Scientific and Technical Advisory Panel

The Scientific and Technical Advisory Panel, administered by UNEP, advises the Global Environment Facility

Calculating Greenhouse Gas Benefits of the Global Environment Facility Energy Efficiency Projects

Version 1.0.

March 2013

Acknowledgments

The work was commissioned by the Scientific and Technical Advisory Panel of the Global Environment Facility (GEF-STAP). The Methodology were prepared by the joint team of the Stockholm Environment Institute – U.S. (SEI-US) and Synapse Energy Economics, Inc. Step-by-step explanation of GHG calculations of each module using specific project examples was prepared by Margarita Dyubanova (STAP Secretariat).

Project team:

Michael Lazarus, SEI-US

Chelsea Chandler, SEI-US

Jean Ann Ramey, Synapse Energy Economics

Thomas Vitolo, Synapse Energy Economics

The authors would like to thank Margarita Dyubanova (STAP Secretariat) and David Rodgers (GEF Secretariat) for their guidance, careful review, and other invaluable input. The authors also greatly appreciate the helpful feedback provided by STAP members, GEF staff, implementing agency representatives, and invited experts who attended the GEF-STAP workshop *Developing GHG Emission Reduction Methodology for GEF Energy Efficiency Projects* held on February 14-15, 2012, in Washington D. C. that helped to refine the draft methodology. The following experts provided very helpful early input, including Lev Neretin (STAP Secretariat), Frank Klinckenberg (Klinckenberg Consultants BV), Richard Hosier, Marcelino Madrigal, Zhihong Zhang, Marcel Alers (UNDP), Pradeep Monga (UNIDO) and Jas Singh (World Bank), Stephane de la Rue du Can & Michael McNeil (Laurence Berkeley National Laboratory), My Ton (The Collaborative Labeling & Appliance Standards Program, CLASP), and Maja Staniec (Wroclaw University of Technology, Poland).

Table of Contents

I. Introduction, Concepts and Definitions

GEF and Energy Efficiency

Since 1991, the Global Environment Facility (GEF) has played a major role in supporting energy efficiency initiatives in developing countries and economies in transition. Through June 2011, GEF provided $1.2 billion in financing and leveraged $8.5 billion in co-financing to more than 200 energy efficiency projects (GEF COP 17 Report[1]). The fraction of GEF's climate change portfolio dedicated to energy efficiency projects has generally grown over time, comprising 38% in GEF-4 (2006-2010). The World Bank estimated that the GEF energy efficiency projects implemented by the World Bank, in the period of 1992-2009, have delivered nearly 100 million tonnes of CO_2 equivalent (tCO2e) in direct emission reductions over the lifetime of the projects, and close to 300 million tCO_2e in indirect emission reductions[2].

GEF requires every climate change project at the *ex ante* stage (Project Identification Form or PIF) to provide an estimate of the avoided or reduced amount of greenhouse gas (GHG) emissions the project expected to deliver. In 2008, the GEF published a Manual describing its methodology for calculating greenhouse gas (GHG) benefits for its energy efficiency (EE), renewable energy (RE), and clean energy technology projects[3]. This methodology since then has provided GEF agencies with a common framework for preparing *ex ante* (before the event) estimates of potential GHG benefits verified further during project development and review stages. While representing a strong foundation, this methodology has nonetheless been open to wide interpretation, providing limited tools and guidance for consistent calculations, and resulting in a somewhat inconsistent application. At the request of the GEF Secretariat and its partners, the GEF Scientific and Technical Advisory Panel (STAP) commissioned a study to review the existing EE methodology, identify its strengths and weaknesses, review alternative approaches, and develop a revised methodology/algorithm for calculating GHG benefits of GEF EE projects[4]. The intent of this proposed revision is to improve the rigor and consistency of the GHG analysis, and to simplify the application of the methodology for GEF agencies, by providing a more complete, and easy-to-use spreadsheet tool that embeds more standardized guidance in the form of algorithms and conservative default factors.

Section 1 and 2 discuss the impetus and process for revising the methodology for EE projects, and summarizes key changes to the existing methodology. Section 3 provides step-by-step instructions for applying the updated methodology to calculate potential GHG emission savings associated with GEF energy efficiency projects. Annex 1 provides examples for calculating GHG benefits in each module of the methodology, while Annex 2 lists other existing tools and methodologies relevant to estimating GHG emission benefits of energy efficiency projects.

STAP and GEF identified the following criteria to guide the revision of the existing RE and EE methodology:

- Simplicity, and minimizing the level of effort required to apply the methodology;
- Availability and ease of data collection;
- Applicability to a broad range of energy efficiency projects;
- Consistency among projects;
- Significance, in order to ensure a greater focus on material impacts;

---

[1] Available at: http://unfccc.int/resource/docs/2012/cop18/eng/06.pdf
[2] Hosier, R. (2010). *Laying the Foundation for a Low Carbon Future: The World Bank-GEF Partnership*.
[3] GEF (2008). *Manual for Calculating Green House Gas Benefits of GEF Project: Energy Efficiency and Renewable Energy Projects.* Available at http://www.thegef.org/gef/sites/thegef.org/files/documents/C.33.Inf_.18%20Climate%20Manual.pdf
[4] The initial RE and EE methodology (footnote 3) remains relevant for calculating GHG benefits of the GEF renewable energy projects.

- Credibility, as reflected in reliance on accepted methods or credible literature and data sources.

Summary of Key Changes in the Methodology

The major changes to the GEF's methodology for EE projects resulting from the application of the above criteria, review of relevant methodologies, and other research are as follows:

- **"Modules" were introduced into a new methodology to allow for component-specific calculations of emission reductions**. In the revised methodology, activity proponents have four modules to choose from: *1) Standards and Labeling, 2) Building Codes, 3) Demonstrations and Diffusion,* and *4) Financial Instruments* - with simple algorithms reflecting the unique attributes of each intervention type. The spreadsheet is designed so that the proponents distinguish activity components and outputs that could have a discernible GHG emission benefits, and then select specific module/s that represent them best. In developing this methodology, over 20 GEF project documents were reviewed by the project team leading to the conclusion that nearly all of the typical GEF EE activity components could be assigned to one or a combination of the proposed four modules. In many instances, projects involve multiple components– combining for example, demonstration projects, with development and enhanced enforcement of a building code. The spreadsheet is designed to enable project proponents to combine multiple activity components (up to 10 within each module), with reporting of results for individual components as well as cumulatively for the entire project. The attributes for each of these modules are discussed in the following section.
- **Added capabilities and specification** of *direct*, *direct post-project*, and *indirect* GHG emission savings were introduced. For example, the revised methodology enables the calculation of the direct, post-project emission reductions associated with policies such as standards and codes, where the policy is established prior to project closure and for GHG savings resulting from equipment purchases or new construction after project closure.
- **The new methodology includes default factors and encourages project proponents to use project-specific dynamic baselines.** In practice, some project documents have done a thorough and conservative job of accounting for autonomous improvements in energy efficiency independent from GEF intervention, while others have not explicitly considered such "independent" from the GEF changes in the project baseline. The revised methodology provides simple, standard algorithms that require the User to specify levels of energy efficiency improvement, penetration of energy efficient equipment, levels of building code compliance, and/or the fraction of activity undertaken likely to occur in a business-as-usual scenario without GEF intervention. In addition, it provides default values, such as an assumed 1% improvement per year in baseline efficiency, which can be revised by users with an appropriate justification.
- **Additional default values are introduced to simplify calculations.** Examples include 1) a selectable database of grid electricity emission factors (based on the CDM combined margin methodology)[5], 2) an avoided transmission and distribution loss factors for electricity saving projects (often not included in the

[5] The revised methodology suggests default use of the combined margin grid electricity factor, as established in CDM methodologies, as a default for EE projects. Marginal emission factors, that reflect the types of electricity generation that is more likely to be displaced by (operated less and/or not built) are more appropriate for estimating emission reduction impacts than the average emission factors commonly presented in national statistics (World Resources Institute and World Business Council for Sustainable Development (2007). *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects*. Washington, DC.). More sophisticated approaches than the CDM grid emission factor methodology are possible, taking into account the load shapes of the energy efficiency activities, and using information on hourly or seasonal variation in emissions of marginal units (e.g. via dispatch analysis) and can provide more accurate estimates (e.g., Vine, E., Hall N., Keating K., Kushler M. , and Prahl R. (2012). *Emerging Issues in the Evaluation of Energy-efficiency Programs: The US Experience*. Energy Efficiency 5: 5–17).

current project descriptions), and 3) fossil fuel combustion emission factors (based on the IPCC Good Practice Guidance[6]).

In addition, the S*tandards and Labeling* module contains illustrative default values for dozens of efficient technologies, such as CFL and LED lighting, numerous appliances, and industrial motors and boilers, along with values for the corresponding standard technologies that they would displace. Default values are available for power consumption, usage hours per day, and days of use per year and represent estimates for a single developing region at a particular point in time. They provide illustrative starting values that could be replaced, as appropriate, with current values developed for the specific project in question.

What Distinguishes the GEF Methodology from Other Models for CO_2 Accounting?

One of the basic features of the GEF's GHG emission reduction quantification methodology has been the distinction between direct and indirect emission reductions. ***Direct GHG emission reductions*** are those achieved by project investments such as technology demonstrations and discrete investments financed or leveraged during the project's supervised implementation period (from the project start to the project closure). In contrast, GHG emission reductions achieved, for example, as a result of market facilitation and development through project-supported policy and institutional frameworks, capacity building, information gathering, and replication effects of demonstration activities, are considered ***indirect GHG emission reductions***. In addition, a third category, ***direct post-project*** emission reductions, has been used to quantify the GHG emission reductions of GEF-supported revolving financial mechanisms that are still active after the project's closure (*ex post*).

These categories have different accuracy of GHG emission reduction estimates, with the *direct emission reductions* presumed to be the most accurate and certain, followed by *direct post-project emission reductions*, and finally, *indirect*. However, in GEF practice GHG accounting for these emission categories was not applied systematically confusing the cumulative impact of GEF investments with respect to GHG emission reductions. The ad-hoc review of some GEF EE projects revealed that several market facilitation and policy-based projects—mostly, for efficiency standards and labeling projects—have reported the resulting emission reductions as *direct,* rather than *indirect,* as the manual would suggest should be done. If, indeed, standards were to be adopted, with enforcement systems, it would be hard to argue that the estimated emission reductions are less certain and attributable to GEF than many other project outputs that are currently considered to lead to direct impacts, such as financing to support ESCO projects. The review also found that *direct post-project* emissions benefits have been reported for non-financial projects, such as dissemination of results from demonstration projects, more often than for the revolving fund projects for which this accounting category is intended to apply.[7]

In order to address the above inconsistency, the revised methodology takes a different approach to the estimation of direct and indirect GHG emission reductions. First, the revised methodology introduces **four modules** enabling analysis of the GHG emission reductions for the key existing types of GEF support for EE projects**: standards and labeling, building codes, demonstration and diffusion, and financial instruments**. In all the modules, policy implementation activities are now explicitly capable of generating direct emissions benefits. For projects where building codes, standards, and labeling components lead to building EE improvements and equipment purchases prior to the project closure, the resulting emission reductions (over the lifetime of those improvements and purchases) are considered as ***direct*** project impacts. Building improvements and equipment purchases that occur

[6] IPCC. (2006). "2006 IPCC Guidelines for National Greenhouse Gas Inventories." http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

[7] See for example, commercial buildings project in Thailand (GEF ID 4165) and residential and commercial buildings project in Namibia (GEF ID 3793).

after project closure are considered to result in *direct post-project* impacts. As a result, in the revised methodology, policy implementation projects are treated similarly to projects involving specific investments.[8]

The earlier methodology provided two options for calculating ***indirect GHG reduction benefits***. The bottom-up method involves multiplying *direct* emission reductions by a *replication factor (RF)*, intended to reflect how many times the investments achieved during the project period might be repeated during an *"influence period"* (e.g., 10 years) after the project closure. The top-down method involves multiplying *total market potential* for CO_2 emission reductions by a *causality factor (CF)*. Market potential combines technical and economic market potential for the technology within the 10 years after the project's lifetime. CF is the percentage of a realized market potential that can be reasonably attributed to the long-term effect of the project as the result of overcoming market barriers.[9]

The revised methodology allows estimating both top-down and bottom-up indirect GHG benefits. The top-down estimate is based on a single market potential analysis and is performed at the project level (as opposed to the module level). In contrast, the bottom-up indirect estimate is calculated for individual activity components. For projects involving demonstration and diffusion activities, or the use of investment instruments, the User can specify (by providing justification) the number of expected replications during the post-project influence period, on a component-by-component basis for each component (e.g., an ESCO or a green building demonstration project).

Data Assumptions and Calculation Results

The project proponent should err on the side of transparency, and generally be cautious and conservative when making assumptions about GHG emission reductions. The calculation produces both, *annual* and *cumulative* results. The spreadsheet presents the results separately for project and post-project periods, including for specific years that users can select.

Currently, CO_2 is the *only* GHG considered in this methodology. For energy efficiency projects, in most cases, where avoided fossil fuel combustion is the principal source of GHG emission reductions within the project boundaries, trace emissions of methane and nitrous oxide from incomplete combustion are quite small (less than 1-2% or less of overall CO_2-equivalent emissions or emission reductions). Where there is a significant on-site leakage of natural gas or biological methane, such emissions could be significant and should be considered in the estimate. This is the case, for example, with the climate benefits of projects that reduce GHG emissions through improved charcoal production (methane and nitrous oxide reductions) or support technologies and frameworks reducing emissions of ozone depleting substances (HFC and HCFC reductions). Where non-CO_2 GHGs are considered, the 100-year global warming potentials from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report[10] should be utilized. While the revised methodology does not provide any calculation tools for these emissions benefits, the "Results" tab in spreadsheet provides a place to enter them.

---

[8] The treatment of standards, labeling, and codes in the category of indirect emission reduction in the earlier methodology may had impacted the certainty and accuracy of emission reduction estimates because indirect methods used in these calculations generally involve the use of rather speculative replication factors (bottom-up approach) and/or the estimated market potential data (top-down approach). Well-vetted methods for quantifying the benefits of these policies already exist and have started to be applied by GEF making it possible in the revised methodology to count these emission reductions as direct emission reductions.

[9] The earlier methodology implied that conducting both top-down and bottom-up analyses can provide a range of estimates that would represent the uncertainties in indirect emissions estimation; however, only some projects in the studied cohort reported a range. While informative and theoretically appealing, the range itself does not serve as a good indication of the underlying uncertainties in indirect emission calculations. Furthermore, the bottom-up result in many cases nearly matches or exceeds the top-down result, suggesting that this exercise does not tend to "bound" the indirect estimate, and may lead to questionable results.

[10] IPCC 4th Assessment Report is available at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html.

More holistic GHG accounting approaches consider life-cycle emission impacts. A possible step in this direction would be to include full life-cycle emission factors for fuels, accounting for emissions from well or extraction point to the point of combustion. Such values can be entered directly into the spreadsheet. A more complete analysis would consider life-cycle emissions for the equipment and construction involved in the project. Both of these approaches, while potentially informative, would substantially increase the level of effort required, introduce significant uncertainties, and go beyond commonly used approaches of project-specific GHG accounting.

Required Data

The following data requirements and assumptions are common to all the modules in the methodology.

Baseline scenarios: Robust assessment of GHG benefits of the GEF EE project depends on the determination of a ***dynamic baseline*** scenario, representing the likely evolution of energy-efficient technologies and practices without GEF intervention. The baseline scenario should be carefully presented in the project document. The revised methodology focuses on specific calculation techniques that can be used to ensure consideration of the likelihood that some improvements will occur in the absence of GEF intervention (see **Error! Reference source not found.**)[11], for example:

- 1% improvement per year in relative efficiency of baseline technology (e.g., unit energy intensity of the baseline technology would decline by 1% per year)
- increase in market share of improved efficiency (project) equipment of 5% per year.

Emission factors: The spreadsheet provides default fuel-specific emission factors drawn from the IPCC 4th Assessment Report[12]. It also contains a database of country-specific electricity emission factors developed under the CDM[13]. Users can overwrite these defaults if more specific information is available.

Lifetimes of investments and technologies: The investment-specific parameter that needs to be determined is the lifetime of the investment or technology deployed. For various operational programs, different technologies, investment conditions, and assumptions are appropriate. The methodology carries over the default from the earlier methodology, highly-generic five year lifetime for appliances. For other technologies, the User should enter and document an appropriate, conservative assumption for the investment lifetime.

[11] As noted by many observers, there can be a tendency by GEF project proponents to understate the likely improvements that might occur under business-as-usual conditions, for example, without the proposed GEF intervention leading to inflated estimation of GEF-specific contribution to GHG emission reductions.

[12] IPCC. (2006). "2006 IPCC Guidelines for National Greenhouse Gas Inventories." http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

[13] See discussion document for the rationale for using these defaults (Lazarus et al. (2012). *Revising GEF's GHG Methodology for Energy Efficiency Projects*. A Discussion Document for the GEF STAP Workshop (February 14, 2012, Washington DC), Feb. 8 Draft. Stockholm Environment Institute – U.S. & Synapse Energy Economics, Inc.).
.

Table 1. Overview of the Methodology Modules

	Standards and Labeling	Building Codes	Demonstration & Diffusion	Financial Instrument
General applicability conditions	Projects that systematically address energy using equipment or devices through standards, labeling or other changes to regulatory and industry structures	Projects that systematically address residential, public, or commercial sector building efficiency through codes or other policy instruments	Projects that include demonstration to strengthen awareness, knowledge, and capacity building; or diffusion that helps to bring about broader use of an energy-efficient technology	Projects that involves direct finance of EE investments or support to financial intermediaries; interventions cannot be easily reduced to common technologies and penetration rates, given diversity of industries, *etc*.
Intervention types	Standards and labeling; minimum efficiency performance standards	Building code establishment; enhanced code enforcement	Technology demonstration and capacity building; technology development and diffusion	Financing mechanisms (loan or revolving funds); ESCO creation/support
Project examples	Appliances (e.g., refrigerators, washing machines, air conditioners. etc.); lighting; space heating and cooling	Insulation, enhanced construction, cool roofs	New building with energy efficiency technologies; retrofit of a building or a set of buildings; implementation of energy management plans and system optimization activities in enterprises	Promoting energy efficiency markets in industrial, commercial, and public buildings sectors
Typical data requirements	Targeted and displaced technologies; either technology power and activity or unit energy consumption; year standard enters into force; percent of new sales compliant with standard	Target and displaced technologies; either technology power and activity or energy consumption per area (kWh/m^2); the year building code enters into force; percent of affected buildings compliant with the code	MWh or GJ savings per "unit" (e.g., per building, foundry, optimization completed, etc.); activity levels (number of "units" replicated each year	MWh or GJ savings per investment unit (e.g., US$); investment in each year
Typical project-specific data sources	Surveys and audits; national statistics; available scenario analyses; manufacturer data	Surveys and audits; national statistics; available scenario analyses; manufacturer data	Energy audits; surveys; national statistics	Audits; market studies of investment effectiveness, ESCO returns, etc.
Algorithms	Stock model based on technology sales and penetration rates	Model based on affected building area (m^2) and penetration rates	Savings per unit multiplied by number of units deployed	Simple ROI model: savings per unit investment multiplied by amount invested
Baseline approach (with default values, where provided in parenthesis)	Annual sales and growth rate for technology/equipment Annual improvement in relative efficiency of baseline technology (1%/year) Annual increase in improved technology penetration (5%)	Annual affected building area (m^2) and growth rate Improvement in relative efficiency of baseline technology (1%/year) Percent compliance with building code (where it currently exists) Existing building energy intensities	Percent of activities implemented in the baseline (i.e., that would have occurred anyway in absence of the project) (10%)	
Other defaults available	Illustrative defaults for about 30 technologies (power consumption and usage characteristics)			

II. Step-by-Step Guide to Estimating the GHG benefits of GEF Energy Efficiency Projects

This section provides step-by-step instructions for using the Excel spreadsheet tool to calculate avoided GHG emissions from GEF energy efficiency projects.

The **Basic Guide** tab of the spreadsheet contains a description of the tabs and the types of information contained in each tab:

Yellow tabs are working tabs where the User inputs data;

Blue tab is the results tab where the User can see the overall results of calculation;

Black tabs are reference tabs for User's information.

The **Basic Guide** also illustrates various functions of cells based on the color:

User-input cells

User-input cells with a pull-down menu

User-input cells that differ from default values

Cells not intended for User input

Cells not appropriate for input or output

Step 1: Enter Basic Project Information

Complete the **Project Info** tab in the spreadsheet tool by entering basic project information data. In addition, the User needs to specify the following general parameters:

1) *Length of the analysis period in year after the project closure* – not to exceed 20 years.
2) *Maximum technology/Measure lifetime* – the default maximum is set at 20 years.
3) *Fuel type(s)* and *emission factors*[14] – the User can choose up to three fuels in addition to electricity by accessing the pull-down menu. Once the fuel is chosen, its associated emission factor[15] will automatically fill in the both the "Default" and "User Specified" fields. As with all defaults, the User can overwrite the value in the User Specified cell. If a project uses a fuel not listed, the User can add the fuel and emission factor by editing values in the black tab entitled "Fuels". Rather than adding a row to the table, the User should replace data in the table for one of the fuels not used in the project.

Step 2: List Activity Components and Select Quantification Model

In **Project Info** tab, the User should list the Activity Components and select a corresponding quantification module.

1) List Activity Components – the User should list activity components for which emission reductions are being quantified. Please note that not all Activity Components have to match the Project Components in the Project Logframe table in the PIF. Activity Components help break down GEF Project Components into separate

[14] Default values in the model were chosen to be conservative and consistent. The use of alternative values should be justified and documented with the explanation in the "Notes" section of the spreadsheet tool itself.

[15] Derived from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

quantification steps when the characteristics of the activities within a component vary. The Activity Components titles will appear in the table headings throughout the model.

Enter Sector/Subsector and *Logframe Output, then Select Module/Intervention Type*–from pull-down menu the User should select the module that best fits each Activity component There are four different modules available for estimating GHG emission reductions associated with the GEF energy efficiency projects:

1) Standards and Labeling,

2) Building Codes,

3) Demonstration and Diffusion, and

4) Financial Instruments.

The User begins by listing all key activity components that could yield emission reductions followed by the module selection that is most appropriate for each component.

The **Standards and Labeling** and **Building Codes** modules are both appropriate for market transformation projects that implement changes to existing regulatory and industry structures. Building codes characterize goals in kilowatt-hours saved per square meter (kWh/m^2), while standards and labeling projects will express savings per unit (e.g., refrigerators, motors) and ask for the number of units to be installed under the project.

The **Demonstration and Diffusion** module is appropriate for: 1) projects that are intended to be used as *a technology demonstration* to strengthen awareness, knowledge, and capacity building, such as a new building with multiple energy efficiency technologies, or a retrofit of a building or a set of buildings; and 2) *diffusion* projects that help to bring about broader use of an energy-efficient technology, such as projects that make a specific energy-efficient technology available at a cheaper price. This module is quite flexible and can be applied for many different types of activity components where savings are estimated based on an expected number of activities or investments.

The **Financial Instruments** module is appropriate for projects that involve investments and financing mechanisms when energy savings may result from discrete activities where the technologies, sectors, or end use may be difficult to predict (e.g., ESCOs or loan instruments), or from replication of pilot and demonstration activities.

Step 3: Model Activity Components

Standards and Labeling Module

In the Standards and Labeling tab the User will find tables for each Activity Component listed under "Standards and Labeling" module in the "Project Info" tab. For each Activity Component, the User should enter several key variables, including:

1) *Target technology*–from drop-down menu the User should choose the fuel used by target technology and displaced technology. The User may overwrite the default in the *User-Specified* column by selecting a fuel from the drop-down menu. Only those fuels selected in the Project Info tab will appear as fuel choices here.

2) *Displaced technology*–the User may overwrite the default displaced technology but must enter the corresponding Power Consumption (in watts for electricity, MJ/hour for other fuels) of the displaced technology in the "Calculate Annual Energy Consumption" table

3) *Useful technology lifetime* in years (less than or equal to the Maximum Lifetime entered in the Project Info tab)

As an example, consider a project on standards and labeling in which LEDs will replace incandescent lighting. While the default "Displaced Technology" associated with a LEDs projects is CFLs, the User can type in any alternative, (in this example, incandescent bulbs). The title "incandescent" will flow through to the Power Consumption row and the value should be updated by the User.

The model contains illustrative default values for more than two dozen efficient technologies, numerous appliances, and industrial motors and boilers, along with values for the corresponding standard technologies that they would displace. Default values are available for: usage hours per year, average power consumption. These values represent estimates for a single developing region at a particular point in time. They provide illustrative starting values that should be replaced, as appropriate, with current values developed for the specific project in question.

For annual energy consumption, the User should choose between:

(Option 1) *allowing the model to calculate annual energy consumption*, OR

(Option 2) *entering the annual energy consumption for the target technology and the displaced technology.*

When using Option 1 (model-calculated energy consumption), the User should enter *power consumption for each technology*, in addition to *technology usage* data. Those values flow through to the following rows, which calculate annual energy consumption. For Option 2, if the annual energy consumption of the target technology and the displaced technology are known, the User should enter them directly in the final rows under "Technology Specifications" table.

The model is designed to represent a *dynamic baseline*, indicating natural adoption of the target technology that would have been happening in the absence of GEF intervention, and the rate of performance improvement for both, the target and the displaced technology. The tables entitled **Market Assumptions, Baseline Assumptions, and Standard/Labeling Project Effectiveness,** contain proxy values to be used in these calculations. Ideally, the User would provide the following inputs:

1) *Annual sales in first year* (expected sales of all units, both the target and displaced technology);
2) *Annual sales growth rate (percentage);*
3) *Market share of target technology in first year;*
4) *Baseline annual increase in target technology market share;*
5) *Annual reduction in energy consumption for the target technology;*
6) *Annual reduction in energy consumption for the displaced technology;*

In addition, the model accounts for standards project effectiveness with the following inputs:

1) *Year the standard is put in place;*
2) *Percent compliance with new standard*

In the table entitled "Annual Inputs and Calculations" (for which the User should scroll to the right), the top row shows the total units of the technology (both target and displaced) sold *annually*. These figures are based on *market assumptions*. The total annual sales of the target technology for each year of the project can be entered manually if the actual market share of the target technology is expected to deviate from the values calculated by the model (e.g. if sales in early years are expected to be slower than the average of sales across all project years). The User would input values directly in the row entitled "MARKET Annual Sales (Units)". Once the value in the initial cell has been altered, the subsequent values will auto-update based on the percentage growth rate in Market Assumptions. The User should overwrite all cells in the row to ensure accurate accounting.

Also in the "Annual Inputs and Calculations" table the User can view the tabulation of the project emissions, baseline emissions, and the difference between the two (delta or savings) for each year, along with the cumulative avoided greenhouse gas emissions.

For standards and labeling activities, the module distinguishes *direct* and *direct post-project* impacts, based on the timing of equipment purchase. Energy and emission savings associated with equipment or appliances purchased prior to the date of project close are considered direct project impacts, while those savings associated with purchases after this date are considered direct post-project impacts.

There is no indirect bottom-up calculation for this module. Indirect, spillover benefits from the establishment of standards and labeling, e.g. in the form of more stringent standards or extension to additional products after project close, are best represented through a market potential assessment, and thus are addressed through the top-down indirect calculation (see Step 4 below).

Cumulative and *annual* project results for all components are summarized in the table titled "Results: Standards and labeling Activity Components" directly below the "Project Information" table in the "Standards and Labeling" tab.

Building Codes Module

In the Building Codes tab the User will find tables for each Activity Component listed under "Building Codes" module in the "Project Info" tab. For each Activity Component, the User should enter several key variables, including:

Target technology;

1) *Fuel used;*

2) *Displaced technology;*

3) *Useful technology lifetime (years)*[16]

The User should choose between:

(Option 1) *allowing the model to calculate annual energy consumption,* OR

(Option 2) *entering the annual energy consumption for the target technology and the displaced technology.*

If using Option 1 (model-calculated energy consumption), the User should enter *power consumption* per square meter of building space for each technology.

The model is designed to represent a *dynamic baseline*, indicating natural adoption of the target technology that would have been adopted in the absence of GEF intervention and the rate of performance improvement for both the target and the displaced technology. To do this, the following inputs are required:

1) *Annual floor area affected in first year;*

2) *Annual affected floor area growth rate;*

3) *Market share of target technology in first year;*

4) *Baseline annual increase in target technology market share;*

5) *Annual reduction in energy consumption for the target technology;*

6) *Annual reduction in energy consumption for the displaced technology;*

In addition, the model accounts for effectiveness of the building code project with the following inputs:

1) *Year the building code is put in place;*

2) *Percent compliance with new code*

Finally, the *area of building floor space* to be affected in each year of the project can be entered manually if the actual market share of the target technology is expected to deviate from the values calculated by the model (e.g. if affected area in early years is expected to be slower than the average of affected area across all project years). To enter this data, the User should scroll to the right to the annual data table for each component. To do this, the User should input values directly in the row entitled "Market Annual Sales (Units)". Once the value in the initial cell has been altered, the subsequent values will auto-update based on the percentage growth rate in *market assumptions*. The User should overwrite all cells in the row to ensure accurate accounting.

Also in the "Annual data" table, the User can view the tabulation of the project savings, baseline savings, and the difference between the two (delta) for each year, along with the cumulative avoided greenhouse gas emissions. The building code activities

[16] While some applications such as insulation, thermal breaks and other construction techniques may have lifetimes longer than 20 years, it is important to consider the forecasting difficulties and uncertainty inherent in the results, making it inappropriate to attempt to capture savings from those longer timelines; as is the case with the deviation from any default values, robust documentation should accompany the new values in the notes section of the model.

module distinguishes between *direct and direct post-project* impacts, based on the timing of equipment purchase. Energy and emission savings associated with buildings built or retrofit prior to the date of project close are considered direct project impacts, while those savings associated with purchases after the project close date are considered direct post-project impacts.

There is no indirect bottom-up calculation for this module. Indirect, spillover benefits from the establishment and enforcement for building codes (e.g., in the form of more stringent codes or more effective enforcement) are best represented through a market potential assessment, and thus are addressed through the top-down indirect calculation (see Step 4 below).

Cumulative and *annual* project results for all components are summarized in the table titled "Results: Building Codes Activity Components" directly below the "Project Information" table in the "Standards and Labeling"

Demonstration and Diffusion Module

In the Demonstration and Diffusion tab the User will find tables for each Activity Component listed under "Demonstration and Diffusion" module in the "Project Info" tab. For each Activity Component, the User should enter several key variables, including:

1) *Energy savings per user-specified unit for each fuel* (e.g., per building, foundry, optimization completed, etc). The User may note in the Notes section the unit for which the savings are calculated.
2) *Lifetime of investment* (years);
3) *Baseline assumption* (% of activities implemented absent GEF intervention);
4) *Number of replications post-project as spillover* (necessary for the indirect bottom-up estimate);
5) *Number of units to be installed in each year of the project*.

   To enter the last input, the User should scroll to the right in the spreadsheet. For each component listed in the "Project Info" tab, there is an "Annual Inputs and Calculations" table. The top row of that table (labeled "Project") requires annual input from the User. For each year of the project implementation period, input the number of units that will be installed in each year of the project. This step should be repeated for each component of the project.

For each year, total savings are calculated by the spreadsheet by multiplying the *total units* that have been installed to date (and are still within their useful lives) by the *savings per unit*.

In the "Annual Inputs and Calculations" table the User can also view the *cumulative direct savings* by fuel, the *total cumulative direct savings*, and *the indirect bottom-up savings*.

Cumulative project results (including all components) are also summarized in the table directly below the "Project Information" in the "Demonstration and Diffusion" tab.

Financial Instruments Module

In the Financial Instrument tab the User will find tables for each Activity Component listed under "Financial Instrument" module in the "Project Info" tab. For each Activity Component, the User should enter several key variables, including:

1) *Monetary unit;*
2) *Energy savings for each fuel per user-specified monetary unit;*
3) *Lifetime of investment in years;*
4) *Baseline assumptions, including percent of activities implemented absent GEF intervention;*
5) *Number of replications post-project as spillover;*
6) *Amount of money to be invested in each year of the project.*

   To enter the final input, the User should scroll to the right to view the annual data table for each component.

For each year the total savings are calculated by multiplying the *total monetary amount* that has been invested to date by the *emission savings per investment*.

In the “Annual Data” table, the User can view the tabulation of the project savings, baseline savings, and the difference between the two (delta) for each year, along with the cumulative avoided energy use and greenhouse gas emissions during the project and post-project periods.

Cumulative project results (for all activity components) are also summarized in the table directly below the “Project Information” table in the “Financial Instrument” tab.

For some projects, one project instrument could have different expected investment returns. The current model addresses this issue by allowing multiple components (to be input in the “Project Info” tab) within each module. For example, in the *financial module*, an ESCO that address commercial building efficiency and industrial efficiency could expect a return of 7 MWh per $1,000 invested on the commercial building components and 5 MWh per $1,000 invested on the industrial components. The User might list one component as “ESCO commercial” and the other as “ESCO industrial” in “Project Info” tab.

Step 4: Calculate Indirect Top-Down Impacts

The indirect top-down estimates can be developed in the table on the top of the “Results” tab. Since multiple activity components may target similar technologies, practices, sectors and end-uses, indirect top-down estimates are assessed at the project level, rather than by each Activity Component. To estimate indirect top-down estimates, the User should enter the following two variables:

1) *Total market potential (tCO2).*

   Enter total market potential for CO2 emission reductions, based on market studies or scenario analysis, achievable during the 10 year project influence period after project closure.

2) *Causality factor (CF).*

   Indicate the level of attribution of the GEF intervention to full market

The User should carefully consider and document the expected causality of the GEF project in achieving the full market potential. The User should take intoaccount that some or all market potential may be achieved without a GEF intervention due market forces or government policies beyond those created by the project. For the GEF Causality Factor, five levels of GEF impact and causality are suggested:

Level 5 = 100 %	The GEF contribution is **critical** and nothing would have happened in the baseline.
Level 4 = 80 %	The GEF contribution is **dominant**, but some of this reduction can be attributed to the baseline.
Level 3 = 60 %	The GEF contribution is **substantial, but modest** indirect emission reductions can be attributed to the baseline.
Level 2 = 40 %	The GEF contribution is **modest**, and substantial indirect emission reductions can be attributed to the baseline.
Level 1 = 20 %	The GEF contribution is **weak**, and most indirect emission reductions can be attributed to the baseline.

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, and deviate from the percent values shown above. Users should provide a narrative with reasoning and justification of their choices in the “Notes” section.

Step 5. Review the Results

Once Steps 1-4 have been completed, the User can review and report the total results shown in the “Results” tab. Proponents are suggested to refer to other project documents and reports on energy efficiency, to ensure that results are of the correct order of magnitude according to the scale of project. Given large uncertainties inherent in *ex ante* estimation, the User should also bear in mind that results are shown with more significant digits than warranted.. Therefore, figures should be rounded to no more than 2 significant digits when reporting the results.

Annex 1: Step-by-step explanation of GHG calculations of each module in the methodology using specific project examples

2.1 Standards and Labeling Module

PROJECT TITLE: **LIGHTING MARKET TRANSFORMATION**

COUNTRY: **Peru**

GEF GRANT: **$1,636,000**

CO-FINANCING: **$8,864,000**

DATES OF IMPLEMENTATION: **2011-2015**

The aim of the project is to enhance promotion and implementation of utilization of energy saving lamps (ESLs) through the transformation of the local lighting products market and the phasing-out of incandescent lamp (ILs) imports and sales.

The project consists of two components:

Component 1: Market Development

The barriers concerning the marketing and promotion of ESLs and the phasing out of IL production and sales are planned to be addressed in this project component. Several activities include: (i) substitution of ILs for Compact Fluorescent Light (CFL)s, comprising about 5 million CFLs, (ii) public lighting schemes to promote energy efficiency lighting technologies (substitution of mercury lamps for sodium lamps) and rationalization of lighting schemes, comprising the distribution and installation of about 1 million ESLs.

Component 2: Policy and Institutional Support Program

This component will support transformation of lighting market with a coherent ESL policy in line with Peruvian governmental policies.

Table 1 presents an extended data that were collected during the project concept preparation:

	Unit	**Value**
Maximum Technology / Measure Lifetime	*years*	5
Target Technology		CFL
Displaced Technology		IL
Power Consumption of CFL	*W*	15
Power Consumption of IL	*W*	60
Daily Usage	*Hr/day*	5
Days Used Each Year	*day*	350
Annual Energy Consumption (CFL)	*kW/year*	26
Annual Energy Consumption (IL)	*kW/year*	105
Annual Sales in Year 2011	*units*	42,612,000
Annual Sales Growth Rate	*%*	2.7
Market Share of CFL in Year 2011	*%*	20.2
Baseline Annual Increase in Market Share of CFL	*%*	1.66
Annual Reduction in Energy Consumption (CFL)	*%*	0

Annual Reduction in Energy Consumption (IL)	*%*	1
Year Standard in Force	*year*	2015
Percent New Sales Compliant with the Standard	*%*	100

Step 1. Enter Project Information in "Project Info" tab.

The Guide provides explanation for the cell colors:

User-input cells

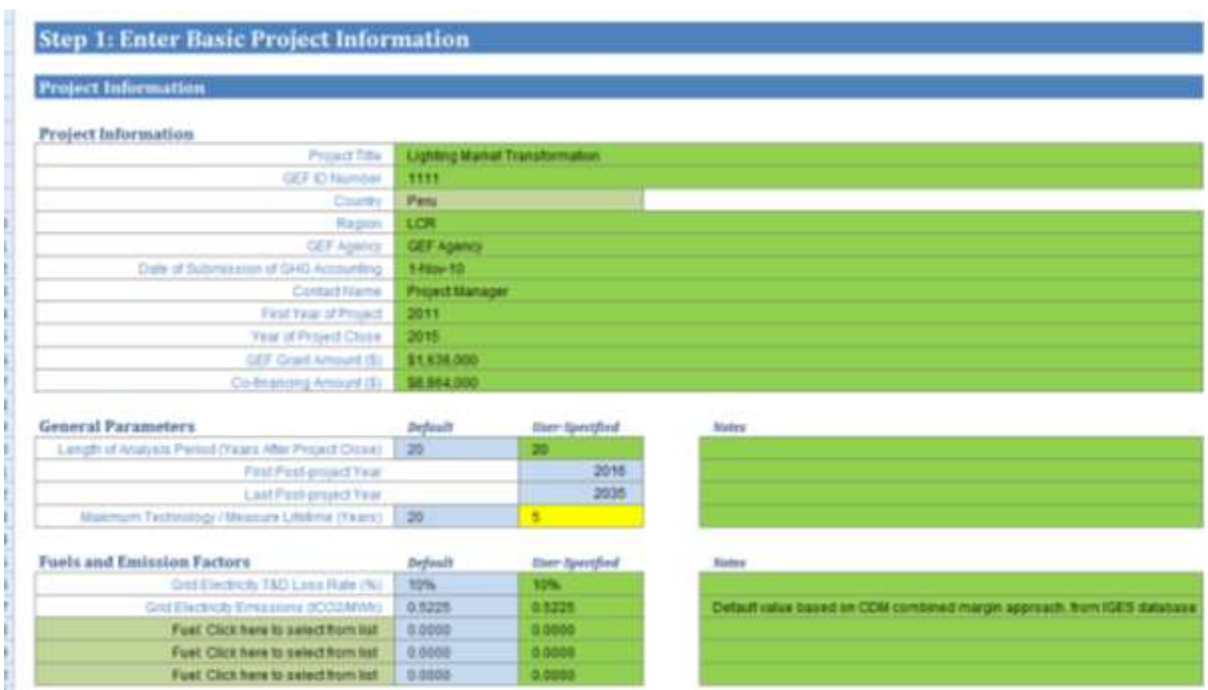
User-input cells with a pull-down menu

User-input cells that differ from default values

Cells not intended for User input

Cells not appropriate for input or output

Once the country name is entered, the region the country is part of will show up.


Step 1: Enter Basic Project Information

Project Information

Project Information

Project Title	Lighting Market Transformation
GEF ID Number	1111
Country	Peru
Region	LCR
GEF Agency	GEF Agency
Date of Submission of GHG Accounting	1-Nov-10
Contact Name	Project Manager
First Year of Project	2011
Year of Project Close	2015
GEF Grant Amount ($)	$1,636,000
Co-financing Amount ($)	$8,864,000

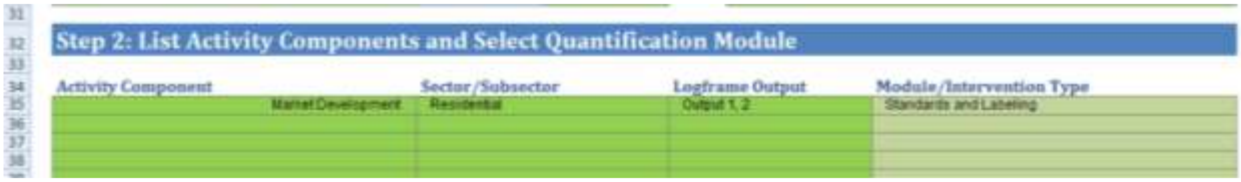
General Parameters	Default	User Specified	Notes
Length of Analysis Period (Years After Project Close)	20	20	
First Post-project Year		2016	
Last Post-project Year		2035	
Maximum Technology / Measure Lifetime (Years)	20	5	

Fuels and Emission Factors	Default	User Specified	Notes
Grid Electricity T&D Loss Rate (%)	10%	10%	
Grid Electricity Emissions (tCO2/MWh)	0.5225	0.5225	Default value based on CDM combined margin approach, from IGES database
Fuel: Click here to select from list	0.0000	0.0000	
Fuel: Click here to select from list	0.0000	0.0000	
Fuel: Click here to select from list	0.0000	0.0000	

Step 2. List Activity Components and Select Quantification Module

In "Project Info" tab, he User should list quantifiable Activity Components in the table. Both project components contribute to one activity component.

In the next step the User selects a module that best fits the Activity Component from the drop down menu on the right. In this case, it is "Standards and Labeling" module.

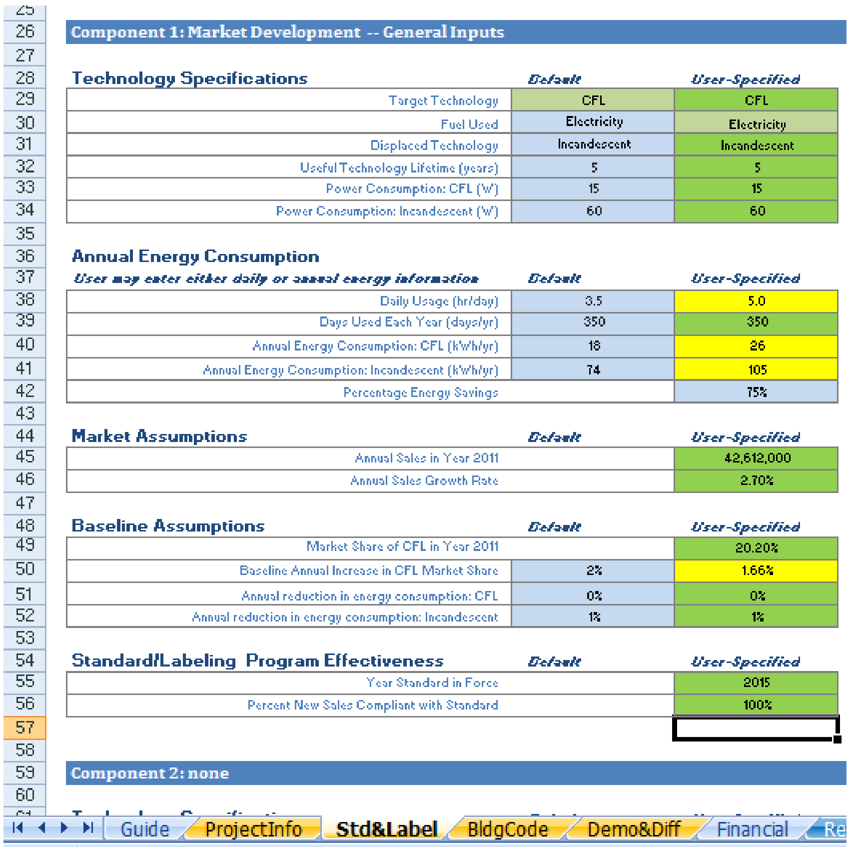


Step 2: List Activity Components and Select Quantification Module

Activity Component	Sector/Subsector	Logframe Output	Module/Intervention Type
Market Development	Residential	Output 1, 2	Standards and Labeling

Step 3. Model Activity Components

The next step is to enter the required variables for the Activity Component.



Component 1: Market Development -- General Inputs

Technology Specifications	Default	User-Specified
Target Technology	CFL	CFL
Fuel Used	Electricity	Electricity
Displaced Technology	Incandescent	Incandescent
Useful Technology Lifetime (years)	5	5
Power Consumption: CFL (W)	15	15
Power Consumption: Incandescent (W)	60	60

Annual Energy Consumption *User may enter either daily or annual energy information*	Default	User-Specified
Daily Usage (hr/day)	3.5	5.0
Days Used Each Year (days/yr)	350	350
Annual Energy Consumption: CFL (kWh/yr)	18	26
Annual Energy Consumption: Incandescent (kWh/yr)	74	105
Percentage Energy Savings		75%

Market Assumptions	Default	User-Specified
Annual Sales in Year 2011		42,612,000
Annual Sales Growth Rate		2.70%

Baseline Assumptions	Default	User-Specified
Market Share of CFL in Year 2011		20.20%
Baseline Annual Increase in CFL Market Share	2%	1.66%
Annual reduction in energy consumption: CFL	0%	0%
Annual reduction in energy consumption: Incandescent	1%	1%

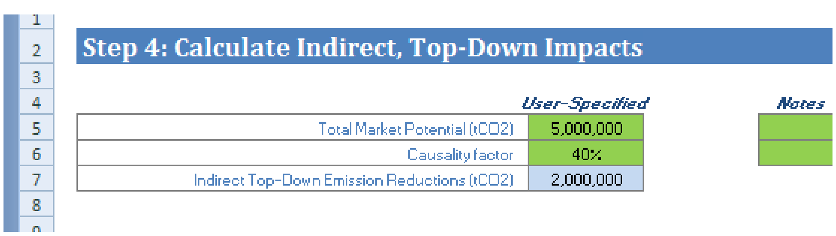
Standard/Labeling Program Effectiveness	Default	User-Specified
Year Standard in Force		2015
Percent New Sales Compliant with Standard		100%

Component 2: none

Guide | ProjectInfo | Std&Label | BldgCode | Demo&Diff | Financial | Re

Step 4. Calculate Indirect Top-Down Impacts

Enter Total Market Potential in tonnes of CO_2 and the Causality Factor of the project in the "Results" tab.



Step 4: Calculate Indirect, Top-Down Impacts

	User-Specified	Notes
Total Market Potential (tCO2)	5,000,000	
Causality factor	40%	
Indirect Top-Down Emission Reductions (tCO2)	2,000,000	

Step 5. Review Overall Results

The results table in the "Results" tab shows overall results for all modules (or all activity components). In case of this project, the results table shows the results of quantification the Standards and Labeling module as it is the module that was used to quantify the impacts of the project components.

The results of the GHG emissions reduction show:

- **Direct** emission reductions achieved during the project length;
- **Direct Post-Project** emission reductions achieved during project influence period of 20 years after the project close date;
- **Indirect Top-Down** reductions achieved through the causal influence of project at the national level.

Step 5: Review the Results

Overall Results

All Components	Cumulative			Annual			
	Total	*2011-2015*	*2016-2035*	*2011*	*2015*	*2025*	*2035*
Direct Electricity Savings (MWh)	12,938,069	2,587,614	10,350,455	0	2,587,614	0	0
N/A	0	0	0	0	0	0	0
N/A	0	0	0	0	0	0	0
N/A	0	0	0	0	0	0	0
Direct Total Energy Savings (GJ)	**46,577,048**	9,315,410	37,261,639	0	9,315,410	0	0
Direct GHG Emission Savings (tCO2)	**7,436,318**	1,487,264	5,949,054	0	1,487,264	0	0
Direct Post-project GHG Emission Savings (tCO2)	**117,448,241**		117,448,241	0	0	6,741,671	5,511,857
Indirect Bottom-up Emission Savings (tCO2)	**0**		0				
Indirect Top-down Emission Savings (tCO2)	**2,000,000**		2,000,000				

2.2 Building Codes Module

PROJECT TITLE: **ENERGY EFFICIENT BUILDING CODES**

COUNTRY: **Syria**

GEF GRANT: **$3,450,000**

CO-FINANCING: **$11,500,000**

DATES OF IMPLEMENTATION: **2010 - 2014**

PROJECT DESCRIPTION

The project objective is to reduce GHG emissions through implementation of energy efficient building codes for new construction in Syria. The project has a goal to establish new Building Code that is expected to set minimum standards for buildings' heating and cooling demand only, thereby primarily affecting the energy consumption of space heating, air-conditioning and ventilation.

Table 1 presents an extended data that were collected during the project concept preparation:

	Unit	Value
New Construction in 2010-2015	*mill.* m^2	107
Average Construction Growth Rate	*%*	15
Grid Electricity Emission Factor[17]	*t* CO_2*/MWh*	0.712
Share of new building area in compliance with BC	*%*	5
New area in compliance with BC	*mill.* m^2	5.355
Average baseline heat demand for space heating (covering 80% of the total area)	*kWh/*m^2	127
Annual Reduction in Baseline Energy Consumption for Heating	*%*	4
Assumed new building code (BC) requirement for space heating	*kWh/*m^2	51
Average baseline electricity consumption for AC&V (covering 60% of total area)	*kWh/*m^2	17
Annual Reduction in Baseline Energy Consumption for Cooling	*%*	1
Assumed new BC requirement for cooling	*kWh/*m^2	11

Step 1. Enter Project Information in "Project Info" tab

The Guide provides explanation for the cell colors:

(green cell)	*User-input cells*

[17] For the grid emission factor, a gradual reduction from 0.824 kgCO_2eq/kWh in 2007 (calculated on the basis of the reported fuel consumption of the Syrian power plants and the net electricity consumption in 2007 as per the latest IEA annual statistics and the 2006 IPCC emission factors for different fuels) to around 0.60 kgCO_2eq/kWh in 2030 is expected from a gradual improvement of the power generation and distribution efficiency and the share of different fuels in power generation. The model allows to enter to enter a static emission factor in the "Project Info" tab. Thus, we will enter the average of two emission factors, 0.712 kgCO_2eq/kWh.

User-input cells with a pull-down menu

User-input cells that differ from default values

Cells not intended for User input

Cells not appropriate for input or output

Once the country name is entered, the region the country is part of will show up.

Step 1: Enter Basic Project Information

Project Information

Project Information	
Project Title	Energy Efficient Building Codes
GEF ID Number	2222
Country	Syria
Region	MNA
GEF Agency	GEF Agency
Date of Submission of GHG Accounting	1-Nov-09
Contact Name	Project Manager
First Year of Project	2010
Year of Project Close	2015
GEF Grant Amount ($)	$3,450,000
Co-financing Amount ($)	$11,500,000

General Parameters	Default	User Specified	Notes
Length of Analysis Period (Years After Project Close)	20	20	
First Post-project Year		2016	
Last Post-project Year		2035	
Maximum Technology / Measure Lifetime (Years)	20	20	

Fuels and Emission Factors	Default	User-Specified	Notes
Grid Electricity T&D Loss Rate (%)	10%	10%	
Grid Electricity Emissions (tCO2/MWh)	N/A	0.7120	Default value not available; please enter value
Fuel: Click here to select from list	0.0000	0.0000	
Fuel: Click here to select from list	0.0000	0.0000	
Fuel: Click here to select from list	0.0000	0.0000	

Step 2. List Activity Components and Select Quantification Module

In "Project Info" tab, he User should list quantifiable Activity Components in the table. In this case, project components contribute to two activity components – space heating and space cooling.

In the next step the User selects a module that best fits the Activity Component from the drop down menu on the right. In this case, it is "Standards and Labeling" module.

Step 2: List Activity Components and Select Quantification Module

Activity Component	Sector/Subsector	Logframe Output	Module/Intervention Type
Building Code Space Heating	Residential and Commercial	Output 1	Building Codes
Building Code Space Cooling	Residential and Commercial	Output 2	Building Codes

Step 3. Model s

The next step is to enter the required variables for the both Activity Components. First, enter the required data for Space Heating Activity Component under 'Component 1: Building Code Space Heating – General Inputs" table in the "Building Code" tab.

Component 1: Building Code Space Heating – General Inputs			
Market Assumptions	*Default*	*User-Specified*	*Notes*
Floor Area (m2) Subject to Code Built in Year 2010		5,355,000	
Annual Construction Growth Rate		15%	
Programme Assumptions	*Default*	*User-Specified*	*Notes*
Annual Electricity Consumption (kWh/m2)		91	

Year Building Code in Force		2014	
Percent New Square Meters Built Compliant with Code		50%	Increases to 80% by 2025
Baseline Assumptions	*Default*	*User-Specified*	*Notes*
Annual Electricity Consumption (kWh/m2)		127	

Percent of Square Meters Built at Code Level Without Programme		0%	
Annual Reduction in Baseline Energy Consumption	2%	4%	

Then enter the required data for Space cooling Activity Component under "Component 2: Building Code Space Cooling – General Inputs" table in the "Building Code" tab.

Component 2: Building Code Space Cooling – General Inputs			
Market Assumptions	*Default*	*User-Specified*	*Notes*
Floor Area (m2) Subject to Code Built in Year 2010		5,355,000	
Annual Construction Growth Rate		15%	
Programme Assumptions	*Default*	*User-Specified*	*Notes*
Annual Electricity Consumption (kWh/m2)		11	

Year Building Code in Force		2014	
Percent New Square Meters Built Compliant with Code		50%	
Baseline Assumptions	*Default*	*User-Specified*	*Notes*
Annual Electricity Consumption (kWh/m2)		11	

Percent of Square Meters Built at Code Level Without Programme		0%	
Annual Reduction in Baseline Energy Consumption	2%	1%	

Step 4. Calculate Indirect Top-Down Impacts

In the "Results" tab of the spreadsheet, enter total market potential for CO_2 and the Causality factor.

Step 4: Calculate Indirect, Top-Down Impacts		
	User-Specified	*Notes*
Total Market Potential (tCO2)	10,000,000	
Causality factor	60%	
Indirect Top-Down Emission Reductions (tCO2)	6,000,000	

Step 5. Review Overall Results

The results table in the "Results" tab shows the overall results for all modules. In case of this project, the results table shows the results of the two components listed under "Building Codes".

The results of the GHG emissions reduction show:

- **Direct** emission reductions are achieved from the adoption of the requirement for new Building Code for construction activities starting the year when the code is in force.
- **Direct Post-Project** emission reductions are direct reduction achieved after project close date.
- **Indirect Top-Down** emission reductions are achieved from the building code enforcement for the period after the project close date.
- There are no Indirect Bottom-Up emission reductions from Building Codes project.

Step 5: Review the Results

Overall Results

All Components	Cumulative			Annual			
	Total	*2010-2015*	*2016-2035*	*2010*	*2015*	*2025*	*2035*
Direct Electricity Savings (MWh)	103,525,211	815,628	102,709,583	0	602,108	602,108	602,108
N/A	1,133,473	77,747	1,055,726	0	0	0	0
N/A	0	0	0	0	0	0	0
N/A	0	0	0	0	0	0	0
Direct Total Energy Savings (GJ)	**373,824,234**	3,014,008	370,810,226	0	2,167,590	2,167,590	2,167,590
Direct GHG Emission Savings (tCO2)	**10,131,116**	699,692	9,431,424	0	471,571	471,571	471,571
Direct Post-project GHG Emission Savings (tCO2)	**64,829,810**		64,829,810	0	0	3,218,163	5,668,890
Indirect Bottom-up Emission Savings (tCO2)	**0**		0				
Indirect Top-down Emission Savings (tCO2)	**6,000,000**		6,000,000				

2.3 Demonstration and Diffusion Module

PROJECT TITLE: **PROMOTING ENERGY EFFICIENCY AND RENEWABLE ENERGY IN SELECTED MICRO, SMALL AND MEDIUM ENTERPRISES CLUSTERS**

COUNTRY: **India**

GEF GRANT: **$2,000,000**

CO-FINANCING: **$7,200,000**

DATES OF IMPLEMENTATION: **2010 - 2014**

PROJECT DESCRIPTION

The aim of the project is to develop and promote market environment for introducing energy efficiencies in process applications in five sectors (ceramic production, hand tool production, foundries, brass production, and dairy production) with a goal of scaling up activities to a nation-wide level in order to reduce energy usage per unit of product, improve the productivity and competitiveness of units, and reduce overall carbon emissions/improve the local environment.

Table 1 presents an extended data that were collected during the project concept preparation:

Industry	Baseline Annual CO_2e Annual Savings	Number of possible implementations	Energy saved (MWh)per implementation
Brass	60	28	117
Ceramics	0	57	2710
Dairy	0	26	3726
Foundry	3048	52	164 (80 MWh of electricity and 302 GJ of coke)
Hand Tools	0	22	69

Step 1. Enter Project Information in "Project Info" tab

The Guide provides explanation for the cell colors:

User-input cells

User-input cells with a pull-down menu

User-input cells that differ from default values

Cells not intended for User input

Cells not appropriate for input or output

Once the country name is entered, the region the country is part of will show up.

Step 1: Enter Basic Project Information

Project Information

Project Information	
Project Title	Promoting Energy Efficiency and Renewable Energy in Selected Micro, Small and Medium Enterprises Clusters
GEF ID Number	3333
Country	India
Region	SAR
GEF Agency	GEF Agency
Date of Submission of GHG Accounting	1-Nov-09
Contact Name	Project Manager
First Year of Project	2010
Year of Project Close	2015
GEF Grant Amount ($)	$2,000,000
Co-financing Amount ($)	$7,200,000

General Parameters	*Default*	*User-Specified*	*Notes*
Length of Analysis Period (Years After Project Close)	20	20	
First Post-project Year		2016	
Last Post-project Year		2035	
Maximum Technology / Measure Lifetime (Years)	20	20	

Fuels and Emission Factors	*Default*	*User-Specified*	*Notes*
Grid Electricity T&D Loss Rate (%)	10%	10%	
Grid Electricity Emissions (tCO2/MWh)	0.8780	0.8780	Default value based on CDM combined margin approach, from IGES databas
Metalurgical Coke (tCO2/GJ)	0.1070	0.1070	Default value based on IPCC (2006)
Fuel: Click here to select from list	0.0000	0.0000	
Fuel: Click here to select from list	0.0000	0.0000	

Step 2. List Activity Components and Select Quantification Module

In "Project Info" tab, he User should list quantifiable Activity Components in the table. Five activities within one project component will contribute to 5 Activity Components.

In the next step the User selects a module that best fits each Activity Component from the drop down menu on the right. In this case, all five activity component fit "Demonstration and Diffusion" module.

Step 2: List Analysis Components and Select Quantification Module

Analysis Component	Sector/Subsector	Logframe Output	Module/Intervention Type
Brass	Industrial	Output 1	Demonstration & Diffusion
Ceramics	Industrial	Output 2	Demonstration & Diffusion
Dairy	Industrial	Output 3	Demonstration & Diffusion
Foundry	Industrial	Output 4	Demonstration & Diffusion
Hand Tools	Industrial	Output 5	Demonstration & Diffusion

Step 3. Model Activity Components

Now when all 5 components are listed in the table, the next step is to enter the required variables for each Activity Component in "Demonstration and Diffusion" tab.

For each component, list required project data, including:

- Electricity and coke savings (MWh) per Best Operating Practice,
- Useful Lifetime of the Investment,
- Percent of Activities Implemented in the Baseline,
- Number of Replications Post-Project as Spillover

For the first Activity Component "Brass", enter the required data as follows:

Component 1: Brass -- General Inputs			
Component Specifications	*Default*	*User-Specified*	*Per Unit*
Annual Electricity Savings (MWh)		117	Best Operating Practice
Annual Metalurgical Coke Savings (GJ)			

Useful Lifetime of Investment	15	15	
Baseline Assumptions	*Default*	*User-Specified*	
Percent of Activities Implemented in the Baseline	10%	5%	
Indirect Bottom-up Estimate	*Default*	*User-Specified*	
Number of Best Operating Practices Implemented During Project Period		28	
Number of Replications Post-project as Spillover		3	
Total		84	

For the Number of Operating Practices, enter annual data in “Annual Inputs and Calculations” table located to the right.

Component 1: Brass -- Annual Inputs and Calculations

		2010	2011	2012	2013	2014	2015	2016
PROGRAMME	Best Operating Practice(s) in Year	5	5	5	5	5	3	
BASELINE	Best Operating Practice(s) in Year	0	0	0	0	0	0	
NET	Cumulative Best Operating Practice(s) in Place	5	10	15	20	25	28	28
DIRECT SAVINGS	Annual Electricity Savings (MWh)	585	1,170	1,755	2,340	2,925	3,276	3,276
	Annual Metalurgical Coke Savings (GJ)	0	0	0	0	0	0	0
	---	0	0	0	0	0	0	0
	---	0	0	0	0	0	0	0

TOTALS	Direct Energy Avoided 2010-2015 (GJ)	43,384	Direct GHG Avoided 2010-2015 (tCO2)	11,838
	Direct Energy Avoided 2016-2035 (GJ)	133,520	Direct GHG Avoided 2016-2035 (tCO2)	36,819
	Direct Post-project Energy Avoided 2016-2035 (GJ)	0	Direct Post-project GHG Avoided 2016-2035 (tCO2)	0

INDIRECT BOTTOM-UP SAVINGS	2016-2035	142,371 tCO2

Repeat Step 3 for the rest four Activity Components.

Step 4. Calculate Indirect Top-Down Impacts

In the ‘Results” tab enter Total Market for CO_2 in tonnes and the Causality Factor for the project.

Step 4: Calculate Indirect, Top-Down Impacts

	User-Specified	*Notes*
Total Market Potential (tCO2)	6.23	
Causality factor	60%	
Indirect Top-Down Emission Reductions (tCO2)	3.74	

Step 5. Review Overall Results:

The results table in the “Results” tab shows the overall results for all modules. In case of this project, the results table shows the results of five Activity Components that are part of one project component.

The results of the GHG emissions reduction show:

- **Direct** emission reductions are achieved from the adoption of the requirement for new Building Code for construction activities starting the year when the code is in force.
- There are no Indirect Bottom-Up emission reductions achieved after project close date through a replication of project results.
- **Indirect Top-Down** emission reductions are achieved from causal influence of the period after the project close date.

Step 5: Review the Results

Overall Results

All Components	Cumulative			Annual			
	Total	*2010-2015*	*2016-2035*	*2010*	*2015*	*2025*	*2035*
Direct Electricity Savings (MWh)	3,873,300	963,085	2,910,215	46,991	258,220	211,229	0
Direct Metalurgical Coke Savings (GJ)	117,780	30,502	87,278	1,510	7,852	6,342	0
N/A	0	0	0	0	0	0	0
N/A	0	0	0	0	0	0	0
Direct Total Energy Savings (GJ)	**14,061,660**	3,497,608	10,564,052	170,678	937,444	766,766	0
Direct GHG Emission Savings (tCO2)	**3,753,246**	933,364	2,819,882	45,543	250,216	204,673	0
Direct Post-project GHG Emission Savings (tCO2)	**0**		0	0	0	0	0
Indirect Bottom-up Emission Savings (tCO2)	**11,259,738**		11,259,738				
Indirect Top-down Emission Savings (tCO2)	**4**		4				

2.4 Financial Instruments Module

PROJECT TITLE: **PROMOTING AND STRENGTHENING AN ENERGY EFFICIENCY MARKET IN THE INDUSTRY SECTOR IN CHILE**

COUNTRY: **Chile**

GEF GRANT: **$2,450,000**

CO-FINANCING: **$9,000,000**

DATES OF IMPLEMENTATION: **2009-2011**

PROJECT DESCRIPTION

The aim of the project is to promote and strengthen energy efficiency in the industry sector in Chile through establishment of the basis for the development of energy efficiency market. The project builds on pilot projects implemented in previous GEF projects that focused on retrofit and optimization of common industrial and commercial energy-intensive systems (refrigerator, industrial compressed air, boiler & steam distribution, and Heating Ventilation and Air-Conditioning (HVAC)).

The project consists of two components:

Component 1: Partial Guarantee Fund for Energy Service Companies (ESCOs).

Component 2: Technical assistance to overcome the lack of information about energy efficiency in the industrial sector.

Both components will use investment funds to implement a financing mechanism to support the development of energy efficiency projects. These investments will be targeted towards small and medium industrial enterprises in sub-sectors, which will have been identified during project preparation for its strong demonstration and impact potential.

Table 1 presents an extended data that were collected during the project concept preparation:

	Unit	Value
Investment Unit	*$*	1000
Electricity Savings per 1000$	*MWh*	0.81
Diesel savings per 1000$	*GJ*	1.57
Useful Lifetime of Investment	*years*	10
Fraction of Investments/Projects Likely to Occur in BAU	*%*	10
Number of ($1000) implemented during the project period	*$*	2,450
Replication factor		2
Average Load Duration	*years*	5
Average Total Fund Operation (years from project start)	*years*	10
Post-project Leakage Rate	*%*	10
Total Market Potential	*t CO_2*	6,482,077
Causality Factor	*%*	20

Step 1. Enter Project Information in "Project Info" tab

The Guide provides explanation for the cell colors:

User-input cells

User-input cells with a pull-down menu

User-input cells that differ from default values

Cells not intended for User input

Cells not appropriate for input or output

Once the country name is entered, the region the country is part of will show up.

Project Information

Project Information			
Project Title	Promoting and strengthening an Energy Efficiency market in the industry sector		
GEF ID Number	4444		
Country	Chile		
Region	LCR		
GEF Agency	GEF Agency		
Date of Submission of GHG Accounting	1-Nov-08		
Contact Name	Project Manager		
First Year of Project	2009		
Year of Project Close	2011		
GEF Grant Amount ($)	$2,450,000		
Co-financing Amount ($)	$9,000,000		
General Parameters	*Default*	*User-Specified*	*Notes*
Length of Analysis Period (Years After Project Close)	20	20	
First Post-project Year		2012	
Last Post-project Year		2031	
Maximum Technology / Measure Lifetime (Years)	20	20	
Fuels and Emission Factors	*Default*	*User-Specified*	*Notes*
Grid Electricity T&D Loss Rate (%)	10%	10%	
Grid Electricity Emissions (tCO2/MWh)	0.5219	0.5219	Default value based on CDM combined margin approach, from IGES databas
Diesel (tCO2/GJ)	0.0741	0.0741	Default value based on IPCC (2006)
			#N/A
Fuel: Click here to select from list	0.0000	0.0000	

Step 2. List Activity Components and Select Quantification Module

In "Project Info" tab, he User should list quantifiable Activity Components in the table. Both project components contribute to one Activity Component.

In the next step the User selects a module that best fits the Activity Component from the drop down menu on the right. In this case, it is "Financial Instrument" module.

Step 2: List Activity Components and Select Quantification Module

Activity Component	Sector/Subsector	Logframe Output	Module/Intervention Type
ESCO for Funds	Industrial and Commercial	Output 1	Financial Instrument

Step 3. Model Activity Components

The next step is to enter the required variables for the Activity Component.

Investment unit for the financial instrument is the monetary unit for which the User enters energy savings. In this case, we chose to use "$1,000" as an Investment Unit.

For Indirect Bottom-Up Estimates, the User should enter annual investments during the project period in the table titled "Annual Investments and Calculations" located to the right of Component 1 table. The sum of years of investment will appear in the blue cell in "Indirect Bottom-Up Estimate".

Component 1: ESCO for Funds -- General Inputs

Instrument Specifications	Default	User-Specified
Investment Unit (e.g. $1M, rupee)		$1000
Electricity Savings per $1000 (MWh)		0.81
Diesel Savings per $1000 (GJ)		1.57
N/A Savings per $1000 (GJ)		

Useful Lifetime of Investment	15	10

Baseline Assumptions	Default	User-Specified
Fraction of Investments/Projects Likely to Occur in BAU	10%	10%

Indirect Bottom-up Estimate	Default	User-Specified
Number of $1000 Implemented During Project Period		2,450
Number of Replications Post-project as Spillover		2
Total		4,900

Post-Project Benefits -- Use only for Revolving Funds	Default	User-Specified
Average Loan Duration (years)		5
Average Total Fund Operation (years from project start)	10	10
Post-Project Leakage Rate		15%
Fund Investment After Project Close ($)		2,083
Turnover Factor		0.85

Component 2: none

Guide | ProjectInfo | Std&Label | BldgCode | Demo&Diff | Financial | Results | Fuels

Step 4. Calculate Indirect Top-Down Impacts

Enter Total Market Potential in tonnes CO_2 and the causality factor of the project in the "Results" tab.

Step 4: Calculate Indirect, Top-Down Impacts

	User-Specified	Notes
Total Market Potential (tCO2)	6,482,077	
Causality factor	20%	
Indirect Top-Down Emission Reductions (tCO2)	1,296,415	

Step 5. Review Overall Results

The results table in the "Results" tab shows the overall results for all modules. In case of this project, the results table shows the results listed under "Financial Instrument" activity component.

The results of the GHG emissions reduction show:

- **Direct** emission reductions are achieved from the establishment of partial guarantee fund for ESCOs.
- **Direct Post-Project** emission reduction that are achieved for the period after project through the revolving fund.
- **Indirect Bottom-Up** emission reductions achieved after project close date through a replication of project results.
- **Indirect Top-Down** emission reductions are achieved from causal influence of the period after the project close date.

Step 5: Review the Results

Overall Results

All Components	Cumulative			Annual			
	Total	2009-2011	2012-2031	2009	2011	2025	2035
Direct Electricity Savings (MWh)	17,861	3,572	14,288	595	1,786	0	0
Direct Diesel Savings (GJ)	34,619	6,924	27,695	1,154	3,462	0	0
Direct N/A Savings (GJ)	0	0	0	0	0	0	0
N/A	0	0	0	0	0	0	0
Direct Total Energy Savings (GJ)	98,916	19,783	79,133	3,297	9,892	0	0
Direct GHG Emission Savings (tCO2)	12,819	2,564	10,255	427	1,282	0	0
Direct Post-project GHG Emission Savings (tCO2)	10,896		10,896	0	0	0	0
Indirect Bottom-up Emission Savings (tCO2)	28,486		28,486				
Indirect Top-down Emission Savings (tCO2)	1,296,415		1,296,415				

Annex 2: Additional Methodologies and Resources for Quantification of GHG Emission Reductions from Energy Efficiency Projects

The revised GEF EE methodology provides several improvements to the quantification of GHG benefits in EE projects, but there are other methodologies that are either more detailed and sophisticated, or more appropriate for other project contexts. These methodologies may be of interest to project proponents as additional resources for alternative estimation methods when algorithms allow to satisfy GEF requirements or for potential default values.

Table **2** lists several of these methodologies and resources. For example, though tailored to standards and labeling projects, the technology/end-use assessment framework in the product prioritization tool created by the Collaborative Labeling & Appliance Standards Program (CLASP) could be extendable to other interventions, and contains potentially useful default values (unit energy consumption, usage characteristics, equipment type) and simplified stock model algorithms.

CDM project databases and methodologies (e.g., AMS-II.J, AMS-II.E.) could provide defaults for country-specific grid electricity factors (combined margin), transmission and distribution (T&D) losses, and lamp usage hours. The Bottom-Up Energy Analysis System (BUENAS) model could lend default values for average equipment lifetimes and autonomous improvement rates.[18] Defaults can also be derived from existing GEF *ex ante* estimates, in instances where the emission reduction calculations exemplify best practices. A useful approach to assess the likelihood of achieving potentials could be to develop discount factors, for example, by comparing prior GEF *ex post* and *ex ante* analyses (where similar methodologies were used for both).

Table 2. Other GHG accounting methodologies and tools for energy efficiency projects[19]

Methodology / Tool	Description / Applicability
Clean Development Mechanism (CDM) Baseline and Monitoring Methodologies	Includes several methodologies and tools applicable to energy efficiency projects and for grid electricity factors for CDM host countries. Potential source of additional algorithms and standardized data and assumptions.
Manual for Calculating GHG Benefits of GEF Transportation Projects & models[20]	Example of a modeling tool to assist with other GHG project types.
GHG Protocol for Grid-Connected Electricity Projects[21]	Guidelines for calculating grid emissions factors.
CLASP Guidebook and calculation tools[22]	Guidelines for establishing and evaluating EE S&L programs and impacts. Tools for assessing policies and measures, including codes and standards. Region-specific default values.
"Appraisal of policy instruments for reducing buildings' CO_2 emissions"[23]	A review of policy instruments for buildings; not EE-specific.
Bottom-up Energy Analysis System (BUENAS) model developed by	A well-developed forecasting model for projecting baseline energy demands and emission savings from buildings and appliances.

[18] Work is currently underway to improve the baseline improvement rates in BUENAS.

[19] The list provided is not intended to be complete as new methodologies and tools are becoming regularly available.

[20] ITDP (2010). *Manual for Calculating Greenhouse Gas Benefits of Global Environment Facility Transportation Projects*. Prepared for the Scientific and Technical Advisory Panel of the Global Environment Facility. New York, NY: Institute for Transportation and Development Policy and available at: http://stapgef.org/greenhouse-gas-benefits-of-gef-projects and Clean Air Initiative for Asian Cities (CAI-Asia), Institute for Transportation and Development Policy (ITDP), and Cambridge Systematics, Inc. *Transport Emissions Evaluation Models for Projects (TEEMP)*.

[21] World Resources Institute and World Business Council for Sustainable Development (2007). *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects*. Washington, DC.

[22] Wiel, S., andMcMahon J. (2005) *Energy-Efficiency Labels and Standards: A Guidebook for Appliances, Equipment, and Lighting*. 2nd Edition. Washington, D.C.: Collaborative Labeling and Appliance Standards Program (CLASP).

[23] Ürge-Vorsatz, D, Koeppel S., and Mirasgedis S. (2007). *Appraisal of Policy Instruments for Reducing Buildings' CO2 Emissions*. Building Research & Information 35 (August): 458–477. doi:10.1080/09613210701327384.

Methodology / Tool	Description / Applicability
LBNL[24]	
CLASP Policy Analysis Modeling System[25]	Free access software tool designed to assess the benefits of standards and labeling programs, and to identify the most attractive targets for appliances and efficiency levels.
IFC Carbon Emissions Estimator Tool[26]	For estimating IFC project emissions; can compare with alternative project. Detailed calculations for gross emissions (e.g., specific types of equipment, refrigerant types); includes construction.
IFC Edge Green Buildings Certification System[27]	Provides user-friendly interface for a set of country-specific calculations to assess building performance over time.
IPCC Fourth Assessment Report, WGIII[28,29]	Ch. 6: Residential and Commercial Buildings; Ch. 7: Industry

[24] McNeil, M., Letschert V,, de la Rue du Can S. (2008). *Global Potential of Energy Efficiency Standards and Labeling Programs*. Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division. The Collaborative Labeling and Appliance Standards Program (CLASP).

[25] Available at: http://www.clasponline.org/en/ResourcesTools/Tools/PolicyAnalysisModelingSystem

[26] Available at: http://www1.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/CB_Home/Policies+and+Tools/GHG_Accounting

[27] Available at: http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/cb_home/sectors/green+buildings/edge

[28] Levine, M., Ürge-Vorsatz D., Blok K., Geng L., Harvey D., Lang S., Levermore G., Mehlwana A., Mirasgedis S., Novikova A., Rilling J., Yoshino H.. (2007). *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Residential and Commercial Buildings. In Climate Change 2007: Mitigation. . Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[29] Bernstein, L., Roy J., Delhotal K., Harnisch J., Matsuhashi R., Price L., Tanaka K.,. Worrell E, Yamba F., Fengqi Z.(2007). *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* Industry. In Climate Change 2007: Mitigation.. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.