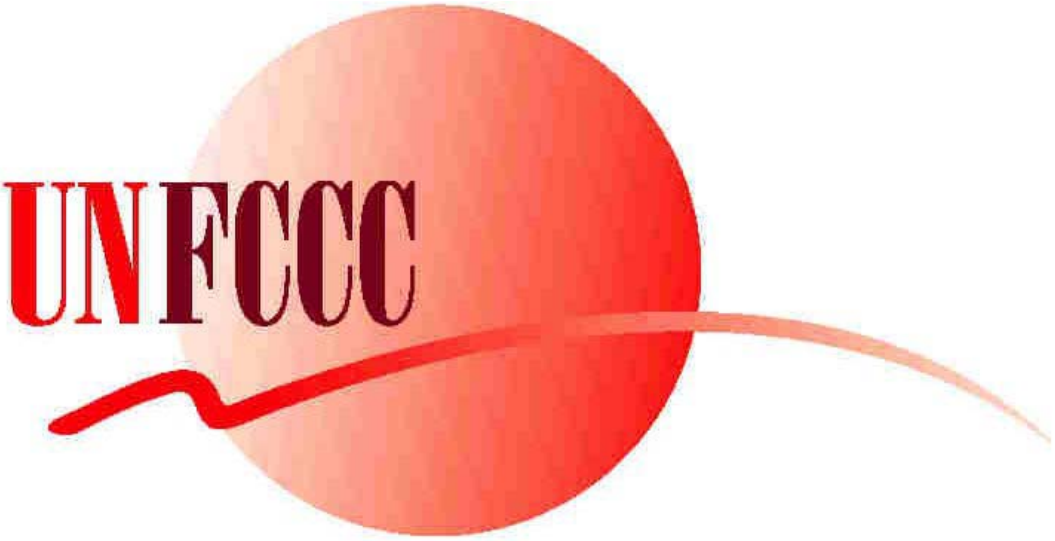
CONSULTATIVE GROUP OF EXPERTS ON NATIONAL COMMUNICATIONS FROM PARTIES NOT INCLUDED IN ANNEX I TO THE CONVENTION
(CGE)



Training Handbook on Mitigation Assessment for Non-Annex I Parties

May 2006

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0 Background

The UNFCCC's Consultative Group of Experts on national communications from Parties not included in Annex I to the Convention (CGE) is a constituted expert body of the Convention with the overall goal of improving the process of preparing second and subsequent national communications by providing technical advice and support to non-Annex I (NAI) Parties. At its eighth session, the Conference of the Parties of the UNFCCC (COP), mandated the CGE to provide technical advice and support, by organizing and conducting workshops, including hands-on training workshops at the regional or sub-regional level, on inventories, vulnerability and adaptation, and mitigation to assist Parties in preparing their national communications.

In its report to the fifteenth session of the Subsidiary Body for Implementation in 2001, the CGE noted that many NAI Parties had not been able to comprehensively assess the GHG abatement options, their reduction potential, and costs and benefits. The CGE also indicated that the assessment of the impacts of abatement options was limited to economic aspects and that there is a lack of analysis and assessment of environmental, social and economic impacts of mitigation across sectors in the economy.

A review of the list of project proposals submitted by NAI Parties in their initial national communications revealed that Parties took different approaches in providing information in their national communications relating to Article 12, paragraph 4, of the Convention. Some Parties presented information on activities that were being implemented, approved for funding or planned for implementation in the short term. Other Parties identified prioritized areas for mitigation or mitigation options based on national circumstances whereas others identified project concepts and profiles.

The COP, at its eighth session, adopted the guidelines to assist developing country Parties in preparing their second and subsequent national communications. These guidelines are further elaborated through the publication of a user manual and the conduct of regional hands-on training workshops.

0.1 Global Hands-on Training Workshop

To address these concerns, the CGE developed materials for use in a **Global Hands-on Training Workshop** designed to assist NAI experts in preparing the mitigation section of their national communications through training on a wide range of mitigation assessment approaches, methods and tools and information on the their relative strengths and weaknesses in different analytical contexts.

The first **Global Hands-on Training Workshop** was held in the City of Seoul, in the Republic of Korea in September 2005. All the materials from that workshop are currently available for download from the following web sites:

http://unfccc.int/resource/cd_roms/na1/mitigation/index.htm as well as
http://forums.seib.org/unfccc.htm

This handbook is intended to complement the materials presented at that workshop. It is intended to serve as a succinct guide or road map to the various issues addressed in the workshop and is intended to be read in conjunction with the PowerPoint slides presented at the Workshop. Both this handbook and the accompanying slides are available online at the above web address, and are intended to make the materials delivered at the Korea workshop useful to those unable to physically attend.

0.2 Structure of this Handbook

This handbook, like the workshop it is based upon, is divided into two main parts.

- **Part 1** presents a guide to the lecture materials presented in the workshop, which contain information on mitigation assessment for NAI Parties. This information is divided into six modules, as follows:

    1. Introduction to Mitigation under the UNFCCC.
    2. Mitigation Assessment: Concepts, Structure and Steps.
    3. Mitigation Options: A Sectoral Review.
    4. Barriers to Mitigation.
    5. Mitigation Methods and Tools.
    6. Reporting of Mitigation Assessments in National Communications.

- **Part 2** introduces the two hands-on training exercises that were conducted during the workshop. The hands-on computer exercises are designed to introduce some of the basic techniques used in a GHG Mitigation Assessment.

Part 1: Mitigation Assessment for NAI Parties

1 Mitigation Assessment under the UNFCCC

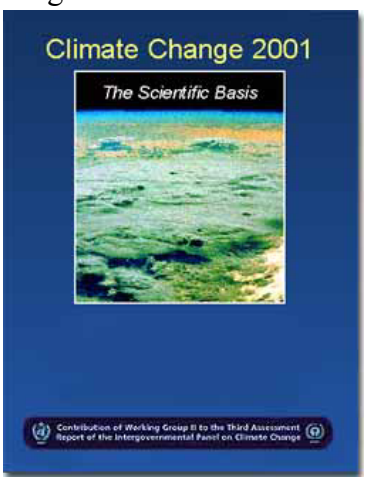
The objective of this module is to provide the participants with an overview of mitigation in the context of climate change, sustainable development and the framework of UNFCCC.

The slides for this module are contained in PowerPoint file: **Module1.ppt**

1.1 The Science of Climate Change

This section provides a brief introduction to the science of climate change. It summarizes:

- Ways in which the atmosphere is changing.
- Some expected impacts of climate change.
- How the Developing Countries are likely to be the most vulnerable to climate change.
- The potential and limitations for adaptation to climate change.
- Approximately what levels of emissions reductions would correspond to different levels of stabilization of atmospheric concentrations of CO2.
- Current and likely future sources of GHGs by region, sector and gas.
- Attributes of key GHGs.



Much of the material presented in this section is based on the following IPCC report:

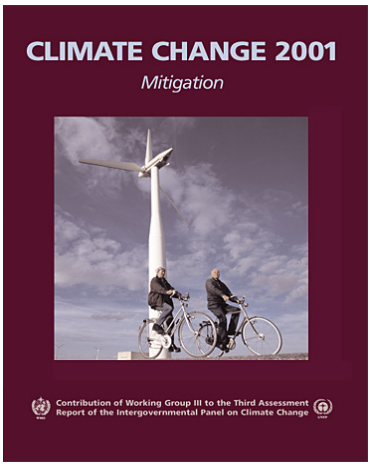
- IPCC (2001) *Climate Change 2001: The Scientific Basis* Available online in Arabic, Chinese, English, French, Spanish and Russian from: http://www.ipcc.ch/pub/reports.htm.

1.2 Definition and Scope of Mitigation

This section provides a review of the definition and scope of mitigation. It reviews:

- Definitions of basic terminology.
- Time frames involved in mitigation activities.
- The scope of mitigation activities (energy sector, non-energy sector, analysis of impacts of mitigation on the wider economy).

1.3 Climate Change 2001: Mitigation (IPCC TAR WGIII)



The slides in this section present a brief overview of the contents of the IPCC report: **Climate Change 2001: Mitigation.**

The Intergovernmental Panel on Climate Change (IPCC) has three working groups:

- WG I to assess the Science of climate change
- WG II to assess Impacts, adaptation and vulnerability
- WG III to assess Mitigation of climate change

WGIII was charged by the IPCC Plenary for the Panel's Third Assessment Report (TAR) to assess the scientific, technical, environmental, economic, and social aspects of the mitigation of climate change.

The major topics covered in the report are:

- Greenhouse Gas Emissions Scenarios
- Technological and Economic Potential of Mitigation Options
- Technological and Economic Potential of Sinks
- Barriers, Opportunities, and Market Potential
- Policies, Measures, and Instruments
- Costing Methodologies
- Global, Regional and National Costs and Ancillary Benefits
- Sectoral Costs and Ancillary Benefits of Mitigation
- Decision Analytic Frameworks
- Gaps in Knowledge

The major conclusions of the report are that:

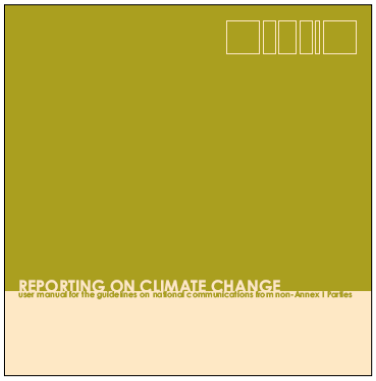
- Climate change is a problem with unique characteristics
- Alternative development paths can result in very different GHG emissions (e.g., SRES)
- Climate change mitigation will both be affected by, and have impacts on, broader socio-economic policies and trends
- Differences in distribution of resources are key considerations (i.e., equity concerns)
- Lower emissions scenarios require different patterns of energy resource development

For more on this topic, refer to:

- IPCC (2001). *Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change.*. Available online in Arabic, Chinese, English, French, Spanish and Russian from: http://www.ipcc.ch/pub/reports.htm

- IPCC (2000). *Emissions Scenarios. Special Report of the Intergovernmental Panel on Climate Change*. Available online in Arabic, Chinese, English, French, Spanish and Russian from: http://www.ipcc.ch/pub/reports.htm

1.4 The UNFCCC Guidelines on Mitigation Assessment



This section provides a detailed explanation of the UNFCCC Guidelines on Mitigation Assessment. The slides cover:

- A description of the scope and structure of the United Nations Framework Convention on Climate Change (UNFCCC).
- An overview of the status of different Parties to the Convention (Annex 1, Annex 2 and non-Annex 1).
- The status of National Communications to the UNFCCC.
- An examination of national commitments on reporting to the UNFCCC.
- An examination of the latest Guidelines for National Communications Preparation for NAI Parties, adopted in 2002 at COP 8, including:
  - Information to be included in NAI national communications.
  - National Circumstances for NAI Parties.
  - Methodological approaches for mitigation.
  - Reporting.

For more on this topic, please refer to:

- UNFCCC (2004). *User Manual for Guidelines on NAI National Communications.* Available online in English, French and Spanish from: http://unfccc.int/national_reports/non-annex_i_natcom/guidelines_and_user_manual/items/2607.php

1.5 The Potential Benefits of Mitigation

This section introduces the topic of the benefits of GHG mitigation. It includes:

- The scope of potential benefits (primary, co-benefits and ancillary benefits).
- Examples of local benefits (i.e. non-global benefits).
- Some key challenges in identifying benefits.

1.6 Interactions Between Mitigation and Development

This section reviews the wider interactions between the dual challenges of mitigation and development. It includes discussion of:

- How wider development goals will likely be undermined by ongoing climate change.

- How developing countries are the most vulnerable to climate changes.
- The need for an integrated approach to climate change and sustainable development.

1.7 Integrating Mitigation and Adaptation

This section discusses the potential for integrating mitigation and adaptation activities. It point out that:

- There are increasing calls to better integrate these two fields by seeking synergies between mitigation and adaptation activities.
- Because of long lag times in the climate system, no mitigation efforts will be able to prevent climate change.
- Conversely, reliance on adaptation alone would lead to a large magnitude of climate change, to which it would be very expensive to adapt.
- However, there may be significant downsides in placing too much focus on seeking synergies. For example:
    - Implementation of synergistic measures can involve great institutional complexity
    - Opportunities for synergistic measures are probably very limited compared to the overall challenges of each field.
    - Many synergistic measures may not be a wise investment in terms of mitigation and adaptation benefits.
    - Risks that activities will be labeled as both mitigation and adaptation activities to make them more attractive for funding – thereby diminishing overall effectiveness of how climate funds are spent.
- Seeking an "optimal" mix of activities may be a poor approach given uncertainties about climate change and the widely differing interests, values and preferences of stakeholders.
- Seeking robustness is probably a better approach to decision making.
- "Mainstreaming" is an emerging approach that seeks to integrate policies and measures that address climate change into ongoing sectoral and development planning and decision making: so as ensure long-term sustainability and reduce vulnerability to both current and future climate.

For more on this topic, refer to:

- Klein et. al. (2003) *Integrating mitigation and adaptation into climate and development policy: Three research questions.* Tyndall Centre Working Paper No. 40. Available online from: http://www.tyndall.ac.uk/publications/working_papers/wp40_summary.shtml

2 Mitigation Assessment: Concepts, Structure and Steps

The objective of this module is to have an in-depth understanding of the concepts, structure and steps involved in conducting a mitigation assessment including a description of how to identify and prioritize technologies and policies in a mitigation assessment.

The slides for this module are contained in PowerPoint file: **Module2.ppt**

Much of this module is based on two important sources:

- Sathaye, J. and Meyers, S. (1995). *Greenhouse Gas Mitigation Assessment: A Guidebook.* Published in complete book form by Kluwer Academic Publishers, Netherlands or available online (minus tables and charts) from: http://ies.lbl.gov/iespubs/iesgpubs.html
- Halsnaes, K.; Callaway, J.M.; Meyer, H.J. (1999). *Economics of Greenhouse Gas Limitations: Methodological Guidelines.* UNEP Collaborating Centre on Energy and Environment, Denmark. Available online from: http://uneprisoe.org/EconomicsGHG

2.1 Introduction

This section introduces some of the key questions that need to be addressed in undertaking a mitigation assessment, including:

- Why do a mitigation assessment?
- Where are the main opportunities for mitigation and what will they cost? The slides show that this is a difficult question because costs depend crucially on the assumptions used in any analysis.
- How should a national team prepare for a mitigation assessment?
- Who should be the key participants in a mitigation assessment?
- How should a mitigation assessment be structured?
- What are the basic steps in a mitigation assessment?
- What should be the analytical timeframe of an assessment?
- How should mitigation assessments be linked/integrated with national GHG inventories and vulnerability and adaptation assessments?
- What are the key parameters in an assessment (e.g. base year, time horizon, boundaries, cost perspective, discount rate, etc.)?
- How should costs be examined and what approaches can be used for dealing with the issue of discounting costs and discounting carbon?
- How should data be collected for a mitigation assessment?
- How can mitigation assessments feed into national GHG mitigation action plans?

For more information on this topic we also suggest the following document:

- Repetto, R. and Austin, D. (1997). *The Costs of Climate Protection: a Guide for the Perplexed.* WRI. http://pubs.wri.org/pubs_description.cfm?PubID=2475

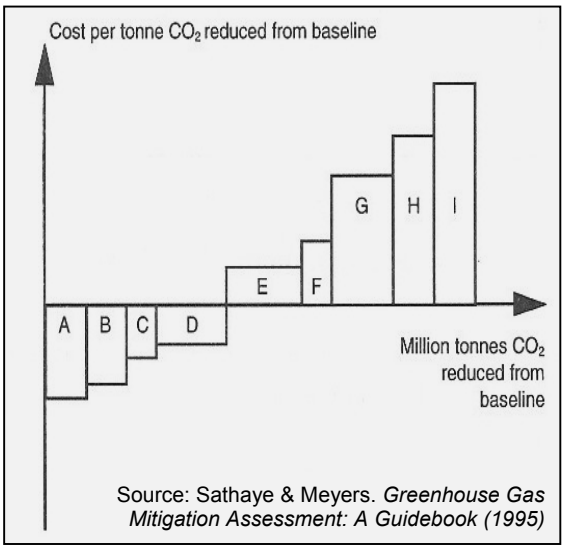
2.2 Baseline Scenarios

This section introduces the concept of baseline scenarios. A baseline is a plausible and consistent description of how a system might evolve into the future in the absence of explicit new GHG mitigation policies. Baseline scenarios are the counterfactual situations against which mitigation policies and measures will be evaluated. This section deals with critical issues related to defining and establishing baseline scenarios, such as:

- Should an assessment have one or more than one baseline?
- How can baselines projection be established and how should the issue of uncertainty be addressed?
- Baselines should not be a simple extrapolation of current trends, but should consider the likely future evolution of activities that effect GHG sources and sinks.
- Alternative approaches or typologies for defining baseline scenarios are also considered.

2.3 Screening Mitigation Options

This section introduces the idea of screening mitigation options. Screening enables a rough assessment of the potential feasibility of options ahead of performing a detailed mitigation scenario analysis in a more complex modeling tool. Screening is particularly important when using bottom-up methodologies in which a wide range of technologies and policies need to be considered. One approach is to prepare a matrix and assign scores or rankings to options in order to identify those options that need to be included later in a more in-depth analysis. Screening helps reduce the level of effort required in a more in-depth mitigation analysis, while also reducing the likelihood of overlooking important options.



Source: Sathaye & Meyers. *Greenhouse Gas Mitigation Assessment: A Guidebook (1995)*

This section deals with important issues related to screening, including:

- Possible Screening Criteria
- How to prepare and use a screening matrix (an example of which is shown below).
- Screening using cost curves.
- Three approaches to developing cost curves (the partial approach, the retrospective systems approach, and the integrated systems approach).

- Macroeconomic implications of screening.

Examples of Criteria	Mitigation Option 1	Option 2	Option 3
Mitigation Potential	Tonnes CO2, score or ranking (low, medium)		
Direct Costs	$/Tonne, C/B ratio, score or ranking		
Indirect Costs - Increase in domestic employment - Decrease in import payments	 Score or ranking Score or ranking		
Consistency with Development Goals - Potential for wealth generation - Consistency with MDGs	 Score or ranking Score or ranking		
Consistency with Environmental Goals -Potential for reducing air, water and other pollution	 Score or ranking		
Long term sustainability of option	Score or ranking		
Data -Availability -Quality	 Score or ranking Score or ranking		
Feasibility (political, social, technical)	Score or ranking		

An example of a screening matrix

2.4 Mitigation Scenarios

This section describes the process of constructing mitigation scenarios. Mitigation scenarios reflect a future in which explicit policies and measures are adopted to reduce the sources (or enhance the sinks) of GHGs, and are used to compare and evaluate GHG mitigation policies and measures against the counterfactual situation described in the Baseline scenario.

This section describes the steps used in constructing mitigation scenarios and also describes some of the broad issues that NAI Parties should consider in framing their mitigation scenarios.

3 Mitigation Options: A Sectoral Review

The objective of this module is to provide an overview of the various technologies and options that might be appropriate for mitigating greenhouse gases, as well as the types of policies and measures that can promote the implementation of those options.

The module is divided into sections, each of which address different energy and non-energy sectors.

The slides for this module are contained in PowerPoint file: **Module3.ppt**

The basis for this module is that numerous technology solutions offer substantial CO2-reductions potential, including renewable energies, fossil-fuel use with CO2 capture and storage, nuclear fission, fusion energy, hydrogen, biofuels, fuel cells and efficient energy end use. No single technology can meet this challenge by itself. Different regions and countries will require different combinations of technologies to best serve their needs and best exploit their indigenous resources. The energy systems of tomorrow will rely on a mix of different advanced, clean, efficient technologies for energy supply and use.

Supply-side technologies are not alone in offering significant potential for emissions reduction. Energy technologies for end-use efficiency in the transport, industrial, and residential and commercial sectors are also crucial.

The sectors included in the module are:

- Industry
- Buildings
- Transport
- Energy supply
- Solid waste
- Land-use, land-use change and forestry
- Agriculture

Note that geological sequestration is not covered in this module but is a potential longer-term mitigation option.

For more on this topic, please refer to:

- IPCC (2001). *Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change.*. Available online in Arabic, Chinese, English, French, Spanish and Russian from: http://www.ipcc.ch/pub/reports.htm
- IPCC (1996) *Technologies, Policies and Measures for Mitigating Climate Change.* Watson, R.T.; Zinyowera, M.C.; Moss, R.H. (eds). Available online from: http://www.ipcc.ch/pub/techrep.htm

- UNDP (2000). *World Energy Assessment: Energy and the Challenge of Sustainability*. Goldemberg, J. (ed.) United Nations Development Programme, United Nations Department of Economic and Social Affairs, World Energy Council. Available online from:
http://www.undp.org/energy/weaover2004.htm

3.1 Industry

This section describes:

- The importance of the industrial sector in terms of its contribution to global GHG emissions.
- Historical trends that show how industrial energy and emissions intensity has been declining in recent decades.
- The special structure of energy use in the industrial sector. This provides unique opportunities for reducing GHG emissions, but also entails particular barriers due for example to the capital-intensive nature of many industries.
- Technical options for reducing GHGs in the industrial sector.
- Opportunities for reducing process-related (ie. eon-energy related) emissions of non-CO2 GHGs.
- Policy options for promoting adoption of GHG reducing technologies in the industrial sector.

3.2 Buildings

The buildings sector covers both residential and commercial buildings. This section describes:

- The importance of the buildings sector in terms of its contribution to global GHG emissions.
- Technical options for reducing GHGs in the buildings sector.
- Policy measures for promoting adoption of GHG reducing technologies in the buildings sector.

3.3 Transport

This section describes:

- The importance of the transport sector in terms of its contribution to global GHG emissions.
- Technical options for reducing GHGs in the transport sector.
- Policy measures for promoting adoption of GHG reducing technologies in the transport sector.

3.4 Energy supply

The energy supply sector includes those industries involved in the extraction of primary energy, those that transform energy supplies from primary fuels into secondary fuels, and

those that are involved in transporting energy. It includes modern sectors such as electric generation, oil refining, ethanol production, coal mining, and oil production as well as traditional sectors such as charcoal making.

This section describes:

- The importance of the energy supply sector in terms of its contribution to global GHG emissions.
- Technical options for reducing GHGs in the energy supply sector. These include options such as switching to lower carbon fuels including biomass and renewable energy forms, increasing energy efficiency,
- Policy measures for promoting adoption of GHG reducing technologies in the energy supply sector, such as market instruments, regulations, voluntary agreements, etc.

3.5 Solid waste

Solid waste management affects the release of greenhouse gases in five major ways:

- landfill emissions of methane,
- reductions in fossil fuel use by substituting for energy recovery from waste combustion,
- reduction in energy consumption and process gas releases in extractive and manufacturing industries, as a result of recycling,
- carbon sequestration in forests, caused by decreased demand for virgin paper, and,
- energy used in the transport of waste for disposal or recycling.

This section describes:

- The importance of the solid waste sector in terms of its contribution to global GHG emissions.
- Technical options for reducing GHGs in the solid waste sector.
- Policy measures for promoting adoption of GHG reducing technologies in the solid waste sector.

3.6 Land-use, land-use change and forestry

Land-use, land-use change and forestry (LULUCF) are the key sectors for non-energy sector greenhouse gas mitigation activities. The main areas for mitigation in this sector include:

1. Forestry
2. Rangelands and Grasslands
3. Agriculture

Key steps in a LULUCF mitigation assessment include:

1. Identification and categorization of mitigation options.
2. Assessment of current and future land area available for mitigation options.

3. Assessment of current and future demand for products and for land.
4. Determination of the land area and product scenarios by mitigation option.
5. Estimation of the carbon sequestration per hectare for major available land classes, by mitigation option.
6. Estimation of unit costs and benefits.
7. Evaluation of cost-effectiveness indicators.
8. Development of future carbon sequestration and cost scenarios.
9. Exploration of policies, institutional arrangements and incentives necessary for the implementation of mitigation options.
10. Estimation of the national macro-economic effects of these scenarios.

This section includes:

- Assessment of the major mitigation options in the forestry, drylands and agriculture sectors.
- A review of the main sources of emissions and the proposed approach for mitigation assessment from the agriculture sector, including
    - CH4 Emissions from livestock and manure.
    - CH4 Emissions from flooded rice fields.
    - Emissions from agricultural soils.
- The section includes a review of both the IPCC Tier 1 and Tier 2 methodologies, including the revisions in the Revised 1996 Guidelines.

4 Barriers to Mitigation

The objective of this module is to provide an overview of the kinds of barriers to greenhouse gas mitigation facing non-annex 1 parties, and to discuss opportunities and mechanisms for overcoming those barriers.

The slides for this module are contained in PowerPoint file: **Module4.ppt**

- A barrier is defined as any obstacle to reaching a potential reduction of GHG that can be overcome by a policy, programme, or measure.
- An opportunity is a situation or circumstance to decrease the gap between the market potential of a technology or practice and the economic, socioeconomic, or technological potential.
- Barriers and opportunities tend to be context-specific, and can change over time and vary across countries. Policies, programmes, and measures may be used to help overcome barriers.
- Barriers identification is a key issue to select feasible mitigation options.

The module is divided into three sections:

- Concepts
- Sectoral Barriers
- Overcoming Barriers
- Examining Barriers During a Mitigation Assessment

This module is based on the following sources of information:

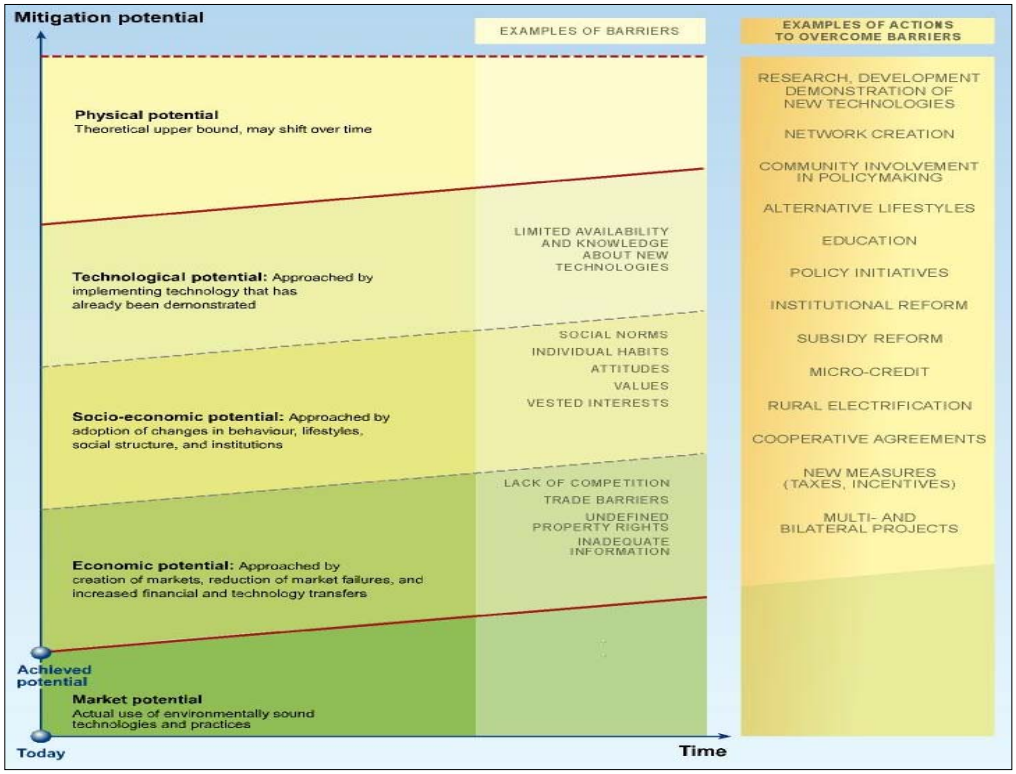
- Chapter 5 of IPCC (2001). *Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change.* Available online in Arabic, Chinese, English, French, Spanish and Russian from: http://www.ipcc.ch/pub/reports.htm
- OECD/IPCC (2000). *Ancillary Benefits and Costs of GHG Mitigation.* Available online from: http://www.oecd.org
- IPCC (2000). *Methodological and Technological Issues in Technology Transfer.* Metz, B.; Davidson, O.; Martens, J.; Van Rooijen S.; Van Wie Mcgrory, L. (eds.) Cambridge University Press. Available online from: http://www.ipcc.ch/pub/reports.htm

4.1 Concepts

This section reviews the key concepts related to mitigation barriers (and opportunities). They include:

- The conceptual framework, which makes explicit the relation between types or categories of barriers and level or potential of GHG mitigation.

- The character of the proposed conceptual framework: its advantages and limitations. Types or categories of barriers are related to different concepts of the *potential* for GHG mitigation.
    - **Market potential** indicates the level of mitigation expected to occur under forecast market conditions.
    - **Technical potential** describes the maximum amount of mitigation achievable through technology diffusion. (if all technically feasible technologies were used in all relevant applications, without regard to their cost or user acceptability).
    - **Economic potential** represents the level of GHG mitigation that could be achieved if all technologies that are cost-effective from a consumers' point of view were implemented.



- The importance of national circumstances. The identification, analysis and prioritization of barriers should be country-based and actions should be tailored to overcome specific barriers, interests and influences.
- The definition and understanding of a barrier itself and the reference to opportunities.
- Sources of barriers, including: prices, financing, international trade, market structure, institutional and regulatory frameworks, information provision, and social, cultural and behavioral norms and aspirations.

4.2 Sectoral Barriers

This section reviews specific examples of barriers in different energy and non-energy sectors of the economy. The sectors reviewed include:

- Buildings
- Transport
- Industry
- Energy Supply
- Forestry
- Solid Waste
- Agriculture

4.3 Overcoming Barriers

This section examines how barriers can be overcome so as to encourage GHG mitigation actions. The section includes:

- A review of the steps involved in diagnosing and overcoming barriers to GHG mitigation.
- National, sectoral and international policies for overcoming barriers.
- Specific sectoral measures for overcoming barriers in the buildings, transport, industry, energy supply, and forestry sectors.

4.4 Examining Barriers During a Mitigation Assessment

This final section examines how the issue of barrier removal can be considered as part of a national communications mitigation assessment. It is suggested that mitigation assessments should describe the requirements for removing barriers, by including information on requirements for:

- Financial support,
- Assessment of technology options for the different mitigation options,
- Institutional capacity-building to sustain mitigation work,
- Regulation policies,
- Further improvements of the national decision framework,
- Costs associated with the implementation of mitigation options.

5 Mitigation Methods and Tools

The objective of this module is to introduce participants to commonly used methods and modeling tools that can be applied for mitigation assessment. The module discusses the advantages, limitations, data and technical requirements of each approach.

The module is divided into two parts.

- **Module 5.1** introduces methods and approaches for energy sector mitigation modeling.
  Module 5.2 describes methods and approaches for the agriculture, land-use and forestry sectors.

The slides for this module are contained in PowerPoint files: **Module51.ppt** and **Module52.ppt.**

5.1 The Energy Sector

Module 5.1 focuses on methods and modeling tools for mitigation assessment in the energy sector. In particular it compares and reviews the characteristics of four software tools that may be useful in various aspects of GHG mitigation assessment in the energy sector:

- MARKAL
- ENPEP-BALANCE
- LEAP
- RETScreen

Note: module 5.1 is NOT intended to provide in-depth training in the use of any of these tools. Separate, in-depth training will be likely required for any tools selected. The intention is only to sufficient information to help parties choose an appropriate tool for their assessments

5.1.1 Approaches for Energy Sector Mitigation Modeling

Various approaches are available for modeling the energy sector in a GHG mitigation assessment. Typically the range of approaches can be divided into two basic approaches: top-down and bottom-up. Some characteristics of these two types of models are outlined below.

Top-Down	Bottom-Up
• Use aggregate economic data • Assess costs/benefits through impact on output, income, GDP • Implicitly capture administrative, implementation and other costs. • Typically assume efficient markets, and no "efficiency gap" • Capture intersectoral feedbacks and interactions • Commonly used to assess impact of carbon taxes and fiscal policies • Less suitable for examining technology-specific policies	• Use detailed data on fuels, technologies and policies • Assess costs/benefits of individual technologies and policies • Can explicitly include administration and program costs • Don't assume efficient markets, overcoming market barriers can offer cost-effective energy savings • Capture interactions among projects and policies • Commonly used to assess costs and benefits of projects and programs • Use a variety of different calculation methodologies including: **optimization**, **simulation** and **accounting frameworks**.

5.1.2 Models for Mitigation Analysis in the UNFCCC Context

UNFCCC Guidelines do not specify which approach is appropriate for national communications on mitigation. Both Top-Down and Bottom-up models can yield useful insights on mitigation.

- Top-down models are most useful for studying broad macroeconomic and fiscal policies for mitigation such as carbon or other environmental taxes.
- Bottom-up models are most useful for studying options that have specific sectoral and technological implications.

However, the lack of off-the-shelf top-down models, the greater availability of physical, sectoral and technological data, and the focus on identifying potential projects has meant that most mitigation modeling has so far focused on bottom-up approaches.

For this reason, the tools examined in this study all use bottom-up modeling approaches (with the exception of MARKAL-MACRO which is a hybrid bottom-up/top-down model).

5.1.3 Types of Bottom-Up Models

Bottom-up models come in three basic types: optimization, simulation and accounting frameworks.

Optimization Models:

- Use mathematical programming to identify configurations of energy systems that minimize the total cost of providing energy services.
- Select among technologies based on their relative costs.
- Typically assume perfect competition/energy cost is only factor in technology choice.
- Useful where complex options need to be analyzed and costs are well known.
- Cost-minimization assumptions may be inappropriate for simulating "most likely" evolution of real-world energy systems in a baseline scenario.
- Tend to be data intensive and complex, so harder to apply where expertise is limited.
- Examples include: MARKAL and TIMES

Simulation Models:

- Simulate behavior of energy consumers and producers under various signals (e.g. price, income levels) and constraints (e.g. limits on rate of stock replacement).
- Make it easier to include non-price factors in analysis compared to optimizing models.
- Balance demand and supply by calculating market-clearing prices.
- Prices and quantities are adjusted endogenously using iterative calculations to seek equilibrium prices.
- Behavioral relationships can be controversial and hard to parameterize.
- Example: ENPEP-BALANCE

Hybrid Models:

- Examine macroeconomic impacts of energy system on the wider economy.
- Changes in the energy system can feed-back to effect macroeconomic growth and structure.
- Production functions allow for substitution among capital, labor and different forms of energy.
- Example: MARKAL-MACRO

Accounting Frameworks:

- Account for flows of energy in a system based on simple engineering relationships (e.g. conservation of energy).
- Rather than simulating decisions of energy consumers and producers, user explicitly accounts for outcomes of those decisions.
- Tend to be simple, transparent, intuitive & easy to parameterize.
- Evaluation and comparison of policies are largely performed externally by the analyst: the framework serves primarily as a sophisticated calculator, database and reporting tool.
- Accounting frameworks ensures physical consistency but not economic consistency.
- Examples: LEAP, RETScreen

5.1.4 Review of Modeling Tools

Module 5.1 includes a review of off-the-shelf software tools that are available for use in performing a GHG mitigation assessment. The criteria for including tools in this review were as follows. Included tools must be:

- widely applied in a variety of international settings,
- thoroughly tested and generally found to be credible,
- actively being developed and professionally supported,
- primarily designed for integrated energy and GHG mitigation analysis, or screening of energy sector technologies

On this basis, the following tools were reviewed:

- **LEAP**: Long-range Energy Alternatives Planning system. Primary Developer: Stockholm Environment Institute
- **ENPEP**: Energy and Power Evaluation Program. Primary Developers: Argonne National Laboratory and the International Atomic Energy Authority (IAEA)
- **MARKAL & MARKAL-MACRO**: MARKet Allocation model. Primary Developers: IEA/ETSAP
- **RETScreen:** Renewable Energy Technology Screening. Primary Developers: Natural Resources Canada

All are integrated scenario modeling tools except RETSCREEN, which screens renewable and other energy technologies (and thus is complementary to the other tools reviewed).

It is worth noting that other tools and approaches may also be appropriate for use in a GHG mitigation assessment. In particular countries may wish to develop their own models or use simpler methods that can be carried out using spreadsheet-based analyses.

Full Disclosure: Dr. Heaps, the lead author of this handbook is the developer of LEAP.

The following two tables provide a detailed comparison of the four software tools reviewed in this model in terms of scope, methodology, geographic applicability, data requirements, time horizon, cost, training and expertise required, etc.

Feature Comparison of GHG Mitigation Assessment Software (Part 1)

Characteristic	LEAP	ENPEP (BALANCE)	MARKAL	MARKAL-MACRO	RETSCREEN
Developer	Stockholm Environment Institute	Argonne/IAEA	IEA/ETSAP		Natural Resources Canada
Home page	www.energycommunity.org	www.dis.anl.gov	www.etsap.org		www.retscreen.net
Scope	Integrated energy and GHG scenarios	Integrated energy and GHG scenarios	Integrated energy and GHG scenarios	Integrated energy-economy and GHG scenarios	Screening of renewable and CHP projects
Methodology - Model type - Soution algorithm - Foresight	 Accounting & spreadsheet-like r Accounting n/a	 Equilibrium simulation Iteration myopic	 Optimization Linear programming Perfect or myopic	 Hybrid Non-linear programming Perfect or myopic	 Accounting Accounting n/a
Geographic applicability	Local, national, regional, global	Local, national, regional, global	Local, national, regional, global		Local
Data requirements	Low-medium	Medium-high	Medium-high		Technology specific
Default data included	TED Database with costs, performace and emission factors (inc. IPCC factors). Coming soon: national energy & GHG baselines.	IPCC Emission factors	None		Extensive defaults: weather data, products, costs, etc.
Time Horizon	User Controlled. Annual results	Up to 75 years. Annual results	User Controlled, Typically reporting for 5 or 10 year time periods		Primarily static analysis

Feature Comparison of GHG Mitigation Assessment Software (Part 2)

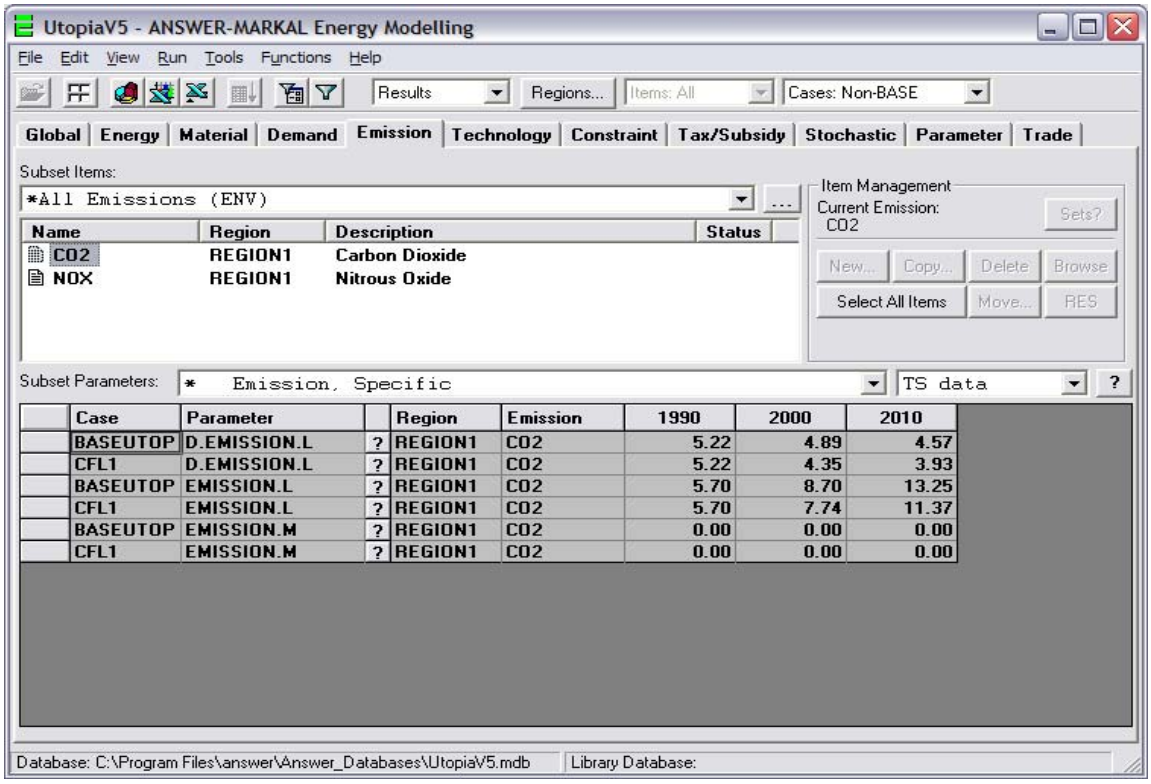
Characteristic	LEAP	ENPEP (BALANCE)	MARKAL/MARKAL-MACRO	RETSCREEN
Expertise required	Medium	High	High	Low
Level of effort required	Low-Medium	High	High	Low
How Intuitive? (matching analyst's mental model)	High	Low	Medium	High
Reporting capabilities	Advanced	Basic	Basic	Excel
Data management capabilities	Advanced	Basic	Basic	Excel
Software requirements	Windows	Windows	Windows, GAMS, solver & interface	Excel
Software cost:	Free to NGO, Govt and researchers in non-OECD countries.	Free to NGO, Govt and researchers.	$8,500-$15,000 (including GAMS, solver & interface)	Free
Typical training required & cost	On request: 5 days/$5000 Also regular international workshops.	5 days $10,000	8 days $30,000-$40,000	Minimal Free distance learning & global network of trainers
Technical support & Cost:	Phone, email or web forum Free limited support.	Phone or email $10,000 for 80 hours	Phone or email $500-$2500 for one year.	Email or web forum Free limited support.
Reference materials	Manual & training materials free on web site	Manual available to registered users	Manual available to registered users.	Manuals free on web site
Languages	English, French, Spanish, Portuguese, Chinese	English	English	Multiple

5.1.5 MARKAL and MARKAL-MACRO

- Generates energy, economic, engineering, and environmental equilibrium models.
- Models are represented as Reference Energy Systems (RES), which describe an entire energy system from resource extraction, through energy transformation and end-use devices, to the demand for useful energy services.
- Calculates the quantity and prices of each commodity that maximize either the utility (MARKAL-MACRO) or the producer/consumer surplus (MARKAL) over the planning horizon, thereby minimizing totally energy system cost.
- Identifies least-cost solutions for energy system planning.
- Selects technologies based on life-cycle costs of alternatives.
- MARKAL-MACRO is an extension of the MARKAL model that simultaneously solves the energy and economic systems. Can be thought of as a hybrid model as merges elements of top-down and bottom-up analysis.
- Note: TIMES: "The Integrated MARKAL-EFOM System" is gradually expected to replace MARKAL and MARKAL-MACRO.
- For more information on MARKAL/TIMES:

  Gary Goldstein, International Resources Group
  Sag Harbor, New York, 11963, USA
  Email: ggoldstein@irgltd.com
  http://www.etsap.org

The ANSWER User Interface for MARKAL

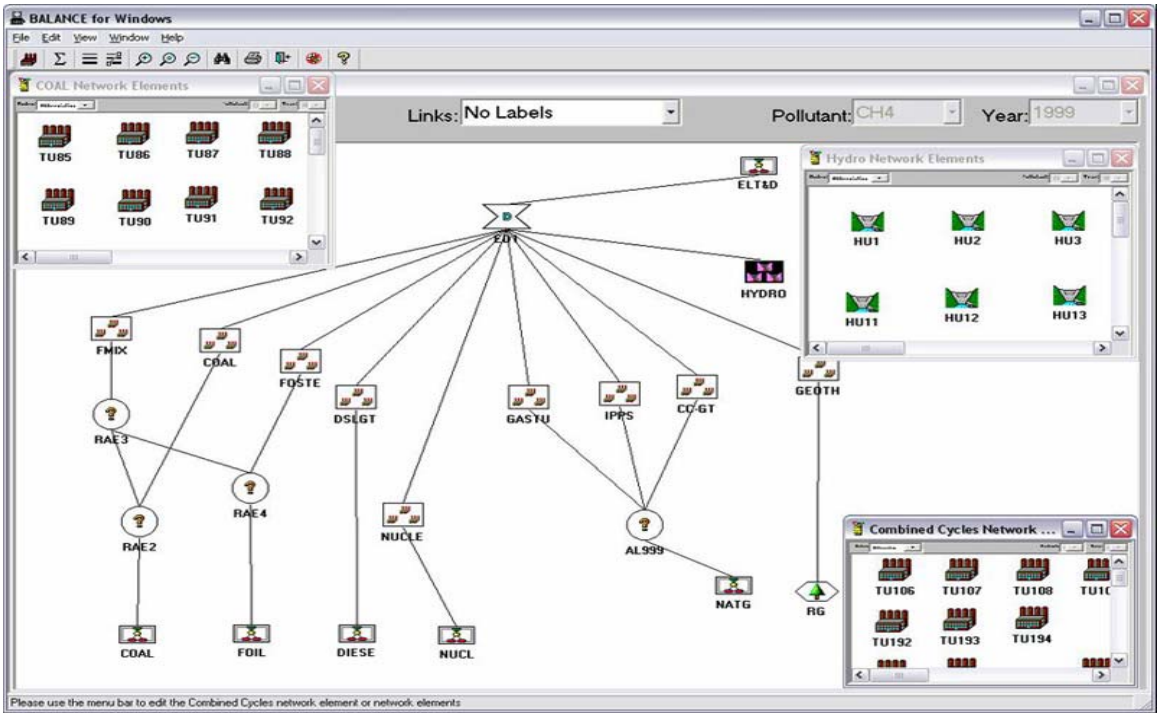


5.1.6 ENPEP-BALANCE

- The Energy and Power Evaluation Program (ENPEP) is a set of ten integrated energy, environmental, and economic analysis tools.
- Here the focus is on one tool, BALANCE, which is most frequently used for the integrated assessment of energy and GHG emissions.
- BALANCE is a market-based simulation that determines how various segments of the energy system may respond to changes in energy prices and demands.
- A system of simultaneous linear and nonlinear relationships that specify the transformation of energy quantities and energy prices through the various stages of energy production, processing, and use.
- Also calculates emissions of GHGs and local air pollutants.
- Uses a logit function that estimates the market share of supply alternatives based on commodity's price relative to alternatives. Consumer preferences can also be included via a "premium multiplier" variable.
- Simultaneously balances supply and demand curves for all fuels. Equilibrium is reached at market clearing prices and quantities.
- Does not minimize costs. Instead, simulates the response of consumers and producers.
- Can be run in combination with other ENPEP tools, such as MAED and WASP.
- For more information on ENPEP:

  Guenter Conzelmann, Center for Energy, Economic, and Environmental Systems Analysis (CEEESA), Argonne National Laboratory (ANL)
  9700 South Cass Avenue, Argonne, IL 60439, USA
  Email: guenter@anl.gov
  http://www.dis.anl.gov/ceeesa/programs/enpepwin.html

The BALANCE User Interface

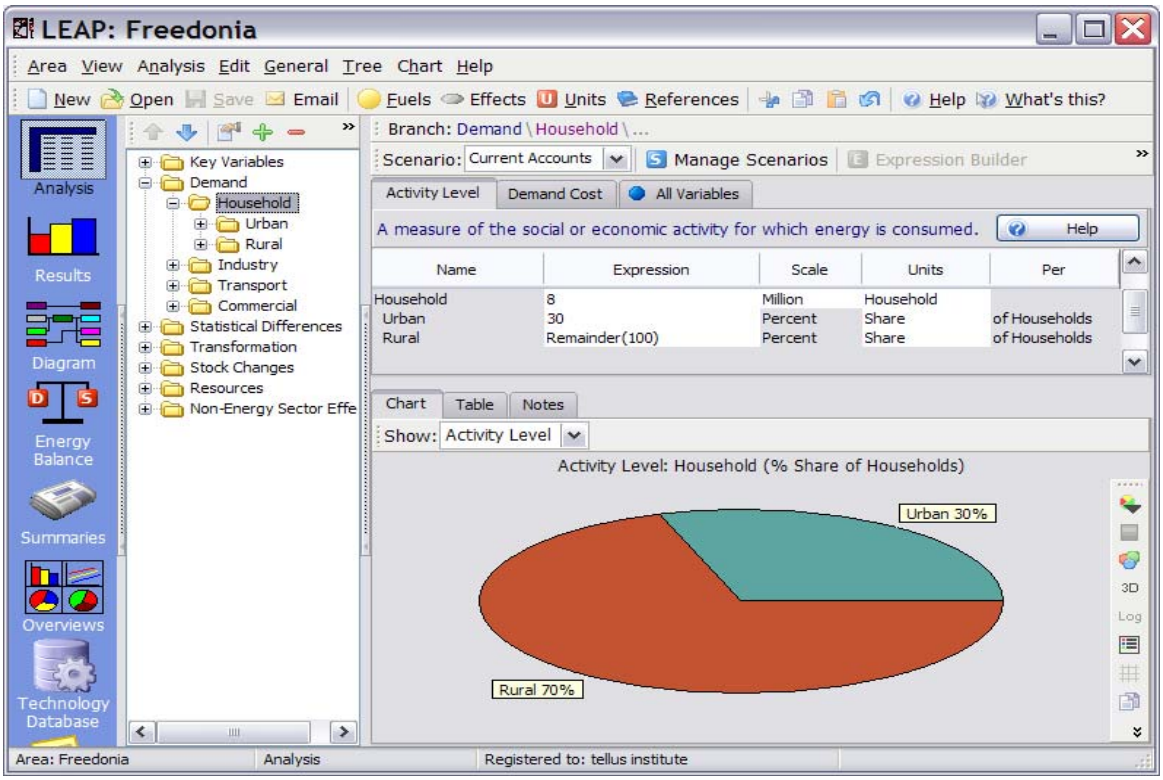


5.1.7 LEAP

- An integrated energy-environment, scenario-based modeling system.
- Based on simple physical accounting and simulation modeling approaches.
- Flexible and intuitive data management and advanced reporting.
- Scope includes demand, supply, resource extraction, GHG emissions and local air pollutants, full system cost-benefit analysis, and non-energy sector sources & sinks.
- Methodology: physical accounting for energy demand and supply via a variety of methodologies.
- Optional specialized methodologies for modeling of specific issues. e.g. stock/turnover modeling for transport analyses.
- Low initial data requirements (for example costs not required for simplest energy and GHG assessment). Many aspects optional.
- Includes TED (Technology and Environment Database): a repository of energy technology data containing technical data, costs, and emissions factors for over 1000 energy technologies.
- Unlike ENPEP and MARKAL, LEAP does not require the user to subscribe to a particular view of how an energy system behaves (e.g. optimization, market-clearing equilibrium). Instead LEAP is based on simple physical energy and environmental accounting principles.
- For more information on LEAP:

  Dr. Charles Heaps
  Stockholm Environment Institute – Boston Center
  11 Arlington Street, Boston, MA, 02116, USA
  Email: leap@tellus.org
  http://www.energycommunity.org

The LEAP User interface



5.1.8 RETScreen

- Evaluates the energy production, life-cycle costs and GHG emissions reductions from renewable energy and energy efficient technologies.
- Intended primarily for project-level analysis (screening/feasibility), not for national-level integrated analyses.
- Does allow options to be compared to a counter-factual situation, but is primarily a static comparison.
- Complements the other tools mentioned here.
- Can be used for screening of options before inclusion in integrated assessments, or for detailed project-level assessments. Can help develop the technical, cost and performance variables required in other models.
- Structured as a set of separate modules, each with a common look and approach. Each module is developed in Microsoft Excel Modules include:
    - Wind energy
    - Small hydro
    - Photovoltaics
    - Combined heat & power
    - Biomass heating
    - Solar air heating
    - Solar water heating
    - Passive solar heating
    - Ground-source heat pumps
    - Energy efficiency measures (coming soon)
- For more information on RETScreen:

    RETScreen Customer Support
    Natural Resources Canada
    1615 Boulevard Lionel-Boulet, Varennes, QC, J3X1S6, Canada
    Phone: +1 (450) 652-4621
    Fax: +1 (450) 652-5177
    Email: rets@nrcan.gc.ca
    http://www.retscreen.net

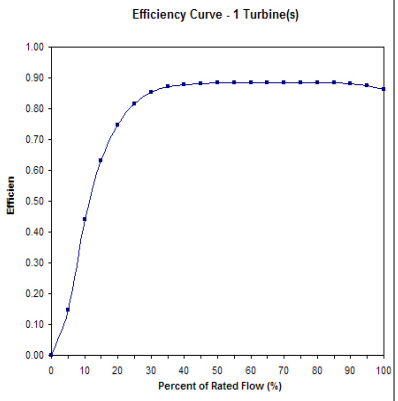
The RETScreen User Interface

RETScreen® Equipment Data - Small Hydro Project

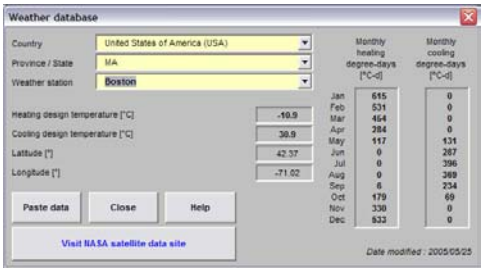
Small Hydro Turbine Characteristics		Estimate	Notes/Range
Gross head	m	146.00	
Design flow	m³/s	1.900	
Turbine type	-	Pelton	See Product Database
Turbine efficiency curve data source	-	Standard	
Number of jets for impulse turbine	jet	1	1 to 6
Number of turbines	turbine	1	
Small hydro turbine manufacturer		Alstom	
Small hydro turbine model		model XYZ	
Turbine manufacture/design coefficient	-	4.5	2.8 to 6.1; Default = 4.5
Efficiency adjustment	%	0%	-5% to 5%
Turbine peak efficiency	%	88.4%	
Flow at peak efficiency	m³/s	1.3	
Turbine efficiency at design flow	%	86.3%	

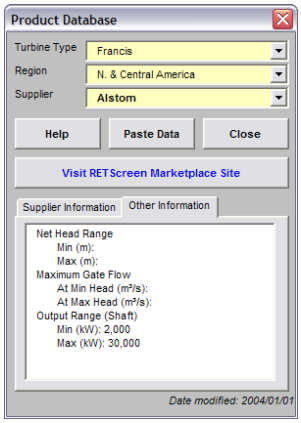
Turbine Efficiency Curve Data

Flow (%)	Turbine efficiency	Turbines running #	Combined turbine efficiency
0%	0.00	0	0.00
5%	0.15	1	0.15
10%	0.44	1	0.44
15%	0.63	1	0.63
20%	0.75	1	0.75
25%	0.81	1	0.81
30%	0.85	1	0.85
35%	0.87	1	0.87
40%	0.88	1	0.88
45%	0.88	1	0.88
50%	0.88	1	0.88
55%	0.88	1	0.88
60%	0.88	1	0.88
65%	0.88	1	0.88
70%	0.88	1	0.88
75%	0.88	1	0.88
80%	0.88	1	0.88
85%	0.88	1	0.88
90%	0.88	1	0.88
95%	0.88	1	0.88
100%	0.86	1	0.86



Intro | Energy Model | Hydrology & Load | Equipment Data | Cost Analysis | GHG Analysis | Financial Su





5.1.9 Conclusions

MARKAL is a good choice if:

- National team already has MARKAL modeling experience.
- Technical and statistical data are relatively plentiful.
- A large number of complex and interacting technology options need to be assessed.
- Assessment team is familiar with concepts of optimization.
- Assumptions of optimizing models are reasonable in the study context.
- Assessment will be conducted over a relatively long time frame (e.g. one year) and able to invest considerable human resources in the assessment.
- The high cost of the software & support is acceptable in your country.

ENPEP-BALANCE is a good choice in similar situations to MARKAL: particularly if there is need to take a market-simulation approach, and optimization assumptions are not appropriate,

LEAP is a good choice if:

- Data is less plentiful.
- National team has less modeling expertise.
- Time available to conduct the analysis is relatively short.
- Inherent assumptions of MARKAL/ENPEP are not appropriate.
- Assessment will focus on both technology choice and other mitigation options.

RETScreen, is complementary to all of the tools mentioned here.

Country-specific approaches, using spreadsheets or other models may also make sense for many parties.

5.2 Non-Energy Sector

Non-energy sector modeling involves three basic steps:

- Assessment of land availability
- Baseline scenario analysis
- Mitigation Scenario analysis

Land-use models can be divided into three categories:

- Process Models (EPIC, CENTURY & Forest-BGC)
- Accounting Models (GLOBC7/8, COPATH)
- Socio-economic Accounting Models (LUCS, GEOMOD, FAC)

A variety of models are available in the forestry sector:

- Individual tree models (e.g. TREGRO)
- Forest gap models (e.g. FORTNITE, FORTNUT, LINKAGES, LOKI)
- Bio-geographical models (e.g.. BIOME, CCVM, MAPPs)
- Ecosystem process models (e.g. CENTURY, FOREST-BGC, GEM)
- Terrestrial carbon circulation models (e.g. PULSE, IMAGE)
- Land-use change models (e.g. Terrestrial Carbon Dynamic model , IMAGE).
- Spreadsheet models (e.g. COPATH, GLOBC7/8)

5.2.1 Estimating Carbon Storage

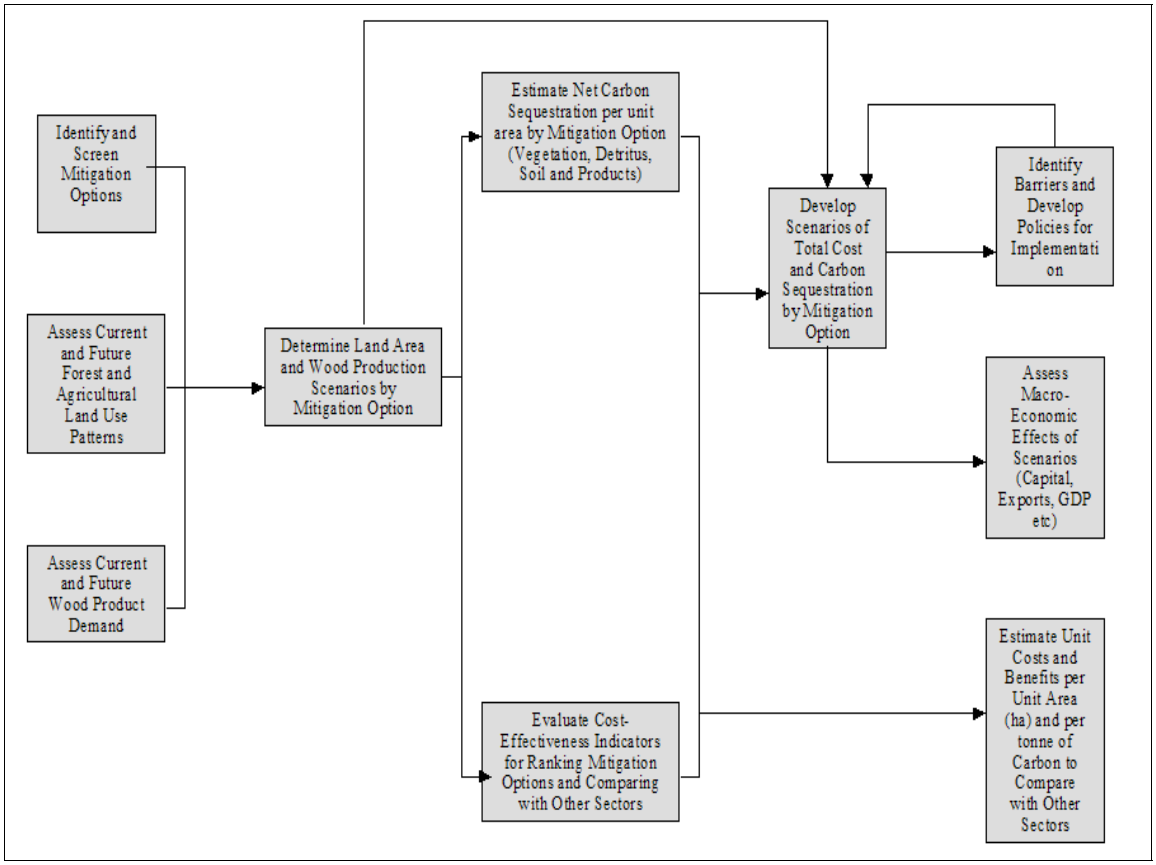
This section describes three major situations for estimating carbon storage:

1. Standing forests
2. Forests managed in perpetual rotations
3. Conservation forests

5.2.2 COMAP

This section reviews the COMAP mitigation assessment approach that can be used to identify the least expensive way of providing forest products and services, while reducing the GHGs emitted or increasing carbon sequestered in the land use change and forestry sector.

COMAP Flow Chart



This section covers:

- A review of COMAP.
- Cost-benefit analysis in COMAP
- An example of mitigation assessment in COMAP
- Issues, short comings, and suggestions

6 Reporting of Mitigation Assessments in National Communications

The objective of this module is to improve the presentation of mitigation assessment section in second and subsequent national communications in a consistent, transparent, comparable and flexible manner according to the UNFCCC guidelines for the preparation of national communications from non-Annex I Parties.

Mitigation assessments form an important part of Parties' national communications on climate change. They are read both by the international scientific community and by national and international policy makers. They therefore need both a high level of scientific rigor and a high level of clarity and comprehensibility.

The module is divided into six sections covering:

- Reporting commitments
- Suggestions for reporting
- Other aspects of reporting
- Preparation of project proposals

The slides for this module are contained in PowerPoint file: **Module6.ppt**

For more on this topic, please refer to:

- UNFCCC (2004). *User Manual for Guidelines on NAI National Communications.* Available online in English, French and Spanish from: http://unfccc.int/national_reports/non-annex_i_natcom/guidelines_and_user_manual/items/2607.php
- Sathaye, J. and Meyers, S. (1995). *Greenhouse Gas Mitigation Assessment: A Guidebook.* Published in complete book form by Kluwer Academic Publishers, Netherlands or available online (minus tables and charts) from: http://ies.lbl.gov/iespubs/iesgpubs.html

6.1 Reporting Commitments

Article 4, paragraph 1, and Article 12, paragraph 1, of the convention provide for each Party to report to the COP:

- Information on its emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol (greenhouse gas inventories);
- National or, where appropriate, regional programmes containing measures to mitigate, and to facilitate adequate adaptation to climate change (general description of steps taken or envisaged by the Party to implement the Convention);
- Any other information that the Party considers relevant to the achievement of the objective of the Convention.

6.2 Suggestions for Reporting

Suggestions for reporting on mitigation include:

- Typically, energy and non-energy sectors can each be reported upon separately.
- Efforts to integrate energy and non-energy sector assessments should be described.
- A summary should present the main findings across energy and non-energy sectors.
- In addition to presenting results, reports should describe assumptions made, methods adopted and sources of data used.
- Reporting should follow international scientific practices for documentation and referencing of data sources.
- Results can be shown in chart and table formats. Charts should be backed-up by numeric tables for clarity. All charts and numeric data should be clearly labeled with units unambiguously specified.
- Note where GHG results are expressed as Tons of Carbon equivalent (Tons Ce) or as Tons of CO2 equivalent.
- Reports can use any unit, but a table of unit conversion factors should be included to enable proper interpretation of results.
- Fuel consumption and production should preferably be reported in standard energy units (e.g., GJ, GWhr, TOE). Where physical units are used (mass, volume) the fuel's energy content and density should also be reported.
- If possible, discuss the uncertainties associated with findings.
- Methodologies: Reporting should describe what modeling methodology was adopted and why, how the structure of the national energy system was reflected in the model, and what disaggregation structure was used and why.
- Scenarios: Reporting should also describe: what scenarios were examined, any sensitivity analyses that were conducted, how the baseline scenario was defined.
- Emissions Calculations: Reporting should present the main emissions factors used in the assessment, describe what assumptions were used about global warming potential and if non-GHG gases were examined, describe how were they assessed.

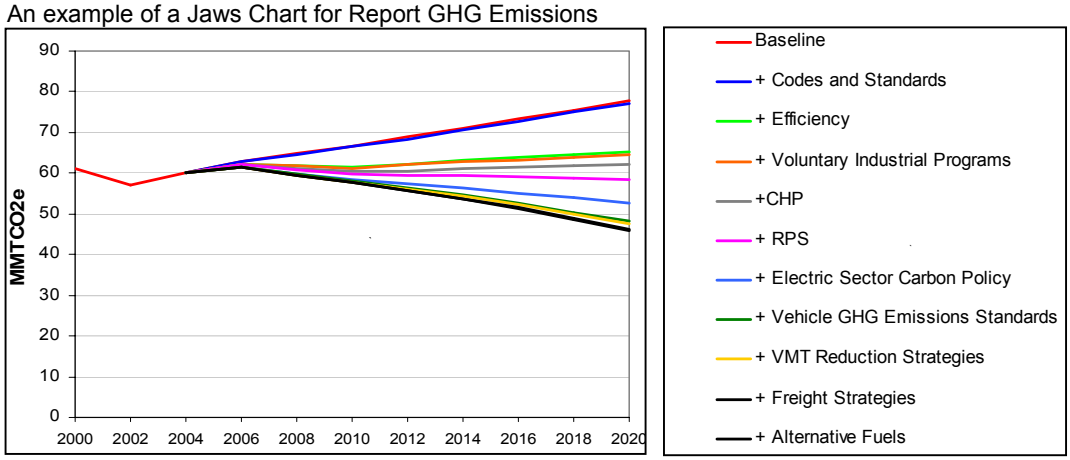
6.3 Suggestions on Types of Results to Include in Reports

Types of results that might be contained in a national communication include:

- **Screening Matrix.** If a screening matrix was used to initially screen mitigation options. Discuss and illustrate the process used for screening technology options, and include the screening matrix used.
- **GHG emissions for the baseline and mitigation scenarios**, disaggregated by sector, by fuel and by gas in each scenario. If GHGs other than CO2 are considered, present results as CO2 equivalents. If included in the study, reporting should also show results for emissions of other local air pollutants (e.g. SOx, NOx particulates, etc.).
- **"Jaws" charts** (see below) help illustrate the GHG savings from the various measures that make-up an overall mitigation scenario. The top line of the chart

shows baseline emissions. Each lower line shows the savings resulting from adding another measure. Plotted over time, this reveals a set of open "jaws". The combined mitigation scenario is the lowest line.

An example of a Jaws Chart for Report GHG Emissions



- Other possible results include: national energy balances, cost curves and cost summaries, primary and final energy consumption by fuel, and by sector/subsector; Final energy intensity (e.g. energy per capita or per unit of GDP); Major results for energy supply sectors such as electric generation, transmission and distribution and oil refining; imports and exports of major fuels where appropriate.

6.4 Preparation of 2nd and subsequent National Communications

Second or subsequent National Communications should build upon the efforts and experiences of Initial National Communications (INCs). A stocktaking exercise can be useful for identifying gaps and areas for further study. For example, stocktaking can help with:

- **Gaps:** what studies/assessments are needed to improve information or fill gaps in knowledge?
- **Uncertainties:** how can the reliability of information be increased?
- **New areas of work:** what areas were not included in the INC?
- **Priorities:** helps to focus on priority areas for next NC.

6.5 Preparation of Project Proposals

Article 12.4 of the UNFCCC states that:

> Developing country Parties may, on a voluntary basis, propose projects for financing, including specific technologies, materials, equipment, techniques or practices that would be needed to implement such projects, along with, if possible,

an estimate of all incremental costs, of the reductions of emissions and increments of removals of greenhouse gases, as well as an estimate of the consequent benefits.

Project proposals can thus be presented as part of national communications.

The UNFCCC CGE has prepared a draft template for reporting project proposals in NAI National Communications. This is shown below:

Proposal Component	Description
Country	
Project title	
Sector	Sector targeted with intervention (energy supply, residential/commercial/institutional, industrial, transportation, LUCF, agriculture, waste disposal, etc.)
IPPC category of mitigation option and technology/measure	Option: i.e. switching to renewable sources of energy
	Technology/measure: i.e. wind turbines
Specific technology needs	
Specific material/equipment needs	
Problem statement and project rationale	Introduction to the problem/current situation, leading into justification for the project
Project objectives/goals	Short-term and/or long-term
Description of project concept and proposed project activities	Specific project activities/stages should be identified here. Description could include a work plan, implementation schedule etc.
Expected project outputs/outcomes:	A description of direct project outputs and/or short term impacts in relation to project objectives
Expected project benefits	Global: if possible, including an estimate of GHG emission reduction/removal from atmosphere
	Local:
Total estimated project cost	In USD if possible
Funding secured by source	Other funding sources should be identified here along with amount of funding secured.
Other financial info	Could include estimates of IRR, cost-benefit ratio, etc.
Project stakeholders	
Project status	e.g., undergoing national eligibility assessment for CDM participation, first stage implemented and following stages dependant upon funding etc.
Additional project info	
For further information	Project developer contact information including address, phone and email (if applicable)

Part 2: Hands-On Exercises for Mitigation Assessment

A series of hands on computer exercises have been developed that are designed to introduce you to some of the basic techniques used in a GHG Mitigation Assessment.

1. **In Exercise One,** you conduct a simplified static screening of mitigation options. This consists of two basic parts.

    - **In part one**, you complete a simple spreadsheet that calculates some of the main quantitative indicators used in a mitigation screening, including the GHG emissions reductions potential from each mitigation option (in Tons of CO2 equivalent) and the costs (in annualized $ per ton of CO2 equivalent).

    - In part two you combine these numbers with a qualitative assessment of various different screening criteria in order to develop an overall screening matrix.

2. **In Exercise Two,** you will use LEAP, an energy scenario modeling tool to create a simple GHG mitigation scenario. The scenario will be created by taking some of the data developed in the first simple static screening exercise and using it as input to LEAP's dynamic integrated energy and GHG mitigation analysis. You will use LEAP to create some of the charts and tables that would typically be included in a national communication on mitigation.

These exercises are described in detail in separate documents. Currently both English and Spanish versions of the documents are available.

You can download these documents together with the spreadsheets and LEAP data sets needed to undertake the exercise here:

http://www.energycommunity.org/default.asp?action=42