Methodology Guidebook

for the Assessment of Investment and Financial Flows to Address Climate Change

Version 1.0

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The analysis of investment and financial flows (I&FF) for greenhouse gas mitigation and climate change adaptation is an important activity for the development of effective and appropriate national responses to climate change. This Methodology Guidebook was prepared to support countries participating in the UNDP global project, "*Capacity Development for Policy Makers To Address Climate Change*." The project seeks not only to strengthen policy making capacity in participating countries, but also to enable those countries to produce analytical results that could serve as inputs to negotiating positions under the United Nations Framework Convention on Climate Change (UNFCCC). The project has been launched and will run in parallel with the "Bali Action Plan" process – the UNFCCC negotiations on long-term cooperative action on climate change set to conclude in December 2009 in Copenhagen at the fifteenth Conference of the Parties.

This Guidebook was initiated in response to the need for developing countries to have a clear approach for conducting national I&FF assessments that duly accounts for national circumstances, capacities, and resources. This version of the document has been prepared to carry out the initial assessments with the first countries in the UNDP project, and will be continually reviewed regarding its user-friendliness, feasibility of implementation, and sectoral scope. We hope that it can be a useful resource for countries not participating in the UNDP project as well.

Please note that this is a living document, which will be improved based upon the experiences of the countries participating in the project. Review comments are invited. Please send comments to Maria Netto (maria.netto@undp.org) and Rebecca Carman (rebecca.carman@undp.org).

For more information on the project, please visit the knowledge platform: www.undpcc.org.

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List of Acronyms and Abbreviations

A/R	Afforestation/reforestation
AFOLU	Agriculture, Forestry and Other Land Uses
BAP	Bali Action Plan
BAU	Business as Usual
BRT	Bus Rapid Transit
BS	Baseline Scenario
CBA	capture based aquaculture
CBD	Convention on Biological Diversity
CBM	coalbed methane
CCS	Climate Change scenario
CDM	Clean Development Mechanism
CH_4	Methane
CHP	Combined Heat and Power
CO_2	Carbon dioxide
DIVA	Dynamic Interactive Vulnerability Analysis
FDI	Foreign direct investment
FF	Financial flow
FMU	Forest management Unit
FR	Forest Restoration
GCM	General Circulation Model
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFCF	Gross Fixed Capital Formation
GHG	Greenhouse gas
GLOFs	Glacier Lake Outburst Floods
HBA	hatchery based aquaculture
HEVs	Hybrid Electric Vehicles
HVAC	Heating, Ventilation and Air Conditioning
I&FF	Investment and Financial Flows
ICHA	International Classification of Health Accounts
ICZM	Integrated Coastal Zone Management
IEA	International Energy Agency
IF	Investment Flow
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification
IT	Investment Type

IWRM	Integrated Water Resources Management
KP	Kyoto Protocol
LPG	Liquid Petroleum Gas
LULUCF	Land Use, Land Use Change and Forestry
MRTS	Mass Rapid Transit Systems
N_2O	nitrous oxide
NAPA	National Adaptation Programme of Action
NGOs	Non Governmental Organizations
NMT	Non-motorized transport
NTFP	Non-timber forest products
O&M	Operation and maintenance
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
PKM	Passenger kilometer
PV	Photo-voltaic
R&D	Research and development
RD&D	Research, development and demonstration
REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
S-HWP	Plantations for Substitution through harvested wood products
S-NWP	Plantations for Substitution through non-wood products
SFM	Sustainable Forestry Management
SHA	System of Health Accounts
SNA	System of National Accounts
SNA93	System of National Accounts, 1993
SO_2	Sulfur Dioxide
TEAM	Tool for Environmental Assessment and Management
TED	Transit Efficient Development
TNA	Technology Needs Assessment
TOD	Transit Oriented Development
UN FAO	United Nations Food and Agriculture Organization
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
V&A	Vulnerability & Adaptation
VKT	Vehicle kilometers travelled
WBCSD	World Business Council on Sustainable Development
WHO	World Health Organization
YR	Year

Foreword

A key issue, especially for non-Annex I Parties to the United Nations Framework Convention on Climate Change, is the magnitude of national efforts needed to reduce greenhouse gas emissions and to adapt to the looming adverse impacts of climate change and the implications of those efforts for future investment and financial flows (I&FF) – including how Foreign Direct Investment and Official Development Assistance will be affected.

There are two main reasons why assessments of future I&FF are particularly critical for developing countries: first, because it is important for countries to have a long-term perspective on what activities to address climate change will mean in terms of additional costs or investment shifts for key sectors; and second, because it is also critical to be able to understand what are the relevant sources of finance and investments needed for developing specific policies and articulating the related needs.

Investment decisions today have important long-term implications because facilities, equipment, and infrastructure affect climate for the duration of their operating lives, which in many cases is 20 years or longer. In addition, investment in a facility or infrastructure project that proves to be maladapted to future climate may result in additional socioeconomic costs and suboptimal operation or inefficiency of the stock of capital.

Through funding from several bilateral donors, the UNDP Environment & Energy Group (EEG) has developed an approach to the national assessment of I&FF which consists of a User Guidebook that has been framed around three guidance documents:

- this *Methodology Guidebook for the Assessment of Investment and Financial Flows to Address Climate Change*,
- guidance on *Preparing a Workplan for the Investment & Financial Flows Assessment*, and
- *Reporting Guidelines for the Assessment of Investment and Financial Flows to Address Climate Change*.

The development of these documents involved the collective efforts and collaboration of a group of international experts, national experts from developing countries that will undertake the I&FF assessment as part of their participation in the EEG project, *Capacity Development for Policy Makers to Address Climate Change,* and regional centres of excellence that are providing technical backstopping to countries as they conduct the I&FF assessment.

The *Methodology Guidebook* provides a systematic and flexible approach for the I&FF assessment of future investments. It can be modified to meet specific needs. The main objective of the Guidebook is to provide guidance to developing countries in identifying and quantifying potential I&FF associated with mitigation and adaptation options as part of a coherent strategy to address climate change that is consistent with sustainable development

and other national priorities. It is hoped that the outputs of the exercise will also provide valuable feedback for studies prepared within the context of National Communications of non-Annex I Parties, and allow countries to strengthen their capacity to draw resources from future climate financing architectures.

Finally, the *Methodology Guidebook* has been developed with a view to further testing this pilot application within the framework of emerging national low-carbon and climate-resilient programmes while ensuring ownership by national governments. Your views on how to improve the methodology are welcomed.

Veerle Vandeweerd
Director, Environment & Energy Group
Bureau for Development Policy
United Nations Development Programme

Introduction

The overall objective of this Methodology Guidebook is to strengthen the capacity of developing countries to formulate and evaluate policy options to address climate change in the context of their overall development objectives. More specifically, this Guidebook provides step-by-step guidance on assessing changes in investments in physical assets and in programmatic measures (collectively referred to as investment and financial flows, or I&FF) needed to mitigate greenhouse gas (GHG) emissions and adapt to climate change in key sectors. Investments range in type and scale from household investments in appliances, to corporate and government investments in infrastructure, to government investments in education and outreach. Sources of funding include both domestic and foreign funds, and private and public funds. The approach is designed to be operationalized at the country level, and is flexible so that it can be adapted to country-specific needs and conditions. The results of I&FF assessments can be used by countries in financial decision making and policy development regarding investment shifts and/or additional capital needed to address climate change, as well as in the development of national negotiation positions for the UNFCCC process.

This Guidebook has been specifically written to assist country teams that are charged with undertaking an I&FF assessment under the UNDP global project, "*Capacity Development for Policy Makers to Address Climate Change*". It is meant to provide a clear and comprehensive description of the I&FF methodology, and practical guidance on issues such as data needs and access, cross-sectoral linkages, and evaluation of policy implications.

Countries participating in the UNDP project have each chosen two to four key sectors for which they will conduct an assessment of I&FF for mitigation and/or adaptation. This document includes methods for each of the combinations of sector and type of climate change measures that the initial set of countries participating in the UNDP project chose to evaluate, namely: energy (mitigation measures), transport (mitigation measures), forestry (mitigation and adaptation measures), agriculture (mitigation and adaptation measures), water management (adaptation measures), public health (adaptation measures), biodiversity (adaptation measures), fisheries (adaptation measures), tourism (adaptation measures), and coastal zones (adaptation measures). Other "sector/type of measures" combinations may be added to subsequent versions of this document.

The I&FF methodology presented here is designed to:

- Assess the types and magnitudes of changes in investments in physical assets and in programs, and associated operation and maintenance costs, needed to implement a set of mitigation and adaptation measures in key sectors of a country;
- Determine the entities that are responsible for those investments and the sources of their investment funds; and
- Provide information needed to evaluate policy instruments that might be used to induce those entities to invest in the proposed measures.

It is important to note that this methodology is not the same as what would be required to assess the full (total) cost of addressing mitigation and adaptation in a country. For mitigation, the full costs would entail an accounting of the costs of meeting a national GHG reduction target over a specific period of time. This typically involves developing multiple projections of future national development and associated GHG emissions for all sectors, for both business-as-usual scenarios and emission reduction scenarios. For adaptation, the full costs of addressing climate change would entail estimating the costs of adapting to all the expected adverse impacts of climate change, as well as the residual costs of impacts for which adaptation measures are not taken or are only partially effective. As with mitigation, a national adaptation cost assessment typically involves developing multiple scenarios of future impacts and adaptation measures. The I&FF methodology described here is narrower in scope. It is independent of national GHG targets, does not cover all sectors of a national economy, does not involve projections of national GHG emissions or anticipated climate change impacts, and does not include residual costs of impacts. Note also that since the focus of an I&FF assessment is the monetary costs of climate change measures, the methodology does not include explicit quantitative estimates of the benefits of those investments (e.g., operating revenues from investments, net GHG reductions, climate impacts avoided).

The remainder of this Guidebook is divided into 14 chapters:

- Chapter II (I&FF Assessment Methodology: Fundamental Concepts and Methodological Steps) defines terminology and technical concepts that underpin the assessment of I&FF for mitigation and adaptation, and describes in detail the steps in an I&FF assessment.
- Chapters III, IV, V, and VI present guidance on applying the I&FF assessment methodology to mitigation measures in the energy, transport, forestry, and agriculture sectors.
- Chapters VII, VIII, IX, X, XI, XII, XIII, and XIV present guidance on applying the I&FF assessment methodology to adaptation measures in the forestry, agriculture, water management, public health, biodiversity, fisheries, tourism, and coastal zones sectors.
- Chapter XV (Follow-Up Analysis to the I&FF Assessment) describes how to follow up the overall assessment to firmly link it to national policymaking processes. In particular, it discusses how policies can influence I&FF to address climate change, it describes types of policy instruments and measures and how to select among them within different contexts, and it discusses international sources of finance for addressing climate change.

II. Investment and Financial Flows Assessment Methodology: Fundamental Concepts and Methodological Steps

2.1 Fundamental Concepts

This section describes the fundamental concepts and terminology that underlie the methodology for national assessments of I&FF for mitigation and adaptation. Some of the concepts and terms presented here are derived from the 2007 UNFCCC report, *Investment and Financial Flows to Address Climate Change*.[1] Although the UNFCCC report is global in scope, and utilizes a different methodology than is described here, it is a useful reference for additional information about assessment of I&FF for mitigation and adaptation.

2.1.1 Methodology Overview

Conceptually, the methodology used here is straightforward. Once the scope of a sector is clearly defined, the relevant investment costs for that sector are projected for two future scenarios: 1) a baseline scenario, which reflects a continuation of current policies and plans, i.e., a future in which no new measures are taken to address climate change (otherwise referred to as a "business-as-usual" scenario), and 2) a climate change scenario, in which new mitigation measures are taken (a "mitigation scenario") or new adaptation measures are taken (an "adaptation scenario"). The investment costs of the baseline and mitigation (or the baseline and adaptation) scenarios are then compared to determine the changes in investments needed to mitigate emissions from the sector (or to adapt to the impacts to the sector). Note that changes in investments may include not only increases in investments (new funding), but also shifts in existing investments (reallocations of existing and currently projected funding levels such that funds in one area decrease, and funds in another area increase).

2.1.2 Investment and Financial Flows (I&FF)

This methodology distinguishes between two distinct types of investments: investment flows and financial flows.

An "investment flow" (IF) is the capital cost of a new physical asset with a life of more than one year, such as the capital cost of a new power plant, a new automobile, a new household appliance, or a new agricultural irrigation system. Investment flows are limited to *new physical*

[1] UNFCCC (2007) can be accessed at: http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/background_paper.pdf

assets because such investments have climate change implications for the duration of the operating lives of the facilities and equipment purchased. Purchase of an existing physical asset, such as an existing vehicle, is excluded because its remaining life and its implications for climate change are not affected by the change in ownership. However, investment flows to retrofit, or considerably expand, an existing physical asset such that the climate change implications of that asset are significantly altered, such as conversion of a traditional coal-fired power plant to a combined cycle gas turbine plant, would be included. Investments in financial assets (such as stocks and bonds), and in physical assets that neither affect climate nor have climate impacts implications (such as metals and commodities), are also excluded because they are unrelated to climate concerns.[2]

Note that an investment flow captures just the initial cost of a new asset. The costs of operating and maintaining new assets (e.g., salaries of personnel, fuel costs) are covered in a separate category of monetary flows (O&M costs of new physical assets), which are discussed in section 2.1.4.

A "financial flow" (FF) is an ongoing expenditure on programmatic measures; financial flows encompass expenditures other than those for expansion or installation of new physical assets. Examples of financial flows include expenditures for an agricultural extension program for farmers, a malaria prevention program to distribute mosquito nets, or the implementation of improved forest management techniques. These expenditures are "operation and maintenance" type costs, e.g., salaries and raw materials.

Examples of several mitigation and adaptation investment types, and the IF and FF for each, are provided in Table 2-1. Note that some investment types can entail both financial flows and investment flows.

[2] Investments in facilities that *produce* such assets, e.g., an aluminum smelting plant, would of course be included.

Table 2-1: Examples of mitigation and adaptation investment types and associated I&FF

Sector (type of climate change measure)	Investment Type	Investment Flows[A]	Financial Flows
Energy (mitigation)	Construction of new high efficiency, fossil-fuel fired, power plant	Capital costs of construction	
	Expansion of public transit (bus) system	Capital costs of new buses and related equipment, and of construction of associated new facilities (e.g., bus stops)	
	Implementation of an equipment retrofit and education program for the commercial sector on energy end-use efficiency improvements	Capital costs of equipment retrofits or replacements in commercial sector (e.g., retrofit of HVAC, or Heating, Ventilation and Air Conditioning, systems)	Program implementation costs, including both government costs and commercial sector costs (e.g., audit of HVAC systems to determine leaks)
Forestry (mitigation)	Implementation of reduced impact logging operations	Capital costs of new equipment needed to implement reduced impact logging techniques	
	Implementation of improved, low-tech silviculture techniques to increase stand-level biomass densities in managed forests		Implementation costs, including raw materials (e.g., seedlings, soil amendments) and training
Agriculture (mitigation)	Implementation of improved livestock feeding program		Implementation costs including raw materials and training
Water (adaptation)	Construction of new desalinization plant	Capital costs of construction	
	Implementation of program to repair leakages from urban water distribution systems		Implementation costs (inspection and repair costs)
Public Health (adaptation)	Construction of new health clinics to treat infectious disease	Capital costs of construction	
	Implementation of program to distribute insecticide-treated mosquito nets		Program implementation costs including raw materials (e.g., nets), training, and fuel and leasing of vehicles for transport
Coastal Zones (Adaptation)	Production of improved flood hazard maps and implementation of improved flood warning system		Map production and program implementation costs

[A] The assets associated with these investment flows will have operation and maintenance (O&M) costs over their lifetimes. The O&M costs of these assets are covered in a separate category of monetary flows.

2.1.3 Investment Entities and Sources of the I&FF Funds

An "investment entity" is an entity that is responsible for an investment. These are the entities that decide to invest in, for example, an array of wind turbines, a new household appliance, a public health program, a national park, or a sand dune stabilization program. This methodology utilizes three types of investment entities: households,[3] corporations, and government. These are described below.

The "sources of the I&FF funds" are the origins of the funds invested by the investment entities, e.g., domestic equity, foreign debt, domestic subsidies, foreign aid. These are described below for each investment entity.

Identification of the entities responsible for the investment decisions, and the sources of the funds that are invested, is an important component of an I&FF assessment because this information is the starting point for the evaluation of policies to change those decisions. To design policies and measures to influence decisions about I&FF, the entities responsible for those decisions and the means by which they obtain their funds must be identified. Government policies to influence investment decisions by households or corporations may include regulations or incentives. For example, households might be convinced to purchase high water efficiency appliances rather than less costly but lower-efficiency appliances if part of the additional cost was borne by the government via subsidies such as rebates on qualifying purchases. In cases in which public spending is needed to implement a mitigation or adaptation measure, options for changing current government priorities and for raising additional funds from domestic or international sources need to be evaluated.

Note that mitigation and adaptation measures that are programmatic (i.e., outreach and education programs) and/or involve subsidies (e.g., tax credits, tax deductions, rebates) or cost sharing agreements are likely to involve more than one investment entity. With such measures, one investment entity, which typically is a government entity, is responsible for the costs of the program. The other investment entities, or entity, are responsible for the investment decisions that are being influenced by the program. For example, the water efficiency subsidy program mentioned in the previous paragraph involves both a government entity, which invests in the program, and households, which invest in high efficiency appliances.

Table 2-2 presents the "taxonomy" of investment entities and sources of I&FF funds used in this methodology for compiling I&FF data. This taxonomy, and the definitions provided below, are derived from the investment flow taxonomy used in the UNFCCC report, *Investment and Financial Flows to Address Climate Change*.[4] The taxonomy used here has been designed to

[3] Note that in the System of National Accounts (SNA, the internationally agreed standard for compiling measures of economic activity), a household is not considered an investment entity unless it produces goods for sale or for its own final consumption (e.g., a farm).

[4] UNFCCC (2007) can be accessed at: http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/background_paper.pdf

steer countries participating in the UNDP capacity development project towards a reasonable and appropriate level of detail in data compilation, while allowing for flexibility in the level of detail reported should data (especially on sources of funds) not be available.

Table 2-2: Taxonomy of investment entities and sources of I&FF funds

Investment Entity	Source of I&FF Funds	
Households	Domestic	Equity and debt
Corporations	Domestic	Domestic equity (including internal cash flow)
		Domestic borrowing (bonds and loans)
	Foreign	Foreign direct investment (FDI)
		Foreign borrowing (loans)
		Foreign aid (ODA)[A]
Government	Domestic	Domestic funds (budgetary)
	Foreign	Foreign borrowing (bonds and loans)
		Bilateral foreign aid (bilateral ODA)
		Multilateral foreign aid (multilateral ODA)

[A] ODA (official development assistance) provided to private corporations is primarily foreign aid that is given to non-governmental organizations (NGOs).

Households

Households are individuals or groups of individuals (e.g., families) who act as one unit financially. Households invest in assets, such as homes, farms, vehicles, and facilities for small unincorporated businesses. All of their investment funds, which include equity (savings), debt (loans from friends, relatives, or financial institutions), and government support in the form of subsidies (e.g., rebates, tax deductions, or tax credits on purchases),[5] are assumed to be domestic to simplify the assessment of I&FF. Although remittances by family members working in foreign countries are substantial for some countries, and are likely to help fund household investments in the recipient countries, spending decisions are usually made by the recipients. Also, whether funds are domestic or foreign is less important for households than for other investment entities when evaluating policies and measures to influence investment decisions.

Corporations

Corporations include both financial corporations and non-financial corporations, and can be either for-profit or not-for-profit. Financial corporations are entities such as banks, credit

[5] Note however, that the costs of such subsidies are a public cost, rather than a cost to the household, so only the net cost to the household (the cost net of any subsidies) should be included in household costs in the I&FF assessment. The costs of the subsidies, if included in an assessment, would be assigned to government entities (see section 2.1.7).

unions, and insurance companies that provide financial services to non-financial corporations, households, and governments. Non-financial corporations produce goods (such as fossil fuels, electricity, food, and timber), and provide non-financial services (such as health care, private education,[6] research, and hospitality services). Non-governmental organizations (NGOs) are a type of not-for-profit corporation. Corporations invest in both physical assets and programs. Their sources of investment funds are both domestic and foreign, and can be in the form of equity (equity in domestic financial markets and foreign direct investment), debt (loans provided by commercial banks and bond sales in the capital market), domestic government assistance (subsidies),[7] or foreign aid (foreign assistance in the form of grants and concessional loans; also known as ODA or official development assistance). All foreign direct investment (FDI) in a country is assumed to go to corporations because FDI tends to be made by multinational corporations seeking to establish or expand operations overseas. However, only part of the FDI is invested in new physical assets or programs; some is used to purchase existing assets through mergers or acquisitions. Only the portion of FDI that is invested in new physical assets or programs should be included in the I&FF assessment.

Governments

Governments are the national, provincial, state, and local governments of a country. Financial and non-financial corporations owned wholly or in part by governments, such as public universities and research institutions, and publicly held oil companies, utilities, and water authorities, are included in this category. Government entities invest in long-lived physical assets and public programs and services that provide public benefits. Examples of such assets include water supply systems, hospitals, and coastal infrastructure; examples of such programs and services include health care, energy research, and agricultural assistance. Note that government entities also invest indirectly (via subsidies) in assets that private entities (households and corporations) purchase (e.g., appliances and vehicles). The funds governments invest include both domestic sources (revenues from taxes and fees, loans from domestic financial institutions, and bond sales in the domestic market) and international sources (debt in the form of foreign loans and bond sales, and foreign aid). In the taxonomy of government sources of funds used here (Table 2-2), foreign aid (or ODA) is divided into bilateral and multilateral components. Bilateral ODA is assistance provided by another country, either as a grant that does not need to be repaid, or as a loan with concessional terms. Multilateral ODA is assistance from an international financial institution (IFI) (such as the World Bank), usually in the form of a loan with concessional terms, but also sometimes in the form of a grant. ODA is an important, and growing, source of government funds for mitigation and adaptation in

[6] Private education would include, for example, private secondary schools and universities. Public education, e.g., public secondary schools and universities, is provided by government entities.

[7] However, as with households, because these subsidies are domestic public funds, only the net cost to the corporate entity is included in corporate costs in the I&FF assessment. The costs of the subsidies, if included in an assessment, would be assigned to Government entities (see section 2.1.7).

developing countries, and strategies to seek additional ODA are likely to vary between bilateral and multilateral sources.

2.1.4. Operation and Maintenance (O&M) Costs of New Physical Assets

The physical assets purchased with investment flows will have operation and maintenance (O&M) costs associated with them (i.e., ongoing fixed and variable costs such as salaries and raw materials). Operation and maintenance costs of new assets need to be included in I&FF assessments because these costs can vary considerably among investment flow types, and can have a significant effect on the total cost of an investment over its lifetime. For example, O&M costs are a much greater share of total costs (capital costs plus O&M costs) for gas-fired electricity generation than photovoltaic electricity generation.

O&M costs include the following categories of costs:

- Salaries or wages of personnel
- Fuel costs such as power and/or fuel for operations, fuel for production
- Public utilities such as telephone service, Internet connectivity, etc.
- Raw materials
- Maintenance and/or leasing of equipment
- Office supplies and consumables
- Advertising
- License or equivalent fees (such as corporation yearly registration fees) imposed by a government
- Real estate expenses, including:
    - rent or lease payments
    - office space
    - furniture and equipment
    - property taxes and equivalent assessments
- Operations fees, such as fees assessed on transportation carriers for use of highways, and production or operation fees, such as subsidence fees imposed on oil wells
- Insurance
- Damage due to uninsured losses, accident, sabotage, negligence, or terrorism

This list is not meant to imply that countries should estimate O&M costs for every category of cost. Countries should estimate O&M costs for those categories that are significant, which will vary among asset types, and may estimate O&M costs in aggregate (e.g., as a percentage of total costs). Step #2 in section 2.2 below provides approaches for estimating O&M costs should data not be readily available.

O&M costs should be assigned to the investment entity that invested in the physical asset, i.e., that owns the asset. Sources of the funds for O&M, which would primarily be in the form of operating revenues, should be disaggregated into the same sources as are used for I&FF (Table

2-2). Note that some of these sources (e.g., FDI) may not be relevant to O&M costs. Note also that the O&M costs that are recorded for a household or corporation IF should be net of any government subsidies.

2.1.5 Scenarios

A scenario is an internally consistent and plausible characterization of future conditions over some specified time period. Each sectoral assessment of I&FF for mitigation requires that both a baseline scenario and a mitigation scenario be developed for that sector, and each sectoral assessment of I&FF for adaptation requires that both a baseline scenario and an adaptation scenario be developed for that sector. In the I&FF assessment methodology, each scenario will have associated with it a stream of annual IF, FF, and O&M costs. This is described below in section 2.2.

The baseline scenario in both cases is a reflection of business-as-usual conditions, i.e., it is a description of what is likely to occur in the absence of new policies to address climate change. The baseline scenario should describe expected socioeconomic trends (e.g., population growth and migration, economic growth), technological change (if relevant), private sector and government plans for the sector, and expected business-as-usual investments in the sector (i.e., specific new assets and programs) given those trends and plans. If policies to address climate change are already being implemented, they should be reflected in the baseline scenario. The description of the plans or forecasts for investments should include information about the nature, scale, and timing of those investments; i.e., information that is needed to derive estimates of annual I&FF, and associated O&M costs.

The mitigation scenario incorporates measures to mitigate GHG emissions, i.e., the mitigation scenario should describe expected socioeconomic trends, technological change (if relevant), new measures to mitigate GHG emissions, and the expected investments in the sector given implementation of the mitigation measures. Similarly, **the adaptation scenario incorporates new measures to respond to the potential impacts of climate change.** The adaptation scenario should describe expected socioeconomic trends, technological change, new measures to respond to the potential impacts of climate change, and the expected investments in the sector given implementation of the measures to respond to potential impacts. Both the mitigation and adaptation scenarios should include information about the nature, scale, and timing of the investments.

There may be sectors in which measures that reduce GHG emissions and/or increase resilience to climatic variability are already being taken, but are being implemented for reasons other than to address climate change. For example, a local government may be implementing water conservation measures for residential and commercial entities because of recent drought conditions. Such measures should be included in the baseline scenario because these measures reflect business-as-usual conditions, and because the costs of implementing such measures may be reflected in the I&FF for the base year (depending upon which year is used as the base

year and the start date for implementation of such measures). Such measures may or may not be included in the climate change (i.e., mitigation and adaptation) scenarios, depending on the nature and scale of the mitigation and adaptation measures assessed. For example, if drought conditions are expected to intensify and increase in frequency with climate change, the adaptation scenario for this example might include an expanded and more stringent water conservation program that would require a greater level of expenditure for implementation. In this case, the adaptation scenario would include the conservation measure that is in the baseline scenario, but at a modified scale.

2.1.6 Assessment Period and Base Year

The assessment period is the time horizon for assessment; i.e., the number of years spanned by the baseline and climate change scenarios and the associated stream of annual IF, FF, and O&M costs. The assessment period for I&FF assessment should be at least 20 years and not more than 30 years. Twenty to 30 years is a reasonable period over which to analyze alternative investment decisions. Also, most significant physical assets with GHG implications have lifetimes of 20 to 30 years, and many forestry mitigation measures require at least 20 to 30 years for the full effects to be realized. If models are used in the analysis, the choice of the assessment period may be dictated by the forecasting period of the models used. A single assessment period for all sectors is preferred; however, the assessment period could differ by sector, and between mitigation and adaptation within a sector, especially if models are used in the analysis.

The base year is the first year of the assessment period, i.e., it is the first year of the baseline, mitigation, and adaptation scenarios. The base year should be set at a recent year for which I&FF and O&M information is available so that the IF, FF, and O&M costs for the first year of all the scenarios are historical data. This grounds the start of the streams of cost data for each scenario in reality. **A base year of 2005 is recommended.** If data are not available for 2005, the most recent year for which information is available should be used. The base year that is chosen should not, if possible, vary among sectors in an assessment.

An end year of 2030 is recommended for the last year of assessment period since this year aligns with typical sector development plans, and results in a reasonable assessment period length. **Therefore, an assessment period of 2005 through 2030 is recommended.**

2.1.7 Cost Accounting Issues

It is important that countries follow a common approach for compiling data on the costs of IF, FF, and O&M so that results are transparent and comparable. Costs should be compiled in real (i.e., inflation adjusted) terms. **Constant 2005 US$ are recommended for this purpose.** Also, **investment costs for assets (IF) should be reported in the year in which they are expected to be incurred,** rather than spreading the costs over the lifetime of the asset. **Financial flows and O&M costs should be reported as annual costs in the year in which they occur.**

Appropriate discounting of future costs (IF, FF, and O&M costs for the baseline and climate change scenarios) should be done to properly account for varying opportunity costs and time preferences of investment entities. This is particularly important given the long time frame of the I&FF assessments. The discount rates chosen should reflect country-specific economic conditions. **It is recommended that countries use two discount rates for their assessment: one public discount rate and one private discount rate.** The public discount rate should be the rate established by the national government's ministry (or department) of finance or economic development for public projects, and should be used for sectors dominated by public investments. The private rate should reflect the opportunity cost of capital for the predominant investment entity in the assessment, and should be used for sectors dominated by private investments. Alternatively, countries may use the public discount rate for all sectors.

The I&FF method does not consider explicitly the contribution of government subsidies in financing private sector (household and corporation) investments (IF and FF) and O&M costs because computing or discriminating subsidies for private investments is not always possible. If there are subsidies or government support, the prices actually paid by the entity will normally differ from full prices by the amount of the subsidy. However, if either the full price or the subsidy amount is not available or known, it will not be possible to compute or discriminate the subsidy amount in the sources of funding. Therefore, **countries should report the effective final costs (i.e. the cost net of subsidies) of IF, FF, and O&M as paid by private sector entities.** If subsidies are significant for a sector, and the costs of the subsidies are available or known, countries may include the costs of subsidies (as a government cost). However, if a country chooses to include subsidies, they should include subsidies in all three categories of costs (IF, FF, and O&M costs).

2.1.8 Benefits & Non-Investment Costs of Mitigation and Adaptation Measures

The purpose of an I&FF assessment is to determine the incremental, direct monetary costs of climate change measures, and the likely sources of those investment funds. Since the methodology is not a cost-benefit type of analysis, quantitative estimates of the direct benefits of investments are not included. Direct benefits of climate change measures include net GHG reductions and climate impacts avoided. If a climate change measure includes a new physical asset that produces goods or services that are sold (e.g., electricity), direct benefits will also include operating revenues that accrue from sales, which can significantly offset the costs of an investment. The nature and scale of GHG and impacts benefits, and the size and sources of significant sales revenues, will be an important consideration when evaluating alternative investments. Therefore, **countries should assess qualitatively the GHG reduction and adaptation benefits of climate change measures; and for those investments that will accrue significant revenues, countries should also assess the relative magnitude of revenues that will accrue over the lifetime of the asset (relative to lifetime O&M costs), and the likely sources of the revenues.**

In addition to direct (intentional) benefits, climate change measures may have other social, economic, and environmental effects. These additional effects are often referred to as "externalities." Externalities may occur in the same and/or a different sector, may occur within and/or beyond national boundaries, and may be positive (a benefit) or negative (a cost). For example, construction of a new hydropower facility instead of a new fossil fuel fired power plant may, in addition to reducing GHG emissions, improve local air quality, but the hydropower facility may have negative environmental and economic impacts on riparian ecosystems and human settlements. Externalities can be important when weighing alternative investments, so **it is recommended that countries assess *qualitatively* the significant social, economic, and environmental externalities of climate change measures in the I&FF assessment**.

Note also that some externalities may affect the costs of other climate change measures. For example, measures to reduce forest degradation are likely to result in forest areas that are more resilient to climatic change than they would have been if forest degradation had continued unabated, and may also make coastal ecosystems (e.g., mangroves and coral reefs) more resilient through reductions in terrestrial erosion and coastal turbidity. In this example, the mitigation measure (reduced forest degradation) reduces the costs of adaptation in the forestry and coastal sectors. The existence of such cross-measure externalities means that inadvertent under- or over-counting of I&FF across measures and across sectors is possible. Countries should be vigilant in checking for this possibility. Assessing such cross-measure effects will help ensure that under- or over-counting does not occur.

2.2 Methodological Steps

This section briefly describes each of the steps in the methodology for national assessments of I&FF for mitigation and adaptation. First, an assessment of the I&FF for mitigation or adaptation in each sector is undertaken. Each sectoral assessment entails eight sequential steps. Once sectoral assessments are complete, the results are compiled and compared across sectors.

2.2.1 Methodological Steps in I&FF Assessments for Each Sector

This section describes the eight steps that would be undertaken for each sectoral assessment of I&FF for mitigation or adaptation (Figure 2-1).

Figure 2-2: Steps in the sectoral assessments of I&FF to address climate change

1. Establish key parameters of the assessment

- Define detailed scope of sector
- Specify assessment period and base year
- Identify preliminary mitigation (or adaptation) measures
- Select analytical approach

2. Compile historical IF, FF, and O&M cost data, subsidy cost data (if included explicitly), and other input data for scenarios

- Compile historical annual IF and FF data, disaggregated by investment entity and source
- Compile historical annual O&M cost data, disaggregated by investment entity and source
- Compile historical annual subsidy cost data, if subsidies are included explicitly in the assessment
- Compile other input data for scenarios

3. Define baseline scenario

- Describe socioeconomic trends, technological change, sectoral and national plans, and expected investments given current sectoral and national plans

4. Estimate annual IF, FF, and O&M costs, and subsidy costs if included explicitly, for baseline scenario

- Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source
- Estimate annual O&M costs for each IF, disaggregated by investment entity and funding source
- Estimate annual subsidy costs for each relevant investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment

5. Define mitigation (or adaptation) scenario

- Describe socioeconomic trends, technological change, mitigation (or adaptation) measures, and investments given implementation of mitigation (or adaptation) measures

6. Estimate annual IF, FF, and O&M costs, and subsidy costs if included explicitly, for mitigation (or adaptation) scenario

- Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source
- Estimate annual O&M costs for each IF, disaggregated by investment entity and funding source
- Estimate annual subsidy costs for each relevant investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment

7. Calculate the changes in IF, FF, and O&M costs, and in subsidy costs if included explicitly, needed to implement mitigation (or adaptation)

- Calculate changes in cumulative IF, FF, and O&M costs, by funding source, for individual investment types and for all investment types
- Calculate changes in annual IF, FF, and O&M costs for individual investment types, for individual sources of funds, and for all investment types and funding sources
- If subsidies are included explicitly, consider calculating changes in cumulative and/or in annual subsidies for IF, FF, and O&M for each investment type and all investment types

8. Evaluate policy implications

- Re-evaluate initial prioritization of mitigation (or adaptation) measures undertaken in step #5
- Determine policy measures to encourage changes in I&FF

Step #1: Establish Key Parameters of Assessment

>>> Define detailed scope of the sector

This Guidebook assumes that countries have already selected the sectors that will be assessed (e.g., energy, agriculture), and have completed a preliminary determination of the scope of each sector (see companion volume *Preparing a Workplan for the Investment & Financial Flows Assessment*). In this step, the precise scope of the sector needs to be determined and defined. This primarily entails determining the specific subsectors that will be included (e.g., coal mining and power production, irrigated crop production, livestock production), and clearly defining those subsectors. In other words, the sectoral boundaries of study need to be clearly delineated. These boundaries determine which processes, activities, entities, and geographic regions (if less than the entire country) are included in the sector.

Many existing sectoral structures could be utilized to define the sectoral scope. For example, the IPCC GHG Inventory sectoral structure can be a useful reference for analyses of mitigation I&FF.[8] However, rather than necessarily relying on existing sectoral structures, it is most important that the sectoral scope be appropriate to national circumstances, especially regarding data availability, the structure of the national government entities in which data reside, and the scope of related assessments that have already been undertaken (e.g., National Communications, Technology Needs Assessments (TNAs), National Adaptation Programmes of Action (NAPAs)). In addition, if a model is used in the I&FF assessment, the sectoral scope may be dictated by the scope of the model used.[9]

There may be sectoral overlaps within a national I&FF assessment since many processes and activities can be encompassed by more than one sector. Sectoral scopes may need to be defined such that there are overlaps among sectors; however, mitigation and adaptation measures, and their associated I&FF, should not be double-counted. For example, if a country is assessing I&FF for adaptation in both the agriculture and the water management sectors, and agricultural demand for water is a significant component of national water demand, agricultural water consumption is likely to be included in both sectoral scopes. If the country decides to evaluate efficiency improvements in agricultural water use as an adaptation measure, the I&FF for that measure should be included in either the agriculture sector analysis or the water management sector analysis, but not both. The decision about which sector should encompass the adaptation measure should be based on national circumstances, including sectoral priorities, and the analytical approach chosen (model or otherwise). Clearly and comprehensively defined sectoral scopes, as well as clearly defined mitigation/adaptation measures, will help avoid double-counting of I&FF.

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8 Table 8.2 in chapter 8 of Volume I of the 2006 Guidelines (Eggleston et al. (eds.), 2006, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*) provides a detailed outline of the GHG inventory structure. This can be viewed at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_8_Ch8_Reporting_Guidance.pdf

9 The sectoral scope should influence the choice of a model, rather than vice versa, but in reality, model choice is limited, and in-country experience with models may reduce the list of available and appropriate models further. Therefore, there may be cases in which a country will need to alter their sectoral scope due to the model that is most appropriate for the assessment.

>>> Specify assessment period and base year

The assessment period and base year need to be selected for the sectoral analysis. Selection criteria should include sectoral scope, national and sectoral planning horizons, data availability, analytical approach,[10] and the timelines used in previous analyses of mitigation and adaptation options. This methodology recommends an assessment period of 2005 (the base year) through 2030, if possible and appropriate.

>>> Identify preliminary mitigation (or adaptation) measures

Prior to the next step (selecting the analytical approach that will be used to develop scenarios and estimate I&FF and O&M costs), a preliminary set of the mitigation (or adaptation) measures to be analyzed must be identified. This preliminary list of measures is needed to assess which analytical approaches can incorporate the measures. The selection of measures should be based on the sectoral scope, national and sectoral country priorities, costs of implementation, benefits of measures (environmental, economic, and social), and prior work on mitigation (or adaptation). The preliminary list often can be obtained from existing sectoral or national plans, National Communications, TNAs, and NAPAs.

>>> Select analytical approach

Countries can use any of several analytical approaches to develop baseline, mitigation, and adaptation scenarios, and associated streams of annual IF, FF, and O&M costs. These include: a suitable sectoral model, a sectoral plan, a projection of sectoral trends, the current situation in the sector (assuming no change), or a combination of those approaches. The selection should be influenced by previous analytical work on mitigation and adaptation, such as for the National Communications, as well as by national circumstances (e.g., in-country capacity and resources), sectoral scope, assessment period, and the preliminary climate change measures identified. Ideally, the approach chosen would involve econometric analysis or demand forecasting techniques.

To be suitable, a sectoral model should cover most or all of the sectoral scope of study, should be able to forecast changes in the sector over the selected assessment period, should be grounded in historical data (see Step #2), should be capable of incorporating the identified adaptation or mitigation measures, and should be capable of projecting streams of annual I&FF by entity and source, ideally based on forecasts of demand for sectoral products and/or services. Ideally, the model would also project annual O&M costs, but if not, these costs can be estimated as described in Steps 4 and 6. A model of the entire national economy could be used instead of a sectoral model, as long as the selected sector is represented in the national economic model with sufficient detail.

[10] Selection of analytical approach occurs *after* this phase of this step, so this is an instance in which iteration might be needed. Once the analytical approach is selected, the chosen assessment period and base year should be re-evaluated to ensure that they are still appropriate.

Ideally, a country would be familiar with a model through prior use before choosing it for their I&FF assessment, given time and resource limitations.

If a suitable model is not available (or a country does not have prior experience with candidate models), a sectoral plan, a projection of trends, or the current situation (assuming no change) can be used as the basis for the analysis. The plan or projection chosen (e.g., a national scenario from the National Communications) should describe anticipated changes in the sector over the selected assessment period in sufficient detail to allow the identified preliminary mitigation or adaptation measures to be re-evaluated and the scale and timing of their implementation identified (Step #5). The plan or projection chosen also needs to be credible for the selected assessment period. For example, the suitability of a trend projection of deforestation rates that implied elimination of all forests in 15 years would need to be carefully re-assessed. And lastly, it is recommended that the plan or projection be based on sectoral demand forecasts, ideally using quantitative methods (e.g., extrapolation of historical sales data).

If a model is not sufficient (e.g., it does not include I&FF), some combination of a model, sectoral plan, projection of trends, and current situation can be used.

An annotated list of possible models for use in each sector, as well as macroeconomic models, can be found in Annex 1.

Step #2: Compile Historical IF, FF, and O&M Cost Data, Subsidy Cost Data (if included explicitly), and Other Input Data for Scenarios

>>> Compile historical annual IF and FF data, disaggregated by investment entity and source

Historical I&FF data are needed to provide a historical basis from which to develop possible future scenarios. The historical data will give assessment teams an understanding of recent investment patterns and a context for public and private plans for the sector, which can be used to inform the development of scenarios and associated cost estimates. In addition, historical I&FF data are needed for the first year of the scenarios (the base year). At a minimum, countries should collect at least three years of historical I&FF data (i.e., for the base year and two years during the previous decade). Ideally, countries would collect 10 years of historical I&FF data, i.e., for the base year and the previous nine years.

Data should compiled for each investment type, and should be annual, be disaggregated by investment entity, and, if possible, by funding source, and also be divided into investment flows and financial flows. This breakdown is required because it represents a fundamental starting point or basis for estimating future investments over time, given public and private plans for the sector, assumptions about the future economic climate for foreign investment, privatization policies, economic barrier removal efforts, and a host of other relevant factors. The definitions of investment types, especially how narrow they are, will depend on sectoral scope and the level of detail of the analytical approach.

Table 2-3 provides a template that illustrates this disaggregation of annual I&FF data, assuming three investment types. Note that this template provides for three different levels of entity/source disaggregation. If a country cannot obtain IF and FF data at the most disaggregated source level, they may be able to derive estimates based on expert judgement (e.g., if corporate investments in a particular investment type are typically funded with x-y percent domestic equity and a-b percent domestic debt, averages of those percentages could be used to allocate each of the total IF and FF for the investment to the two sources). Alternately, a country may need to aggregate sources (e.g., aggregate corporate domestic equity and corporate domestic debt, and report in either row depending on which source is likely to be the dominant source for corporate investments in the particular investment type). And if detailed source information is not available, a country can compile data by domestic versus foreign sources within each investment entity. However, countries should make every effort to compile I&FF data at the most disaggregated source level.

The I&FF data that need to be collected may reside in one or more of several locations (e.g., national accounts, ministry records and plans, industry records, statistical agencies, utilities, research institutions). For this reason, country teams are encouraged to devise a data collection strategy prior to collecting the data. It is recommended that country teams take a bottom-up approach to data collection and start their data collection process with records and plans of appropriate ministries, agencies, or industries where cost information is likely to be more specialized and detailed than in national accounts, which tend to be highly aggregated to conform to international norms. Arrangements for interagency sharing of data should have already been made as part of the preparation phase (see companion UNDP document *Preparing a Workplan for the Investment & Financial Flows Assessment*). Sectoral I&FF data may also be available from research organizations and academic institutions, including parastatal research organizations, private research institutions, and universities.

In some cases, information that is not readily available from a bottom-up data source may be extractable from a top-down assessment (e.g., national accounts). For example, ministry plans may have a detailed budgetary estimate for new equipment that was planned for implementation in the current year without any breakdown into the investment entities and sources of the funds for the equipment. The national accounts data, on the other hand, may have an indication of the breakdown of investments by entities and sources to meet the ministry's budget. However, it is highly unlikely that this information will be at the level of the sectoral scope being considered. Hence, certain judicious assumptions (i.e., assumptions based on expert judgment) will need to be made in applying this breakdown in entity and source to the specific sectoral scope of study. Assumptions such as these will be necessary and inevitable throughout the assessment process, and should be carefully documented in the assessment report to ensure transparency as well as permanent documentation. Whatever data sources are used, careful attention must be paid to sectoral boundaries because sectors may be defined differently in different data sets.

Table 2-3: Template for one year of historical I&FF data

Note: The actual data set would include additional columns for additional investment types in 2003, as well as for the additional years in the historical time series. Some investment types will have more than one category of investment entity (e.g., demand side management projects in the energy sector). Also, Households IF and Corporations IF and FF should be net of subsidies. If subsidy costs are included explicitly in the assessment, the domestic funds source for Government IF and FF should include subsidy costs.

Category of Investment Entity	**Year: 2003**												
	Source of I&FF Funds		**Investment Type 1**			**Investment Type 2**			**Investment Type 3**			**Total IF&FF**	
			IF (2005 US$)	**FF** (2005 US$)	**Total I&FF** (2005 US$)	**IF** (2005 US$)	**FF** (2005 US$)	**Total I&FF** (2005 US$)	**IF** (2005 US$)	**FF** (2005 US$)	**Total I&FF** (2005 US$)	**Total IF** (2005 US$)	**Total FF** (2005 US$)
Households	Domestic	Equity and debt											
	Total Household Funds (all domestic)												
Corporations	Domestic	Domestic equity (including internal cash flow)											
		Domestic borrowing (bonds and loans)											
		Total Domestic Sources											
	Foreign	Foreign direct investment (FDI)											
		Foreign borrowing (loans)											
		Foreign aid (ODA)											
		Total Foreign Sources											
	Total Corporation Funds												
Government	Domestic	Domestic funds (budgetary)											
	Foreign	Foreign borrowing (loans)											
		Bilateral foreign aid (bilateral ODA)											
		Multilateral foreign aid (multilateral ODA)											
		Total Foreign Sources											
	Total Government Funds												

>>> Compile historical annual O&M cost data, disaggregated by investment entity and source

Historical O&M data are also needed to provide a historical basis from which to estimate future O&M costs for new physical assets, as well as to provide data for the first year of the scenarios. **Annual O&M costs for the physical assets that are in operation during the historical period should be collected (or estimated).** In other words, annual O&M costs for assets purchased during the historical period, and for assets purchased prior to the historical period but that are still in operation, should be collected. **The number of years for which historical O&M cost data are compiled should be the same as is done for historical I&FF data (i.e., for three to ten years).** The O&M costs of the assets that are expected to still be in operation after the historical period (i.e., during some part, or all, of the assessment period) will be needed in Step 4 (and possibly in Step 6), so **information about the expected lifetimes of the assets in operation during the historical period, and annual fluctuations in O&M costs (if any), also need to be collected.**

Historical annual O&M data should be compiled for each investment type, should be disaggregated by investment entity and, if possible, also by funding source. The O&M data for assets purchased during the historical period should be tracked separately from the O&M data for assets purchased before the historical period so that the total costs of assets (IF + O&M) purchased during the historical period can be estimated. Table 2-4 illustrates the disaggregation of three years of historical O&M cost data for an asset purchased in 2003. Similar tables would be completed for the O&M costs of assets purchased before the historical period, but without the IF data.

The O&M data that need to be collected may reside in one or more of the locations for I&FF data (e.g., national accounts, ministry records and plans, industry records, statistical agencies, utilities, research institutions). If such data are not available, countries should utilize one of the following approaches to derive estimates:

- Adopt O&M cost data from similar assets in other countries, and adjust the O&M data to in-country production and consumption rates.
- Derive estimates from proportional relationships between O&M costs and total costs, or between O&M costs and capital costs (e.g., 10%, 25%, or 75%). Use either standard assumptions about proportional relationships, or proportional relationships observed in other countries.

>>> Compile historical annual subsidy cost data, if subsidies are included explicitly in the assessment

The explicit inclusion of subsidy costs in the I&FF assessment is optional because discriminating subsidy costs from other costs may not always be possible. However, if a country chooses to include subsidies explicitly, they should include them for all three categories of costs (IF, FF, and O&M) in the historical data set. Historical subsidy data will be helpful when estimating future subsidy costs, and will be needed for the first year of the scenarios. **If subsidies are included**

explicitly, annual costs of subsidies for each type of investment during the historical period should be collected (or estimated). Subsidies should be compiled separately for IF, FF, and O&M. The number of years for which historical subsidy cost data are compiled should be the same as is done for historical I&FF and O&M data (i.e., for three to ten years). Table 2-5 illustrates the disaggregation of three years of historical subsidy cost data for IF, FF, and O&M.

Information on subsidies may be available from relevant government ministries or agencies, statistical agencies, research organizations, academic institutions, and private sector entities.

>>> *Compile other input data for scenarios*

In addition to historical I&FF and O&M cost data, the characterization of the scenarios and estimation of annual costs for the scenarios will require the collection of other historical and non-historical data relevant to the sector. What data are needed will depend on the analytical approach chosen, the sectoral scope, and whether I&FF for mitigation or for adaptation measures are to be assessed. For example, if a model is to be used, basic socioeconomic and technological data may be needed for model inputs (e.g., population and economic growth projections, demand forecasts for products and services, technology development forecasts). Also, development of appropriate mitigation and adaptation scenarios will require information about current, past, and expected future GHG emissions and expected future impacts and sectoral vulnerabilities.

As with I&FF data, information may be available from relevant government ministries or agencies, statistical agencies, research organizations, and academic institutions.

Table 2-4: Template for three years of historical O&M cost data for an investment flow in 2003

Note: Households and Corporations O&M should be net of subsidies. If subsidy costs are included explicitly in the assessment, the domestic funds source for Government O&M should include subsidy costs.

Category of Investment Entity	**Investment Type 1: 2003 Investment Flow and Associated Annual O&M Costs**							
	2003 Investment Flow			**Associated Annual O&M During Historical Period**				
	Source of IF Funds		**IF** (2005 US$)	Source of O&M Funds		**2003 O&M** (2005 US$)	**2004 O&M** (2005 US$)	**2005 O&M** (2005 US$)
Households	Domestic	Equity and debt		Domestic	Equity and debt			
	Total Household IF (all domestic)			Total Household O&M (all domestic)				
Corporations	Domestic	Domestic equity (including internal cash flow)		Domestic	Domestic equity (including internal cash flow)			
		Domestic borrowing (bonds and loans)			Domestic borrowing (bonds and loans)			
		Total Domestic Sources			Total Domestic Sources			
	Foreign	Foreign direct investment (FDI)		Foreign	Foreign direct investment (FDI)			
		Foreign borrowing (loans)			Foreign borrowing (loans)			
		Foreign aid (ODA)			Foreign aid (ODA)			
		Total Foreign Sources			Total Foreign Sources			
	Total Corporation IF			Total Corporation O&M				
Government	Domestic	Domestic funds (budgetary)		Domestic	Domestic funds (budgetary)			
	Foreign	Foreign borrowing (loans)		Foreign	Foreign borrowing (loans)			
		Bilateral foreign aid (bilateral ODA)			Bilateral foreign aid (bilateral ODA)			
		Multilateral foreign aid (multilateral ODA)			Multilateral foreign aid (multilateral ODA)			
		Total Foreign Sources			Total Foreign Sources			
	Total Government IF			Total Government O&M				
Total Annual O&M (2005 US$)								

Table 2-5: Template for three years of historical subsidy cost data

Note: This table would be completed with government subsidy cost data if the costs of subsidies are included explicitly in the assessment. There may be subsidies that encompass more than one of the three types of costs (IF, FF, and O&M), but that are not separable, in which case just the total subsidy columns would be completed.

Investment Type	2003				2004				2005			
	IF Subsidy (2005 US$)	FF Subsidy (2005 US$)	O&M Subsidy (2005 US$)	Total Subsidy (2005 US$)	IF Subsidy (2005 US$)	FF Subsidy (2005 US$)	O&M Subsidy (2005 US$)	Total Subsidy (2005 US$)	IF Subsidy (2005 US$)	FF Subsidy (2005 US$)	O&M Subsidy (2005 US$)	Total Subsidy (2005 US$)
Investment Type 1												
Investment Type 2												
Investment Type 3												

Step #3: Define Baseline Scenario

This step entails characterizing the sector over the assessment period, assuming business-as-usual conditions, i.e., it is a description of what is likely to occur in the sector in the absence of new policies to address climate change, and given current sectoral and national plans. The baseline scenario should describe expected socioeconomic trends, technological change, public and private sectoral plans, relevant national plans, and expected investments (i.e., physical assets and programs) in the sector, including the nature, scale, and timing of those investments. The baseline scenario should be consistent with trends reflected in the historical data collected in the previous step, unless sectoral or national plans dictate otherwise.

If a model is being used in the analysis, it can be used to develop and define the baseline scenario. Otherwise a sectoral plan, a projection of trends, or the current situation (assuming no change), or some combination, can be used as the basis of the projection. A sectoral development plan may have been developed by the relevant ministry or government agency, or if sectoral investments are dominated by private sector entities, investment plans may be available from those entities.

In cases in which countries have already made progress in addressing climate change, these measures should be reflected in the baseline scenario, rather than trying to separate out current action on climate change. This is particularly important given the desired outcome of the analysis, specifically the *additional* resources needed to address climate change, i.e., above and beyond resources already invested in mitigation and adaptation.

Step #4: Estimate Annual IF, FF, and O&M Costs, and Subsidy Costs if included explicitly, for Baseline Scenario

>>> Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source

In this step, annual IF and FF for the baseline scenario are estimated. As discussed above, costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US$, should be reported in the year in which they are expected to be incurred, and should be discounted using appropriate public and private discount rates. The annual IF and FF estimates for each investment type should be disaggregated by investment entity and funding source, and also be divided into investment flows and financial flows.

The output of this step will be a stream of annual investment flows and/or financial flows for each investment type for the entire assessment period, by investment entity and funding source. These data should be organized as in Table 2-3, i.e., there would be a set of data for each year compiled in the format of Table 2-3.

The source of these data, or method of estimation, will depend on the analytical approach, the sectoral scope, and the types of investment entities that are relevant. The I&FF estimates may

be the output from a sectoral model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

>>> Estimate annual O&M costs for each IF, disaggregated by investment entity and funding source

Annual estimates of O&M costs for the baseline scenario are also needed. These must include the O&M costs for assets purchased during the assessment period, and the O&M costs for assets purchased before the assessment period and that are expected to still be in operation. As discussed above, costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US$, should be reported in the year in which they are expected to be incurred, and should be discounted using appropriate public and private discount rates. The annual O&M estimates for each investment type should be disaggregated by investment entity and funding source (as in Table 2-4), and also be divided into O&M for assets purchased during the assessment period, and for assets purchased prior to the assessment period. **For those assets purchased during the assessment period that are expected to still be in operation after the last year of the assessment period, annual O&M costs for each additional year the assets will be in operation should be estimated, up to an additional five years after the last year of the assessment period.** This will enable more accurate estimates of total costs for new assets to be made.

The output of this step will be a stream of annual O&M costs for each investment type that includes a new asset purchased during the assessment period, and streams of annual O&M costs for assets purchased prior to the assessment period, disaggregated by investment entity and funding source.

As with I&FF data, O&M estimates may be from the output from a sectoral model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

>>> Estimate annual subsidy costs for each investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment

If a country chooses to include subsidies explicitly in their assessment, annual subsidy costs for the baseline scenario need to be estimated. Subsidies should be estimated for each relevant investment type, and for all categories of cost (IF, FF, and O&M), as in Table 2-5. Costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US$, should be reported in the year in which they are expected to be incurred, and should be discounted using appropriate public and private discount rates.

Subsidy estimates may be from the output from a sectoral model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

Step #5: Define Mitigation (or Adaptation) Scenario

This step entails developing a description of what is likely to occur in the sector, over the assessment period, in the presence of new policies to address climate change. The climate change (i.e., mitigation or adaptation) scenario should describe expected socioeconomic trends, technological change, relevant sectoral and national plans, the new mitigation (or adaptation) measures that will be implemented (including the nature, scale, and timing of each), and expected sectoral investments given implementation of the measures.

In the first stage of this step, the preliminary set of the mitigation (or adaptation) measures that were identified in step #1 should be re-evaluated, given the analytical approach chosen in step #1, the data compiled in step #2, and the baseline analysis completed in step #3, and revised if needed. As discussed in the first part of step #1, the mitigation (or adaptation) measures should be defined clearly and completely to avoid double-counting. It is recommended that at this stage, countries also undertake an initial prioritization of the mitigation (or adaptation) measures, based on national development priorities, sectoral development priorities, and national or regional climate change concerns. This initial prioritization will be re-evaluated, and priorities will be evaluated across sectors, in the final step of the sectoral assessment of I&FF (step #8).

If a model is being used in the analysis, it can be used to develop and define the climate change scenario. Otherwise, a sectoral plan, a projection of trends, or the current situation (assuming no change), or some combination, can be used as the basis of the projection. Prior work on climate change (e.g., National Communications, TNAs, NAPAs, GHG mitigation assessments, vulnerability assessments) should be utilized in this step.

Step #6: Estimate Annual IF, FF, and O&M Costs, and Subsidy Costs if included explicitly, for Mitigation (or Adaptation) Scenario

>>> Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source

In this step, annual IF and FF for the mitigation (or adaptation) scenario are estimated. As with the baseline scenario, costs should be in real terms (ideally in constant 2005 US$), should be discounted, and should be reported in the year in which they are expected to be incurred. I&FF estimates should be disaggregated by investment entity and funding source, and also be divided into investment flows and financial flows. The output of this step will be a stream of annual investment flows and financial flows for each investment type for the entire assessment period, by investment entity and funding source, i.e., a set of data for each year compiled as in Table 2-3.

The source of these data, or method of estimation, will depend on the analytical approach, the sectoral scope, and the types of investment entities that are relevant. The I&FF estimates may be from a sectoral model or from planning documents, or might be derived from the historical data or be based on expert judgement. If a model is not used, information may be available from the investment entities, government ministries or statistical agencies, and/or research institutions, as well as from prior work on climate change.

>>> Estimate annual O&M costs for each IF, disaggregated by investment entity and funding source

Annual estimates of O&M costs for the mitigation (or adaptation) scenario are also needed. These must include the O&M costs for assets expected to be purchased during the assessment period, and the O&M costs for assets purchased before the assessment period and that are expected to still be in operation. As with the baseline scenario, costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US$, should be reported in the year in which they are expected to be incurred, and should be discounted using appropriate public and private discount rates. The annual O&M estimates for each investment type should be disaggregated by investment entity and funding source (as in Table 2-4), and also be divided into O&M costs for assets purchased during the assessment period, and for assets purchased prior to the assessment period. For those assets purchased during the assessment period that are expected to still be in operation after the last year of the assessment period, annual O&M costs for each additional year the assets will be in operation should be estimated, up to an additional five years after the last year of the assessment period. This will enable more accurate estimates of total costs for new assets to be made.

The output of this step will be a stream of annual O&M costs for each investment type that includes a new asset purchased during the assessment period, and streams of annual O&M costs for assets purchased prior to the assessment period, disaggregated by investment entity and funding source.

As with I&FF data, O&M estimates may be from a sectoral model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

>>> Estimate annual subsidy costs for each relevant investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment

If a country chooses to include subsidies explicitly in their assessment, annual subsidy costs for the climate change scenario need to be estimated. Subsidies should be estimated for each relevant investment type, and for all categories of cost (IF, FF, and O&M), as in Table 2-5. Costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US$, should be

reported in the year in which they are expected to be incurred, and should be discounted using appropriate public and private discount rates.

Subsidy estimates may be from the output from a sectoral model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

Step #7: Calculate the Changes in IF, FF, and O&M Costs, and in Subsidy Costs if included explicitly, Needed to Implement Mitigation (or Adaptation)

The changes in IF, FF, and O&M costs that are needed to implement the mitigation (or adaptation) measures in the sector are calculated in this step by subtracting baseline scenario costs from climate change scenario costs. There are two primary objectives of this step: 1) to determine how cumulative IF, FF, and O&M costs would change; and 2) to determine how annual IF, FF, and O&M costs would change. Five separate sets of calculations should be completed – two for estimating changes in cumulative IF, FF, and O&M, and three for estimating changes in annual IF, FF, and O&M. In addition, if subsidy costs are included explicitly in the assessment, the changes in subsidy costs may be calculated. The accompanying volume on reporting (*Reporting Guidelines for the Assessment of Investment and Financial Flows to Address Climate Change*) contains worksheets that can be used as models for developing country-specific worksheets for performing these calculations.

>>> Calculate changes in cumulative IF, FF, and O&M costs, by investment entity/funding source combination, for individual investment types and all investment types

These two calculations are designed to determine how cumulative investments by each investment entity/funding source combination would change, for each investment type and for all investment types, between the baseline scenario and the climate change scenario.

The first calculation entails estimating the incremental cumulative IF, FF, and O&M costs needed to implement each investment type in the sector, by individual investment entity/funding source combination. The two steps in this calculation, which would need to be carried out for all investment types in the sector, are:

1) For each investment type, calculate cumulative IF, FF, and O&M costs for each investment entity/funding source combination, in both the baseline scenario and the climate change scenario, by summing annual estimates over all years in the assessment period (e.g., 2005-2030).
2) For each investment type, calculate incremental cumulative IF, FF, and O&M costs for each investment entity/funding source combination by subtracting cumulative IF, FF, and O&M costs in the baseline scenario from cumulative IF, FF, and O&M costs in the climate change scenario.

Equations 2.1, 2.2, and 2.3 illustrate these steps for IF. The same computations would be carried out for FF and O&M costs. Table 2-6 illustrates how the results for IF, FF, and O&M costs for one investment type would be displayed in a table. Note that each investment type may not include all three types of costs (IF, FF, and O&M); and that if there are IF for an investment type, the IF are likely to occur in only one or a few years over the assessment period.

The results of this calculation will indicate which cumulative funding sources for each investment entity would need to grow, and which would need to decrease, for individual investment types in the sector.

Equation 2.1: Cumulative Baseline Scenario IF for Individual Investment Types, by Funding Source/Investment Entity Combination

$$\text{CumIF}(\text{BS}, \text{IT}i, \text{IE/FS}j) = \sum_t \text{IF}(\text{BS}, \text{IT}i, \text{IE/FS}j, \text{YR}t)$$

Where:

$\text{IF}(\text{BS}, \text{IT}_i, \text{IE/FS}_j, \text{YR}_t)$ = annual IF for investment type (IT) *i* in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j*, and for year (YR) *t*

$\text{CumIF}(\text{BS}, \text{IT}_i, \text{IE/FS}_j)$ = cumulative IF for investment type (IT) *i* in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j*

Equation 2.2: Cumulative Climate Change Scenario IF for Individual Investment Types, by Funding Source/Investment Entity Combination

$$\text{CumIF}(\text{CCS}, \text{IT}i, \text{IE/FS}j) = \sum_t \text{IF}(\text{CCS}, \text{IT}i, \text{IE/FS}j, \text{YR}t)$$

Where:

$\text{IF}(\text{CCS}, \text{IT}_i, \text{IE/FS}_j, \text{YR}_t)$ = annual IF for investment type (IT) *i* in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j*, and for year (YR) *t*

$\text{CumIF}(\text{CCS}, \text{IT}_i, \text{IE/FS}_j)$ = cumulative IF for an investment type (IT) *i* in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j*

Equation 2.3: Incremental Cumulative IF for Individual Investment Types, by Investment Entity/Funding Source Combination

$$\Delta\text{CumIF}(\text{IT}i, \text{IE/FS}j) = \text{CumIF}(\text{CCS}, \text{IT}i, \text{IE/FS}j) - \text{CumIF}(\text{BS}, \text{IT}i, \text{IE/FS}j)$$

Where:

$\Delta\text{CumIF}(\text{IT}_i, \text{IE/FS}_j)$ = incremental cumulative IF for investment type (IT) *i*, for investment entity/funding source combination (IE/FS) *j*

Table 2-6: Incremental cumulative IF, FF, and O&M costs for one individual investment type

Note: An additional set of nine columns would be added for each additional investment type in the sector. The first row is completed with simple labels and formulas to illustrate the incremental calculations. Positive values in the last three columns would indicate that IF, FF, and/or and O&M costs would increase for that investment entity/funding source combination; negative values indicate that IF, FF, and/or O&M costs would decline for that investment entity/funding source combination.

Category of Investment Entity	Source of Funds		Cumulative (2005-2030) IF, FF, and O&M Costs Investment Type I (million 2005US$)								
			Baseline Scenario			Climate Change Scenario			Incremental Cost		
			IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
Households	Domestic	Equity and debt	A1	B1	C1	D1	E1	F1	G1=D1-A1	H1=E1-B1	I1=F1-C1
	Total Household Funds (all domestic)										
Corporations	Domestic	Domestic equity (including internal cash flow)									
		Domestic borrowing (bonds and loans)									
		Total Domestic Sources									
	Foreign	Foreign direct investment (FDI)									
		Foreign borrowing (loans)									
		Foreign aid (ODA)									
		Total Foreign Sources									
	Total Corporation Funds										
Government	Domestic	Domestic funds (budgetary)									
	Foreign	Foreign borrowing (loans)									
		Bilateral foreign aid (bilateral ODA)									
		Multilateral foreign aid (multilateral ODA)									
		Total Foreign Sources									
	Total Government Funds										

The second calculation entails estimating the total incremental cumulative IF, FF, and O&M costs needed to implement all the investment types in the sector, by investment entity/funding source combination. These values are the sum of the values in the previous calculation, aggregated over all investment types. The steps in this calculation are:

1) Calculate cumulative IF, FF, and O&M costs for all investment types, for each investment entity/funding source combination, in both the baseline scenario and the climate change scenario by summing cumulative IF, FF, and O&M costs for each investment type over all investment types.
2) Calculate incremental cumulative IF, FF, and O&M costs for each investment entity/funding source combination by summing incremental cumulative IF, FF, and O&M costs for each investment type over all investment types in the sector.

Equations 2.4, 2.5, and 2.6 illustrate these steps for IF. The same computations would be carried out for FF and O&M costs.

This calculation will show which cumulative funding sources would need to increase, and which would need to decrease, for the entire set of investment types in the sector. A display of these results in tabular form would have the same layout as in Table 2-6, but would include only one set of 9 data columns. Figure 2-1 illustrates how the results for IF would look if displayed graphically with a column chart. Corresponding figures for incremental cumulative FF and O&M costs for all investment types would look similar, although fewer sources and investment entities might be required.

Equation 2.4: Cumulative Baseline Scenario IF for All Investment Types, by Investment Entity/Funding Source Combination

$$\text{CumIF}(BS, IT_{ALL}, IE/FS_j) = \sum_i \text{CumIF}(BS, IT_i, IE/FS_j)$$

Where:

CumIF(BS, IT_i, IE/FS_j) = cumulative IF for investment type (IT) *i* in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j*

CumIF(BS, IT_{ALL}, IE/FS_j) = cumulative IF for all investment types (IT_{ALL}) in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j*

Equation 2.5: Cumulative Climate Change Scenario IF for all Investment Types, by Investment Entity/Funding Source Combination

$$CumIF(CCS, IT_{ALL}, IE/FS_j) = \sum_t CumIF(CCS, IT_i, IE/FS_j)$$

Where:

$CumIF(CCS, IT_i, IE/FS_j)$ = cumulative IF for investment type (IT) *i* in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j*

$CumIF(CCS, IT_{ALL}, IE/FS_j)$ = cumulative IF for all investment types (IT_{ALL}) in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j*

Equation 2.6: Incremental Cumulative IF for all Investment Types, by Investment Entity/Funding Source Combination

$$\Delta CumIF(IT_{ALL}, IE/FS_j) = CumIF(CCS, IT_{ALL}, IE/FS_j) - CumIF(BS, IT_{ALL}, IE/FS_j)$$

Where:

$\Delta CumIF(IT_{ALL}, IE/FS_j)$ = incremental cumulative IF for all investment types (IT_{ALL}), for each investment entity/funding source combination (IE/FS) *j*

>>> Calculate changes in annual IF, FF, and O&M costs for individual investment types, for individual sources of funds, and for all investment types and funding sources

These three calculations are designed to determine how annual investments for each investment type, and for each investment entity/funding source combination, and for all investment types and all investment entity/funding source combinations, would change between the baseline scenario and the climate change scenario.

The first calculation entails estimating the incremental annual IF, FF, and O&M costs for all investment entity/funding source combinations needed to implement each investment type in the sector, in each year of the assessment period. The steps in this calculation are:

1) For each investment type, calculate annual total IF, FF, and O&M costs in both the baseline scenario and the climate change scenario by summing IF, FF, and O&M costs in each year over all investment entity/funding source combinations.
2) For each investment type, calculate incremental annual total IF, FF, and O&M costs by year by subtracting annual total IF, FF, and O&M costs for the baseline scenario from annual total IF, FF, and O&M costs for the climate change scenario.

Equations 2.7, 2.8, and 2.9 illustrate these steps for IF. The same computations would be carried out for FF and O&M costs. Table 2-7 illustrates how the results for IF, FF, and O&M costs for two investment types would be displayed in a table. Note that each investment type may not include all three types of costs (IF, FF, and O&M); and that if there are IF for an investment type, the IF are likely to occur in only one or a few years over the assessment period.

This calculation will show how incremental annual total IF, FF, and O&M costs for individual investment types would change over time in the sector.

Equation 2.7: Annual Total Baseline Scenario IF for each Investment Type

$$IF(BS, IT_i, IE/FS_{ALL}, YR_t) = \sum_i IF(BS, IT_i, IE/FS_j, YR_t)$$

Where:

$IF(BS, IT_i, IE/FS_j, YR_t)$, = annual IF for investment type (IT) *i* in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j*, and for year (YR) *t*

$IF(BS, IT_i, IE/FS_{ALL}, YR_t)$ = annual IF for investment type (IT) *i* in the baseline scenario (BS) for all investment entity/funding source combinations (IE/FS_{ALL}), and for year (YR) t

Equation 2.8: Total Annual Climate Change Scenario IF for each Investment Type

$$IF(CCS, IT_i, IE/FS_{ALL}, YR_t) = \sum_i IF(CCS, IT_i, IE/FS_j, YR_t)$$

Where:

$IF(CCS, IT_i, IE/FS_j, YR_t)$ = annual IF for investment type (IT) *i* in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j*, and for year (YR) *t*

$IF(CCS, IT_i, IE/FS_{ALL}, YR_t)$ = annual IF for investment type (IT) *i* in the climate change scenario (CCS), for all investment entity/funding source combinations (IE/FS_{ALL}), and for year (YR) *t*

Equation 2.9: Incremental Total Annual IF for each Investment Type

$$\Delta IF(IT_i, IE/FS_{ALL}, YR_t) = IF(CCS, IT_i, IE/FS_{ALL}, YR_t) - IF(BS, IT_i, IE/FS_{ALL}, YR_t)$$

Where:

$\Delta IF(IT_i\ IE/FS_{ALL}, YR_t)$ = incremental IF for investment type *i*, for all investment entity/funding source combinations (IE/FS_{ALL}) and for year (YR) *t*

The second calculation entails estimating annual incremental I&FF needed to implement all investment types in the sector, for each investment entity/funding source combination, in each year of the assessment period. The steps in this calculation are:

1) Calculate annual IF, FF, and O&M costs for all investment types, for each source/investment entity in both the baseline scenario and the climate change scenario by summing annual IF, FF, and O&M costs for each investment entity/funding source combination over all investment types.
2) Calculate incremental annual IF, FF, and O&M costs for each investment entity/funding source combination by subtracting annual IF, FF, and O&M costs for the baseline scenario from annual IF, FF, and O&M costs for the climate change scenario, for each investment entity/funding source combination.

Equations 2.10, 2.11, and 2.12 illustrate these steps for IF. The same computations would be carried out for FF and O&M costs. Table 2-8 illustrates how the results for IF would be displayed in a table. Corresponding tables for FF and O&M costs would have the same structure.

This calculation will show how incremental annual IF, FF, and O&M costs for all investment types would change over time in the sector.

Equation 2.10: Annual Baseline Scenario IF for all Investment Types, by Investment Entity/ Funding Source Combination

$$IF(BS, IT_{ALL}, IE/FS_j, YR_t) = \sum_i IF(BS, IT_i, IE/FS_j, YR_t)$$

Where:

$IF(BS, IT_i, IE/FS_j, YR_t)$ = annual IF for investment type (IT) *i* in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j* and year (YR) *t*

$IF(BS, IT_{ALL}, IE/FS_j, YR_t)$ = annual IF for all investment types (IT_{ALL}) in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j* and year (YR) *t*

Equation 2.11: Annual Climate Change Scenario IF for all Investment Types, by Investment Entity/Funding Source Combination

$$IF(CCS, IT_{ALL}, IE/FS_j, YR_t) = \sum_i IF(CCS, IT_i, IE/FS_j, YR_t)$$

Where:

$IF(CCS, IT_i, IE/FS_j, YR_t)$ = annual IF for investment type (IT) *i* in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j* and year (YR) *t*

$IF(CCS, IT_{ALL}, IE/FS_j, YR_t)$ = annual IF for all investment types (IT_{ALL}) in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j* and year (YR) *t*

Equation 2.12: Incremental Annual IF for all Investment Types, by Investment Entity/Funding Source Combination

$$\Delta IF(IT_{ALL}, IE/FS_{j,}, YRt) = IF(CCS, IT_{ALL}, IE/FSj, YRt) - IF(BS, IT_{ALL}, IE/FS_{j,}, YRt)$$

Where:

$\Delta IF(IT_{ALL}, IE/FS_{j,}, YR_t)$ = incremental annual IF for all investment types (IT_{ALL}), for each investment entity/funding source combination (IE/FS) *j* and year (YR) *t*

The third calculation entails estimating annual, total incremental IF, FF, and O&M costs for all investment types in the sector for each year of the assessment period (Table 2-9). The steps in this calculation are:

1) Calculate annual total IF, FF, and O&M costs (for all investment entity/funding source combinations) for all investment types, by year, in both the baseline scenario and the climate change scenario by summing IF, FF, and O&M costs in each year over all investment types and all investment entity/funding source combinations, for each scenario.
2) Calculate incremental annual, total IF, FF, and O&M costs by subtracting annual total IF, FF, and O&M costs for all investment types in the baseline scenario from annual total IF, FF, and O&M costs for all investment types in the climate change scenario.

Equations 2.13, 2.14, and 2.15 illustrate these steps. The same computations would be carried out for FF and O&M costs.

This calculation will show how incremental annual total IF, FF, and O&M costs for all investment types would change over time in the sector.

Equation 2.13: Annual Total Baseline Scenario IF for all Investment Types

$$IF(BS, IT_{ALL}, IE/FS_{ALL}, YRt) = \sum_{I}\sum_{j} IF(BS, ITi, IE/FSj, YRt)$$

Where:

$IF(BS, IT_i, IE/FS_j, YR_t)$ = annual IF for investment type (IT) *i* in the baseline scenario (BS), for investment entity/funding source combination (IE/FS) *j*, and for year (YR) *t*

$IF(BS, IT_{ALL}, IE/FS_{ALL}\ YR_t)$ = annual total IF for all investment types (IT_{ALL}) in the baseline scenario (BS), for all investment entity/funding source combination (IE/FS_{ALL}), and for year (YR) *t*

Equation 2.14: Annual Total Climate Change Scenario IF for all Investment Types

$$IF(CCS, IT_{ALL}, IE/FS_{ALL}, YRt) = \sum_{I} \sum_{j} IF(CCS, ITi, IE/FSj, YRt)$$

Where:

$IF(CCS, IT_i, IE/FS_j, YR_t)$ = annual IF for investment type (IT) *i* in the climate change scenario (CCS), for investment entity/funding source combination (IE/FS) *j*, and for year (YR) *t*

$IF(CCS, IT_{ALL}, IE/FS_{ALL}\ YR_t)$ = annual total IF for all investment types (IT_{ALL}) in the climate change scenario (CCS), for all investment entity/funding source combination (IE/FS_{ALL}), and year (YR) *t*

Equation 2.15: Incremental Annual Total IF for all Investment Types

$$\Delta IF(IT_{ALL}, IE/FS_{ALL}, YRt) = IF(CCS, IT_{ALL}, IE/FS_{ALL}, YRt) - IF(BS, IT_{ALL}, IE/FS_{ALL}, YRt)$$

Where:

$\Delta IF(IT_{ALL}, IE/FS_{ALL}, YR_t)$ = incremental annual IF for all investment types (IT_{ALL}) and for all investment entity/funding source combination (IE/FS_{ALL}), for year (YR) *t*

>>> If subsidies are included explicitly, consider calculating changes in cumulative and/or in annual subsidies for IF, FF, and O&M costs for each investment type and all investment types

If subsidies are included explicitly in the assessment, countries should consider undertaking various incremental calculations for the subsidy costs. Which, if any, incremental calculations are appropriate will depend on the nature, scale, and timing of subsidies in the baseline and climate change scenarios. Table 2-10 illustrates how both cumulative and annual incremental costs would be estimated for either individual investment types or all investment types.

Table 2-7: Incremental annual total IF, FF, and O&M costs for two individual investment types

Note: Additional sets of 9 columns would need to be added for each additional investment type in the sector. The first row is completed with simple labels and formulas to illustrate the incremental calculations.

Year	Annual Total IF, FF, and O&M Costs Investment Type I (million 2005 US$)									Annual Total IF, FF, and O&M Costs Investment Type II (million 2005 US$)								
	Baseline Scenario			Climate Change Scenario			Incremental Cost			Baseline Scenario			Climate Change Scenario			Incremental Cost		
	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
2005	A1	B1	C1	D1	E1	F1	G1= D1-A1	H1= E1-B1	I1= F1-C1	J1	K1	L1	M1	N1	O1	P1= M1-J1	Q1= N1-K1	R1= O1-L1
2006																		
2007																		
2008																		
…Additional rows would be added for each of the intervening years (2009-2029)																		
2030																		

Table 2-8: Incremental annual IF for all investment types, by investment entity/funding source combination

Note: This table is broken into two parts because of space limitations of the page. The first row of the table is completed with simple labels and formulas to illustrate the incremental calculations.

Year	Annual IF for All Investment Types by Investment Entity/Funding Source Combination (million 2005 US$)																	
	Households			Corporations														
	Domestic			Domestic						Foreign								
	Equity & Debt			Domestic Equity			Domestic Borrowing			FDI			Foreign Borrowing			ODA		
	BS	CCS	Δ	BS	CCS	Δ	BS	CCS	Δ	BS	CCS	Δ	BS	CCS	Δ	BS	CCS	Δ
2005	A1	B1	C1= B1-A1	D1	E1	F1= E1-D1	G1	H1	I1= H1-G1	J1	K1	L1= K1-J1	M1	N1	O1= N1-M1	P1	Q1	R1= Q1-P1
2006																		
2007																		
2008																		
…Additional rows would need to be added for the intervening years (2009-2029)																		
2030																		

Year	Annual IF for All Investment Types by Investment Entity/Funding Source Combination (continued) (million 2005 US$)											
	Government											
	Domestic			Foreign								
	Domestic Funds			Foreign Borrowing			Bilateral ODA			Multilateral ODA		
	BS	CCS	Δ	BS	CCS	Δ	BS	CCS	Δ	BS	CCS	Δ
2005	S1	T1	U1= T1-S1	V1	W1	X1= W1-V1	Y1	Z1	AA1= Z1-Y1	AB1	AC1	AD1= AC1-AB1
2006												
2007												
2008												
…Additional rows would need to be added for the intervening years (2009-2029)												
2030												

Table 2-9: Incremental annual IF, FF, and O&M costs for all investment types and all investment entity/funding source combinations

Note: The first row of the table is completed with simple labels and formulas to illustrate the incremental calculations.

Year	Annual IF, FF, and O&M Costs for All Investment Types & All Investment Entity/Funding Source Combinations (million 2005 US$)								
	Baseline Scenario			Climate Change Scenario			Incremental Cost		
	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
2005	A1	B1	C1	D1	E1	F1	G1= D1-A1	H1= E1-B1	I1= F1-C1
2006									
2007									
2008									
…Additional rows would be added for each of the intervening years (2009-2029)									
2030									

Table 2-10: Incremental cumulative and annual IF, FF, and O&M subsidy costs for individual investment types

Note: This same table format could be used for all investment types. The first and last rows, and the first column, of the table are completed with simple labels and formulas to illustrate the incremental calculations, and the cumulative figures.

Year	Annual IF, FF, and O&M Subsidy Costs for Investment Type I (million 2005 US$)								
	Baseline Scenario			Climate Change Scenario			Incremental Cost		
	IF Subsidy	FF Subsidy	O&M Costs Subsidy	IF Subsidy	FF Subsidy	O&M Costs Subsidy	IF Subsidy	FF Subsidy	O&M Costs Subsidy
2005	A1	B1	C1	D1	E1	F1	G1= D1-A1	H1= E1-B1	I1= F1-C1
2006	A2								
2007	A3								
2008	A4								
…Additional rows would be added for each of the intervening years (2009-2029)									
2030	A26								
Cumulative	A27=SUM(A1:A26)	B27=SUM(B1:B26)	C27=SUM(C1:C26)	D27=SUM(D1:D26)	E27=SUM(E1:E26)	F27=SUM(F1:F26)	G27=D27-A27	H27=E27-B27	I27=F27-C27

Step #8: Evaluate Policy Implications

The purpose of this step is to evaluate the policy implications of the results of the previous step for the sector. The analyses in the previous step estimate the magnitudes of changes in IF, FF, and O&M by each investment entity and from each funding source that would be needed to implement the mitigation or adaptation measures in the sector. The analyses also identify how IF, FF, and O&M costs would need to change over time, for each investment type, for each investment entity/funding source combination, and for all investment types and all investment entity/funding source combinations.

It is recommended that at this stage, countries first re-evaluate their initial prioritization of the mitigation (or adaptation) measures that was undertaken in step #5, based upon the incremental cost estimates that have been derived. Note that this Guidebook is not recommending that cost be the most important criterion for prioritizing climate change measures, but instead that incremental costs be added to set of evaluation criteria that a country is using to evaluate and prioritize climate change measures.

Next, the incremental I&FF results from the previous step, in conjunction with the re-prioritization of climate change measures and O&M cost results, should be used to determine which investment entities are responsible for the most significant (largest and/or highest priority) changes in I&FF, and the predominant sources of their funds. Then, the policy measures that might be used to induce those entities to implement the proposed measures and change their investment patterns, and the additional sources of funds that might be utilized to meet new investment needs, need to be evaluated. It will be particularly important to distinguish between public and private sources of finance, as well as between domestic and foreign sources. Policy measures include a variety of instruments, including regulations, incentives, and education. New sources of funds include both domestic options, e.g., taxes, and foreign options, e.g., ODA. Information on policy options can be found in the UNDP document *National Policies and Their Linkages to Negotiations Over a Future International Climate Change Agreement*[11], which gives an overview over a range of policy instruments as well as examples from countries in Africa, Asia and Latin America.

2.2.2 Final Methodological Step: Compile and Compare Sectoral I&FF Assessments

After steps 1 through 8 are completed for each "sector/type of measures" combination that a country has chosen, the sectoral results must be compiled so that mitigation and adaptation investments for each investment entity/funding source combination, and for each year, can be compared across sectors and across mitigation and adaptation.

[11] Tirpak et al. (2008) can be accessed at: http://www.undp.org/climatechange/docs/English/UNDP_National_Policies_final.pdf

At a minimum, two compilations of sectoral results should be completed – one for incremental cumulative total I&FF, and one for incremental annual total I&FF. The accompanying volume on reporting (*Reporting Guidelines for the Assessment of Investment and Financial Flows to Address Climate Change*) contains worksheets that can be used as models for developing country-specific worksheets for these compilations.

For the first compilation (incremental cumulative IF and FF for each sector/type of measures combination), the results from Equation 2.6 for both IF and FF would be compiled for all sectors in both mitigation and adaptation. Table 2-11 displays such a compilation for a national assessment that includes energy/mitigation, forestry/mitigation, forestry/adaptation, and public health/adaptation.

For the second compilation (incremental annual total IF and FF for each sector/type of measures combination), the results from Equation 2.15 for both IF and FF would be compiled for all sectors in both mitigation and adaptation. Table 2-12 displays such a compilation for the same "sector/type of measures" combinations used in Table 2-11.

In addition to Tables 2-11 and 2-12, it is recommended that countries consider producing more detailed versions of these tables. Specifically, a version of Table 2-11 could be produced for the highest priority individual investment types. This would enable comparisons among sectors of sources of funding for major investment types. A version of Table 2-12 for the highest priority individual investment types could also be produced, which would enable comparisons among sectors of the timing of investments for high priority investment types.

Table 2-11: Incremental cumulative IF & FF for all investments in all sectors

Note: This is an example of the results that would be displayed for an I&FF assessment for energy/mitigation, forestry/mitigation, forestry/adaptation, and public health/adaptation.

Category of Investment Entity	Source of I&FF Funds		Incremental Cumulative (2005-2030) IF & FF (million 2005 US$)							
			Mitigation				Adaptation			
			Energy		Forestry		Forestry		Public Health	
			∆IF	∆FF	∆IF	∆FF	∆IF	∆FF	∆IF	∆FF
Households	Domestic	Equity and debt								
	Total Household Funds (all domestic)									
Corporations	Domestic	Domestic equity (including internal cash flow)								
		Domestic borrowing (bonds and loans)								
		Total Domestic Sources								
	Foreign	Foreign direct investment (FDI)								
		Foreign borrowing (loans)								
		Foreign aid (ODA)								
		Total Foreign Sources								
	Total Corporation Funds									
Government	Domestic	Domestic funds (budgetary)								
	Foreign	Foreign borrowing (loans)								
		Bilateral foreign aid (bilateral ODA)								
		Multilateral foreign aid (multilateral ODA)								
		Total Foreign Sources								
	Total Government Funds									

Table 2-12: Incremental annual total IF & FF for all investments in all sectors

Year	Incremental Annual Total (2005-2030) IF & FF (million 2005US$)							
	Mitigation				Adaptation			
	Energy		Forestry		Forestry		Public Health	
	∆IF	∆FF	∆IF	∆FF	∆IF	∆FF	∆IF	∆FF
2005								
2006								
2007								
2008								
…Additional rows would be added for each of the intervening years (2009-2029)								
2030								