weights of these avenues vary greatly among different projects.

(c) In the interest of sustainability and replicability, the GEF-supported part of the project often focuses on interventions that have long-term cost-reduction effects (e.g., through capacity building or enabling environments), but by themselves do not have impact on GHG emissions as such.

The methodology accounts for this by estimating separate direct and indirect impact figures with different uncertainties attached: it does not recommend totaling these figures. As is described in more detail in what follows, a GEF project has direct CO_2eq emission reductions achieved by investments that are directly part of the results of the projects; direct post-project emission reductions through those investments that are supported by GEF-sponsored revolving financial mechanisms still active after the projects' supervised duration; and a range of indirect impacts through market facilitation and development. The methodology employs conservative assumptions to account for the uncertainties in the assessment of the scale of impacts, as well as the causality of the GEF intervention and shifting (dynamic) baselines.

What Is Direct GHG Impact in Transportation Sector Projects?

There are five physical elements of the transport sector, which GEF projects can influence to reduce GHG emissions: vehicle fuel efficiency, greenhouse gas intensity of the fuel used, amount of transport activity, mode of transport chosen, and amount of capacity/occupancy used[3]. Direct emission reductions are calculated by assessing the change in GHG emissions that are expected to be attributable to the GEF and co-finance investments made during the project's supervised implementation period due to impact on one or combination of these five elements. These are then projected for, and totaled over, the respective lifetime of the investments both during and post implementation. All CO_2eq savings resulting from investments made within the boundaries of a project—as defined by the logframe (a commonly-used project management matrix used to track project activities and outcomes), either using GEF resources or the resources contributed by co-financiers and tracked through monitoring and evaluation systems—will be counted toward a project's direct effects. The GEF GHG accounting methodology also includes what will be referred to here (for consistency with other GEF accounting terminology) as "direct secondary impacts" – often referred to by transport and environmental planners as "indirect" effects - such as GHG impacts that come from changes in land use or vehicle ownership which in turn resulted from a GEF investment, can also accrue as direct impacts.

What Is Direct Post-Project GHG Impact of Transportation Projects?

[3]Salon, Deborah. *An Initial View on Methodologies for Emission Baseline*, 2001. Schipper, Lee, Celine Marie-Lilliu, and Roger Gorham, June 2000, *Flexing the Link between Transport and Greenhouse Gas Emissions*, 2000.

Although rarely used in transportation sector projects to date, the GEF allows the establishment financial mechanisms that are operational after the project ends, such as partial credit guarantee facilities, risk mitigation facilities, or revolving funds. Such ongoing mechanisms may facilitate investments yielding GHG reductions, which can, in turn, be quantified with the same methodology as the direct investments. However, because these impacts continue beyond the timeframe of normal project monitoring systems as a fund recycles itself, they are considered separately as "direct post-project impacts." Although the same assumptions for investment lifetimes and emission factors are used as in the case of direct emission reductions, the nature of direct post-project emissions dictates that conservative assumptions be used with reference to leakage rates and financial instruments' effectiveness.

So far only one GEF transportation project, which educated mechanics in Pakistan on improving engine efficiency in tune-ups, has used a revolving fund or credit guarantee facility. In that case, as loans to set-up training and improved engine tune-up facilities were paid back, the funds were programmed to be re-dispersed to fund more training and facilities continually until the fund was depleted due to leakage. These approaches have been valuable in other GEF initiatives and in non-GEF transportation investment facilitation. Similar revolving funds might be envisioned for the development of private sector parking management concessions linked to urban improvement districts, or the development of road user charging and smart traffic management systems linked to performance contracts for corridor operations and management.

Table 1: Three Types of GHG Emission Reductions in GEF Projects

Type of GHG emission reduction	**Direct**	**Direct post-project**	**Indirect**
Example component of a GEF intervention that can cause this type of GHG emission reduction	Project activities and investments whose outputs and secondary impacts are tracked in the project's logframe	Investments supported by mechanisms (e.g., revolving funds) that continue operating after the end of the project	Project components that encourage replication such as study tours, capacity building, public promotion, etc.
Logframe level	Has a corresponding activity or investment with an output that is tracked in the logframe	Not corresponding to a specific logframe level	Outcome/impact on level of global environmental objective
Quantification method	Use of GEF TEEMP models with default values (or provision of additional data)	Based on assumptions of functioning post-project mechanisms	Based on the replication rate o the project using bottom-up or top-down methods
Qty of assessment	Highest level of certainty and accuracy for minimal data inputs (lower than the CDM)	Reasonable level of accuracy, medium level of certainty	Lower levels of accuracy and certainty

Credit guarantee facilities could be used to help secure low-cost private financing for development of GEF projects, cutting the risk premium attached to bonds related to private or public project financing, much like the Transportation Infrastructure Finance and Innovation Act

(TIFIA) in the United States, which provides Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. Capitalization of such loan guarantee programs might be done on a national or regional basis to leverage substantial additional short-term investment capacity by expanding access to credit markets. The result might be to advance the timing of investments in such measures as bus rapid transit (BRT), non-motorized transportation network improvements, high quality vehicle registration and traffic management systems, or freight system efficiency improvements. These actions, in turn, might support timely early action on GHG reductions and demonstration of transportation system co-benefits, enabling a dynamic local leader to deliver quick results to constituents soon after taking office.

What Are Indirect GHG Emission Savings of Transportation Projects?

All GEF projects endeavor to catalyze replication of project activities beyond the original project scope by emphasizing capacity building, promotion of project activities, the removal of market barriers, and development of innovative approaches. Because of this focus on replication and market expansion of sustainable transportation projects, their largest impacts typically lie in the long-term GHG reductions achieved after a project is complete. These GHG emission reductions from replication are referred to as "indirect" GHG impacts, and are counted separately from direct impacts because they occur outside the project logframe. To estimate the indirect impact, one must rely heavily upon assumptions and expert judgment. The potential of a project's replicability derives not only from its market potential, but also project attributes which increase replication potential such as activities which encourage replication, quality of project design, and the amount of co-benefits a project achieves. As their level of uncertainty and accuracy is different from direct or direct post-project savings, it is not appropriate to aggregate the two types of savings.

Projects should be conservative in estimating the size of the geographic area or market for calculating likely indirect impacts. The majority of projects should not go beyond the regional or country area, although in some cases a wider sphere of influence can be permitted.

Indirect impacts are measured using two different approaches, resulting in a range of potential indirect impacts. The first one—referred to as "bottom-up"—should provide the lower, more conservative extent in the range of possible indirect impacts. It requires an expert judgment on the degree to which a project is likely to replicate within its sphere of influence, given the effectiveness of a project's demonstration power to catalyze similar projects. The direct and direct post-project impacts of a project are simply multiplied by the number of times that a successful investment under the project is likely to be replicated after the project's activities have ended.

The second "top-down" approach is generally used to find the highest extent in the range of potential indirect impacts. It estimates the combined technical and economic market potential for the project type within the 10 years after the project's lifetime. Using the maximum realizable market size further implies that there would be no baseline changes over considerable periods of time, and that all emission reductions in that sector or market can be attributed entirely to the GEF intervention. Clearly, both of these assumptions are unlikely to hold in reality. Therefore, the assessment contains a correction factor variable, the "GEF causality factor," that expresses the degree to which the GEF intervention can take credit for these improvements. This causality factor is used to calibrate the "top-down" estimate for the indirect benefits, which generally provide the upper limit of the range of indirect GHG benefits.

For some types of transport projects, such as BRT, there is currently enough historical data to support the estimation of a replication rate based on observed experience with previously implemented systems. Accepted replication rates based on historical observations may be used instead of creating a range of indirect impacts using these two methods. The dissemination of other types of transport sector projects, both GEF and non-GEF projects, can and should also be tracked and so that observation-based dissemination rates can be utilized for more project types. Such evaluation should be a priority for ongoing refinement of this GEF transportation GHG analysis methodology.

What Are Local Co-Benefits and Why Are They Important to Global Benefit?

As stated earlier, the main objective of GEF investments is to generate global environmental benefit. However, transportation projects also produce significant local co-benefits in the areas of public health, travel time, and economic growth, that are, in many cases, are the primary justification for the host country to pursue project activities. The greater the co-benefit to the local stakeholder, the greater is their interest in implementing the project successfully. Similarly, projects with high local co-benefits are also more likely to be replicated in other cities/regions. For these reasons it is advantageous to account for co-benefits, as they are an important factor in its likelihood for success in reaching its potential for global benefit.

II. STEP-BY-STEP GUIDE FOR ALL TYPES OF PROJECTS

Calculating GHG reductions from GEF projects is a process with several steps and its complexity depends on the number and type of project components. Some project components contain investments which lead to direct GHG emission reductions. Other components (e.g., revolving funds) typically lead to direct as well as to direct post-project GHG emission reductions. A third group might lead—first and foremost, if not exclusively—to indirect GHG emission reductions. Since there are many different ways to intervene in the transport sector to reduce GHGs, there can be no "one size fits all" methodology to be used effectively in evaluating their impact. Instead, specific methodologies have been developed for common projects types.

At the heart of these methodologies are a series of models that streamline and provide a consistent approach for calculating the GHG impact of various transport projects called the Transportation Emissions Evaluation Model for Projects (TEEMP), to be used along with this manual. The models are especially useful as they can provide an ex-ante estimation of the direct GHG impact of a project in a consistent way with very little local data. This is because the models use conservative default values - based on research, observed results from similar projects, and expert opinion – to estimate impact. Whenever local data is available, it can easily be inputted into the models to provide a more accurate – and, due to the conservative numbers used as defaults, larger – direct GHG impact ex-ante estimation.

TEEMP Release 1.0 was developed with support from the Asian Development Bank (ADB) and used to evaluate the carbon footprint of ADB's transportation projects between 2000 and 2009 and various strategies that might reduce transport CO_2eq emissions. TEEMP Release 1.1 has been expanded and enhanced with support from the GEF-STAP and Climate Works Foundation for GEF, addressing more modal interventions and transport management strategies. Commitments are being finalized in fall 2010 to ensure continued support for TEEMP software development. These efforts will result in estimation of more region-specific default factors for emissions and travel behavior, enhanced user-friendliness and ease-of-use, and wider validation of TEEMP default factors and frameworks, with continued peer review and oversight by key GEF stakeholders, including the ADB, Inter-American Development Bank, World Bank, UN agencies, and Stockholm Environment Institute. Such refinements will be made available on public websites in a timely way and discussed through several regional workshops. STAP will be organizing a review meeting half-way through the GEF-5.

The typical sequence in calculating CO_2eq emission reductions for a GEF project application:

(a) Calculate the dynamic baseline emissions of the scenario without a GEF contribution. If using TEEMP models to find direct impact, no separate baseline must be established in this step because TEEMP models effectively calculate a baseline using a market-shed analysis approach automatically. Instead, the user should be sure to input all dependable local transport data that is available into the TEEMP model. If dependable local data is unavailable, default values are used.

(b) Next, calculate the direct emissions impact for the GEF scenario, including all GEF and co-financing investments that are tracked in the logframe during the project's implementation. The difference between this GEF project scenario emissions and the baseline emissions equals the direct emission impact of the project. If TEEMP models are used, this figure is the model's main output.

(c) If, for the post-project period, a project-sponsored financial mechanism will remain in place and keep providing support for GHG-reducing investments, which would not happen in the baseline case, estimate the direct post-project emission reductions for these investments.

(d) Estimate what emission reductions will occur from replication and market expansion outside of the logframe or in the post-project period that will have a causal link to the GEF intervention. For these, calculate the indirect emission reductions. If it is appropriate for the situation, use both methods: the bottom-up and the top-down to create a range of potential impacts. In some cases, only the bottom-up method will make sense. For certain types of transportation interventions, such as BRT, accepted replication rates based on observed impacts can be used.

Figure 1 contains a flowchart illustrating this process.

Assumptions and Data Requirements

The data and assumptions necessary for the GHG emissions reduction assessment will vary by the type of transportation sector intervention. All GEF impact estimations, whether using the TEEMP models or not, should incorporate as much local observed data as is available, but can rely on conservative default values based on research and past experience that are agreed upon by experts, when none is available.

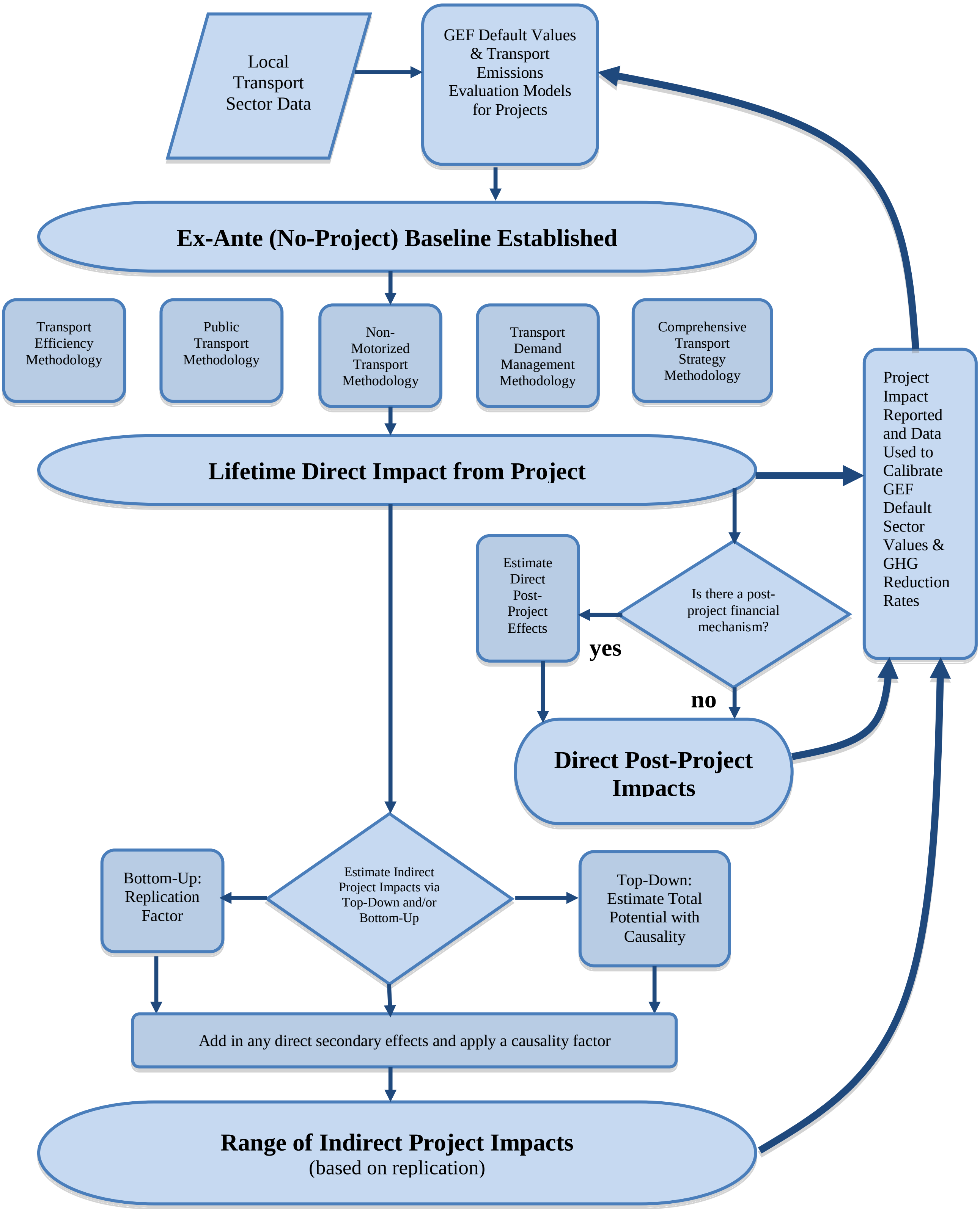
Some general rules are important in all steps of the GHG emission reductions assessment for the GEF:

(a) All GHG impacts are converted to metric tons of CO_2eq.

(b) The CO_2eq reductions reported are cumulative reductions, calculated for the lifetimes of the investments. In absence of more detailed guidance, 10 years for vehicles and 20 years for infrastructure may be used. No GEF projects may claim impacts for more than 20 years.

(c) No discounting for future GHG emission reductions.

Figure 1: Steps for data collection and development of baselines, impact estimations, and calibration over GEF transport project lifetime



As a general rule when applying this methodology, the project proponent should err on the side of transparency, and generally be cautious and conservative when making assumptions on GHG emission reductions.

For many GEF projects, the principal GHG emission focus will be on CO_2, which ties closely with fuel use. Where possible, applicants are encouraged to consider other GHGs:

(a) Global warming potentials of non-CO_2 greenhouse gases: Table 2 reproduces the Intergovernmental Panel on Climate Change (IPCC) figures, which should be used for all purposes in GEF projects where non-CO_2 gases are considered. Typically, the 100-year figures are used.

Table 2: Global warming potential of other greenhouse gases[4]

Gases	Lifetime (years)	Global Warming Potential Time Horizon		
		20 years	100 years	500 years
Methane (CH_4)	12	72	25	7.6
Nitrous Oxide (N_20)	114	289	298	153
HFC-23 (hydrofluorocarbon)	270	12,00	14,800	12,200
HFC-134a (hydrofluorocarbon)	14	3830	1430	435
Sulfur Hexafluoride	3200	16,300	22,800	32,600

*IPCC AR3 figures in parenthesis where different from AR4 values.

Black carbon, formed through the incomplete combustion of fuels, is another potent climate forcing agent emitted in the transport sector, considered to have global warming effects second only to CO_2. Mitigating black carbon may also be one of the most effective means of controlling climate change. Shifting from fossil fuels to other fuel sources and adopting newer engine technology and emissions standards are all methods of reducing black carbon. This manual does yet not incorporate emissions of black carbon in its methodologies because at the time of publication, the UNFCC has not yet assigned a global warming potential for black carbon. Projects are encouraged to account for this in their calculations when reliable data is developed.

(b) Baseline scenarios: Whether a traditional comprehensive baseline is calculated or TEEMP models using a market-shed analysis are employed, it is imperative that a "dynamic" no-project baseline scenario is considered. This means that all impact analyses should incorporate not just the status quo, but growth trends of transport behavior, different technologies, mode shares, carbon-intensity of fuels, and fuel economy of vehicles, etc. for the specific market without the GEF or co-financing intervention over the period of the intervention. The approaches here will be different for different types of transportation sector interventions. In some markets fuel economy may be increasing due to regulatory pressure (the US, for instance), while in other markets it is possible that fuel economy will decline as wealthier motorists opt for larger vehicles.

[4] 2007 IPCC Fourth Assessment Report (AR4), Chapter 2: Changes in Atmospheric Constituents and in Radiative Forcing. http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Ch02.pdf)

Where limited market information is readily available a conservative estimate of a modest improvement in fuel economy standards should be assumed.

Table 3: Default Emission Factors for GEF TEEMP Models

(c)

Vehicle Type	Speed	Fuel Type			Fuel Efficiency @ 50 km		CO_2eq emissions factor per liter of fuel		CO_2eq emissions per vkt		Average CO_2eq emissions factor by vehicle type
	km/hour	% Split			km/liter		kg CO_2eq/liter		kg CO_2eq/km		kg CO_2eq/km
		Petrol	Diesel		Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	All Fuels
Cars	22	95%	5%	100%	9	11	2.75424	2.94348	0.306026667	0.267589091	0.304105
2-Wheeler	22	100%		100%	60	0	2.75424	2.94348	0.045904		0.045904
3-Wheeler	22	100%		100%	22	24	2.75424	2.94348	0.125192727		0.125193
Taxi	22	30%	70%	100%	8	11	2.75424	2.94348	0.34428	0.267589091	0.290596
Bus	22		100%	100%	1.8	2.2	2.75424	2.94348	1.530133333	1.337945455	1.337945
Jeepney/RTV	22		100%	100%	6	7	2.75424	2.94348	0.45904	0.420497143	0.420497
Walking	4										
Cycling	12										
LRT											

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s: For the baseline technologies, as well as for the technologies to be deployed under the GEF Alternative Scenario, the proposal needs to contain the expected emissions factors, i.e., how many kilograms of CO_2eq are going to be emitted for each vehicle kilometers traveled (VKT) by mode and vehicle type, using either the default emission factors provided as part of the *GEF TEEMP* or more accurate locally-measured data. The default emissions factors used in all TEEMP models are illustrated in the above table. Use of emission factor models such as COPERT in conjunction with regional travel models and local travel and vehicle activity survey data is encouraged, where these are available and deemed to be adequately calibrated to observed local conditions. It must be noted that emission factors will vary considerably based on vehicle fleet composition, vehicle speed and operating conditions, and vehicle occupancy, with additional variation based on temperature, fuel characteristics, and other factors.

(d) Lifetimes of investments: The second investment-specific parameter that needs to be determined is the lifetime of the investment. All baselines and direct impact calculations should be calculated over the accepted lifetime of the investment. The methodology specifies pre-approved default values for the lifetimes of the relevant technologies, and proponents are encouraged to utilize these default values. In the absence of more detailed guidance, 10 years may be appropriate for vehicle technology and 20 years for infrastructure, but analysts should use sound judgment and reasoning to establish the appropriate lifetime.

Calculating and Refining Baseline CO_2eq Emissions

Baseline emission calculations for GEF applications should follow the guidance below:

(a) In the project application phase transportation projects require the establishment of a dynamic baseline, which serves as a "business-as-usual" emissions inventory projected for the scenario without any GEF or co-financing contribution to the project. If TEEMP models are used for the ex-ante direct impact estimation, a separate baseline need not be created as the TEEMP inherently calculates a no-project dynamic baseline in its market-shed analysis of the GHG impact of a GEF project.

(b) Ex-ante baselines should contain a description of the country or city's development and transportation activities without investments from the GEF or co-financing, but with engagement of the respective implementing agency, if that engagement would happen without the GEF. In the baseline scenario, projects should describe the characteristics of the transportation sector, the emission factors, the markets to be transformed, and the lifetime of the investments. This information needs to be collected in the project preparation phase. In absence of good local data the ex-ante baseline will be developed using a minimum of resources: limited local traffic and travel counts/surveys and the default values from the TEEMP models for fuel cycle and emissions factors. A potential source of funding to accomplish the creation of a baseline inventory and/or the data required by TEEMP models for further GHG impact analysis required in the GEF Project Document (PAD) can come from applying for a GEF Project Preparation Grants (PPG) in the initial Project Information Form (PIF) document or as funding used to prepare projects under programmatic approaches. In cases where current and/or historical travel activity data is weak, its acceptance is subject to GEF approval and possible discounting. GEF has separate guidelines for Incremental Cost Analysis, which relate to the incremental costs imposed as a result of caring for the global environment, not to those incremental costs that are caused by developmental additionalities. In other words, the baseline scenario includes developmental activities of national governments and implementing agencies.
Baselines must be calculated over the same period as the GEF project alternative scenario, which is the lifetime of the project's components. TEEMP models will do this automatically.

(c) GEF transport projects should incentivize the development of detailed plans for gathering current observation-based data to be used by the client to replace the sketch analysis baseline used in the project application phase and to better inform planning and regulation, help secure funds from other climate-related sources, and for GEF project monitoring and evaluation. Proposed methodologies should support data supply to tracking tools currently being established in climate change focal area. While the GEF has limited leverage to ensure the ex-post impact assessment is carried out, all projects should include components for monitoring and evaluation utilizing data collected using proposed methodologies. Better data improves planning and makes projects more successful and easier to replicate. In this respect, the ongoing collection of the data to run travel demand models and emissions models, such as traffic counts, household surveys (origin-destination, by purpose), GPS vehicle and personal activity monitoring, local fuel and emissions testing, etc. is encouraged. The GEF should also encourage the use of enhanced modeling methodologies, when possible, that include sensitivity to induced demand impacts of changes in travel time and cost of different modes, and some effort to estimate longer-term impacts on land development patterns. This data will then be used to refine the *GEF TEEMP* for use in future projects[5].

(d) It is important for GEF to consider the greater transport sector context for introduction of GEF funded initiatives. Applicants are required to include impacts for other major, planned transport sector interventions that are not GEF-funded but are within the impact area of a proposed GEF-funded transport initiative in the no-project baseline. This is especially important where such undertakings may impact motor vehicle travel demand and therefore also affect the impact of GEF investments. If, for example, a new ring road or major roadway expansion is being implemented in or around the impact zone of a proposed GEF project, the impacts of these should be included in the baseline analysis. The *GEF TEEMP* includes sketch models that can be used to evaluate not only the types of transport investments typically funded by GEF, but also other alternatives such as mass rapid transit, railways, expressways, and rural roads, so that such contextual analysis might be facilitated.

(e) Baseline emissions estimates must include all transportation modes affected by the project within the project area. Thus projects that shift travels from multiple modes will need to establish baselines which include multiple modes over a large area, while others may only need basic data about a small group of vehicles to establish a baseline effective for estimating the ultimate impact of the project. Projects that combine multiple interventions will need to establish baselines for each type of intervention for which they claim direct impacts, but will generally find significant benefits from combining multiple strategies into an integrated approach.

Calculating Direct Emission Impacts

Projecting the impact of a variety of different transport projects early in the project cycle is often difficult as data is not available and many critical operational or technological decisions are not made until the project is ready to open or go on the market. For this reason, GEF has created a sketch analysis methodology for developing rough estimates of direct GHG.

The following guidance should be followed to calculate direct emission reductions:

(a) Direct emission reductions are achieved where GEF investments emit less GHGs than a no-project scenario would. The development of voluntary carbon funds, voluntary markets for certified emission reductions, obligatory markets for carbon emissions, and the methodological progress in the Clean Development Mechanism have all stimulated efforts to refine the methodologies for carbon emission reduction accounting and baseline definition in the context of direct GHG abatement from investment projects. All of these certification mechanisms target the same emission reductions from specific investment projects that can be counted under "direct emission reductions" for GEF projects. Several methodologies have been published

[5] STAP is committed to assisting further GEF partners in improving the accountability of transport projects and thus proposes to convene a workshop reviewing a progress in applying proposed methodologies including revising TEEMP model default factors during GEF-5 mid-term phase. Furthermore, as the methodology is developed further it is important that all major types of transport interventions that are supported by GEF become included such as freight and logistics. As GEF is widening its support to urban planning, the methodologies need to be extended to assess GHG impacts of such actions as well.

to analyze the direct emission reduction effects of CDM projects. The main ideas for these methodologies, which tend to be more rigorous and data-intensive, can be applied to calculate direct emission reductions for GEF projects in place of using the TEEMP.

(b) Almost all GEF projects combine tangible investments in infrastructure or planning which result in direct emissions impacts with investments in less-tangible project components such as including education, capacity-building, and/or public outreach. The impacts from these investments accrue from replication beyond project boundaries, following only indirectly from the project activities. When this is the case, these reductions should be subsumed separate from direct impacts under the category "indirect impacts," discussed below. The most clear-cut criterion to decide whether investments should be counted toward direct or indirect emission reductions is whether the investment is included in the logframe of the GEF project and whether it is monitored as part of the project's performance indicators. In many cases, even though a project component's impact is included in the project's logframe, there exists no reliable way to know or quantify its impact on emissions. In this case, no impact should be recorded. Direct impacts should only be recorded for investments with known and quantifiable impacts, such as infrastructure, policy, and planning.

(c) To quantify the GHG direct impacts of GEF projects, the approaches chosen for the GEF projects is derived from international experience and best practices, but also kept as simple as possible. As in the calculation of baselines, the approaches vary by type of transportation sector intervention being proposed:

I. Transportation Efficiency Projects (Clean Vehicles/Fuels)
II. Public Transportation Projects
III. Non-Motorized Transportation Projects
IV. Transportation Demand Management Project
V. Comprehensive Regional Transport Initiatives

TEEMP models incorporate baseline calculation in their "market-shed" approach to impact calculation. If a project's impact cannot be calculated using a TEEMP model, the general equation below should be followed, which is derived from international best practices and based on the "ASIF" model. All investments responsible for direct effects are evaluated in terms of the energy or fuel (avoided over the lifetime of the respective investments). Different technologies have different assumed lifetimes. The saved fuel or energy is then multiplied by the marginal CO_2eq intensity of the energy supply. The formula is:

*[CO_2eq direct] = [E] *[c] = [e] *[l] *[c],*

where [CO_2eq direct] are direct GHG emission savings of successful project implementation in CO_2eq, in tonnes.
[E] is cumulative fuel or energy saved or substituted, e.g., volume/mass of fuel used (or MWh if electric); $E = \Sigma(l * e)$.
[c] is CO_2eq intensity of fuel/energy
[e] is the average annual fuel/energy replaced, e.g., in volume/mass of fuel used (or MWh if electric).
[l] is the average useful lifetime of equipment in years.

(a) The lifetime of the infrastructure determines the duration over which the GHG savings may occur. That means that the impact of all investments that are made during the project is the same, irrespective of whether they are undertaken in year one or five of project implementation. However, they must be made during the project's supervised operations to count as "direct" GHG emission reductions.

(d) Because of the setup of GEF projects (and a conservative interpretation of the GEF co-financing rules), investments are counted toward this sum irrespective of whether they are financed by GEF support or by co-financing. The decisive criterion for the question of whether to include or exclude an investment is whether it is included in the monitoring and evaluation framework proposed in the logframe.

(e) Another type of direct impacts, referred to collectively as "direct secondary impacts," may also accrue from the secondary effects of GEF and co-financer investments, including GHG impacts from: supportive policy reforms, fuel standards, motorization rates, and land use changes that are catalyzed by GEF and co-financer investments. A common example of a direct secondary impact would be when there is an intensification of land uses, as a result of a GEF-financed transit project, that in turn further reduces private auto trips within the BRT corridor.

Direct impacts from secondary effects can be calculated using the same methodologies used for direct impacts but a GEF causality factor should always be applied (similar to the top-down indirect impact methodology, see below). For instance, in the land use intensification example above, the transit facility may have been a necessary but not sufficient contribution to the intensification of land use, which also happened as a result of supportive zoning reform. Therefore the GEF project may not be able to claim full credit for the GHG impact of the land use intensification. Instead a GEF causality factor (40%) might be applied because the GEF project made only a "moderate" contribution.

(i) Level 5 = "The GEF contribution is critical and nothing would have happened in the baseline," GEF causality = 100 percent
(ii) Level 4 = "The GEF contribution is dominant, but some of this reduction can be attributed to the baseline," GEF causality = 80 percent
(iii) Level 3 = "The GEF contribution is substantial, but modest indirect emission reductions can be attributed to the baseline," GEF causality = 60 percent
(iv) Level 2 = "The GEF contribution is modest, and substantial indirect emission reductions can be attributed to the baseline," GEF causality = 40 percent
(v) Level 1 = "The GEF contribution is weak, and most indirect emission reductions can be attributed to the baseline," GEF causality = 20 percent

Using TEEMP Models to Estimate Direct Impact

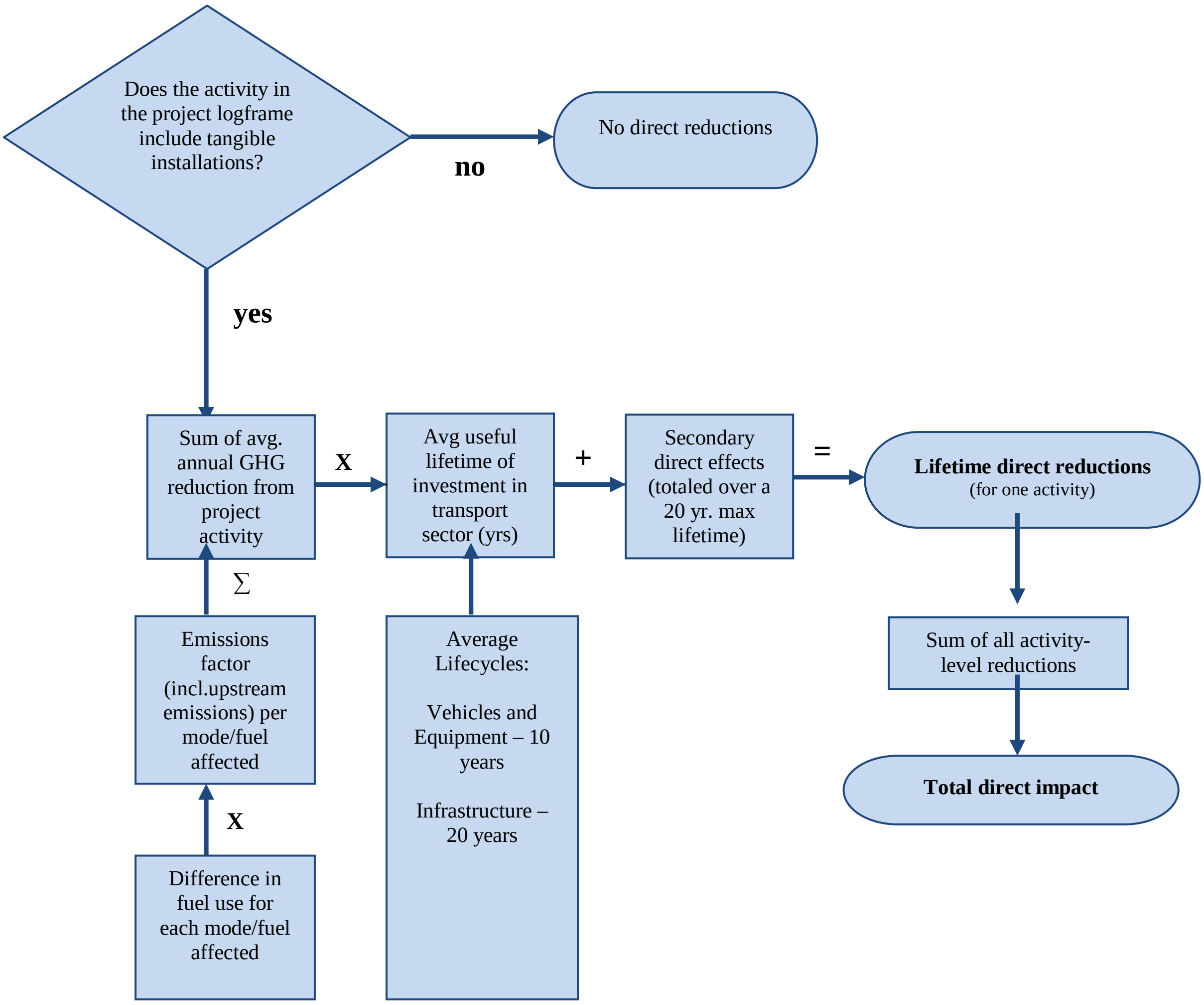
TEEMP models are spreadsheet models that guide users through a streamlined process of estimating emissions impacts for certain types of more common transportation projects. Currently, TEEMP models exist for bike-sharing, bike-ways, BRT, expressways alternatives, mass rapid transit, pedestrian facility improvements, railway alternatives, as well as several different transportation demand management (TDM) programs. Each of the models has a "Basic

Guide" and "Home" worksheet tab which explain how to get started using the model. When using these spreadsheet models the cells are color-coded according to the following scheme:

TEEMP Spreadsheet Model Cell Color-Coding

Green Cells	Required User input
Red Cells	Default Value, which can be replaced with local data, if available
Blue Cells	Output: GHG Impact (User does not modify)
Yellow/Orange Cells	Internal Calculation Cells (User does not modify)

Figure 3: Flowchart for calculating direct GHG emission reductions for transport projects



Calculating Direct Post-project Emission Reduction Effects

In some cases, GEF projects implement a GEF-supported financing mechanism that will continue to support direct investments after the implementation or supervision period of the project. An example is a revolving fund for up-front financing of bus rapid transit, parking management, and urban improvements, which is refinanced from user fees, loan repayments, or a partial credit guarantee facility that might be fully exposed at the end of the project, but then reduces its credit risk exposure and thus keeps looking for new investments. Depending on the leakage rate, facilities of this type can lead to a multiple of the original direct investment, which in turn can lead to a multiple of the associated emission savings long after the project itself has ended. For instance, in an early phase of the GEF a revolving loan was created to finance equipment for engine tune-ups in Pakistan.

These "direct post-project" emissions are calculated based on the direct effects that are achieved during project implementation. It is necessary to make assumptions on the impact that the post-project facility (e.g., the revolving fund) will have after the project. For a revolving fund, for example, the rates of reflow and leakage will determine how many investments can be financed after the supervised implementation period. A “turnover factor” (TF) is defined as the number of times the post-project investments will be larger than the direct investments. The formula then is:

$$[CO_2eq\ direct\ post\text{-}project] = [CO_2eq\ direct\ ] * [TF],$$

where [CO_2eq direct post-project] are emissions saved with investments after the project, supported by post-project financial mechanisms;

[CO_2eq direct] are direct emissions savings to the degree that they are supported through the mechanism that causes the post-project impacts;

[TF] is a turnover factor, determined for each facility based on assumptions on the fund leakage and financial situation in the project country

In the equation above, the turnover factor “TF” is equal to the number of times that the whole fund volume is expected to be invested and reinvested after the project. The first turnover will usually happen within the project’s supervised implementation period, and thus count toward the direct emission reduction, not toward emissions reductions taking place through subsequent “turnover” of the funding.

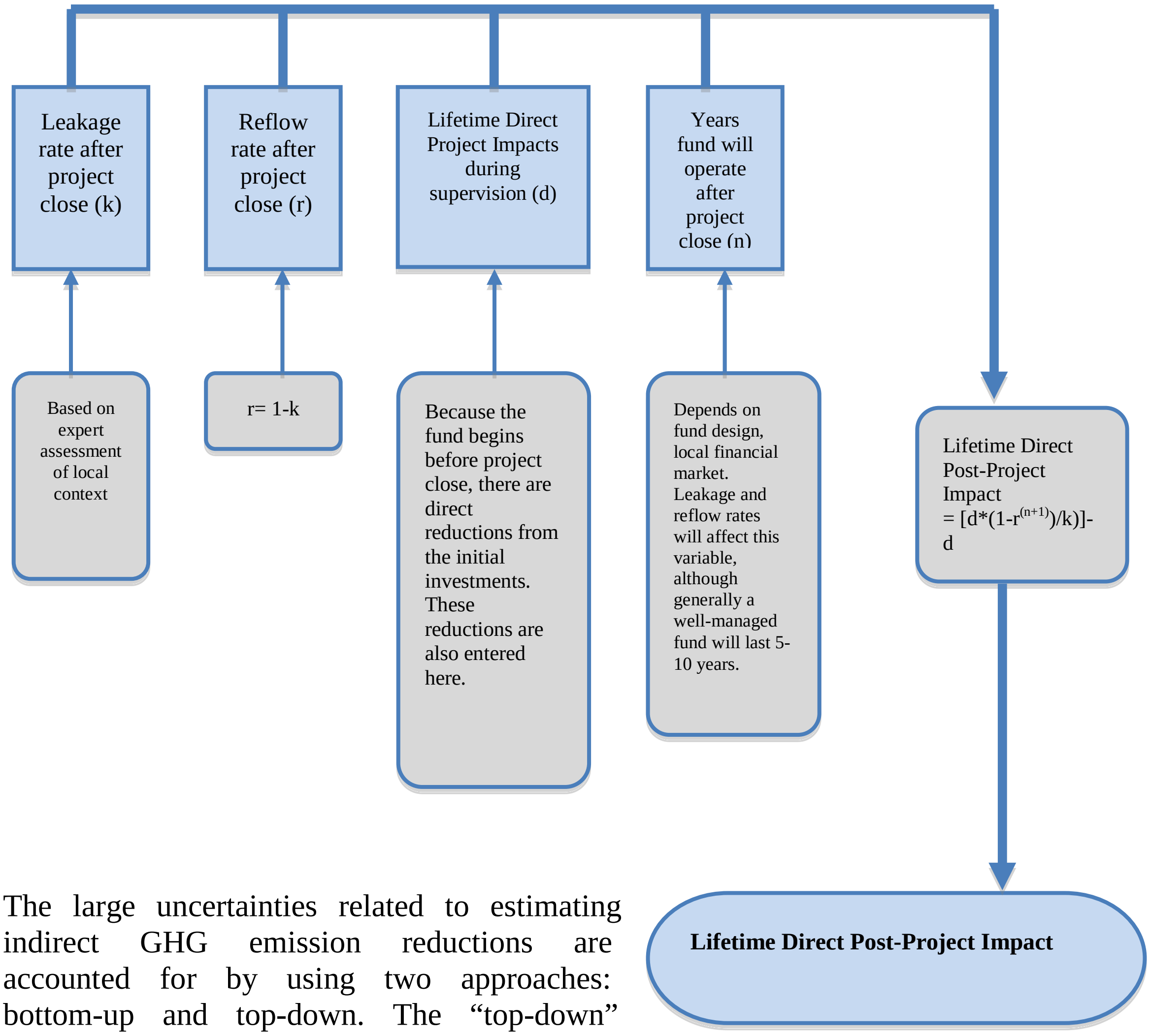
The estimates for direct post-project effects are subject to a higher degree of uncertainty than the direct GHG project outputs. In the project, they should be reported separately from the direct project output, as they actually are a form/type of indirect emission reductions, but ones that can be assessed with a higher degree of certainty than the purely indirect emission reductions. Figure 4 illustrates how to calculate direct post-project GHG impacts.

Calculating Indirect Impacts

The mission of the GEF is to be catalytic and therefore its approach emphasizes strategic interventions and their long-term impacts. GEF projects that catalyze replication of sustainable transport projects in multiple cities or regions or remove barriers and bring sustainable transport technologies to a wider market can accrue large indirect GHG reduction impacts.

During project preparations, project documents must include the estimated long-term impacts of their interventions and contain the data and assumptions used to complete this estimation. It is difficult to accurately assess the after-implementation impacts of a market facilitation and barrier removal projects whose implementation lies years ahead and thus two techniques, bottom-up and top-down indirect impact estimation, are employed in tandem to generate a range of potential impacts.

Figure 4: Direct post-project GHG emission reductions calculation



The large uncertainties related to estimating indirect GHG emission reductions are accounted for by using two approaches: bottom-up and top-down. The "top-down" approach uses the size of the entire national/regional market as a starting point, under given assumptions for costs and benefits of the technology. For a bus-related project in one city, for instance, the entire nation/region-wide bus fleet could be the potential scale of market for the proposed intervention's indirect impact. This results in the most optimistic assessment – full market penetration - and thus it is the upper-most limit for the range of potential GEF project impacts. Alternatively, using the "bottom-up" approach one makes a conservative estimation of the number of times the project is likely to multiply in the long run, resulting in a lower limit of the range of the potential indirect impact. Whenever appropriate, both approaches should be used in a complementary manner. Expert opinion is required to determine the top-down market potential and the bottom-up replication factor. To minimize the risk of exaggerated project expectations, one should use conservative estimates for the replication effects in either approach.

Market and replication potential for a project is not the only factor to drive indirect impacts, three other factors must be considered in the expert analysis of a project's indirect impact: project activities which facilitate replication, the creation of attractive local co-benefits from project activities, and the quality of a project and its ability to be successful. These activities, further explained in following paragraphs, increase a project's replication factor in the bottom-up approach and may increase a project's causality factor in the top-down approach.

Some assumptions that have to be made to calculate indirect effects:

(a) A standard project influence period for GEF effects has been assumed to be 10 years. This means that a typical project will exert some influence on local market development for about 10 years, i.e., non-baseline investments that happen within 10 years after the project can be counted toward indirect impacts, with the reductions being cumulative over their respective lifetimes. In some cases, the influence period might be shorter.

(b) When assessing the potential for project replicability in the bottom-up approach, or the size of the potential market in the top-down approach, estimates should be conservative and limited to a realistic scope.

(c) If a project envisions a second phase or tranche at a later stage, and the GEF contribution to this second phase is not approved by the GEF Council, the GHG abatements achieved during the second phase are counted as indirect effects.

(d) Most transport sector GEF projects should limit the tabulation of indirect impacts to impacts within the same region or country as the project. In some cases, however, innovative transportation projects have influence beyond their own country borders. For example, small nations with only a single large city and no potential to replicate a large-scale transport project within their national borders may still play a catalytic role in the immediate region. This is especially true in regions of smaller, closely connected countries with strong cultural and commercial links, such as Central America or Southeast Asia could argue to accrue indirect impacts beyond a country's borders but within its sphere of influence. Examples of internationally catalytic projects are well-known: congestion pricing in Singapore, BRT in Curitiba, and bicycle-sharing in Paris.

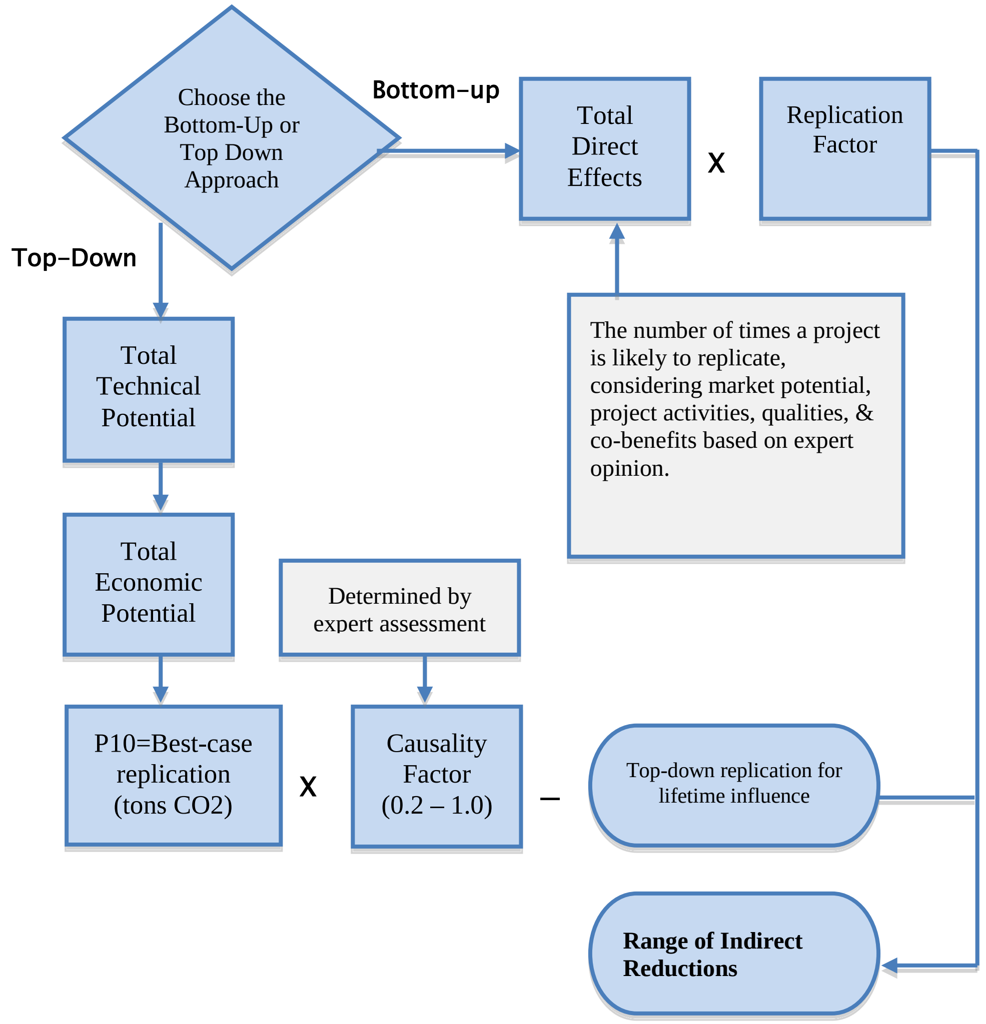
(e) For portfolio-wide aggregation, double counting issues for indirect impacts need to be addressed.

Some reality checks can be used to test the final results. For example, the bottom-up indirect calculation exceeds the sum of the direct and direct post-project results. On the other hand, it should be smaller than the total market potential of the technology.

The potential for replication and indirect impact should also be linked to the funding and quality of project components which encourage replication such as publication of results, public outreach, educational outreach, capacity building, support for study tours and exchanges, etc.

Figure 5 illustrates how to calculate the indirect GHG impacts of GEF projects using both approaches. Both approaches are discussed in more detail below.

Figure 5: Flowchart for indirect GHG emission reductions



Calculating Indirect Impacts—Bottom-up Approach

The bottom-up approach for calculating indirect GHG reductions generally provides the lower extent in the range of possible indirect impacts from a project. It starts with the direct effects of the investments under a project, and multiples that number by a factor representing the number of times the project is likely to be replicated in other places/markets. For example, a bus rapid transit project developed through a GEF project might save 200,000 tons of CO_2eq over the lifetime of the infrastructure. Judging from the local conditions, one could assume that within 10 years after the project ends, five more cities in the country will adopt BRT systems with similar levels of GHG reduction. Mathematically, the direct GHG emission reductions are then multiplied by the assumed factor of replication (five) to find the bottom-up indirect reduction.

The bottom-up replication factor should be determined by an expert and based on four factors:

a) Market Potential: a conservative estimate of its real potential for places and markets where it is likely to replicate.
b) Project Quality: high-quality, full-featured projects are more likely to succeed, and successful projects are more likely to replicate.

c) Project Activities Which Encourage Replication: study tours, capacity building, technical assistance, public promotion, publication and dissemination of project information and results all help to promote and facilitate project replication.
d) Local Co-Benefits: When a project has strong local co-benefits in addition to global benefit, it becomes more attractive to other places and markets and thus more likely to replicate.

The formula is:

[CO_2eq indirect bottom-up] =[CO_2eq direct][RF],*

where [CO_2eq indirect bottom-up] are emissions saved with investments after the project, as estimated using the bottom-up approach, in tons of CO_2eq.

[RF] is a replication factor, i.e., how often will the project's investments be repeated during the 10 years after project implementation, determined by expert and reflects the degree to which the project emphasizes activities which encourage replication.

[CO_2eq direct] is an estimate for direct and direct post-project emission reductions, in tons of CO_2eq.

In the BRT example above, the replication factor would be 5, and the indirect savings calculated by the bottom-up methodology would be 1 million tons of CO_2eq.

To date, there is no empirical assessment of the replication factors for the GEF portfolio, partly because the portfolio is not mature enough for systematic observation, partly because no post-project evaluations are taking place. Therefore, for the time being, the replication factors should be explicitly determined in the project proposal for each project. When assessing these replication factors, two major aspects should be taken into account:

(a) The first is the expected probability of replication, which is mostly related to the question of whether a particular transportation intervention is profitable or politically desirable and for that reason offers some incentives to the local public or private stakeholders for replication;

(b) The second is the question of how this likelihood compares to the amount of investment already taking place directly under the project.

In the absence of empirical assessments, generalized replication factors can be employed in the assessment, relating to the design and activities of the project.

Developing these replication factors on the basis of experiences collected within GEF projects and from similar projects outside the GEF is underway but far from being completed. What is clear is that for a project to be widely replicated, it needs to be a 'high-quality, full-featured' project that is politically popular in the host city with sufficient status and visibility to "impress" other cities. The parameters of a 'high-quality, full-featured' project are defined in the project-specific sections of this document as necessary. The potential for replication and indirect impact should also be linked to the funding and quality of project components which encourage replication such as publication of results, public outreach, educational outreach, capacity building, support for study tours and exchanges, etc. Project activities which contribute to project replication, such as study tours, capacity building, technical assistance, public promotion, publication and dissemination of project information and results should be taken into account when calculating indirect impacts. These activities increase a project's replication factor in the bottom-up approach and increase a project's causality factor in the top-down approach.

Where specific guidance has not been provided below in the specific descriptions for project types, each project/program during preparation should decide on a replication factor based on the knowledge of the local market, keeping in mind that the assessment should be conservative. Some reality checks are that the replication should always be smaller than the overall market potential, and that a comparison with the direct and direct post-project impacts should lend itself to a reasonable explanation.

Calculating Indirect Impacts—Top-Down Approach

The underlying assumption of the top-down approach is that removing barriers and/or investing in the promotion of and capacity building for sustainable transport initiatives may allow successful projects to leverage the whole market for the relevant initiative. If all barriers to market implementation are removed, market forces should exploit the full economic potential offered by the respective market. Full economic potential, in the case of a public transit intervention would be the entire provision/demand for public transit – all buses in the country, for instance - within the region/country/sphere of influence of the project. Therefore, the starting point is the whole economic potential for GHG abatement of a given application in the project's host country or sphere of influence.

The top-down indirect impact calculation is generally constitutes the high extent of the range of potential indirect impacts. It starts with an assessment of the total market size or total potential for the provision of the specific transportation infrastructure the project seeks to implement if all potential was exploited within the project's entire host country or sphere of influence. This is determined, rather simply, by the number of cities or regions that could support such infrastructure, technical capacity, and typical investment rates in the country that can be expected under post-project circumstances.

The total amount of potential additional project locations should then be corrected downward, if it seems technically unfeasible to tap it within 10 years of the project's completion. In order to correct the 10-year potential by the "baseline shift," i.e., that part of the potential that would have been tapped by the market without a GEF intervention, the GEF causality factor is used. The GEF causality factor describes how much of the buildup of capacity can really be attributed to the GEF intervention, and how much would have happened in the business-as-usual scenario in the long-term. The calculation of indirect impacts should also account for the degree to which projects budget funding for and program components that promote the specific transportation interventions through public outreach, capacity building, publicizing project results, and organizing educational tours with leaders from other areas.

In most GEF climate change interventions, estimates for full economic potential are created in the project development phase. Many technologies that reduce greenhouse gases are already widely available and the trend in longer term production costs widely known, so their broader dissemination trends are easier to estimate with some degree of certainty. Such estimates should be given a greater weight than projects employing new technologies where performance and future production costs are difficult to determine. The latter rely on expert estimates that are difficult to verify independently. The relatively disappointing results of previous GEF efforts towards hydrogen fuel cell vehicle development might serve as a cautionary tale in this regard.

In addition, the identification of specific GEF causality in the dissemination of the technology needs to be carefully documented. Because market forces or government policies might generate some of these achievements at a later point in time even without a GEF intervention (baseline shift), this figure is then multiplied by an assumed GEF causality factor. The value is assigned by an expert in the field, which indicates to what degree the GEF intervention can claim causality for the reduction.

For the GEF causality factor, five levels have been assumed:

(a) Level 5 = "The GEF contribution is critical and nothing would have happened in the baseline," GEF causality = 100 percent
(f) Level 4 = "The GEF contribution is dominant, but some of this reduction can be attributed to the baseline," GEF causality = 80 percent
(g) Level 3 = "The GEF contribution is substantial, but modest indirect emission reductions can be attributed to the baseline," GEF causality = 60 percent
(h) Level 2 = "The GEF contribution is modest, and substantial indirect emission reductions can be attributed to the baseline," GEF causality = 40 percent
(i) Level 1 = "The GEF contribution is weak, and most indirect emission reductions can be attributed to the baseline," GEF causality = 20 percent

When estimating the GEF causality factor, one should also take into account the nature of the baseline. The causality factor accounts for baseline shifts, that is, for those situations where the nationwide baseline is expected to move toward a less carbon-intensive situation even without the GEF intervention. While the GEF causality factor is useful and can deliver consistent results, GEF causality factors should rely on situation-specific justifications and be estimated conservatively. If, in the future, the methodology shifts to a different method of setting the baseline, the GEF causality factor could be simplified.

The formula for calculating indirect impacts with the top-down methodology is the following:

$$[CO_2eq\ indirect\ top\text{-}down] = [P10]*[CF],$$

where [CO_2eq indirect top-down] are GHG emission savings in tonnes of CO_2eq as assessed by the top-down methodology.
[P10] is technical and economic potential GHG savings with the respective application within 10 years after the project (not including direct and direct post-project impacts).
[CF] is a GEF causality factor.

Calculating the Local Benefit of Transportation Projects

Wherever possible, local benefits that would be a direct result of project impacts should be quantified and included in the GEF project document for CEO endorsement. As noted in the above methodologies, the presence of significant co-benefits in a project increases its likelihood of achieving success and the replication factor that determines its indirect impact. Co-benefits include, but are not limited to: travel time savings; expanded travel options and opportunities, job growth, technical capacity building, economic development, income growth, and additional employment; air pollution reductions and increases in physical activity that improve public health; and user cost savings.

Wherever possible, the TEEMP models calculate savings in particulate matter linked to respiratory illness and safety issues like traffic fatalities, as detailed in the specific methodologies. Any and all verifiable co-benefits which result from transport projects should be detailed in GEF project documents, whether calculated by TEEMP models or via another methodology.

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