



# Assessing Investment & Financial flows to address climate change in the **ENERGY** Sector

UNDP I&FF Methodology Guidebook

# Relevance of energy sector

- **Primary source** of global greenhouse gas (GHG) emissions
- Emissions from this sector **have grown faster** than those in any other sector since 1970, & will continue to be the largest source of global GHG emissions
- Energy sector **key to development**: energy-related GHG emissions are growing fast in most highly dynamic (high growth) developing countries
- **Some mitigation options bring important local co-benefits**: energy security, low cost energy options, improved local environmental & health conditions, etc.

# 1. Establish key parameters of the assessment

- Define scope & boundaries for the assessment
  - ▣ What are the key subsectors to be included?
- Define the institutional framework
- Specify the time horizon for the analysis: 2015-2030 recommended, base year 2015 recommended
- Build on existing model for the sector where possible

# 1. Establish key parameters of assessment

Define boundaries for the assessment

## Example list of subsectors for screening & prioritization

Subsectors	Data availability	Investment (baseline & prior 10 years)	Priority in target scenario			
			High	Medium	Low	Rank
Fossil-fired generation						
Total electricity						
Oil supply						
Gas supply						
Coal supply						
Petroleum refining						
Electricity, gas distribution & water supply						
Gas distribution						
Nuclear generation						
Transmission & distribution						
Renewables including Large & small hydro						

## 1. Establish key parameters of assessment

## Select analytical approach

- Development of simple spreadsheets
- Use of existing energy models
- Sector projections/trends
  - ▣ To arrive at an estimate of projected demand & supply in the sector

## 2. Compile historical I&FF data and other input data for scenarios

- Focus: Local data at adequate aggregation level to identify investment types (e.g. wind energy facilities, biomass fired power plant, etc.), public programmes (e.g. energy efficiency program to replace incandescent bulbs), their costs & financing sources
- Recommended options: Sector investment & public programmes data, projections & development plans  
GHG Inventories, National Communications to UNFCCC

## 2. Compile historical I&FF data and other input data for scenarios

### Sources of Data

- National accounts:
  - ▣ System of National Accounts (SNA)
  - ▣ Systems of integrated environmental & economic accounts (SEEA)
- Existing sectoral plans
- Energy sector/econometric models:
- Private sector reports
- Other sources: GHG Inventories, National Communications etc.

## 2. Compile historical I&FF data and other input data for scenarios

### Historical Data (2006-2015)

- Electricity production by fuel & technology
- Electricity consumption by sector & fuel
- Inventory of large generation & transmission infrastructure, including commissioning & expected retirement/upgrade timescales
- Capital infrastructure investment data 2006-2015
- O&M data for key infrastructure
- Electricity price & subsidy data
- GHG emissions data for electricity sector
- Power generation efficiencies 2006-2015
- Transmission & distribution losses 2006-2015
- National energy resource assessments

### Forecast Data (2015-2030)

- Socio-Economic growth forecasts (population/GDP)
- National energy forecast models
- Forecasts for electricity production
- Forecast electricity demand & export
- National resource assessments by fuel
- Forecast sector investment data
- Forecast upgrades for end of life equipment
- Forecasts for price support & subsidies
- Emissions projections for sector 2015-2030
- Cost forecasts for new & emerging technologies



- Compile annual IF&FF data at the appropriate level of disaggregation (according to the national circumstances):
  - ▣ By investment type i.e.:
    - Switch to renewable energy sources
    - Improved efficiency of electricity production (e.g. gas turbine efficiency)
  - ▣ By investment entity
    - Government
    - Public corporations
    - Private corporations (domestic)
    - Private corporation (foreign)
    - ODA

2. Compile historical I&FF data and other input data for scenarios

Data collection, rely on national accounts data

## Examples of I&FF data disaggregation in each sub-sector

Category of Investment Entity	Source of I&FF Funds	Investment Flows (2005 \$)		Financial Flows (2005 \$)	
		Facility / Technology Type 1	Facility / Technology Type 2	Practice / Measure Type 1	Practice / Measure Type 2
Households	Domestic				
	Total Household Funds (all domestic)				
Corporations	Domestic (e.g. Business investments in hotels, restaurants )				
	Foreign (e.g. Int'l service industry- travel agencies, tourism info centers)				
	Total Corporation Funds				
Government	Domestic (e.g. Physical infrastructure- roads, communication)				
	Foreign				
	Total Government Funds				

### 3. Define Baseline Scenario

- Define the physical basis for the Baseline Scenario
- **A baseline scenario:** description of what is likely to occur in the absence of ADDITIONAL policies to address climate change; expected socioeconomic trends (e.g., population growth & migration, economic growth), technological change (if relevant), & expected business-as-usual investments in the sector.

### 3. Define baseline scenario

### Define baseline scenario

- Characterizing baseline for each relevant energy supply & energy end-use subsector over the assessment period
  - ▣ Assuming no new climate change policies are implemented
- Baseline scenario reflects
  - ▣ Current sectoral & national plans
  - ▣ Expected socioeconomic trends
  - ▣ Expected investments in the subsectors

### 3. Define baseline scenario

## Define physical basis for the Baseline Scenario

- Information should be disaggregated by:
  - ▣ Year (starting 10 years before the Base Year)
  - ▣ Source (by corporations & government)
  - ▣ Type (national funds, foreign direct investment, official development assistance)

## 4. Derive I&FF for baseline scenario

- Compile annual data, disaggregated by investment entity, source, investment flow type, & financial flow type & disaggregate costs of conventional & unconventional sources of energy
- Calculate the **total investment cost** in real, unannualized terms over the planning period
- Define **annual investment costs** associated with the new plan
- Develop a **breakdown of total investments** into major categories (e.g., ODA, FDI, domestic funds)

## 4. Derive I&FF for baseline scenario

Define annual I&FF

### Adding costs to baseline scenario

Funding entity category	Source of funds	Cumulative investment (2015-2030)	
		(billion 2015 \$)	(%)
Governments	Domestic funds (budgetary)		
	Foreign borrowing (loans)		
	Foreign aid (ODA)		
Corporations	Domestic equity		
	Foreign investment		
	Domestic debt		
	Foreign borrowing		
	Government support		
	Foreign aid (ODA)		
<b>Total</b>			

## 5. Define Target scenario

- **Target scenario:** incorporates measures to reduce GHG emissions
- The target scenario should describe expected socioeconomic trends, technological change (if relevant), relevant measures to mitigate GHG emissions, & the expected investments in key areas of the energy sector (e.g. end-use & supply subsectors) to implement those mitigation measures.
- Costing tools & international information sources may help to identify I&FF needs for different mitigation options



## 5. Define target scenario

# Energy Sector Mitigation Measures

Category of Mitigation Measure	Energy Supply Measures		Energy End-Use Measures	
	Reduce Combustion Emissions	Reduce Fugitive Emissions	Reduce Combustion Emissions	Reduce Energy Demand
Improve efficiency of energy use	Efficiency improvements in energy supply processes		Efficiency improvements in energy end-use technologies	Energy conservation measures
Reduce emissions per unit of energy production or use	Switch to lower carbon fuels		Switch to lower carbon fuels	
	Switch to alternative energy sources		Switch to alternative energy sources	
		Reduce fugitive losses (including recovery & use)		

## 5. Define target scenario

### Two approaches to define Target Scenario

- *Approach #1: assume an end point for energy supply emissions*
  - E.g. setting a target in 2030 for emissions from the energy supply sector
- *Approach #2: assume a set of technologies for energy supply:*
  - E.g. Review national potential for energy policy that articulate a set of technological options, such as renewable energy, & other carbon-reducing options to meet future energy demand

## 6. Derive I&FF for Target Scenario

- Compile annual data, disaggregated by investment entity, source, investment flow type, & financial flow type
- Define annual investment costs associated with the alternative management plan
- Calculate the total investment cost in real, unannualized terms over the planning period.
- Develop a breakdown of total investments into major categories (e.g., ODA, FDI, domestic funds)

## Adding costs to target scenario

Funding entity category	Source of funds	Cumulative investment (2015-2030)	
		(billion 2015 \$)	(%)
Households	Equity & debt		
Governments	Domestic funds (budgetary)		
	Foreign borrowing (loans)		
	Foreign aid (ODA)		
Corporations	Domestic equity		
	Foreign investment		
	Domestic debt		
	Foreign borrowing		
	Government support		
	Foreign aid (ODA)		
	<b>Total</b>		

## 7. Calculate changes in annual I&FF needed to implement adaptation

- Subtract the baseline annual I&FF, by entity & source, from the mitigation annual I&FF, by entity & source
- Subtraction of the Baseline Scenario from the Target Scenario
- Sum incremental amounts over all years, by entity & source

## 7. Calculate changes in annual I&FF needed

Subtract the baseline annual I&FF from the target annual I&FF

- For each chosen energy mitigation/adaptation option, the analysis should identify the incremental investment (total dollars) by source (domestic funds, ODA, FDI etc.) up through 2030 necessary for its implementation

7. Calculate changes in annual I&FF needed

Summarizing incremental investments

Funding entity category	Source of funds	Investment (billion 2015 \$)		
		Cumulative (2015-2030)		Incremental
		Baseline scenario	Adaptation Scenario	
Households	Equity & debt	Baseline value	Adaptation value	Adaptation minus Baseline value
Governments	Domestic funds (budgetary)			
	Foreign borrowing (loans)	...	...	...
	Foreign aid (ODA)	...	...	...
Corporations	Domestic equity	...	..	...
	Foreign investment	...	...	...
	Domestic debt	...	...	...
	Foreign borrowing	...	...	...
	Government support	...	...	...
	Foreign aid (ODA)	...	...	...
	<i>Total</i>	Sum (Baseline)	Sum (Adaptation)	Sum (Baseline minus Adaptation)

## 8. Evaluate policy implications

- Determine policy instruments & measures to encourage changes in I&FF
- Identify the entities that are responsible for the significant incremental changes in I&FF
- Determine the predominant sources of their funds, particularly important to distinguish between public & private sources of finance



## 8. Evaluate policy implications

Assess contribution and suitability of different policy options given country conditions

### Examples of mitigation & policy option

Policy options Mitigation measure	Economic Instrument	Regulations	Information provision	Other instruments
Energy efficiency Improvement	Energy tax Tradable permits Fiscal incentives for efficient appliances	Performance standards for electric appliances	Information campaigns Labelling of energy efficient equipment	Voluntary Agreements R&D programme (to develop more efficient technologies)
Energy source switching (e.g. substitute biomass for fossil fuels)	GHG tax Tradable permits	Power plant fuel portfolio standards	Information provision/ campaigns	R&D programme (e.g. to develop Hydrogen)
Increased Renewable Energy Capacity	Capital grants Feed-in tariffs Tradable permits	Renewable targets	Green electricity validation	Voluntary Agreements

## 9. Synthesize results and complete report

- For more information on synthesizing results, documentation & the completion of the report, please refer to the Reporting Guidelines

# Q&A CLARIFICATIONS



