How-to Guide:
Low-emission Development Strategies and Nationally Appropriate Mitigation Actions: Eastern Europe and CIS

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INTRODUCTION: objectives and overview of this guide

The transition to low-emission development in both developed and developing economies has been recognized internationally as an imperative to stabilizing greenhouse gas (GHG) concentrations in line with a 2^{o}C temperature increase scenario. However to date there is only limited practical experience of designing and implementing comprehensive national low emission development (LED) strategies (LEDS), and no guidelines on the preparation of such strategies or on Nationally Appropriate Mitigation Actions (NAMAs) developed and adopted in the United Nations Framework Convention on Climate Change (UNFCCC) process. At the same time, fast start financing committed by developed countries at the Copenhagen Climate Conference 2009 is already supporting countries in developing and implementing LEDSs and NAMAs.

This guide is designed to help policy makers and policy experts:

- determine opportunities for low-emission development and;
- design national LEDS or NAMAs in their respective countries.

Recognizing that each country has unique national circumstances and priorities, this guide describes the main steps in the process of developing LEDS and NAMAs that a country would need to follow; it identifies the main questions that need to be addressed at each stage of the process and describes the main relevant policy instruments available, based on the analysis of the practical experience with LEDS and related processes to date. Where possible the guide uses practical examples to illustrate various elements of a LEDS. Therefore this guide is intended to help policy makers organize the process of developing LEDS or NAMAs and to assist in preparing initial concepts for such strategies or actions. It is also intended to serve as the basis for determining strategic national goals and for obtaining international finance to support national actions. It can also be used as a reference for where to find more detailed information on various elements.

This guide is particularly targeted at countries in Eastern Europe and the Commonwealth of Independent States region, however it can also be useful for countries in other regions considering or initiating the development of LEDSs or NAMAs.

ACRONYMS

AR4	IPCC's Fourth Assessment Report
CA	Copenhagen Accord
COP	Conference of the Parties
ECIS	Europe and the Commonwealth of Independent States
GEF	Global Environmental Facility
GHG	Greenhouse Gases
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LED	Low Emission Development
LEDC	Low-Emission Development Concept
LEDS	Low-Emissions Development Strategy
MRV	Measurement, Reporting and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NCs	National Communications
PAMs	Policies and Measures
TNA	Technology Needs Assessment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

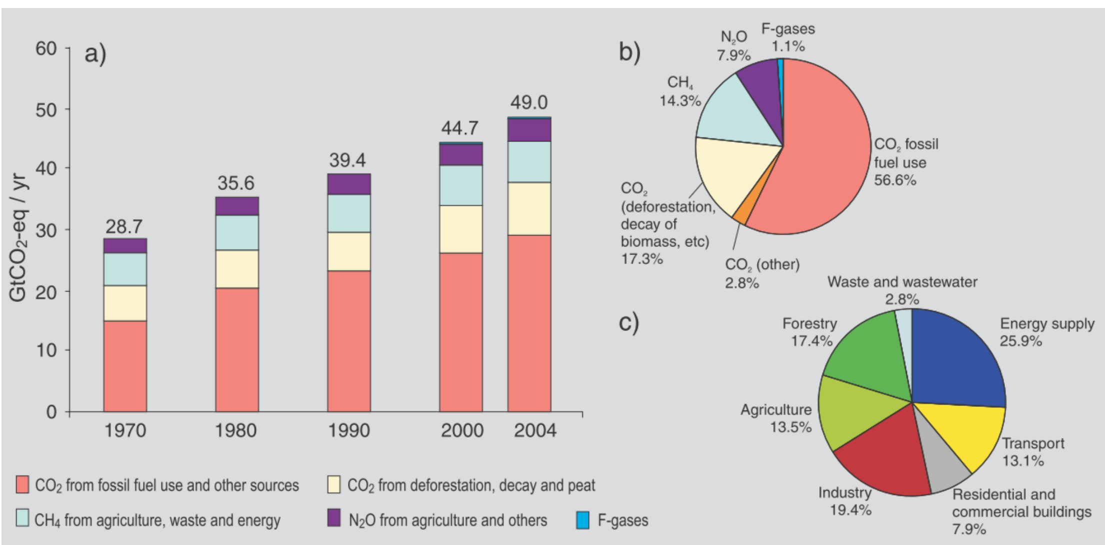
Chapter 1: Transition to Low-Emission Development – an overview

1. Global climate change and greenhouse gas emission trends: shifting towards low-carbon society

1.1. Global emission trends and climate change

Climate change presents a challenge unprecedented in human history. In November 2007, the International Panel on Climate Change (IPCC) released its fourth assessment report, in which it concluded that warming of the climate system is now unequivocal.
Over the past 35 years, global emissions of greenhouse gases (GHGs) have seen dramatic growth of 70%. The main contributor to GHG emissions is fossil fuel combustion in the energy and industrial sectors, as well as the transport sector. These sectors together are roughly responsible for about 60% of global emissions. A significant contribution to global GHG emissions is also made by the agriculture and forestry sectors (see Figure 1).

Figure 1: Global GHG emission trends in 1970–2004 and contribution of sectors to GHG emissions in 2004



Source: IPCC AR4, Synthesis Report

The IPCC recommended in its fourth assessment report that, for a fair chance to limit increases in average global temperature to 2^{o}C, the concentration levels of GHG need to stabilize at 450 parts per million carbon dioxide equivalent. To ensure that, emissions by developed nations would need to fall by 25%–40% by 2020, and 80%–95% by 2050, while developing countries would need to "deviate substantially" from a business-as-usual scenario. Similarly, the 2007–2008 *United Nations Development Programme (UNDP) Human Development Report* stated that an overall 50% reduction of the world GHG emissions to below 1990 levels by 2050 will be required. The report recommends that to achieve the above global objective, developed countries cut GHG emissions by at least 80% by 2050, with 20–30% cuts by 2020. For the large emitters in developing countries it recommends aiming for an emission trajectory that would peak in 2020 with 20% cuts by 2050.[1]

1.2. Transformation in global investment and development patterns

Reaching these emission reduction goals requires transition to low-emission development pathways around the globe. This means decoupling carbon emissions from economic growth through a series of measures across all economic sectors, such as energy efficiency improvements, changes in fuel mix, managing land use change and others.
In 2008 the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) analyzed the investment and financial flows that will be needed to meet worldwide mitigation and adaptation requirements in 2030. One of the key findings of the review is that the additional investment and financial flows in 2030 to address climate change amounts to 0.3 to 0.5% of global domestic product in 2030 and 1.1–1.7% of global investment in 2030.[2]

Energy is the key factor of economic growth. Access to clean and affordable energy is one of the main prerequisites for sustainable economic and social development. As noted above, production and consumption of energy is also the main source of global GHG emissions. It should therefore be the focus of mitigation policies. The International Energy Agency estimates that 22 trillion dollars in new energy investment will be needed between 2005 and 2030. By 2030 the result would be a 55%% increase in global primary energy use, with developing countries accounting for three quarters of that total.[3]

The McKinsey Global Institute has estimated that the projected growth of global energy demand can be cut at least by half by 2020 through increasing energy productivity, with the associated significant reduction of GHG emissions compared to business-as-usual scenario. Additional annual investments of US$170 billion for the next 13 years would be sufficient to capture the energy productivity opportunity among all end users.[4]

Similarly, the IEA has shown that, on average, an additional one dollar invested in more efficient electrical equipment, appliances and buildings, avoids more than two dollars in investment in electricity supply.[5] This ratio is highest in non-OECD countries. Improving energy efficiency in industry is one of the most cost-effective measures to help supply-constrained developing and emerging countries meet their increasing energy demand and loosen the link between economic growth and environmental degradation. Based on demonstrated industrial energy efficiency policies and commercially available technologies, industry has the potential to decrease its energy intensity and emissions by 26% and 32% respectively. That would allow for an 8% reduction in total global energy use and 12.4% in global CO_2 emissions.[6]

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1 *Charting A New Low-Carbon Route To Development A Primer on Integrated Climate Change: Planning for Regional Governments*, United Nations Development Programme, June 2009.

2 FCCC/TP/2008/7: *Investment and financial flows to address climate change: An update*. Technical paper.

3 IEA. 2007. *World Energy Outlook 2007*. Paris: International Energy Agency.

4 *The case for Investing in Energy Productivity* – McKinsey Global Institute – February 2008

5 *World Energy Outlook 2006* – IEA - 2006

6 IEA. 2007. *World Energy Outlook 2007*. Paris: International Energy Agency.

1.3. Transition to low-carbon development

Many countries have recognized close linkages between the prospects for sustainable economic growth and the need to transition to low-emission development. Energy supply and efficiency, energy security and climate change mitigation are mutually reinforcing policy goals. A number of countries have developed national low-carbon or green growth strategies, as will be discussed below. Many large economies have used a significant part of their financial stimulus packages to support recovery from the financial crisis in 2009 to support greener industries, in particularly in the energy sector.

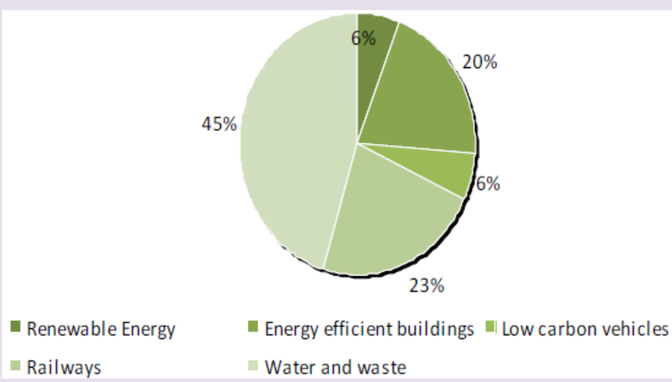
Box 1: Green stimulus package – example of the Republic of Korea

The financial and economic crisis in 2008 resulted in a fall in the Republic of Korea's growth rate below 4% in the fourth quarter of 2008, compared to an average rate of growth of between 7–8% in the last ten years.

The country launched a "Green New Deal" on 6 January 2009 as a means of stimulating job creation and revitalizing the economy. The stimulus package, which is comprised of a mix of financial, fiscal and taxation policies, amounted to a total of $38.1 billion, the equivalent of 4% of GDP, to be implemented over the period 2009–2012. A total of $30.7 billion (about 80% of the total stimulus package) was allocated to environmental themes such as renewable energies ($1.8 billion), energy efficient buildings ($6.19 billion), low carbon vehicles ($1.8 billion), railways ($7.01 billion) and water and waste management ($13.89 billion).

It disbursed almost 20% of its green stimulus funds by the end of the first half of 2009, compared to only 3% for most other countries. In addition, the government introduced income and corporate tax cuts. Income tax was reduced by 2 per cent. The threshold of tax deductions was raised from 1 million to 1.5 million won (approx. $1,284–$1,784). Corporate tax was also reduced from 25% to 22% in 2009 and to 20% in 2010 for large companies and from 13% to 11% in 2009 and to 10% in 2010 for small and medium enterprises.

Figure 2: Republic of Korea's green stimulus spending per sector



These measures seem to have contributed to stimulating economic recovery. The country was one of the few OECD countries to register a positive growth in the first quarter of 2009 (0.1%) and recorded the highest growth rate in the second quarter (2.3%). The Green New Deal will run through 2012, while the long-term strategy will continue to be pursued through five-year green growth plans; the first of which is implemented from 2009 to 2013.

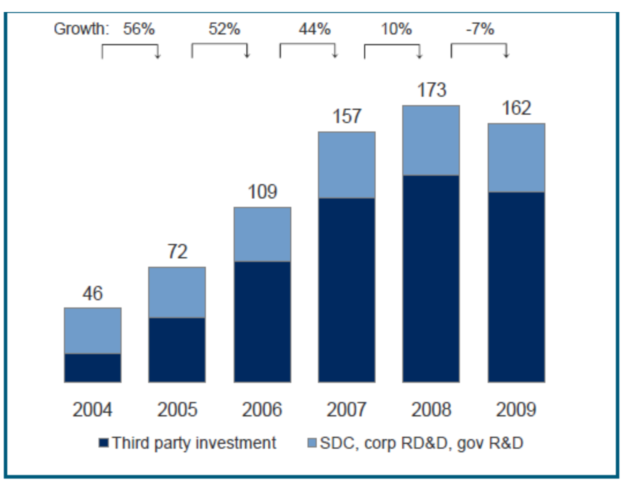
Source: *Overview of the Republic of Korea´s National Strategy for Green Growth*, prepared by the United Nations Environment Programme as part of its Green Economy Initiative, April 2010.

In the financial crisis of 2008–2009, major economies announced an estimated $188 billion of “green stimulus” programmes, and that money is gradually being spent. The US announced a grant scheme to support renewable energy projects, while other places around the world – including Finland, Ontario, New South Wales, Ukraine, Serbia and the UK (for small-scale generation) – followed the examples of Germany, Spain and others in Europe by announcing feed-in tariff programmes to encourage investment in technologies such as wind and solar[7]. Also, out of $119 billion invested in 2009 worldwide by the financial sector in clean energy companies and utility-scale projects, $33.7 billion took place in China, up 53% on 2008.

The major development banks, led by Germany’s KfW and the European Investment Bank, also became important factors in helping the renewable energy sector to weather the storm and expand into new markets.

Greece has recently announced that it will invest 12 billion Euros ($15.6 billion) in green growth projects over the next five years (Reuters, 28 July 2010). This amounts to more than 10% of the 110 billion Euros bailout fund it received from the EU and the IMF. If successful, Greece will get 40% of its electricity from renewable sources within 10 years, compared to only 4% today.

Figure 3: Global new investment in sustainable energy, 2004–2009, USD bln.



SDC = small distributed capacity. New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals

Source: Bloomberg New Energy Finance

Cited in *Global Trends in Sustainable Energy Investment 2010*: Executive Summary, SEI and Bloomberg New Energy Finance, 2010

Implementation of ambitious climate change mitigation policies should start as soon as possible. The 2007–2008 UNDP Human Development Report estimates that the above global goal can be achieved with an annual emission reduction of about 1.5% if action begins today. However, if emission reduction measures are delayed by 8 to 10 years, an annual global emission reduction of greater than 3% will be needed, which is widely regarded as being beyond current technological means. Moreover investments in energy and industrial

7 *Global Trends in Sustainable Energy Investment 2010*: Executive Summary, SEI and Bloomberg New Energy Finance, 2010.

infrastructure require significant time for planning and implementation, while such investment decisions made today will determine GHG emission pathways for the next 30 years and beyond.
Changing to low emission development pathways offers significant other benefits, such as greater energy security and improved resilience to energy price shocks, improved health due to lower conventional pollutant emissions, greater and agricultural and land-use productivity. Instead of locking in high-carbon infrastructure, countries have the opportunity to advance to new technologies such as wind and solar energy, low energy buildings, energy efficient industrial production and sustainable transport.

Box2: Low-carbon development concept of the Republic of Kazakhstan

Kazakhstan is in the process of developing a concept on low-carbon development to be integrated into the national development agenda.

Kazakhstan, an Annex I country, but not Annex B country for the Kyoto protocol, has an economy with medium and high carbon intensity and a relatively low GDP per capita.

In 2005, among 186 countries, Kazakhstan occupied 71st place according to GDP per capita with $9,529 but according to the amount of GHG emissions per capita it occupied 14th place with 19.1 tonnes of CO2 and 24th place on the GDP carbon intensity with 1,559.2 tonnes CO2/$1000.

Kazakhstan actively participates in international efforts to prevent climate change. While developing the concept on low-carbon development to be integrated into the national development agenda and identifying its purposes, Kazakhstan took economic and technological development, justice and social influence of the proposed measures into account.

The country aspires to achieve "sound" development to promote climate change prevention, reach sustainable economic development and improve the standard of living. Kazakhstan, as a relatively developed country, still faces the problem of poverty, and is standing on the crossroad of choosing the proper development approach. The current opportunity to develop a low-carbon economy is due to the necessity created by climate change. And in the first place this is the tendency to develop low-carbon energy, restructuring of economy, energy saving and sustainable development.

Achieving low-carbon development faces the challenge of high economic growth, which is characterised today by an energy structure relying on coal, with basic technological development and labour power, and also with the presence of sufficient administrative structures and institutional frameworks. Despite this the GDP of Kazakhstan doubled in 2000–2008, and although GHG emissions increased by 60,1% the carbon intensity of GDP decreased by 20.7%.

The transition to low-carbon development provides a chance for economic growth without further heavy industrialization of the country, using all opportunities in the country and worldwide.

Effective international cooperation on climate change is key to:

- ensuring the global goal of keeping GHG concentration at safe levels can be met;
- mobilising financial and technological resources to support developing countries in mitigating and adapting to climate change.

Mitigation policies and measures will primarily be implemented domestically at national, regional and local level. To be successful, mitigation policies need to be aligned with, and integrated into, national development priorities, strategies and plans. This can only be achieved – and sustained – through involvement and commitment at all levels of decision-making with an open and efficient intersectoral dialogue.

Box 3: European Union and low-carbon development

The European Union (EU) has been taking the lead globally on climate change action and transition to low-carbon development path, both through the implementation of domestic policy and through pushing policy processes at the international level.

In the European Union climate change legislation is enacted both at the level of the EU as well as at the level of individual Member States. The EU has set a target of reducing GHG emissions by 20% below 1990 levels by 2020. It has also indicated that if other countries undertake comparable action, and an international post-2012 agreement is reached, it will tighten the emission reduction target to 30% below 1990 levels. The EU has implemented a domestic emission trading system (EU ETS).

In order to achieve the emission reduction commitments of the EU, the climate policies have been divided in two sectors:

- the trading sectors (large industries, power producers), where the legislative tool to achieve emission reductions is the EU-ETS;
- the non-trading sectors (transport, agriculture, buildings) where each Member State is responsible to achieve reductions through domestic actions and policies.

In addition the EU has adopted an ambitious energy policy. It has set an EU-wide target of reaching 20% renewables in the energy use and a 10% biofuels in transport energy use by 2020. Other measures at the EU level include regulation of the average emissions from new cars at 130 g/km. Some Member States have also introduced carbon taxes: in Sweden the tax is set at 23 Eurocents per liter of fuel consumed and has been in operation since 1991, while France introduced a carbon tax in February 2010 at €17 per tonne of CO2.

Several EU Member States have pioneered national low emission development strategies. In 2008–2009 the United Kingdom developed the UK Low Carbon Transition Plan: National Strategy for Climate and Energy, which sets out the roadmap and concrete steps to deliver emission cuts in the UK of 18% on 2008 levels by 2020 and over a one third reduction on 1990 levels. Several other EU countries have developed national climate change strategies. The experiences of these countries in developing national strategies will be drawn upon in this guide.

The EU also runs many projects and programs supporting climate change policies in developing countries. It has committed the largest amount of fast-start financing following the Copenhagen Conference in December 2009. The EU has indicated that a significant amount of that financing will go to supporting mitigation actions in developing countries, including design and implementation of national low-emission development strategies and of nationally appropriate mitigation actions in non-Annex I countries.

2. International climate policy

2.1. Climate change treaties

The foundation for international cooperation on climate change is laid by the United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992. The convention set the goal of avoiding dangerous interference with the climate system and listed the main principles on which international cooperation in this area should be based.

The UNFCCC did not set emission reduction targets, but divided countries into two groups in relation to the level of efforts they are expected to undertake. Annex I Parties, which include industrialized countries (mainly OECD members) and many economies in transition (EITs) are expected to take the lead in dealing with climate change. Non-Annex I Parties are mainly developing countries. They were encouraged but not required to regularly report on their emissions and to undertake mitigation measures. They are also eligible to receive funding from the international funds.

The Kyoto Protocol to the UNFCCC, adopted in 1997, set more powerful and concrete emission reduction measures. Most Annex I Parties have agreed to the quantified emission reduction targets for the period 2008–2012, as inscribed in Annex B to the Kyoto Protocol. The EIT Parties have “flexibility” in implementing their commitments, i.e., to select a baseline year other than 1990 for their specific commitments. Annex II Parties, the OECD members within the Annex I group, must provide assistance to non-Annex I Parties to adapt to the adverse impacts of climate change and promote the development and facilitate the transfer of environmentally-sound technologies.

The Kyoto Protocol also encompasses three market-based or so called ’flexible mechanisms’:

• Joint Implementation (JI);
• Clean Development Mechanism (CDM);
• Emissions trading.

These mechanisms were introduced with the aim of giving the parties flexibility in fulfilling their commitments and to make it possible for emissions mitigation to be achieved more cost-effectively.

However, following the release of the IPCC Third Assessment Report it has been recognized at international level that the current level of efforts determined under the Kyoto Protocol and UNFCCC will not be enough to prevent dangerous climate change. A new stage in international climate negotiations was launched at the Climate Change Conference in Bali in 2007, with the adoption of the Bali Action Plan. It was recognized that action by both developed and developing countries, according to national circumstances and capabilities, will be required, with the latter being supported through finance and investment, technology and capacity building.

2.2. From Bali to Copenhagen

Over the past two years international negotiations focused on developing a comprehensive framework for enhanced action on climate change. These negotiations were expected to deliver an agreed outcome outlining the main elements of the future framework at the

Climate Change Conference in Copenhagen in December 2009. However it was not possible to finalize the technical negotiations under the UNFCCC and the Kyoto Protocol and therefore to adopt formal decisions in Copenhagen. In a parallel setting the Heads of States representing the major emitting countries and main negotiating groups have negotiated a Copenhagen Accord[8], which outlines the main elements of the future framework and commits a significant amount of finance from developed countries to assist developing countries in combating climate change. The Accord however was not formally adopted at the closing plenary, due to opposition by several countries, but 'taken note of', which left it at the level of a political declaration rather than a formal decision under the United Nations.

It was also decided to extend the mandates of the negotiations under the UNFCCC and the Kyoto Protocol by one more year and to complete the work for adoption of the outcomes at the next climate change talks in December 2010 in Mexico.[9] Parties were asked to submit written notice to the UNFCCC Secretariat of their support of the Copenhagen Accord by 31 January 2010. Countries were further asked to submit, by the same date, their pledges for emission reduction targets (for industrialised countries) and for mitigation actions (for developing countries) for the period up to 2020, which would then be reflected in the Appendices to the Accord.

2.3. The Copenhagen Accord

In the Accord, countries commit to keeping global temperature rise below 2 ^{o}C through deep cuts in GHG emissions, achieving peaking of global emissions as soon as possible, while noting that emissions in developing countries will take longer to reach their peak. Annex I Parties commit to implement individually or jointly quantified economy-wide emissions targets for 2020. Non-Annex I Parties will implement Nationally Appropriate Mitigation Actions. Least Developed Countries and Small Island Developing States may undertake these actions voluntarily and on the basis of external financial support. The Accord further recognized that low-emission development strategies are indispensable to sustainable development. Mitigation actions taken by non-Annex I Parties will be subject to domestic measurement, reporting and verification (MRV) procedures and reported on every two years through national communications. However, internationally supported NAMAs will be subject to international MRV procedures. Furthermore the Accord makes a reference to the Kyoto Protocol, requesting Parties to the Kyoto Protocol to "further strengthen the emission reductions initiated by the Kyoto Protocol" and notes the important role of markets in future climate change policy.

The Accord also calls for the immediate establishment of a mechanism including so called REDD-plus, which aims to reduce deforestation, forest degradation and promote forest conservation, to enable the mobilisation of financial resources from developed countries. New and additional resources from developed countries in the amount of "approaching USD $30 billion" is pledged for the period 2010–2012, with balanced allocation between adaptation and mitigation, and USD $100 billion per annum envisaged from 2020 onward.

Even though the Copenhagen Accord does not have a legal standing within the UNFCCC process, it is being considered and supported by most countries. The chapeau of the Copenhagen Accord lists 114 Parties agreeing to the Accord. A further 24 Parties informed

[8] http://unfccc.int/files/meetings/cop_15/application/pdf/cop15_cph_auv.pdf

[9] For a detailed account of the negotiations during the Copenhagen Climate Change Talks see *Earth Negotiations Bulletin*, Summary of the Copenhagen Climate Change Conference: 7 -19 December 2009, Vol. 12 No. 459, Tuesday, 22 December 2009. Online at http://www.iisd.ca/climate/cop15/

the UNFCCC secretariat of their intention to be listed as agreeing to the Accord after the report of the Copenhagen Conference was published. As of 25 July 2010, 137 of the 193 Parties to the Convention had officially communicated their support to, or association with, the Copenhagen Accord.[10] Many of these countries had further provided information on the mitigation commitments or actions that they would undertake. While negotiations on the future international regulatory framework on climate change are still underway, the main elements of the framework are quite clear. The guidance of the Copenhagen Accord points towards the type of actions that will be expected from various groups of countries. Moreover, finance already committed in Copenhagen and thereafter can already be used for supporting NAMAs in developing countries. Similarly, development of national low-emission development concepts, strategies and identification of concrete mitigation measures and the associated needs can and should start as soon as possible.

3. The ECIS region and low-emission development

The Eastern Europe and the Commonwealth of Independent States (ECIS) region hosts 6 of the 20 most GHG-intensive economies in the world (see Table 1) and remains one of the most energy-intensive regions in the world, both in terms of energy consumption and production. The region is responsible for about 12% of global GHG emissions, 10% of the word's energy demand, but only 5% of the world's GDP. Energy losses account for almost a third of total domestic energy use. Electricity consumption in the region grows at an average annual rate of 3.7%. Fossil fuels are expected to remain the primary energy source in the near future.

Due to large GHG emissions per dollar of GDP produced, the region has large potential of cost-effective GHG emission reduction per dollar invested.

Table 1: Most carbon-intensive transition economies

Country	Carbon intensity of GDP, tCO_2eq/mln$ PPP	World rank
Uzbekistan	3,081	2
Serbia	2,265	5
Kazakhstan	1,872	8
Ukraine	1,380	11
Turkmenistan	1,376	12
Russia	1,302	15

Source: Climate Analysis Indicators Tool 2008, http://cait.wri.org

Given the expected economic growth, it is critical to start changing to a low-carbon development path and to decouple economic growth from GHG emission to prevent sharp GHG emission growth expected under business-as-usual scenario in the region. Countries in the ECIS region vary in their treatment under the UNFCCC and the Kyoto Protocol: some belong to Annex I of the UNFCCC together with other developed countries and countries with economies in transition, while others do not. Some countries have emission reduction targets under Annex B of the Kyoto Protocol while others do not (see Table 2). Furthermore the climate change policy of some countries in the region is influenced by their relationship to the European Union (EU), where the Member States follow the unified EU policy on climate change (see Box 3). Countries that are in the process of accession to

[10] See the UNFCCC website at: http://unfccc.int/home/items/5262.php

the EU also orient themselves toward the EU position on climate change and, being mainly non-Annex I Parties to the UNFCCC, are more inclined to come forward with NAMAs. See Box 3 above for a description of EU policy in relation to LEDS.

Table 2: ECIS countries in relation to the UNFCCC and Kyoto Protocol

Annex I and Annex B	Annex I, but not Annex B	Non Annex I, EU members	Non Annex I, accession to EU	Non Annex I
All new EU members Croatia Russian Federation Ukraine	Kazakhstan – (*pending Annex B*) Turkey Belarus- *(pending Annex B)* Malta- *(in 2010)*	Cyprus	Albania Bosnia and Herzegovina Montenegro Serbia FYR of Macedonia	Armenia Azerbaijan Georgia Kyrgyzstan Moldova Tajikistan Turkmenistan Uzbekistan

Countries in the region have a lot in common, particularly in terms of their potential to mitigate GHG emissions and opportunities to transition to the low-carbon development path. Many countries, especially in the sub-regions, have similar political characteristics, economic development profiles, standards of living and capacity development needs. The majority of countries' status towards UNFCCC and the KP (for SEE also EU accession) is also similar in any of the sub regions and thus they have similar commitments under the climate change treaties.

Information about association and mitigation actions of the ECIS region countries submitted to the Appendixes of the Copenhagen Accord is provided in Chapter 3 below.

Chapter 2: Mitigation and national development concepts of Low-emission Development Strategies and Nationally Appropriate Mitigation Actions

1. Low-emission development strategy as a tool for transition to sustainable development

The recognition of the importance of low-emission development strategies (LEDS), which culminated in the Copenhagen Accord´s statement that they are "indispensable for sustainable development", is a significant step towards implementing transition to low-carbon economic growth. Similarly, the current versions of the negotiating text under the UNFCCC contain several options that recognize the importance of LEDS, and in some cases request developing countries to develop low-emission development plans.[11] Many industrialized countries and international development agencies are interested in providing financial, technical and analytical support for the development of ambitious country-owned low-emission development strategies. Such strategies can act as catalysts to support the transition to low carbon economic development, resulting in sustained employment and investment growth, increased financial flows through carbon markets, reduced GHG emissions and other social, economic, and environmental benefits.

LEDS form a strategic plan to assist the country in shifting its development path to a low-carbon economy and achieve sustainable development, based on the socio-economic and development priorities of the country. It has a long-term component that includes a strategic vision, and a short and medium-term component that lists specific actions to be undertaken to get on a low carbon pathway.[12]

Often it is also suggested that a comprehensive LEDS should also include a strategy for transition to climate-resilient development or incorporate a national action plan on adaptation. However while recognizing that development of an all-encompassing climate change strategy would be preferable, in this guide we limit our analysis to mitigation issues. However, it should be kept in mind that adaptation and mitigation strategies are closely linked. When evaluating mitigation options we should take into account future climate change effects and potential adaptation measures that the sector may need to undertake, for example the hydropower sector may experience lower water flows. Similarly, some adaptation strategies may lead to increased emission and would require greater effort on the mitigation side.

LEDS should serve as frameworks for low-carbon transition beyond the pursuit of marginal improvements of old technologies, allowing advance towards low-carbon technologies and

[11] Text to facilitate negotiations among Parties. Note by the Chair, 9 July 2010. FCCC/AWGLCA/2010/8.

[12] Adapted from *Low Carbon Growth Plans: Advancing Good Practice*, Project catalyst, August 2009.

infrastructure with long-term mitigation and market potential. LEDS can be seen primarily as policy instruments which support governments in their national decision-making. However they can also support global goals by providing national strategic context to the mitigation efforts for which countries receive international recognition or international support (such as for NAMAs).

Comprehensive LEDS assume a national economy-wide approach, but can also be designed and implemented at the level of a region or a sector, but in such cases potential leakage of GHG emissions should be considered. It is critical that LEDS is closely linked to existing sustainable development goals and strategies, poverty eradication and economic growth strategies.

In addition to setting overall strategic goals, LEDS should contain a concrete set of measures leading to GHG emission reduction, quantification of the corresponding emission reduction for each measure and the financial requirements to implement them. For non-Annex I Parties the set of measures can be expressed as NAMAs. Finally LEDS should outline the approach to implementation, determining concrete steps and timelines as well as provisions for monitoring, measurement, reporting and verification of results and a mechanism for further improvement on the basis of the experience in the implementation. These elements of LEDS will be discussed in further detail later.

While practical experience with LEDS is still relatively limited, several developed and developing countries have started to implement LEDS,. Table 3 below gives examples of such countries and the main features of the plans. The timeframes for preparation of such plans varied significantly from country to country. For example, Bangladesh's strategy was developed in 6 months, while South Africa spent 3 years building consensus around the fact-base.[13]

Currently there is no accepted international methodology on how LEDS should be designed and what elements they should have. Since every country has its specifics, LEDS should be first of all country-driven.

Table 3: National low carbon and low emission strategies and plans developed to date

Country	Date	Product
Bangladesh	Sep 2008	Bangladesh climate change strategy and action plan (draft)
Brazil	Dec 2008	National Plan on Climate Change (PNMC)
China	Jun 2007	National Climate Change Program
Costa Rica	Jul 2007	Peace with Nature
EU	Jan 2008	EU Energy and Climate Package

[13] *Low Carbon Growth Plans: Advancing Good Practice*, Project catalyst, August 2009. Available at: http://www.project-catalyst.info/images/publications/lcgp_paper.pdf

Guyana	May 2009	Transforming Guyana's Economy While Combating Climate Change
India	Jul 2008	National Action Plan on Climate Change (NAPCC)
Indonesia	Nov 2007	National action plan addressing climate change
Japan	Jul 2008	Action plan for achieving a low carbon society
Mexico	2007, Mar 2009	National Strategy on Climate Change Special Program on Climate Change (PECC)
South Africa	Jul 2008	Long Term Mitigation Scenarios (LTMS) Climate Change Policy Framework
South Korea	Aug 2008	'Low Carbon, Green Growth' Vision and 1st National Basic Energy Plan (2008~2030) and Comprehensive Plan on Combating Climate Change
U.K.	Jul 2009	The UK Low Carbon Transition Plan
U.S	May 2009	U.S. Climate Bill

Source: *Low Carbon Growth Plans: Advancing Good Practice*, Project catalyst, August 2009. Available at: http://www.project-catalyst.info/images/publications/lcgp_paper.pdf

The most recent and comprehensive attempt to develop a methodology for development of a LED strategy has been made by the United States, which has supported the creation and development of an open internet portal on LEDS, based on the Wiki principle of operation.[14] The information presented on this portal and the underlying methodology has been taken into account in the development of this Guide.

[14] *Low Emissions Development Strategy (LEDS): Generalized Methodology for Preparation and Implementation of LEDS*, available at http://en.openei.org/apps/LEDS/

2. Nationally Appropriate Mitigation Actions

The concept of Nationally Appropriate Mitigation Actions (NAMAs) was first formally introduced into the international negotiations in 1997 through the Bali Action Plan. NAMAs were suggested as the appropriate form of mitigation action by developing countries. The Bali Action Plan determined that enhanced action on mitigation should also include NAMAs by developing country Parties in the context of sustainable development. These NAMAs would be supported and enabled by technology, financing and capacity-building, in a measurable, reportable, and verifiable manner (paragraph 1.b (ii) of the Bali Action Plan). The negotiations on the nature of NAMAs, as well as on the rules for their measurement, reporting and verification (MRV), as well as for their support have not yet concluded.

However, broadly three types of NAMAs are being proposed:

- **Unilateral**
  Mitigation actions undertaken by developing countries on their own.

Useful resources:

LEDS portal: Generalized Methodology for LED Preparation and Implementation at: http://en.openei.org/apps/LEDS/

Low Carbon Growth Plans: Advancing Good Practice, Project catalyst, August 2009. Available at: http://www.project-catalyst.info/images/publications/lcgp_paper.pdf

Low Carbon Growth Country Studies—Getting Started. Experience from Six Countries, World Bank 2009. Available at: *http://www.esmap.org/filez/pubs/1016200941528_FINAL_LCCGP_Paper1.pdf*

- **Supported**:
  Mitigation actions in developing countries, supported by finance, technology and capacity building from Annex I countries.

- **Creditable**
  Mitigation actions in developing countries generating credits for carbon market.

As noted earlier, according to the Copenhagen Accord, non-Annex I Parties **will** implement mitigation actions. Mitigation actions taken by non-Annex I Parties (unilateral NAMAs) will be subject to their domestic MRV procedures and reported on every two years through national communications on the basis of guidelines to be adopted by the Conference of the Parties. Provisions are to be made for international consultations and analysis under clearly defined guidelines that will ensure that national sovereignty is respected.

NAMAs seeking international support ('supported NAMAs) will be recorded in a registry along with relevant technology, finance and capacity building support. They will be subject to international MRV procedures in accordance with guidelines to be adopted by the Conference of the Parties. There is no reference in the Copenhagen Accord to whether any NAMAs will generate credits for the carbon market.

Under the Copenhagen Accord, Parties were asked to communicate their intended mitigation actions to the secretariat for inclusion to the Appendix II by 31 January 2010. However, many Parties submitted their communications after the deadline, and others have stated they intend to submit. These submissions are kept track of and are made available at the UNFCCC website.

In order to register their NAMAs with the Copenhagen Accord and submit a request for financial support for the actions, non-Annex I countries must prepare an appropriate submission. While no formal guidance currently exists on what such submissions should include, the principal questions that need to be addressed in a NAMA submission are clear, as consensus starts to emerge around the relevant parts of the draft negotiating text under the UNFCCC. These issues are discussed further in this guide.

Useful resources:

Nationally Appropriate Mitigation Actions: Insights from example development, by Martina Jung, Marion Vieweg, Katja Eisbrenner, Niklas Höhne, Christian Ellermann, Sven Schimschar, Catharina Beyer with contributions by CTS Mexico, Ecofys 2010 available at http://www.ecofys.com/com/publications/brochures_newsletters/documents/Report_Ecofys_NAMA_overview_ENG_04_2010.pdf

Nationally Appropriate Mitigation Actions by Developing Countries: Architecture and Key Issues, The Center for Clean Air Policy, Washington, D.C. December 1, 2009 available at http://www.ccap.org/docs/resources/916/NAMAS_PAPER_FINAL_DEC%201.pdf

Addressing climate change in national sustainable development strategies – common practices. Background Paper NO. 12. DESA/DSD/2008/ 12

3. Mitigation actions in the ECIS region submitted to the Appendixes of the Copenhagen Accord

Most ECIS countries have associated themselves with the Copenhagen Accord and indicated mitigation actions they would be willing to undertake, albeit in some cases only if financial, technological and capacity building support is provided.
As of 25 July 2010, six countries from the region have not yet formally associated with the Copenhagen Accord[15]. All of them are non-Annex I, apart from Turkey, which is listed in Annex I of the UNFCCC. All other sixteen Annex I countries in the region have submitted quantified economy wide emission targets for 2020.

Table 4: Emission targets submitted to the Copenhagen Accord by Annex I Parties in the ECIS

Country	Target proposed
Belarus	10-15% of 1990 levels.
Croatia	5% of 1990 levels. Temporary target, which will be adjusted upon accession to EU. Base year upon decision 7.CP/12.
EU member states[16]	EU target: 20-30% of 1990 levels.

[15] Azerbaijan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan .

[16] Including the following countries from the ECIS region: Bulgaria, Cyprus, Czech Republic, Hungary, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

Kazakhstan	15% from 1992 – voluntary taking target as Annex B
Russia	15-25% of 1990 levels.
Ukraine	20% of 1990 levels with a number of conditions.

In their submissions to the Copenhagen Accord, many non-Annex I countries from the region have indicated NAMAs they would undertake (see Table 4 below). Albania, Bosnia and Herzegovina, Montenegro and Serbia have not been able to provide any information on planned NAMAs (Albania, Bosnia and Herzegovina, Montenegro and Serbia), indicating that they will be able to do so after they finalize their subsequent national communication.
In most cases this information is limited to listing the measures without quantifying the associated emission reductions. Most of the proposed Nationally Appropriate Mitigation Actions are not divided into the autonomous and internationally supported, although the need for financial, technological and capacity building support is generally noted. Besides the usual mitigation measures in the electricity and transport sectors, measures are envisaged in the waste management and forestry sectors as well (for example in Armenia and Macedonia).

In some cases NAMAs are linked to low-carbon development and the need of development of low-emissions plans is explicitly noted (such as Georgia). Georgia plans to achieve MRV deviation from the business as usual scenario, and Moldova aims to achieve reduction not less than 25% of 1990 level of national GHG emissions by 2020. The target of Moldova is similar to those of some Annex I and advanced developing countries, however no clarification is provided on whether, and if so how much, and support would be needed to implement it.

The existing international climate change framework and EU policy in this area supports developing countries and countries with economies in transition in their efforts to pursue economic growth while decreasing the rate of growth in GHG emissions. The agreement of developing countries (through the Bali Action Plan and the Copenhagen Accord) to design and implement NAMAs in the context of sustainable development presents an important opportunity for countries in the region, as does the commitment of developed countries in Copenhagen to provide significant financial support to this end. Development and implementation of NAMAs for non-Annex I countries and LEDS for all countries in the region would allow economies to grow along greener and more sustainable paths, to create new jobs in the green sectors of economy and to increase their international competitiveness.

Table 5: Examples of Nationally Appropriate Mitigation Actions proposed in the ECIS region, as at 25 July 2010

Country	Proposed Nationally Appropriate Mitigation Actions
Armenia	• Implementation of "The National Program on Energy savings and Renewable energy of the republic of Armenia" 2007 • Expansion of the electrical transport and increase of natural gas in motor's fuel balance • Decrease in methane emissions from solid municipal waste and waste water • Restoration of degraded forests, afforestration and reducing volumes of deforestration, sustaining soil CO2 content and ensuring its increase.
Georgia	• To establish NAMAs in the context of sustainable development, supported and enabled by technology and capacity-building, in a measurable, reportable and verifiable manner. • To achieve MRVed deviation from the baseline (below business as usual levels) supported and enabled by technology and capacity-building.

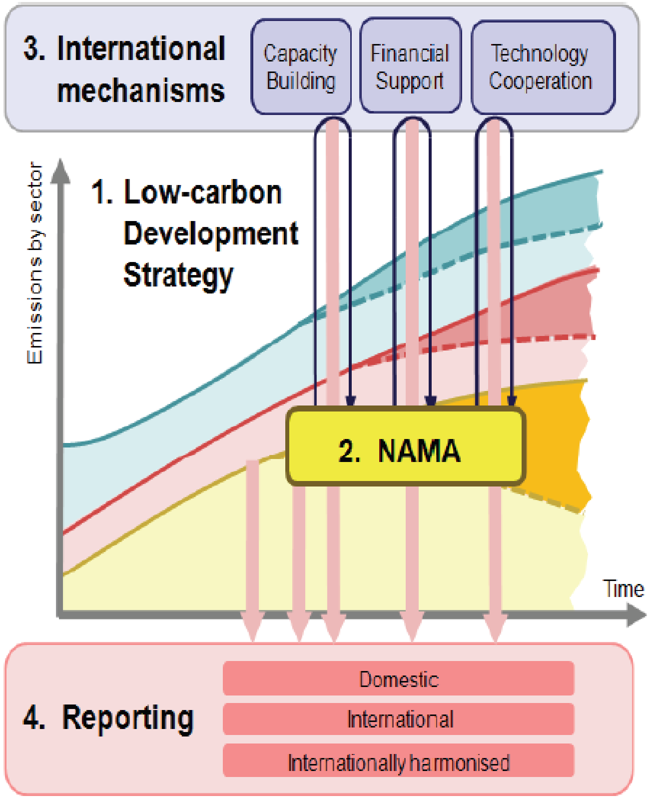
Country	Proposed Nationally Appropriate Mitigation Actions
	• To establish the baseline or reference case against which the action shall be MRVed. • All mitigation actions by Georgia will be voluntary and nationally appropriate actions supported and enabled by technology, financing, and capacity-building, through existing mechanisms, the Technology Mechanism and other mechanisms established by the CA. • To support the CDM one of the most important means for further cooperation in the field of NAMAs since CDM holds the potential to lead to significant investments, better environmental performance, job creation and poverty alleviation. • To develop a low carbon growth plan and low carbon strategy, in particular through the use of renewable energy investments and global cooperation. • To take effort to build a low-carbon economy that ensures continued growth and sustainable development
FYR of Macedonia	• GHG emissions in electric power sector: harmonization with the EU legislation; ensuring stability in energy supply with investment activities for building new big HPP and TPP on gas; Increase the share of renewables in the energy sector and improvement of EE • GHG emission reduction in the industrial energy transformations and heating sector: Reduction of the use of carbon intensive fuels; improvement of EE and energy savings; increase of the contribution of RES in the country energy balance and awareness raising of the final consumer • Transport: Improvement of the overall efficiency in the transport sector and EE of the vehicles, of the urban and inter-city transport and harmonization with the EU legislation • Waste Sector: GHG emission reduction at the existing landfills, improvement for efficient methane collection and reduction of N2O emissions • Agriculture and forestry: legislative base; introduction/development of mitigation technologies in agriculture; strengthening the national and local capacities for carbon financing; • Education on application of mitigation measures in agriculture and implementation of measures in forestry.
Moldova	• A reduction not less than 25% of 1990 level total national GHG emissions by 2020, through implementation of global economic mechanisms focused on climate change mitigation in accordance with the UNFCCC's principles and provisions

4. Developing Low-Emission Development Strategies: main elements

Choosing an approach to LEDS and NAMA development

Comprehensive sets of actions and policies are required to create a framework for a shift to low emission development trajectories of individual sectors and ultimately the entire economy. These actions can either be designed within the overall framework of an integrated LED strategy for a country, or can represent a discrete set of measures or NAMAs in various sectors. Figure 4 below, adapted from *Climate Strategies*, represents well the difference and the linkages between the concepts of LED strategies and NAMAs.

Figure 4: Relationship between LEDS and NAMAs



1. **Low-carbon/emission development strategy** outlines the intended overall economic, energy and emissions trajectory for a country. It helps to identify trigger points for policy intervention, i.e. to identify and prioritize NAMAs.

2. **Nationally appropriate mitigation actions** (NAMAs) comprises of a set of concrete projects, programmes and policies that shifts a sector/technology in a country onto a low-carbon development trajectory.

3. **International support mechanisms** can provide support for individual NAMAs.

4. **Monitoring and Reporting** is necessary for the implementation and is required for obtaining international support for NAMAs. This requires detailed quantitative and qualitative evidence.

Source: *International Support for Domestic Action: Mechanisms to Facilitate Mitigation in Developing Countries*. Policy Summary, Climate Strategies, 15 September 2009.

It has been proposed in the international negotiations that developing countries would put forward a national climate plan or LEDS that would identify mitigation opportunities and outline in general terms types of NAMAs that it intends to implement. At the moment the deliberations on NAMAs and LEDS have not yet concluded. The question therefore is still open whether LEDS would be required under the post-2012 international framework or whether they would remain voluntary for non-Annex I countries and the focus will be on NAMAs.

However, regardless of the outcome of the international negotiations on this issue, LEDS are a useful tool to:

- ensure coherence of individual NAMAs in a given country;
- help plan and implement a broad range of mitigation activities;
- identify the need for international support;
- detail a pathway to a low-carbon future that each country elects to follow.

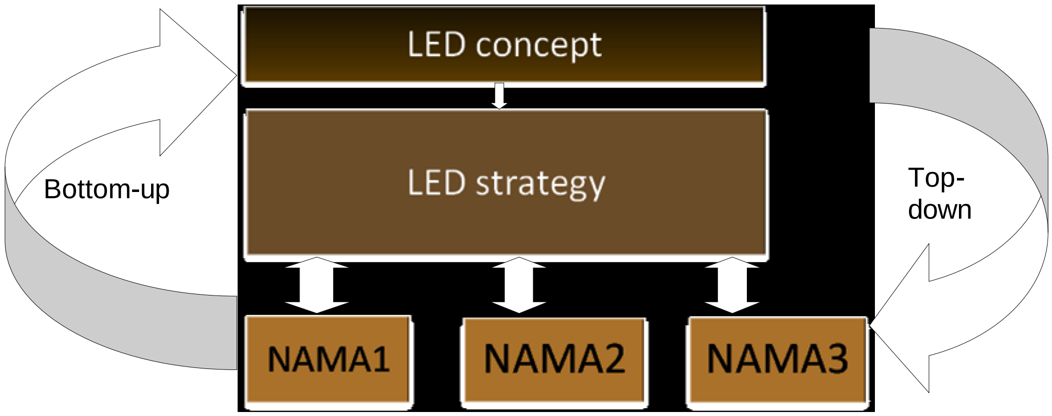
Comprehensive LED strategy helps for the evaluation of individual NAMAs and for developing long-term financing and technical-assistance plans for NAMA implementation. Furthermore, creating LEDS allows NAMAs to be linked with the country´s development plans. LEDS can incorporate various types of NAMAs, including:

- energy-efficiency measures;
- waste management policy;
- transportation-sector policies;
- technology deployment.

Countries can currently choose which approach to follow depending on their national circumstances, their status under the UNFCCC and KP, and what level of ambition is affordable. Some may decide to pursue a comprehensive approach of developing a LEDS containing a set of concrete measures or NAMAs; others may only be ready to identify of a limited set of specific NAMAs or for integration of LED concerns into the existing se ctoral development strategies.

Option 1: Comprehensive approach: from LEDS to NAMAs
Under this option the most ambitious and comprehensive approach is taken. A country decides to develop a comprehensive LED strategy, starting from a general low-emission development concept, moving on to develop a full low-emission strategy containing a set of concrete mitigation actions (NAMAs) that ensure quantifiable reduction of emissions in various sectors (see Figure 5).

Figure 5: Comprehensive approach to LEDS and NAMA development



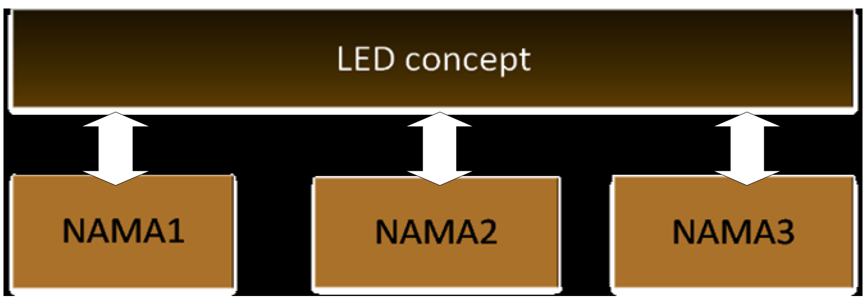
Under a **top-down approach**, LEDS development starts with determining the overall policy objective and emission reduction goal for the country (in some cases it is set by the international obligation, e.g. under the Kyoto Protocol) before moving on to identifying concrete measures in various sectors (NAMAs). This approach often relies on the results of macro-economic modelling.	Under the **bottom-up approach**, emission reduction options in various sectors are identified and analyzed first, resulting in the determination, quantification and prioritization of mitigation measures or NAMAs. The overall emission reduction to be achieved under the LEDS is then determined through the integration and further prioritization of individual measures identified in various sectors.

This approach is most suitable for countries with more a advanced national climate change process, and with good information and analytical basis, such as existing national and sectoral GHG projections etc. In the ECIS region this option may be of particul ar interest to countries that have a national economy-wide GHG emission reduction target under the KP (e.g. Annex B Parties: Russia, Ukraine, Croatia, new EU Member States) and for countries that took such obligation voluntarily (e.g. Belarus, Kazakhstan). Some of these countries have already developed national communications, prepared national GHG inventories and initial reports under Article 7, paragraph 4, of the Kyoto Protocol on calculation of the assigned amount. While these documents do not substitute LEDS and are not directly suited to policy-making decisions, they contain useful information that will aid development of the LEDS. Furthermore, this option may be considered by non-Annex I countries that have already announced, or that are considering, an economy wide emission reduction target or a goal to develop a comprehensive LEDS (e.g.Moldova, Georgia).

Option 2: Narrow focus on identification of concrete NAMAs
Some countries are not ready to go for the development of comprehensive LEDS and are looking first to identify and implement actions in certain sectors, or to require further analysis to determine aggregate national level opportunities for GHG emission reduction. In such cases, developing more narrowly focused quantified NAMAs could be deemed more appropriate at the initial stage.

Even though no comprehensive LEDS will be developed under this approach, it may still be helpful to develop at least a low-emission development concept, to put NAMAs in each sector into the context, to ensure better coordination of the implementation of actions and of their monitoring, Measurement, Reporting and Verification (MRV) and to lay a foundation for future efforts towards developing a LEDS.

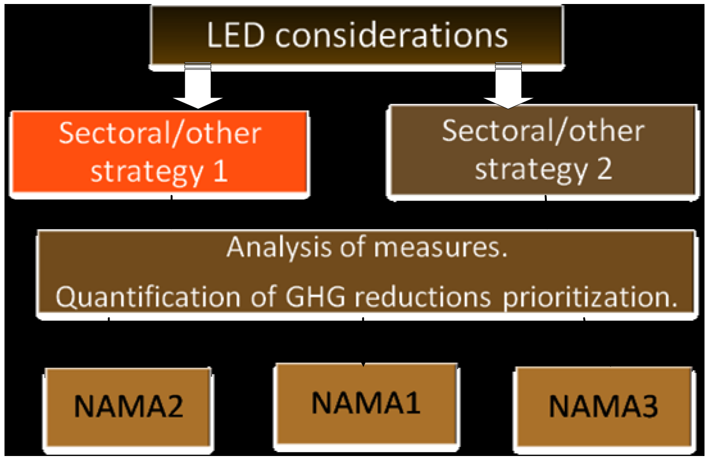
Figure 6: Narrow focus on identification of concrete NAMAs



Option 3: Incorporating LED concerns into existing programmes
Some countries may opt for an approach where the low-emission development concerns are simply incorporated into existing strategies, such as energy efficiency or renewable energy policies. These strategies are then examined through the perspective of reducing GHG emissions. The emission reductions associated with various measures are quantified and the measures updated and prioritized accordingly. Priority measures with significant GHG emission reduction could be considered for implementation as NAMAs.

Furthermore, in some cases the area/territorial based strategies at both national and level and below (including for poverty reduction, socio-economic development, sustainable development and province/district development) can also serve as good entry points for integrating low carbon development concerns and measures. In such cases similar steps would be applied as described above. Starting by integrating LED concerns at sub-national level may serve as a pilot that can then be scaled-up later to the national level.

Figure 7: Incorporating LED concerns into existing programmes



This option may be suitable for countries that have already developed a set of comprehensive policies for key sectors (i.e. energy, forestry, agriculture, transport) that would lead to reducing GHG emissions, but lack quantification of the emission reductions associated with different policy options, and would like to prioritize these options through transition to low-carbon sustainable development.

Main steps in LEDS and NAMA development

While the precise steps that a country would need to follow to develop LEDS or NAMAs will depend on its national circumstances and the ambition level chosen (as discussed above), the main elements necessary for the decision-making remain similar.

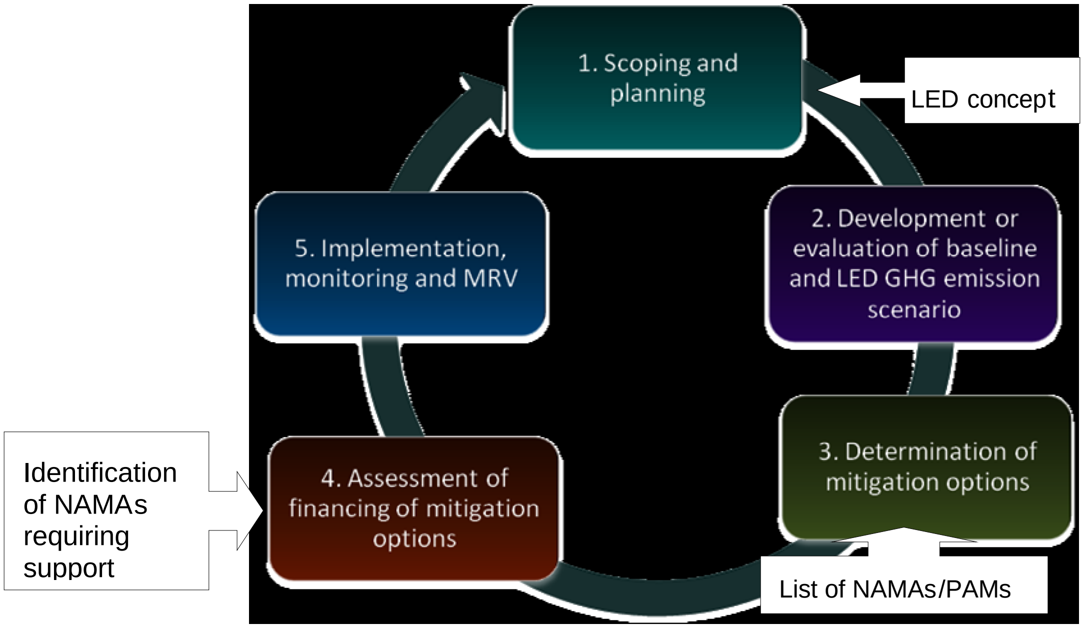
The process of developing a comprehensive low-emission development strategy will include:

- scoping and planning;
- determining future GHG emission trends under the baseline scenario (without implementation of additional mitigation measures) and under the LED scenario;
- identifying GHG emission mitigation opportunities in key sectors and formulating concrete NAMAs;
- evaluating available financing and external support needs, as well as implementing monitoring and Measurement, Reporting and Verification (MRV) of the results (see Figure 8).

Countries pursuing the more narrow approach of only identifying NAMAs (Option 2) or integrating LED concerns into the existing sectoral strategies can adapt the steps accordingly. A detailed discussion of each step with examples follows in the corresponding chapters of this guide.

A LEDS is not a fixed process: each country can customize the methodology based on its national goals and circumstances. National development priorities determine whether the study targets all major emitting sectors or just specific areas. A LED study typically identifies emission mitigation opportunities and their associated costs and benefits, laying a foundation for Nationally Appropriate Mitigation Actions (NAMAs) for non -Annex I countries or policies and measures (PAMs) in the case of Annex I countries[17].

Figure 8: Main steps in the development of LEDS



[17] *Low Carbon Growth Country Studies—Getting Started. Experience from Six Countries* , World Bank 2009. Available at: http://www.esmap.org/filez/pubs/1016200941528_FINAL_LCCGP_Paper1.pdf

Chapter 3: Scoping and planning LEDS

1. Main principles of LEDS development

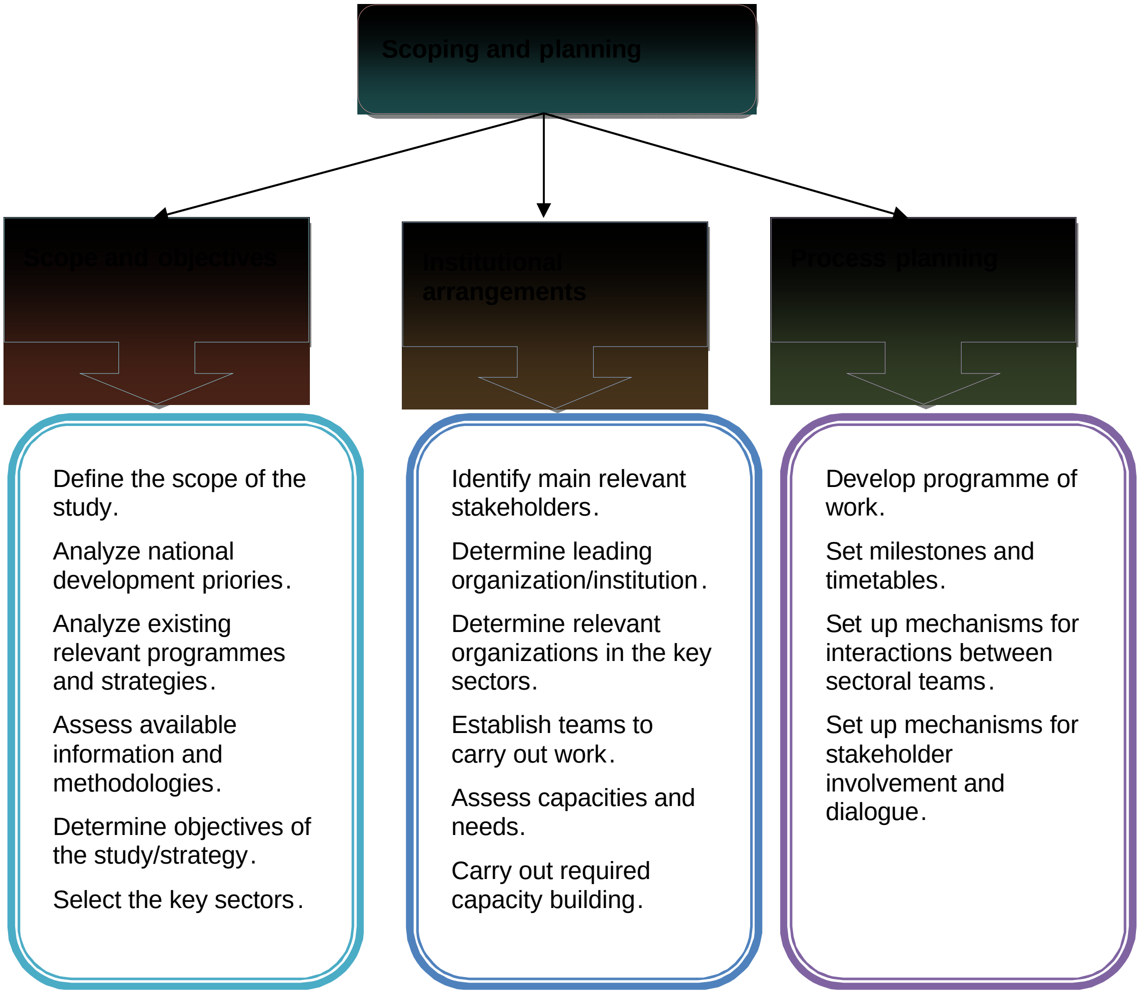
The first stage in the development of a LEDS is to scope the study and plan the process. Developing a LEDS is a process that should bring together and build consensus among policymakers and other relevant stakeholders on the future low emission development goals and pathways. Therefore careful planning and good organization of the process of the strategy development is critical for the overall success. At this stage a country should consider LEDS in the context of national development priorities and existing climate-related programs.

Analysis of existing LED and low-carbon development studies, as well as studies on national Millennium Development Goals, showed that while approaches to scoping and planning national strategy development vary from country to country, the following key principles are important to success.

- The LED process needs to be backed-up by sustained **high-level political commitment** to ensure the process defines national policy.
- A **flexible approach** to study design and implementation, which responds to national priorities, is required.
- A **nationally owned**, **transparent** and collaborative study process.
- **Inclusiveness**: broad stakeholder engagement (i.e. including national, regional and local governments, civil society, private sector, international development agencies) to enable data collection and cross-sector analysis and support.
- **Building on existing national planning processes,** strategies and integration into government structures, drawing on local expertise, institutions, and resources.
- **Regular review and iteration** taking into account the lessons learnt during the implementation, new scientific information and evolving socio-economic situation.

Figure 9 below shows the main elements of the scoping and planning stage of a national LED strategy. First of all, the scope and objectives of a study should be determined based on national circumstances and priorities. Institutional arrangements should then be made to enable effective, transparent and inclusive policy development. Finally, detailed planning for LED study and policy development, consultation and adoption should be undertaken. These essential elements of scoping and planning are discussed in greater detail below. It is important to note that these three main elements should not be viewed as consecutive steps in the process, but can be launched in parallel.

Figure 9: Main elements of scoping and planning stage of L EDS



2. Determine scope and objectives

As discussed in Chapter 1, countries in the ECIS region may have different level of ambition as to whether they would want to develop a comprehensive LEDS containing a set of NAMAs, or whether they would set a narrower goal of identifying a list of NAMAs or integrate LED concerns into their existing sectoral programmes. Also, some countries may decide to limit their efforts initially to developing LEDS for particular sectors. Based on that decision, countries can skip some of the steps in the process described in this guide as they find appropriate to their circumstances.

The decision on the scope of the effort should be taken at the first stage of the process on the basis of the **analysis of the national situation**, including:

- national development priorities and trends, including economic, social, poverty eradication, sustainable development, energy security, green job creation and how they relate to low-emission development goals;

- the position of the country and its commitments under the UNFCCC and the Kyoto Protocol;

- existing relevant programmes and strategies e.g. national and sectoral programmes that affect GHG emission (e.g. renewable energy or energy efficiency programmes, land-use and waste management initiatives, national sustainable development strategies etc.), on-going and past climate change related projects (e.g. in the UNDP/GEF pipeline, under the UNDP MDG Carbon Facility, other initiatives).
-

To ensure that LEDS incorporates existing studies and development plans, **existing country-based data and methodologies** should be reviewed (e.g. GHG emissions inventory and forecasts/scenarios, national communications to the UNFCCC, economic models for the key sectors, carbon supply curves, climate technology needs assessments, development plans for key sectors). On the basis of this initial review, any gaps in information and methodologies should be identified and a method to address them determined. Table 5 below provides some examples of relevant national policy documents used in the process of LED development in selected countries.

Identifying objectives of a LEDS is a critical step in the planning process. These objectives are more concrete than the general scope determined initially and should connect the LEDS to the country's development priorities, clearly articulating how a LEDS would contribute to reaching national development goals. Finally, sectors that represent the highest priority for low emission development for the country should be determined.

The result of the analysis of the scope and objectives can be presented in the form of a **Low Emission Development Concept (LEDC)**, which is a concise policy document that outlines the objectives of a LED strategy, its links and contribution to the country´s national development goals. Preparing a LEDC may also be useful for countries that decide to limit their efforts initially to developing a list of NAMAs or to integrating LED concerns into existing sectoral programmes. A LEDC allows putting such efforts into an overall context of development planning. It also makes it easier to justify financing for NAMAs seeking international support.

Table 6 below provides some examples of objectives set in past low carbon studies. They range from very specific (e.g. in the case of China for specific sector-energy efficiency) to broad (e.g. Indonesia, Mexico).

Table 6: Low carbon growth country studies: relevant policy, scope, and highlights

	Relevant national policy papers	Scope/objective of low carbon growth study	Study highlight
Brazil	National Plan on Climate Change	Assess potential to lower carbon content of development.	Land use and land use change model.
China	National Climate Change Programme (2007), 11th Five-year (2006-10)	Support policy/strategy development to improve energy efficiency.	Renewable energy and energy efficiency.
India	Integrated Energy Policy (2006); 11th Five-year Plan (2007-12), National Plan on Climate Change (2008)	Articulate cost-effective strategy to lower carbon intensity and enhance economic growth.	Bottom-up modelling of specific sectors and capacity building.

Indonesia	National Action Plan on Climate Change (2007)	Address macroeconomic questions of costs and effects of low carbon development on economic growth.	Strategic options for development.
Mexico	National Climate Change Strategy (2007)	Identify and analyze low carbon options, policies, and strategies.	Comprehensive low carbon programme.
South Africa	National Climate Response Strategy (2004), Long-term Mitigation Scenario (2007).	Review long-term mitigation scenarios and develop implementation strategies in key sectors.	Implementation support for energy efficiency.

Source: *Low Carbon Growth Country Studies—Getting Started. Experience from Six Countries*, World Bank 2009.

3. Institutional arrangements and process planning

The institutional arrangements for a LEDS should first of all determine an intuition/several institutions that would take the leadership and responsibility for coordinating the process and establish a mechanism for cross-sectoral cooperation and broader stakeholder participation. The challenge is to build and sustain high-level stakeholder support (both public and private) throughout the development of the strategy.

Stakeholders may include various ministries (including social and health sec tors ministries) as well as local governance institutions and community groups. In setting up the process for LED development it is also important to ensure equal gender representation and ensure mainstreaming on gender issues into the LEDS. Gender mainstr eaming assesses the different implications of any planned action for men and women and pertains to legislation, policies or programmes. It presents a strategy to make the concerns and experiences of men and women an integral dimension of the design, implem entation, monitoring and evaluation of policies, initiatives and programmes. When realized, it ensures that women and men benefit equally from the development process, thereby resulting in effective and sustainable policies and programmes.[18]

The most appropriate institutional design will depend on national circumstances of particular countries. It is important that key agencies involved in national development planning participate in the LED process. Moreover some arrangement for a national coordinating body should be made. Table 6 below shows examples of the institutional arrangements in the past LED plans. Some of these institutions existed prior to low carbon growth plans, but others were created during the study, a number include interministerial representation.

[18] *Resource Guide on Gender and Climate Change*, United Nations Development Programme, 2009.

The methodology for LEDS developed by the US government[19] suggests that it is useful to consider forming working arrangements at several levels, including creation of a primary stakeholder group, technical working teams and national leadership team. The primary stakeholder group should include representatives of national government from various sectors, state and local governments, business, academia, environmental and other civil society groups. It leads the process and makes policy decisions. Technical teams, comprised of sector-specific national and international technical experts, carry out technical work and design policy options. A high-level leadership advisory team comprised of high-level representatives of stakeholders, guides the process, endorses decisions and supports implementation.

Box 4 below shows the example of the institutional set-up of the Green Growth Strategy in the Republic of Korea, which is one among the most comprehensive and ambitious low carbon strategies implemented by advanced developing countries. The institutional arrangements in Korea provided for highest level leaders, as well as designed consultation and coordination mechanisms with all relevant ministries, regional government, private sector and civil society. Particularly interesting is Korea´s experience in involving general public through special awareness raising and behavioural programmes, as described in Box 4.

In the ECIS region many countries have good experience with inter-ministerial dialogues on various issues, including on climate change. These experiences can be built upon in the design of mechanisms for cross-sectoral cooperation during the development and implementation of a LEDS. Simplified steps in setting up institutional arrangements are:

- identify main relevant stakeholders (incl. NGOs, academia, general public);
- determine leading organization/institutions;
- determine relevant organizations in the key sectors;
- establish teams to carry out work.

Once the expert teams have been formed it is important to evaluate requirements for capacity building of experts, stakeholders and policy-makers to enable development and implementation of a LEDS at different levels. Significant gaps in capacity should be addressed at an early stage of the process. In some cases international support for capacity building can be requested to address clearly identified needs. Technical can also be obtained through the participation of international experts.

Finally, as with any programme planning process, practical arrangements would need to be made to make sure that a LEDS process is managed in a transparent and effective way. A work programme or plan, and an associated budget for carrying out the study, must be developed. This should include concrete milestones and timetables.

Table 7: Institutional arrangements in the past low carbon growth strategies

	Lead institution(s)	Coordinating body
Brazil	Ministry of Foreign Affairs, Ministry of Environment,	Inter-ministerial Committee on Climate Change

[19] *Generalized Methodology for Preparation and Implementation of Low Emissions Development Strategies*, prepared by the U.S. Department of Energy and National Renewable Energy Laboratory in consultation with the U.S. Agency for International Development, U.S. Department of State, U.S. Environmental Protection Agency, and U.S. Department of Agriculture, Draft April 9, 2010.

	Ministry of Science and Technology (1999)	
China	National Development and Reform Commission	National Development and Reform Commission
India	Planning Commission, Ministry of Environment and Forests, and Ministry of Power (2007)	Prime Minister's Council on Climate Change
Indonesia	Ministry of Finance, National Council on Climate Change	National Council on Climate Change (2008)
Mexico	Interministerial Committee: Energy, Environment and Finance	Inter-secretarial Commission on Climate Change (2005)
South Africa	Department of Environment and Tourism, Department of Energy, Eskom, National Energy Efficiency Agency	Department of Environment and Tourism

Source: *Low Carbon Growth Country Studies—Getting Started. Experience from Six Countries*, World Bank 2009.

Box 4: Institutional architecture of the Green Growth Strategy in the Republic of Korea

The green growth strategy was created by relying on an institutional approach that leverages existing and new structures within government. There is an ongoing effort to involve the private sector, academia and civil society, as well as measures aimed at fostering education, awareness and behavioral change among the general public.

The planning and formulation of the strategy and its five-year plan has brought about an inter-agency process that involves all government ministries. The Presidential Committee on Green Growth, established in 2009, is a fundamental pillar of this institutional set-up. With representatives from all government ministries, the private sector, academia, and civil society, the committee has met four times since its creation and before the release of the Five-Year Plan for Green Growth.

At each ministry, a Chief Green Officer, generally at Director-General level, is the designated focal point for interacting with the committee. Also the Korea Environment Institute, the Korea Institute for Industrial Economics and Trade, the Korea Institute of Public Finance, and economics and environment scholars participated in the formulation of the Green Growth strategy.

To foster understanding of the objectives of the strategy and to induce public action to support those objectives educational programmes have been developed to raise awareness and to encourage behavioral change in daily consumption patterns. This includes the expansion of a carbon labeling system started in January 2009 and the launching of a new green lifestyle index. Additionally, a carbon cash-back system grants carbon points to consumers purchasing low-carbon products, which can then be exchanged for concessions at public facilities. The carbon point system is also being promoted to encourage households to save energy, water, and gas. About 400,000 households were participating in this program as of October 2009.

Source of the figure: Presentation by the Ministry of Foreign Affairs and Trade Republic of Korea.

The Republic of Korea has adopted a green procurement law (the Green Consumption Enhancement Act) to increase the consumption of environmentally-friendly products by central and local government agencies. The government also plans to double the share of eco-friendly agricultural products from 4.5 per cent in 2009 to 10 per cent in 2013.

Source of the text: Overview of the *Republic of Korea´s National Strategy for Green Growth*, prepared

Box 5: Institutional infrastructure of the arrangement of Low-carbon development concept of the Republic of Kazakhstan

The Ministry of Environment Protection is leading on dealing with climate change and development of the concept.

For this purpose an interdepartmental working group was created to coordinate development of the strategic plan and main activities. At the initial stage of the development process representatives of all interested ministries and departments, as well as independent experts were included in this working body. The role of the leading scientific organization–developer was assigned to the Kazakhstan scientific research Institute of Ecology and Climate (KAZNIIEK). Representatives of other departmental institutes and interested groups are also involved in the process.

The development of the concept is based on analysis of government plans and development programs, including:

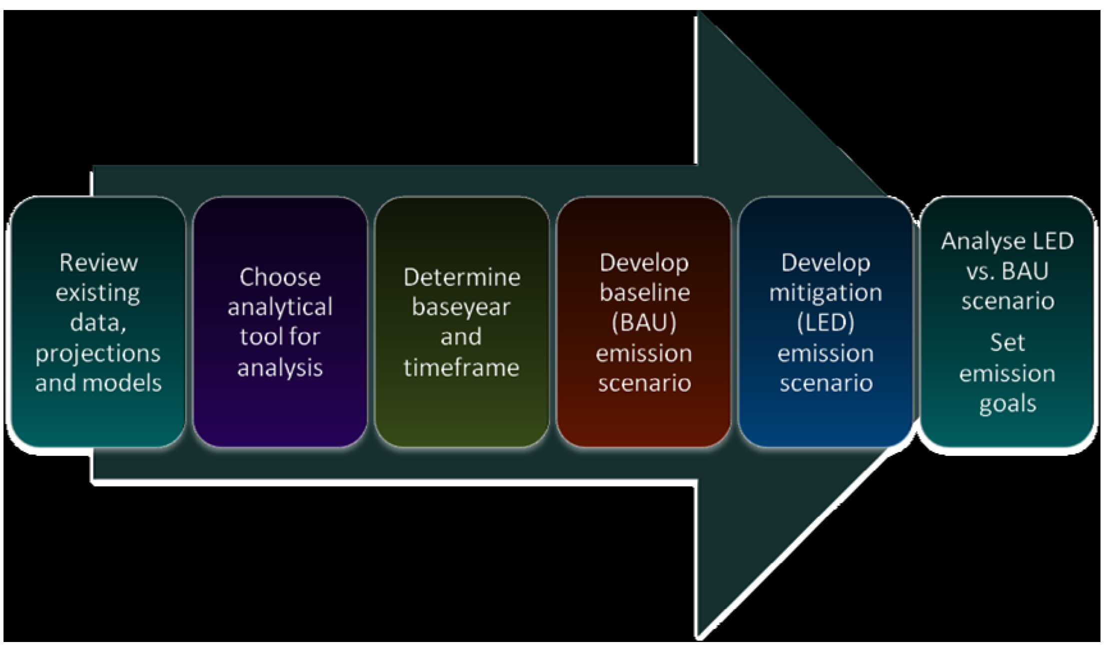
- Strategic Development plan of the Republic of Kazakhstan till 2020;
- Strategy of Development of Kazakhstan till 2030;
- Concept of Transition of the Republic of Kazakhstan to Sustainable Development for 2007–2024;
- Strategy of Industrially Innovative Development till 2015;
- Concept of Ecological Safety of the Republic of Kazakhstan for 2004 2015;
- Transport Strategy of the Republic of Kazakhstan till 2015;
- Ecological Code of RK;
- Effective Usage of Energy and Renewed resources of the Republic of Kazakhstan with the purpose of Sustainable Development for the period till 2024.
-

The transition to low-carbon development must indicate what changes in the above-stated documents should be made for a successful start of the low-carbon development of the country. It must establish entry conditions and position for successful structuring of the low-carbon social-economic system in the country.

Chapter 4: Developing baseline and low-emission (mitigation) scenarios

In the second stage of the process it is necessary to develop baseline and mitigation scenarios for GHG emissions. A scenario is an internally consistent and plausible characterization of future conditions over a specified time period. A baseline scenario reflects the situation in the absence of new climate change mitigation policies. It describes socioeconomic trends, technological change, sectoral and national plans and expected GHG emissions given current sectoral and national trends and plans. A mitigation scenario incorporates measures to mitigate greenhouse gas (GHG) emissions.

Figure 10: Main elements of the development of GHG scenarios



1. **Review existing projections and models and gather data for GHG emission scenarios**

GHG emissions scenarios are usually based on a set of assumptions about their underlying forces, derived from historical trends and current understanding. Assumptions are often formulated with the help of formal models, which transform images of the future in quantitative emissions scenarios.[20]
According to a World Bank study[21], most LED studies so far have developed their own reference and low carbon growth scenarios, choosing internationally recognized modelling tools that could best be adapted to sector needs and national objectives. Choice of model – macroeconomic, bottom-up, or financial – depends on the scope of the analysis, the sector studied, and the resources and data available locally.

First of all, the LED team should review projections and models that already exist in the country either for the whole economy or for particular sectors and see how these models or scenarios can be adapted to the study. Alternatively international or regional models can be useful.

The team should review available information and consider whether sufficient data are available to develop business as usual (BAU) projections for the economic growth, energy demand and supply, land use and GHG emissions.

Table 8 below lists some useful data resources for developing GHG scenarios. Further useful sources can be found at the CO_2 Scorecard website at: http://www.co2scorecard.org/databasenotes/.

It is important to note that modelling is not mandatory to make a scenario. Countries may use a number of approaches depending on the national circumstances and availability of data.

Some examples are described in more detail below.

Table 8: Examples of useful data resources for GHG emission scenarios

Theme	Useful information sources
Economy and development	International Monetary Fund data World Bank: World Development Indicators Human Development Reports World Resources Institute Climate Analysis Indicators Tool
Energy demand and supply, including clean energy generation	IEA World Energy Outlook IEA Energy Technology Perspectives World Resources Institute EarthTrends Low Carbon World database Energy Information Agency USA
National and sectoral trends for the country in question	National Communications (1st, 2nd) National strategies & plans System of National Accounts (SNA) Sectoral plans and models, projections of sectoral trends

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20 *An Overview of Global Greenhouse Gas Emissions and Emissions Reduction Scenarios for the Future*, DG Internal Policies of the Union, EU Policy Department Economic and Scientific Policy , IP/A/CLIM/NT/2007-07 PE 400.994

21 *Low Carbon Growth Country Studies —Getting Started. Experience from Six Countries* , World Bank 2009. Available at: *http://www.esmap.org/filez/pubs/1016200941528_FINAL_LCCGP_Paper_1.pdf*

GHG emission trends globally, by region and country	World Resources Institute Climate Analysis Indicators Tool UNFCCC Greenhouse Gas Inventory Data U.S. Department of Energy - Carbon Dioxide Information Analysis Centre (CDIAC) U.S. Energy Information Agency (EIA) IPCC Task Force on National GHG inventories

2. Choosing analytical tools for development of GHG emissions scenarios

The most extensive guidance on calculation of GHG emissions has been developed by IPCC (see below). The IPCC's *Guidelines for National GHG Inventories* has been formally accepted as the international methodological basis for preparation of national inventories under the UNFCCC.

Useful methodological resources for GHG scenarios include:

- *IPCC Guidelines for National Greenhouse Gas Inventories*. IPCC 2006.
- *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. IPCC 2001.
- *An Introduction to the economics of climate change policy*, by John P. Weyant, Prepared for the Pew Centre on Global Climate Change, 2000.

In simplified terms, the estimation of CO_2 emissions from stationary combustion of fossil fuels is a function of the quantity of energy consumed by a particular economic activity in the relevant sector, the type and amount of fuel burnt to produce the associated energy and the carbon emission factor of the fuel burnt. Of these values, the quantity of fuel delivered and consumed is the basic variable that determines the volume of energy-related GHG emissions in the country in a given year. Therefore in order to build GHG emission scenarios for BAU and LED it is necessary to evaluate projected levels of outputs and associated energy demand in the key sectors, as well as to make assumption regarding the structure of energy supply (or consumption).

As far as GHG emission factors, the basic (default) values are provided by the IPCC methodology. However, in order to improve the accuracy of national emission estimates, the IPCC recommends determining appropriate national or local values. Even though the IPCC guidelines do not offer country-specific carbon emission factors, they do suggest some country-specific assessment of net calorific values, including for Russia, Ukraine, Kazakhstan and some other ECIS countries. Most of these values are based on international assessments.[22]

In order to derive the data on energy consumption in the future to arrive then at the GHG emission scenarios in various sectors, formal modelling is often used. Countries may choose between top-down macroeconomic models and bottom-up analysis. For more details on the types of models see Box 6.

[22] *National GHG Emission Factors in Former Soviet Union Countries*, TSU Internship Report IPCC NGGIP/IGES prepared by Olga Gassan-zade, March 2004 available at http://www.ipcc-nggip.iges.or.jp/tsu/intern_report/TSU_InternshipReportOlga.pdf

Table 9 below provides examples of models that can be used to develop an energy sector pathways analysis.

There are also models that can be used for the analysis of the land-use sector. The LEDS pathways portal[23] gives the example of the following three models:

- Global Timber Model (GTM) for the forest sub-sector;
- Mini-Climate Assessment model (MiniCAM) for the agriculture and energy sub-sector;
- Forestry and Agricultural Sector Optimization Model – greenhouse gas version (FASOMGHG).

Table 9: Examples of models for the energy sector

Model	Type	Data Inputs	Model Outputs
LEAP - Long Range Energy Alternatives Planning System	Bottom-up, Accounting Framework	Least data intensive. Data needs include macroeconomic variables and energy supply and demand data. Model includes the Technology and Environmental Database (TED) which has energy technology data for performance and cost as well as environmental impacts for many technologies. Model also includes IPCC emission factors and energy and GHG baselines.	Integrated energy and GHG scenarios, showing interactions between different policies and measures, transformation analysis, and social cost benefit analysis.
MARKAL- MARKet ALlocation	Bottom-up, Optimization Model (other hybrid MARKAL models exist, e.g. such as MARKAL-TIMES)	Technology cost and performance data, input cost and price elasticity supply side data (e.g. fuel), market demand side data, emission inventory and emission factors.	Integrated energy economy and GHG scenarios. Estimates of energy prices and demand, marginal value of technologies within the system, fuel and technology mixes, GHG emissions and mitigation costs, optimizes investment in the economy and maximizes consumer welfare.
ENPEP BALANCE- Energy and Power Evaluation Program	Simulation Mode	IPCC emission factor data included in model	Integrated energy and GHG scenarios - Energy system responses to change in price and demand, GHG emissions and local air pollutants

Source: LED strategy pathways analysis at: *http://en.openei.org/wiki/LEDS_Pathways_Analysis*

[23] http://en.openei.org/wiki/LEDS_Pathways_Analysis

GHG emission scenarios that are being developed with the use of different analytical tools may lead to varying emission projections depending on the assumptions used and uncertainties involved in evaluating the future. According to the IPCC the main uncertainties in emissions scenarios relate to[24]:

- **Choice of future path:** this depends on the choice of parameters and their combinations (e.g. low population growth and high GDP).
- **Interpretation of stories:** qualitative storylines can be interpreted by modellers using different drivers.
- **Understanding of the linkages between driving forces:** often the understanding of linkages between driving forces is incomplete or only qualitative.
- **Methodological approaches:** models use different approaches (e.g. depending on whether they use top-down or bottom-up approaches, see below) and might use different assumptions driving input/output relationships and cause/effect chains.
- **Different data sources:** modellers can choose from different sources of data, for example for the base year data, historical development trajectories, current investment requirements, etc.
- **Rare events:** rare events might happen and prove different outcomes from the model runs.

[24] Cited in *An Overview of Global Greenhouse Gas Emissions and Emissions Reduction Scenarios for the Future*, DG Internal Policies of the Union, EU Policy Department Economic and Scientific Policy, IP/A/CLIM/NT/2007-07 PE 400.994

Box 6: Types of models for GHG emission projections

There is a wide variability among the models in terms of timeframes (long-run vs. medium and short-run) and in the way models describe the world (e.g. geographical aggregation of regions), the economy (e.g. consumption, choices, investments, energy sector characterisation), the way they include technological change (e.g. how they treat uncertainty, learning by doing, R&D investments, behavioural change) and the way they describe the energy sector.

Traditionally a distinction was made between **macro-economic models** and more **technically oriented bottom-up models**. The former can provide consistent scenarios in terms of GDP, labour productivity, consumption and investment expenditure, government balance, etc. The major disadvantage of such models is that they ineffectively represent the energy system and do not fully incorporate technological options to reduce GHG emissions. The more technically oriented bottom-up models better represent the technical determining factors of emissions and incorporate engineering data and technological choices, but usually require detailed sectoral data, which is not always readily available in all countries.

More recently, hybrid models have been developed that integrate top-down and bottom-up approaches, which allow a more detailed inclusion of technological change, mainly in the energy sector, within top-down macro-economic models, traditionally used at the global level.

Source: Adapted from *An Overview of Global Greenhouse Gas Emissions and Emissions Reduction Scenarios for the Future*, DG Internal Policies of the Union, EU Policy Department Economic and Scientific Policy, IP/A/CLIM/NT/2007-07 PE 400.994

Table 10 below presents examples of approaches and modelling tools that have been used in various low carbon growth studies analyzed by the World Bank. For example, the study in Indonesia focused on an overview of the implications of alternate low carbon paths through macroeconomic modelling and scenario development using an existing Computable General Equilibrium (CGE) model. Mexico used a bottom-up approach to assess and prioritize 40 low carbon options for 2007 to 2030. In Brazil and India no existing tools could meet study objectives, so new models were developed for land use, for land use change and forestry and for energy planning. Argentina developed GHG emission scenarios for 2012 associated with three different scenarios of economic development (see Box 8).

3. Determining base year and timeframe for the analysis

In developing BAU and mitigation (LED) emission scenarios it is important to determine the timeframes that will be the focus of the analysis. In this it is useful to keep in mind developments in the international climate change policy. In the post-2012 negotiations and in the Copenhagen Accord, the medium-term (up to 2020) and the long-term (2050) emission trends and targets are being discussed. As far as the base year goes, the Kyoto Protocol uses emissions levels in 1990 as the reference level for Annex I Parties, while economies in transition included in Annex I are given flexibility in choosing their base year. Developing countries in their submissions on NAMAs to the Copenhagen Accord have chosen various reference years. Some refer to reductions below current level, some to 2005 or 2000 levels.

Table 10: Examples of models used in past low carbon growth country studies

Country	Model	Origin	Comment
Brazil	Partial equilibrium and macroeconomic model specifically designed for the land use, land use change, and forestry sectors	Created by study team	Additional existing models used for energy, transport, and waste sectors
India	Bottom-up, user-friendly, Excel/Visual Basic model	Created by study team	Designed for low-cost, ongoing use; easy to update and refine projections
Indonesia	Built on existing CGE modelling work	Used existing model	
Mexico	LEAP-an input/output bottom-up model for long-range energy alternatives planning	Used existing model	Incorporated outputs from LEAP in the CGE model
South Africa	Based on Markal framework for national energy modelling	Existing model used by national research team	Analyzed implications for national GHG emission trajectories

Source: *Low Carbon Growth Country Studies—Getting Started. Experience from Six Countries*, World Bank 2009.

Box 7: Defining the base year and time frameworks for the analysis of the concept of the Republic of Kazakhstan

Independence of Kazakhstan was declared on December, 16th, 1991. It was initially supposed that 1992, the first year of independence, will be the base year for the convention but further analysis of the quality and the availability of the statistical information on the national economy, as well as the will to follow the general principles of the convention, have shown that 1990 will be more acceptable base year. In this relation Kazakhstan, as well as the majority of the countries of the Annex I, has declared the voluntary obligations in relation to base year 1990.

At the international negotiations key stages for the purposes of the parties of the convention were considered for the periods up to 2020, 2030 and 2050. Kazakhstan considers these years to be the starting points, for which quantitative purposes of the amount of re-education are defined.

The base year for modeling the scenarios of emissions is used the last year, 2008, for which the inventory of emission was conducted.

4. Developing reference emission scenario(s)

The next step is to develop and analyze business as usual (BAU) emission scenario, which describes what can occur without new policies to address GHG emissions. Many countries in the ECIS region have already developed BAU scenarios i.e. for their national communications to the UNFCCC. These existing scenarios should then be analyzed to check whether any updates are required in the light of revised economic development scenarios and national and sectoral policy decisions.

Countries that do not have a BAU scenario in place will need to develop one. To do so they will need information on the expected socioeconomic trends, technological change, energy demand and supply, land use, GHG emissions and on the emission factors for various GHG emitting processes collected at the previous steps. Ideally a scenario of ‘no additional action’ or BAU should be developed till 2050. Existing GHG emission inventories in the ECIS region can serve as a good starting point for developing BAU scenario.

It is important that the baseline scenario projections are reviewed by stakeholder and government teams, to ensure support and consensus by all parties involved and to provide an adequate basis for comparison of options throughout the study.

5. Developing a mitigation emission scenario(s)

Once the BAU scenario has been constructed, the next step is to develop a mitigation or low-emission development (LED) scenario to study the effects of different policies on emissions generated by different sectors (e.g. energy sector, transport sector, agricultural sector).

Depending on the objectives of the LED study several mitigation or LED scenarios may need to be developed to account for several scenarios of future policies or economic development.

Box 8: Developing GHG emission scenarios for 2012 in Argentina

In the analysis of GHG emissions in Argentina in 2012 the need to develop quantitative scenarios was identified. Emissions of the main GHG gases were estimated for the main economic sectors in the country: households, services, agriculture/livestock, industry, energy, transportation and waste. For modelling the team used the PoleStar programme, designed by the Stockholm Environmental Institute, which provides a flexible framework for construction and evaluation of alternative development scenarios.

It was decided to develop scenarios that, rather than representing different rate of GDP growth, differ in terms of the growth pattern:

Industrial model

The country's economy follows an industrial growth path, with the share of industry in GDP increasing faster than for other sectors, reaching 19% in 2012. The economy experiences a 2.96% growth per year, a value that exceeds the 1991–2001 decade. Predominant fuels are natural gas (44%) and oil by-products (30%).

Agro-exporting model

Primary activities expand at a higher rate, including the agro-exporting sector and mining. The economy experiences export-led growth. Employment levels do not improve and infrastructure and services grow at the pace of the primary sector needs.

Power based model

Under this scenario expansion of energy intensive intermediate goods with vertical integration of energy companies is assumed. Growth is experienced in sub-sectors related to gas pipelines, oil pipelines, electrical transmission networks, ports and roads. The energy consumption grows at an average rate of 2.78% per year, which is lower than under the industrial model. The main energy source is natural gas, accounting for 43.4%, followed by oil by-products, with 31.5% and electricity, with 17.25%.

Projects of future GHG emissions vary in accordance with the development pattern adopted by the country. In 2012, the higher emissions would occur under a development industrial model, followed by the energy based model and finally, by the agro-exporting model. Results vary from a maximum of 3 MTCE between the higher and lower emission scenarios, with the highest increase of emissions observed under the industrial model (a 20% growth to 1997). In addition, these scenarios also result in various distributions of the GHG emissions among the main sectors of economy.

Source: Adapted from *Greenhouse Gas Emissions Scenarios ARGENTINA – 2012*, Argentine Business Council for Sustainable Development – CEADS.

To develop a LED emission scenario it is necessary to identify alternative projections for long-term economic, policy, and market conditions through adjusting assumptions, constraints and inputs to the forecasting tool chosen at an earlier step (see overview of forecasting tools above). If potential development and emission pathways are being evaluated for several key sectors – as should ideally be the case if capacities permit – these sectoral pathways need to be integrated to develop an economy-wide pathway.

The example of GHG emission scenarios in Argentina for post-2012 demonstrates a different approach to choosing the basis for future options. In the Argentinean study scenarios vary in terms of the models of the future economic growth and the different importance of various sectors (energy, industry and agriculture) in driving economic development in the future.

Figure 11 below presents the example of Ireland, where two mitigation scenarios were developed: 'with measures' and 'with additional measures', based on various policy interventions in the key sectors (energy-related, agriculture, waste and forestry) being discussed by the government. The scenario 'with additional measures' incorporates more aggressive policies in the energy sector.

Figure 11: Mitigation scenarios for Ireland

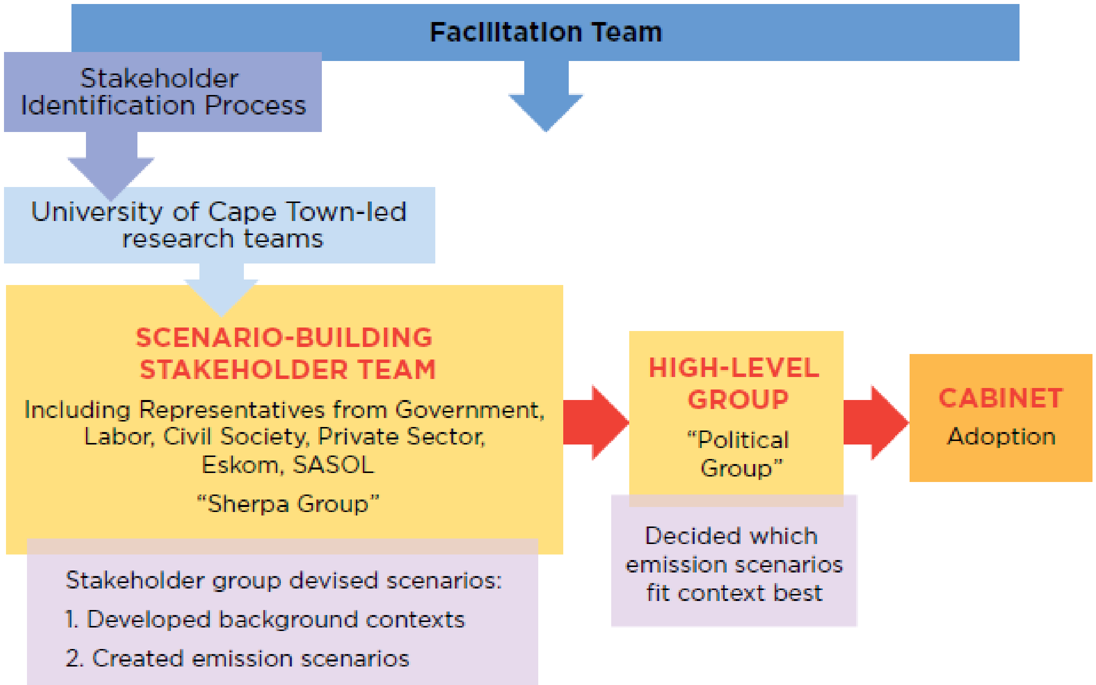
Scenario	Basis for projection
With measures	**Energy-related emission projections** Based on SEI Baseline Energy Forecast. Assumes ESRI´s World Recovery scenario. **Agriculture emission projections** Based on forecast animal numbers, nitrogen fertilizer use and crop statistics. **Waste** Assumes that the Landfill Directive targets will be reached in 2010, 2013 and 2016. **Forestry** Estimates of forest cover are based on current rates of afforestation.
With additional measures	**Energy-related emission projections** Incorporates in addition the targets and planned measures outlined in the White Paper on Energy, Irelands National Energy Efficiency Action Plan and the measures agreed in the Programme for the Government. **Agriculture, waste and forestry emission projects** Same as under 'with measures' scenario.

Source: *Ireland's Greenhouse Gas Emissions Projections: 2010-2020*, Environmental Protection Agency, April 28, 2010 available at: http://www.epa.ie/downloads/pubs/air/airemissions/EPA_GHG_Emission_Projections_2010.pdf

As discussed earlier, each country needs to be guided by its national circumstances and development priorities in designing its future low-emission development scenarios and corresponding GHG emissions. It is also critical to involve a broader stakeholder group in the discussion of mitigation or LED scenarios to ensure common understanding and ownership. Figure 12 below shows institutional arrangements for developing mitigation scenarios in South Africa.

Evaluation of the BAU and mitigation (LED) GHG emission scenarios developed during this step would serve as a good basis for the decision making, in particular in determining economy-wide and sectoral goals for limitation of GHG emissions growth or for setting absolute quantified goals for GHG emission reduction.

Figure 12: South Africa's long-term mitigation scenarios process



Source: *Low Carbon Study: South Africa*, World Bank Presentation, April 2009.

6. Developing GHG emission scenarios in the ECIS region

Two specific regional studies have recently been undertaken on emission factors for Ukraine and Russia (see below), which will allow for more precise evaluation of BAU and LED GHG emission pathways.

Box 9: Recent studies on GHG emission factors in ECIS region:
Development of the electricity carbon emission factors for Russia: Baseline Study for Russia, European Bank for Reconstruction and Development, April 2010 available at http://www.lahmeyer.de/fileadmin/fm-lahmeyer/dokumente/li-aktuell/Draft_Baseline_Study_Russia.pdf
Development of the electricity carbon emission factors for Ukraine: Baseline Study for Ukraine, European Bank for Reconstruction and Development, April 2010 available at http://www.lahmeyer.de/fileadmin/fm-lahmeyer/dokumente/li-aktuell/Draft_Baseline_Study_Ukraine.pdf

Some countries in the ECIS region are members of the Energy Technology Systems Analysis Program (ETSAP), an implementing agreement of the International Energy Agency (IEA). Many of the countries have been using the MARKAL model, which is a generic model tailored to represent the evolution, over a period of usually 40 to 50 years, of a specific energy system at the national, regional, state or province or community level. This includes Bulgaria (Energoproekt), Czech Republic (Ministry of Industry and Trade, Energy Efficiency Center (SEVEn); SRC International), Estonia (Tallinn Technical University), Slovakia (Ministry of Economy), Slovenia (Institute for Power Economy and Electric Industry), Turkey (Kocaeli University) and Ukraine (Odessa Regional State Administration).[25] This work can serve as the basis in some countries for developing GHG emission scenarios.

Many countries in the ECIS region used the LEAP tool in preparation of GHG emission forecasts for their national communications. LEAP is an integrated modelling tool that can be used to track energy consumption, production and resource extraction in all sectors of an economy. It can be used to account for both energy and non-energy sector GHG emission sources and sinks. In addition to tracking GHGs, LEAP can also be used to analyze emissions of local and regional air pollutants, making it well-suited to studies of the climate co-benefits of local air pollution reduction.[26]

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[25] *The Energy Technology Systems Analysis Program (ETSAP)*, http://www.etsap.org/users/main.html

[26] http://www.energycommunity.org/default.asp?action=47

Box 10: Example of GHG emission scenarios in the Russian Federation

In the latest national communication to the UNFCCC, Russia presented a forecast of GHG emissions according to three scenarios of development:

Moderate scenario is largely based on the economic growth and energy efficiency increase rates observed before the economic crisis. This scenario is more likely during the recovery phase of the economic growth (the phase of actual recovery from the crisis) and less likely during the consequent growth phase.

Innovation scenario assumes significant utilization of the potential for efficiency improvement in the use of energy. Energy intensity of production for many products and services will be decreased through speeding-up energy saving innovations and price liberalizations and due to structural changes in the economy.

Scenario with additional measures assumes that in addition to the measures foreseen in the innovation scenario a targeted policy on limitation and reduction of GHG emissions will be implemented. This could include market and non-market measures, such as putting a price on GHG emissions, e.g. through an emission trading system. Additional measures also include stimulation of renewable energy, control of coal methane emissions, deployment of carbon capture and storage technologies and etc. Implementation of these additional measures may lead to greater GHG emission reduction than under the scenario with additional measures, however in this case first the lowest cost options will be implemented.

GHG emissions in Russia in 2005–2030

Moderate							
		2005	2007	2010	2015	2020	2030
Total	$MtCO_2$-eqv.	2,12	2,19	2	2,3	2,75	3,56
	% to 1990	63,8	66,1	60,2	69,1	82,9	107,5
Innovational							
Total	$MtCO_2$-eqv.	2,12	2,19	2	2,07	2,45	2,94
	% to 1990	63,8	66,1	60,2	62,3	74	88,4
With additional measures							
Total	$MtCO_2$-eqv.	2,12	2,19	2	2,04	2,40	2,82
	% to 1990	63,8	66,1	60,2	61,4	72,2	84,9

Source: *Fifth National Communication of the Russian Federation*, 16 March 2010, http://unfccc.int/resource/docs/natc/rus_nc5_resubmit.pdf.

Below are some examples of development of GHG emission scenarios in the ECIS region, namely from the Republic of Moldova and the Russian Federation.

Box 11: GHG emission scenarios in the Republic of Moldova

To assess the GHG emissions abatement potential in Moldova, the following tools were used:

- ENPEP software pack for the electrical power sector;
- LEAP software for the thermal power sector and transport sectors;
- *Software for the Workbook of the Revised 1996 IPCC Guidelines* (IPCC, 1997) for industrial processes,
- Agriculture and LULUCF sectors; CO_2 FIX V2.0 Model developed by the European Forestry Institute under the CASFOR Project INFRAS;
- *Tool for calculating CH4 emissions from Solid Waste Disposal Sites following the First Order Decay Method and Software for the Workbook of the Revised 1996 IPCC Guidelines* (IPCC, 1997) for wastewater handling category under waste sector.

The aggregated projections for GHG emissions in 2005–2030 were made on the basis of three scenarios:

- baseline scenario (BLS) that in principal does not provide for abatement measures;
- high alternative scenario (HAS);
- intermediary alternative scenario (IAS).
-

HAS and IAS have taken into account the policies and measures included in the sectoral action plans on GHG emissions abatement.

In relation to the national level of GHG emissions (without LULUCF) reported in 2005, by 2030 it is expected that total direct GHG emissions will increase by 155.7% under the BLS, by 123.0% under the HAS, and by 138.7% under the IAS.

Implementing the planned abatement measures, in particular those specified in the individual sector action plans on GHG mitigation, would allow the reduction of total national GHG emissions by 2030 relative to the baseline scenario without LULUCF by 12.8% under the HAS and by 6.6% under the IAS. It would also enable the reduction of national GHG emissions by 14.5% under the HAS and by 5.9% under the IAS with LULUCF.

Source: Second national communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change. Republic of Moldova. 27 January 2010 .

Box 12: GHG emissions scenarios in the Republic of Kazakhstan

To estimate the potential of GHG reduction and plotting the curves of fossil fuel burning, the ??RKALmodel has been used. The research models are concentrated on the energy sector because it is the source of more than 85% of emissions. An estimate in the variation of emissions in other sectors in the result of implementation will be defined by expert assessment.

The aggregated forecasts of GHG emissions for 2005–2050 were constructed for three basic scenarios.

Base scenario which reflects the current policy of the country, formulated in strategic governmental documents. This scenario contains almost no measures to reduce emissions and is based on plans to increase the efficiency of national economy and living standards by using traditional technologies and recycling cheap energy and raw resources of the country.

Scenario with obligations of 15–25%, which restricts GHG emissions by 15% by 2020 and by 25% by 2050 in regards to 1990 emission levels.

Scenario with obligations of high reductions, admitting that a post-Kyoto regime will be based on the condition, where Annex I countries of the UNFCC (including Kazakhstan) should reduce emissions to 80–90% of 1990 levels.

Alternative scenarios consider political and technical measures that provide for the inclusion of sectoral plans of action to reduce GHG emissions.

According the analysis, realization of the concept of the transition of Kazakhstan to low-carbon development till 2050 at the scenario of 15–25% will have a positive social and economic effect and will render considerable assistance to the realization of national strategies including:

- Kazakhstan-2030;
- the concept of transition of Kazakhstan to sustainable development for the period till 2024;
- strategic plan for development of Kazakhstan till 2020.

The model has shown that reducing GHG emissions to 80–90% of 1990 levels by 2050 will negatively affect social and economic development because:

- the republic will be compelled to import the electric power;
- huge investments will be needed to modernize current energy capacities, which will lead to an increase of the power cost price of goods and services and will decrease their price competitiveness. Most possibly it will lead to full macroeconomic depression.

The model has been used to define the maximum level of reduction of GHG emissions till 2050, indicated 50% attainability of the reduction. But it is necessary to consider that 50% obligations are achievable with an investment of huge financial resources which the country has no opportunity to invest.

In general, it is necessary to note that the forecasted scenarios cannot consider direct and indirect economic benefits from measures taken to increase energy efficiency and energy savings, from the decrease of demand for energy, and introduction of renewable resources. Also in the process of large-scale strategy or strategic planning, it is necessary to provide the best world experience on the promotion of the low-carbon measures with the use of economic tools which will create necessary stimulus and will bring additional economic gains.

Chapter 5: Determining mitigation options in the key sectors

Once the overall goals and scenarios for low emission development pathways have been determined (as discussed in Chapter 4), countries need to identify concrete mitigation actions and policies to ensure the greenhouse gas (GHG) emission reduction necessary to reach the goals and follow these pathways. The main steps of this stage of the process are shown in Figure 13 below and involve:

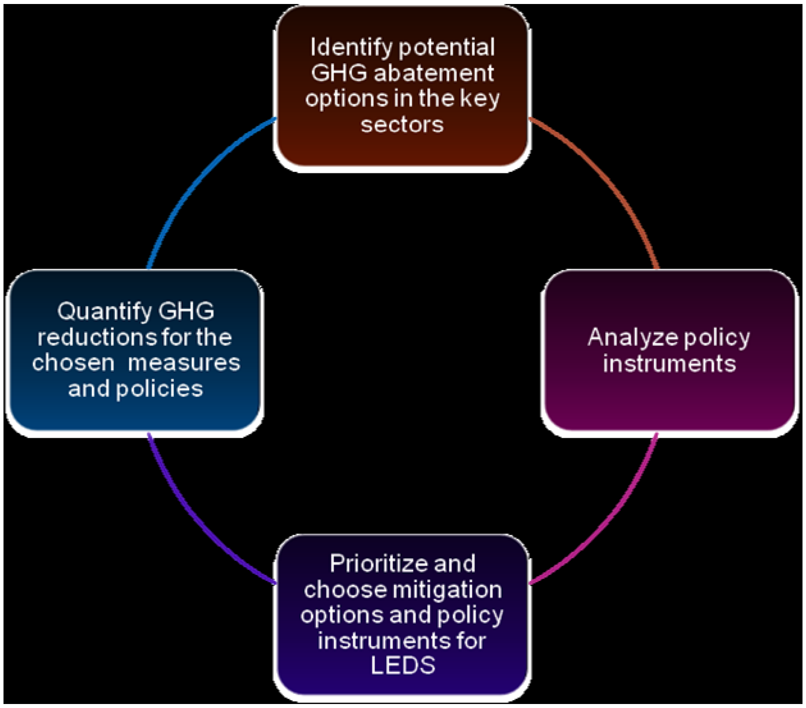
1. Identifying potential GHG abatement options in the key sectors.
2. Analyzing potential policy instruments to ensure implementation of abatement options.
3. Prioritizing and choosing mitigation measures and policies (NAMAs and PAMs) based on national circumstances.
4. Quantifying emission reductions associated with the chosen options.

Throughout this process it is important that, similarly to the previous stage, stakeholders are again closely involved in the process. In particular, identification and selection of the priority mitigation measures and policies should be endorsed through the consultation process involving representatives from the economic sectors in question, and from civil society and business.

Evaluation of policy instruments should include instruments that have reduction of GHG emissions as their main purpose, as well as instruments that have an effect on emission trends despite perhaps being introduced for another purpose (e.g. feed-in tariffs on renewable energy). Experience with low carbon development plans and LEDS to date shows that they usually include a combination of existing and new policies.

Countries that pursue the development of a comprehensive LEDS, including GHG emission scenarios as described in Chapter 4, would already have a significant amount of information necessary for analysis of the GHG abatement options available in the course of their work on GHG emission scenarios. Countries pursuing a more limited option of identifying concrete measures or NAMAs in various sectors would need to first undertake analysis of existing national and sectoral programmes in order to determine the mitigation potential of various sectors, as described in Chapter 4.

Figure 13: Main steps in the determination of mitigation measures and policies in the key sectors



1. Identification of potential GHG abatement opportunities in the key sectors

Opportunities for GHG emission reduction will vary from country to country and from sector to sector both in terms of their abatement potential and cost of abatement. Priority mitigation measures are often selected by drawing on modelling results and cost benefit analysis, and should be based on:

- national and sectoral country priorities;
- prior work on mitigation;
- feasibility of implementation of a measure;
- benefits of measures (environmental, economic, & social);
- existing sectoral or national plans;
- national communications;
- Technology Needs Assessments (TNAs).

A good inventory of the policy best practices and lessons learned for key sectors is provided at the USAID LEDS portal at the Policy and Program Design Toolkit[27], including energy efficiency policy, sustainable energy regulation, feed-in tariffs, state and local policy planning instruments, technology transfer. The IEA's Policies and Measures Databases[28] is another important resource for the energy sector.

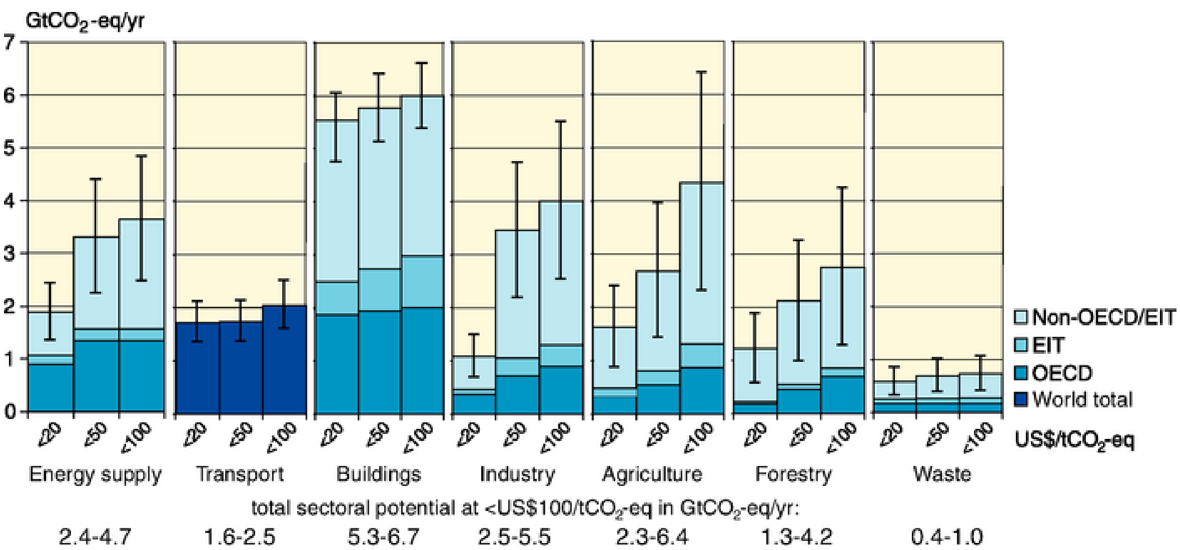
27 http://en.openei.org/wiki/Gateway:International/Policy_and_Program_Design#Policy_Analysis_Resources, Accessed on 9 August 2010.

28 http://www.iea.org/textbase/pm/index.html

1.1. Global mitigation potential

Figure 14 below presents the results of the analysis by the IPCC of the mitigation potential by sector in the key regions at the cost of reduction below 100 USD. According to this analysis, globally, as well as for the economies in transition (EITs) specifically, the largest mitigation potential lies in the building sector, followed by industry, agriculture and energy supply. Significant opportunities are also in the transport sector, although in this particular analysis the corresponding potential was not disaggregated by region.

Figure 14: Economic mitigation potentials by sector in 2030 estimated from bottom-up studies



Source: IPCC, AR4

Table 13 annexed to this chapter lists the main mitigation technologies and practices commercially available in various sectors, as well as the mitigation policies considered by the IPCC to be effective in implementing the corresponding technologies and practices.
Some examples of measures in the **transport sector** are: more efficient vehicles, hybrid technology, biofuels, change of mode of transport from road to rail, public transport in general and cycling/walking, as well as public planning.

Measures in **residential and commercial energy efficiency** include more efficient lighting and using daylight, more efficient electrical appliances, improved insulation and passive and active solar energy for heating and cooling.

According to the IPCC, the most important mitigation measures in **agriculture** are better land use to increase carbon sequestration, reduced specific emissions from cattle (for example through feed adjustment and improved farmyard manure handling), improved technology for the spreading of nitrogen fertilizer, production of biofuels and increased energy efficiency. As noted earlier, the mitigation potential for measures in agriculture in a global perspective is comparable to the energy and transport sectors.

In the **waste sector**, examples of measures include recycling methane from landfills, incinerating waste for energy recovery, composting organic waste instead of landfilling and recycling and waste minimization.

1.2. Country-specific mitigation options analysis

One of the analytical instruments widely used in the analysis of mitigation measures is the **marginal abatement cost curve (MACC).** MACCs provide an overall assessment of the level of emissions reduction which a particular measure delivers by a particular date and the associated cost per tonne in terms of net present value. Measures are then ranked according to their unit cost, with some measures having negative costs, for example by saving money through energy efficiency (see the example of MACC for Macedonia below).

The cost curve estimates are inherently conservative because they only include technologies that are commercial or near-commercial today and normally do not include potential from changes in behaviour. Nevertheless cost curve analysis is a powerful tool for assessing, prioritizing and communicating emissions abatement measures. In particular it enables countries to identify measures that can be taken with negative or modest cost and measures that can be captured relatively quickly.[29]

In addition to the factors included in the cost calculation there are other aspects that influence whether a measure is implemented or not. Therefore the barriers to the implementation of measures should be analysed.[30]

Many countries have already initiated or completed their first assessments under the **technology needs assessment (TNA)**, initiated within the UNFCCC framework. Many countries in the ECIS region have also completed TNAs (see Table 10 below), which can serve as a good basis for analysing key mitigation options.

The purpose of a TNA is to identify, evaluate, and prioritize technological means for achieving low emission sustainable development in developing countries, increasing resilience to climate change and avoiding dangerous anthropogenic climate change. Properly conceived and implemented, a TNA can achieve several additional desirable ends, namely contributing to enhanced capacity in developing countries to acquire environmentally sustainable technologies, developing important links among stakeholders in developing countries to support future investment and barrier removal, and diffusing high priority technologies throughout key sectors of the national economy.

The TNA identifies key technologies for the priority sectors and categorizes them according to their short or medium to long-term availability and the scale of implementation (small or large). Finally, the sector technologies in each category are prioritized through a multi-criteria decision assessment method. This allows for a technology strategy to be formulated over time, and assists in identifying key technologies that may not necessarily have the highest priority in the sectors, but would be useful across a number of sectors.

Table 11: Technology needs assessments in ECIS region submitted to the UNFCCC (as at 7 August 2010)

Country	TNA document
Albania	*Albania's Technology Needs Assessment*
Armenia	*Capacity building in the republic of Armenia for technology needs*

[29] *Low Carbon Growth Plans: Advancing Good Practice*, Project Catalyst August 2009

[30] *The Development of the Swedish Climate Strategy. A summary of the data*, produced by The Swedish Energy Agency and The Swedish Environmental Protection Agency ahead of Checkpoint 2008.

	assessment and technology transfer for addressing climate change problems "Armenia - country study on Climate change" project phase I
Azerbaijan	Capacity Improvement Activities on Climate Change in the Priority Sectors of Economy of Azerbaijan Initial National Communication of Azerbaijan Republic on Climate Change. PHASE 2
Croatia	Republic of Croatia. Technology needs assessment report. Final report.
Georgia	*Capacity building to assess technology needs, modalities to acquire and absorb them, evaluate and host projects* full document (1.8 MB); only the annex (0.5 MB)
Republic of Moldova	*Technology Needs Assessment and Development Priorities - Report Elaborated under the United Nations Framework Convention on Climate Change*
Tajikistan	The First National Communication of the Republic of Tajikistan under the United Nations Framework Convention on Climate Change. Phase 2.
The former Yugoslav Republic of Macedonia	Evaluation of Technology Needs for GHG Abatement in the Energy Sector
Turkmenistan	Initial national communication of Turkmenistan under the united nations framework convention on climate change. Phase 2. Capacity building in priority areas of the economy of Turkmenistan in response to the climate change
Uzbekistan	Initial national communication of the republic of Uzbekistan under the United Nations Framework Convention on Clima te Change - Phase 2

Source: Analysis on the basis of the information at the UNFCC website: www.unfccc.int

Table 11 and Figure 15 below present the results of the TNA analysis in the Former Yugoslav Republic of Macedonia, which allowed choosing priority mitigation measures.

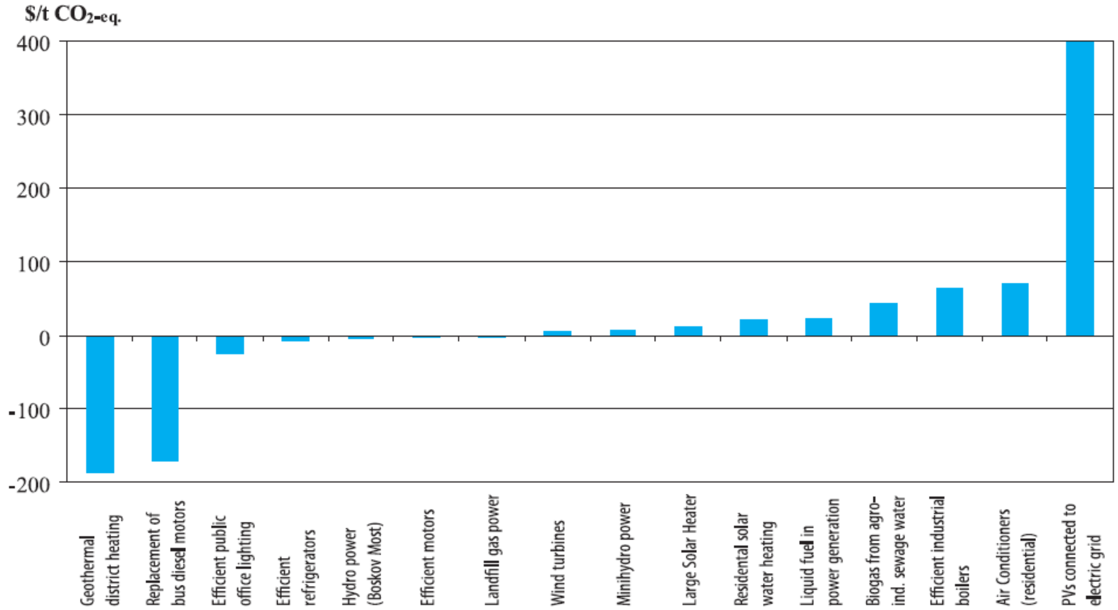
Table 12: Main characteristics of the selected abatement options in the TNA for the Former Yugoslav Republic Macedonia

Reduction option	US$/t CO_2	Unit type	Emission reduction t CO_2/unit	Units penetrating in 2010	Emission reduction in 2010		
					Per option Mt/year	Cumulative	
						Mt/year	%
Geothermal district heating	-187.15	1 unit	2,269.34	1	0.0023	0.0023	0.01%
Replacement of bus diesel motors	-171.49	1 bus	22.75	2,000	0.0455	0.0478	0.27%
Efficient public office lighting	-24.98	1000 bulbs	87.60	200	0.0175	0.0653	0.36%
Efficient refrigerators	-8.63	1 refrigerator	0.58	150,000	0.0876	0.1529	0.85%
Hydro power plant (Boskov Most)	-4.09	1 plant	202,195.87	1	0.2022	0.3551	1.97%
Efficient motors	-3.22	1 kW	0.78	25,000	0.0194	0.3745	2.08%
Landfill gas power	-2.85	1 plant	112,232.58	1	0.1122	0.4868	2.70%
Wind turbines	4.16	1 MW	2,872.98	50	0.1436	0.6304	3.50%
Minihydro power	7.21	4 MW plant	12,423.71	1	0.0124	0.6428	3.57%
Large Solar Heater	11.70	1 unit	62.16	200	0.0124	0.6553	3.64%
Residental solar water heating	19.35	1 unit	1.32	100,000	0.1320	0.7873	4.37%
Liquid fuel in power generation	22.71	1 plant	1,238,139.75	1	1.2381	2.0254	11.25%
Biogas from agro-ind. sewage water	43.21	1 digester	11,699.89	3	0.0351	2.0605	11.45%
Efficient industrial boilers	63.93	2 tones of steam	29,652.40	50	1.4826	3.5431	19.68%
Air Conditioners (residential)	70.51	1 air conditioner	0.16	60,000	0.0094	3.5525	19.74%
PVs connected to electric grid	398.22	1 kW	1.10	500	0.0006	3.5531	19.74%

Total baseline emission in 2010: 18 Mt $CO_{2\text{-eq.}}$ *

Source: *Evaluation of Technology Needs for GHG Abatement in the Energy Sector for the Former Yugoslav Republic Macedonia*, Ministry of Environment and Physical Planning, Skopje, April 2004

Figure 15: Specific cost of measures for GHG emissions abatement in Macedonia



Source: *Evaluation of Technology Needs for GHG Abatement in the Energy Sector for the Former Yugoslav Republic Macedonia*, Ministry of Environment and Physical Planning, Skopje, April 2004

2. Review of the potential climate change mitigation policy instruments

Once technical GHG mitigation options have been determined, the most appropriate policy instruments to ensure implementation of the mitigation measures should be considered. The cost of capital, taxes and subsidies have significant impact on the attractiveness of low-carbon investment. In many countries, energy subsidies distort price signals and present a substantial disincentive to invest in energy efficiency and renewable energy. Other major obstacles to low emission development include capital constraints, a lack of awareness and understanding of low-carbon opportunities, the lack of available low-emission technologies and the lack of capacity to design and implement the required regulations, financing mechanisms and energy efficiency measures.

To promote transition to low emission development (LED), and to ensure reaching the LED goals, countries may choose from a range of policy instruments that aim at removing above barriers through technological interventions, regulatory and institutional frameworks.
A broad set of policies is required to set standards, reduce transaction costs, align incentives, monitor performance and otherwise overcome market failures. It is particularly important to change financial incentives for private sector to allow earning a competitive rate of return on investments in lower-carbon options.[31]

No single policy instrument will be sufficient to tackle the wide range of sources and sectors emitting GHGs; different instruments are needed to overcome different barriers to mitigation and to provide the right incentives to households and firms. It should also be noted that any given policy instrument can be more effective in one sector than another. Therefore the most appropriate policies for each sector should be determined.

[31] *The Economics of Climate Change Mitigation: Policies and Options for Global Action beyond 2012*, OECD 2009.

Table 14 annexed to this chapter presents the results of analysis by the IP CC on what measures and policy instruments are considered effective in the key sectors. However, each country should consider these recommendations from its own perspective and take its national specifics and circumstances into account.

It is also important to note that some of the policy instruments can be implemented at different levels (e.g. at national or regional level), depending on national circumstances and the approach chosen to the implementation of a LEDS and NAMAs (e.g. national, sectoral or territorial).

Box 14 below presents an example of how various GHG mitigation policy instruments have been considered in the course of development of the national climate change strategy in Sweden. As noted in the box, the analysis included both instruments that cut across sectors (i.e. EU ETS) and sector-specific instruments (i.e. electricity certificate system).

Box 14: Analysis of GHG mitigation instruments in Sweden

In the process of revisin g its climate change strategy in 2007 , Sweden analyzed its existing and potential new policy instruments. The principles underlying the choice of instruments have been that they should lead to a **long-term switch to lower greenhouse gas emissions** in the period to 2020 and beyond, including:

- provide incentives for climate measures in investments with a long life ;
- lead to a switch of the energy system to renewable energy ;
- reduce energy use in the building stock (via new construction and refurbishment);
- lead to increased energy efficiency in the transport sector ;
- provide incentives for technological development and technology diffusion.

The instruments have been divided into sector -transcending instruments and the sectors of energy supply, industry, transport, residential, waste and agriculture.

Sector- transcending	**Collective control by sector**		
EU trading scheme	Transport	Sector- transcending + Sector-specific	The project-based mechanisms
Taxes	Energy supply		
Research	Industry		Local and regional climate efforts
Information	Residential		
Public planning	Agriculture		
Klimp	Wastel		

The instruments have been analy zed on the basis of their contribution to attainment of objectives, cost - effectiveness, dynamic efforts (the incentiv es for technical development) and other effects such as distribution effects, effect on employment, competitiveness of industry, other environmental objectives and effect on energy supply.

Existing policy instruments in Sweden

- **Energy and carbon dioxide tax , including petrol and diesel tax** : the current system of energy taxes is based on a combination of carbon dioxide taxes, energy taxes on fuel, nuclear power tax and consumption tax on electricity. There is a reduced rate of tax for parts of industry and co mmerce and in the production of combined heat and power.

- **Environmental code legislation is in place since January 1999.**

- **Klimp – local climate investment programmes** : a government grant introduced by parliament in 2002. It is principally municipalities tha t apply for grants and implement programmes in collaboration with industry and commerce and other players in the municipalities.
- **Electricity certificate system** is mandatory for users of electricity, which have to purchase a certain quantity of certificates in proportion to their electricity consumption. The objective is to increase electricity from renewable energy sources of 17 TWh by 2016. The certificates are issued to producers of renewable electricity, thereby giving financial compensation for the addi tional cost involved in producing renewable electricity.
- **Grants for production of electricity from wind power** represent e nvironmental bonus for wind power. The programme is being scaled down.
- **Energy efficiency programmes** : in return for implementation of energy efficiency measures energy - intensive businesses the government is to offer full relief from the EU 's minimum tax level on electricity.
- **More efficient energy use** : information and training, grants for procurement of ener gy-efficient technology, testing, labeling and certification and grants for municipal energy advice.
- **Building regulations**: requirements for the energy efficiency and permitted heat losses. Requirements concerning energy performance only apply to new const ruction.
- **Measure in transport sector** : vehicle fuel taxes , annual vehicle tax differentials depending of efficiency , tax relief on motor biofuels.
- **A ban on landfilling** combustible waste (2002) and a ban on landfilling organic waste (2005).

Source: Adapted from: The Development of the Swedish Climate Strategy. A summary of the data produced by The Swedish Energy Agency and The Swedish Environmental Protection Agency ahead of Checkpoint 2008.

The discussion of various policy instruments below is largely based on the work by the IPCC and OECD. A distinction is made between the following types of domestic mitigation policy instruments:

- economic and fiscal measures, including CO_2 and energy tax; emission trading schemes; other market-based measures (e.g. green certificates for renewables); phasing out of environmentally harmful subsidies and introduction of targeted fiscal measures (e.g. landfill tax, feed-in tariffs for renewable);
- command-and-control measures or standards and regulations;
- voluntary industry/sector agreements;
- capacity building and information instruments (e.g. public awareness, capacity for implementing agents);
- Research and development (R&D) policies (e.g. R&D for low carbon technologies, pilot demonstration projects)

In addition, there are several non-climate national policies that can have an important influence on GHG emissions and should be considered in the course. These include policies focused on poverty, land use and land use change, energy supply and security, international trade, air pollution, structural reforms and population policies (IPCC, AR4).

2.1. Economic and fiscal instruments

The use of economic and fiscal instruments, such as carbon taxes or emissions trading schemes (ETS), is the simplest way to put a price on GHG emissions and to discourage carbon-intensive activities. These instruments encourage emitters to look for and implement the cheapest abatement options, thereby minimizing the overall cost of reducing emissions to the economy. Carbon taxes and ETS are already in place in several industrialized countries, including all EU member states. Furthermore, many developing countries are currently considering implementing regional, sectoral or national emission trading schemes, and some work on this is happening in the Republic of Korea, Mexico, South Africa and China.

2.1.1. Carbon and energy tax

A GHG emission tax is one of the commonly used instruments in many industrialized countries to achieve emission reduction. The tax provides a way to set a price on carbon. In the absence of any other market failure, GHG emission taxes should persuade emitters to adopt all cheap abatement options that are available (depending on the level of the tax). The OECD has assessed emission reductions from key developed countries and the European Union and associated costs of a variety of carbon taxes applied across all Annex I countries. Both total costs and emission reductions achieved in 2020 compared with 1990 levels for a given carbon price vary substantially across regions. For several countries/regions, namely Australia and New Zealand, Canada, and the United States, carbon prices of at least USD 50 per tonne of CO_2eq would be required if emissions are to return to 1990 levels by 2020.

In practice, administration and compliance costs shape the cost-effectiveness of a GHG emission tax. However for developing countries it is also a big challenge to enforce an

emissions tax. In addition, the way in which the revenues from the tax are recycled is important. In general, the more revenues are used to reduce other taxes that have negative side effects on economic activity, the greater the cost-effectiveness of the scheme. Two areas of fiscal spending that could be considered in recycling carbon tax revenues in a socially optimal way are (i) targeted social support for the poor hurt by the resulting higher energy prices, and (ii) temporary subsidies with a sunset clause for economic activities that need it to ensure a smoother adjustment over several years to a low-emission path.
In determining cost effectiveness of carbon taxes the following arguments should be considered.

- The high costs of monitoring certain emission sources either raise tax collection costs or, if the emissions concerned go untaxed, prevent potentially cheap abatement options from being exploited.

- The monopolistic power of emitters in their output markets, especially in the energy sector, may lead to simple adjustment of product prices in response to the tax.

- The effectiveness of the tax can also be reduced by its interaction with other policies that affect the incentives for the firms to use less carbon-intensive processes, e.g. fiscal incentives for energy production/use and agricultural subsidies.

- Public or quasi-public enterprises may not have strong incentives to respond adequately to the tax, partly because they have objectives other than profit maximisation, and looser budget constraints than firms in the private sector.

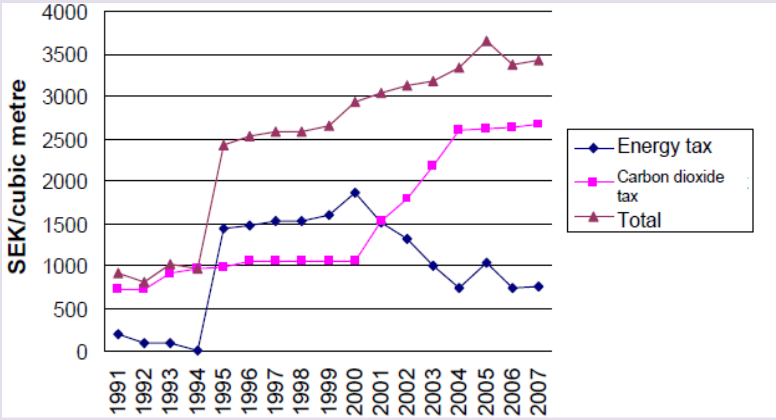
Nevertheless, GHG emissions taxes give emitters a continuing incentive to develop and/or adopt new emissions-reducing technologies, providing a price signal to investors and reducing long-term uncertainty in relation to mitigation investments. It should also be noted that usually carbon taxes are not very popular with the private sector, which prefers greater flexibility example e.g. by emission trading schemes. Furthermore, to be effective in incentivizing climate change mitigation, carbon tax (or caps on GHG emissions) would need to be adopted across the globe, as asymmetric implementation may cause carbon leakage through shifts of industries with polluting activities to geographies where there is no tax or cap on GHG emissions.

Box 15 below describes example of implementing carbon tax system in Sweden.

Box 15: Carbon tax in Sweden

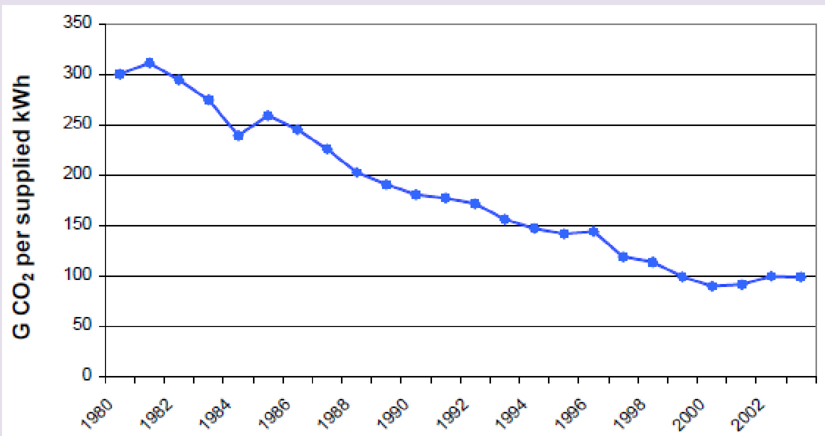
Even though energy and carbon taxes serve different purposes, with the former having a fiscal purpose of providing revenue for the treasury and the latter to internalize the costs of carbon dioxide emissions, it is difficult to distinguish which effects come from each tax. These taxes together contributed about SEK 63 billion of revenue for 2006. The highest revenue from carbon dioxide tax comes from oil products, while energy tax produces high revenues from both fossil fuels and electricity use. There has been a substantial increase in carbon tax since the green tax shift was introduced in 2000. Energy tax has been lowered over the same period (see Figure 16).

Figure 16: Energy and carbon dioxide on heating oil between 1990 and 2007



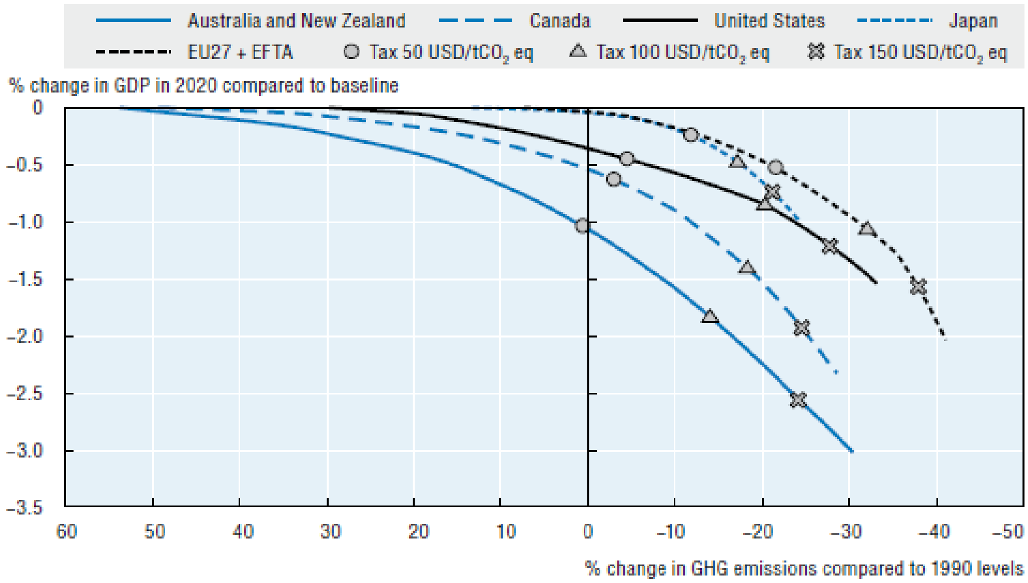
The effects of taxes on GHG emissions have been significant, particularly in the residential sector and in district heating production (see Figure 17 below). Taxes in industry have not had a clear effect on emissions, as the total level of tax on fossil fuels has decreased in comparison with 1990. The rates of energy and carbon dioxide tax on petrol and diesel have been index linked since the late 1990s. The tax increases on motor fuels, implemented between 1990 and 2005, are considered to have reduced carbon dioxide emissions from road traffic, particularly from cars, because of the high willingness to pay and the lack of clearly competitive alternatives.

Figure 17: Specific CO_2 emissions from district heating production in Sweden, 1980-2004



Source: *The Development of the Swedish Climate Strategy.* A summary of the data produced by The Swedish Energy Agency and The Swedish Environmental Protection Agency ahead of Checkpoint 2008.

Figure 18. Total costs and emission reductions achieved for a given carbon tax



Source: Cost-Effective Actions to Tackle Climate Change, Policy Brief, August 2009, Organization for Economic Cooperation and Development (OECD), 2009.

2.1.2. Emissions trading schemes

Under the cap-and-trade system, a designated central authority sets a limit or cap on the amount that can be emitted. Companies must obtain emission allowances (or credits) to cover the amount of GHG emissions they produce. The total amount of permits cannot exceed the cap, limiting total emissions to that level. Companies short of emission allowances must buy permits from those who pollute less than the amount of permits they hold. This transfer of allowances is referred to as emissions trading: the buyer is paying a charge for emitting, while the seller is being rewarded for having reduced emissions below the allowed amount.

Companies will sell permits as long as their market price exceeds their marginal abatement costs and vice-versa. Thus, those who can reduce emissions most cheaply will do so, thereby achieving the reduction at the lowest possible cost to society. The price of permits depends on the overall tightness of the target and on the initial allocation of permits. Permits can be auctioned, distributed in proportion to past emissions ("grandfathering") or allocated by some other rule.

ETS can be implemented at various levels - nationally or internationally, covering all sectors or only specific ones. The wider the coverage, however, the broader the trading options among emitters, and hence the greater the cost efficiency of the system.
ETS systems are now in operation in the European Union, Norway, and some states in North America. A number of other countries are discussing or planning to introduce such a system. Existing ETSs vary significantly in terms of their target, size, and other design features. At present there are virtually no direct links between them, other than the link between the EU and Norwegian ETSs.

However, as more ETSs are expected to emerge in the future, linking such systems is increasingly becoming important in climate change negotiations. Under direct linking, regulated entities can use emission permits from another ETS to meet their domestic emission targets. Such linking allows lowering the overall cost of meeting the joint target. Any eventual linking of ETSs would require harmonisation of their features.

It should also be noted that setting-up an ETS requires significant effort and bears sizeable up-front and enforcement costs. Furthermore implementation problems may arise if there is no reliable initial data on emissions or when emission sources are diffuse, and hence emission is hard to monitor.

2.1.3. Removing environmentally-harmful subsidies

Direct and indirect subsidies can be important policy instruments, but they have strong market implications and may increase or decrease emissions depending on their nature. Subsidies that increase emissions typically involve support for fossil fuel production and consumption, as they tend to expand the subsidized industry, relative to the non-subsidy case. For example subsidies to the fossil fuel sector result in higher emissions due to increased consumption of fuels, while subsidies to agriculture can result in the expansion of agriculture into marginal lands and corresponding increases in emissions (IPCC, AR4). Removing subsidies to energy consumption and production is therefore a policy step that removes de facto reward for carbon emissions. It lowers the overall cost of meeting a given emission-reduction target in a country and frees up finances that can be reallocated to support other social objectives.

Energy subsidies are particularly high in Russia, other non-EU eastern European countries, and a number of large developing countries. Joint analysis by the OECD and the International Energy Agency suggests that removing these subsidies could reduce GHG emissions by over 30% relative to BAU levels by 2050 in non-EU Eastern European countries, Russia and the Middle East, and by over 10% globally (see Figure 19). Removing subsidies would also increase the efficiency of these economies, leading to increased GDP growth, and would lower the global cost of stabilizing GHG concentrations. According to OECD[32], all countries/regions (with the exception of non-EU Eastern European countries) would benefit from a unilateral removal of energy subsidies and real income gains would range from 0.1% in Brazil to over 2% in India and Russia in 2050. Nonetheless, broad-based energy subsidy removal in all non-OECD countries would lower the demand for, and thereby the world prices of, fossil fuels, which would imply terms-of-trade and output losses for fossil-fuel producing countries.

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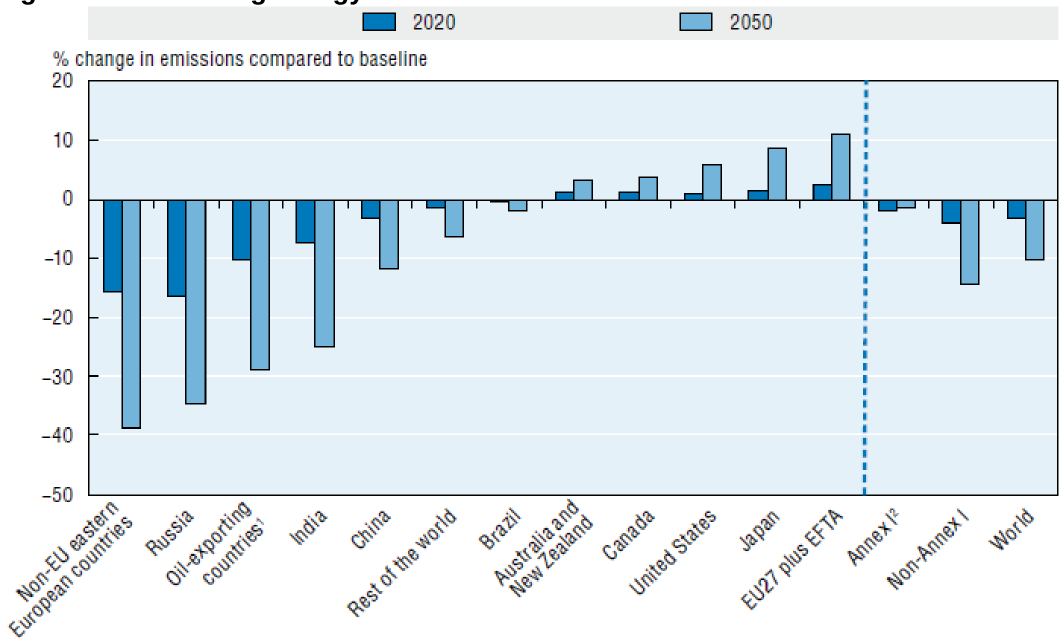
[32] *The Economics of Climate Change Mitigation: Policies and Options for Global Action beyond 2012*, OECD 2009.

Figure 19: Removing energy subsidies cuts GHG emissions in non-OECD countries



1. The region includes the Middle East, Algeria-Lybia-Egypt, Indonesia, and Venezuela.
2. Annex I countries are countries that have agreed to reduce their greenhouse gas emissions under the Kyoto Protocol. They include most OECD member states and some countries from Central and Eastern Europe in transition to a market economy.

Source: OECD, ENV-Linkages model.

Source: Cost-Effective Actions to Tackle Climate Change, Policy Brief, August 2009, Organization for Economic Cooperation and Development (OECD), 2009.

2.1.4. Financial incentives and access to finance

Financial incentives or subsidies aimed at reducing emissions range from support for Research and Development (R&D), investment tax credit, and price supports (such as feed-in tariffs for renewable electricity).

Many countries provide financial incentives, such as tax credits for energy-efficient equipment and price supports for renewable energy, to stimulate the diffusion of technologies. In the USA, for example, the Energy Policy Act of 2005 contains several financial incentives for various advanced technologies; these financial incentives have been estimated at $11.4 billion over a 10-year period (IPCC, AR4).

One of the most effective incentives for fostering GHG reductions are price supports associated with the production of renewable electricity, which tend to be set at attractive levels. These incentives have already resulted in the significant expansion of the renewable energy sector in OECD countries due to the requirement that electric power producers purchase such electricity at favourable prices.

For example, the US Public Utility Regulatory Policy Act of 1978 requires electric utilities to buy renewable energy at "avoided cost". In Europe, specific prices have been set at which utilities must purchase renewable electricity – these are referred to as 'feed-in tariffs'. Feed-in tariffs for renewable energy are also being introduced in some developing countries, e.g. in India, China, South Africa and many others. As long as renewables remain a relatively small portion of overall electricity production, consumers see only a small increase in their electricity rates. The main problem with them is cost-effectiveness: they are expensive instruments, particularly in the long-run as interests and industries grow to expect the continuation of subsidy programmes (IPCC, AR4).

Given the substantial capital requirements, access to finance is a critical factor for transition to LED. To date, a wide range of financing mechanisms has been used around the world, often in conjunction with multilateral financing through the GEF and carbon markets, to enable energy efficiency and other low carbon investments. There are also several examples of successful public-private partnerships providing capital to end-users, such as partnerships with banks.[33]

Box 16: Planned and discussed main financial instruments for GHG emissions reduction in Kazakhstan

In the process of developing a low-carbon concept, analysis of existing and potential policy instruments has been conducted. Instrument selection was based on ensuring the long-term reduction of GHG emissions during till 2020 and further, including but not limited to:

- stimulation of long-term measures and investments into emissions reduction;
- energy use decrease in industrial sector;
- energy efficiency in transport and other sectors;
- R&D and technology transfer.
-

The following fiscal and financial instruments are being discussed:

- a gradual transition from direct taxes (income taxes) to indirect (value added, excise duty etc.) for energy saving stimulation and emissions reduction;
- a gradual decrease and elimination of subsidies for energy use in combination with measures for protecting the most vulnerable population and business;
- establishing a carbon market and national system for emission trading for energy intensive sectors of industry. Potential participation in the international emissions trading market and participation in JI projects;
- carbon tax introduction for producers not covered by carbon market;
- green certificates trading, differentiated preferences and other measures as well as 3R (reduce, reuse, recycle) principles and voluntary commitments;
- creating stimulation and financial funds on energy efficiency, renewable energy sources use, R&D, use of new low-carbon technologies and products.

[33] *Energy for a Sustainable Future, The Secretary-General´s Advisory Group on Energy and Climate Change (AGECC),Summary Report and Recommendations* , 28 April 2010, New York.

2.2. Standards and regulations (command-and-control instruments)

Market-based instruments should be complemented with other approaches e.g. by regulatory standards and regulations ('also referred to as command-and-control measures' [CAC]), policies to encourage the development and adoption of low-carbon technologies, and capacity building and information campaigns to encourage changes in behaviour.

Regulatory standards are the most common form of environmental regulation. They specify the action(s) that a firm or individual must undertake to achieve an environmental objective. They may specify technologies or products to use or not use and/or contain more general standards of performance or of acceptable and unacceptable behaviour. They fall into two broad categories:

- technology standards, which require emitters to use specific abatement technologies;
- performance standards, which set specific environmental limits that must not be exceeded (e.g. a certain amount of emissions per unit of output), but without requiring particular technologies.

By forcing all firms to undertake specific emission reduction efforts regardless of their individual abatement costs, CAC instruments do not minimize overall abatement costs because they impose the same constraints on firms regardless of how many cheap abatement options they have. They do not provide polluters with the incentive(s) to search for better approaches to reducing pollution. In this, technology standards are usually more costly than performance standards, as the latter give firms greater flexibility in selecting the abatement option that is most adapted to their individual situation. In addition, unlike price-based instruments, standards lack the potential for delivering a "double dividend" since they do not raise fiscal revenues.

However, if carefully designed, CAC instruments can address several market imperfections that are not dealt with by market-based incentives, for example when emissions cannot be perfectly monitored (e.g. fugitive emissions from pipelines, methane from agriculture) or when information is not equally available to two contracting parties with opposite goals. An example of the latter is in the housing market, where landlords have better information than tenants but have little incentive to install the most energy-efficient equipment, as they do not pay the energy bill). In the former case the problem can be solved through technology standards, while in the latter information instruments, such as public disclosure requirements or eco-labelling, can be used (IPCC, AR4).

Energy efficiency standards for lighting and home appliances represent some of the fastest and easily realized opportunities in energy efficiency. In addition, national energy management standards, which have proven successful in OECD countries in delivering significant energy efficiency gains in industry, buildings and transport, can bring worldwide benefits. But effective tracking and monitoring of the implementation of these standards is critical to success.[34]

CAC instruments can be preferable to market-based incentives when polluting entities or individuals are not responsive to price signals. Technology standards may be easier to implement and track than performance standards in countries with low institutional capacity. Standards may also help increase emission abatement efforts in state enterprises with market power.

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[34] *Energy for a Sustainable Future,* The Secretary-General´s Advisory Group on Energy and Climate Change (AGECC),Summary Report and Recommendations, 28 April 2010, New York.

2.3. Capacity development and Information instruments

Information instruments – such as public disclosure requirements, labelling programmes for consumer products and awareness campaigns – may affect public behaviour towards low carbon options, allowing consumers to make better-informed choices. Information instruments can also be used to improve the effectiveness of other instruments. Capacity-building is a necessary cross-cutting component of climate change mitigation policies. Implementation of all of the instruments discussed in this chapter requires minimum appropriate technical and institutional capacity in the implementing regulatory and enforcement agencies, as well as in the private sector and the variety of other stakeholders.

Successful initiatives usually require a combination of policy and financial incentive measures enabled through regulation, standards and incentives, as well as innovative financing, institutional and technical capacity building and informational programmes.[35]

2.4. Voluntary agreements

Voluntary agreements (VA) between governments and private parties to limit GHG emissions are another possible climate mitigation instrument. VAs have long been used in a number of OECD countries and have received growing attention for climate change in recent years. By contributing to information gathering and dissemination of best-practice, they can help address information problems, similarly to information instruments. They also raise awareness and understanding of mitigating options for firms and sectors, rely on consensus building and are easy to implement, which often makes them politically more acceptable than other instruments. Often VAs are used as a way to adopt more stringent policies at a later stage.

There has been a VA in the EU since 1998 under which car manufacturers have committed themselves to reduce average emissions of carbon dioxide from new cars in the EU by 2008/2009 to a maximum of 140 grams per kilometre. The European Commission has made a proposal to replace the voluntary agreement with legislation on binding emission requirements for car manufacturers averaging 130 grams per kilometre by 2012[36]. Box 17 below provides examples of other voluntary programmes implemented in various countries.

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[35] *Energy for a Sustainable Future,* The Secretary-General´s Advisory Group on Energy and Climate Change (AGECC),Summary Report and Recommendations, 28 April 2010, New York.

[36] *The Development of the Swedish Climate Strategy*. A summary of the data produced by The Swedish Energy Agency and The Swedish Environmental Protection Agency ahead of Checkpoint 2008.

Box 17: Examples of national voluntary agreements

The Netherlands Voluntary Agreement on Energy Efficiency

A series of legally binding long-term agreements based on annual improvement targets and benchmarking covenants between 30 industrial sectors and the government with the objective to improve energy efficiency.

Australia "Greenhouse Challenge Plus" programme

An agreement between the government and an enterprise/industry association to reduce GHG emissions, accelerate the uptake of energy efficiency, integrate GHG issues into business decision making and provide consistent reporting.[19]
http://www.greenhouse.gov.au/challenge

European Automobile Agreement

An agreement between the European Commission and European, Korean and Japanese car manufacturing associations to reduce average emissions from new cars to 140 gCO_2/km by 2008–2009.
http://ec.europa.eu/environment/CO_2/CO_2_agreements.htm

Canadian Automobile Agreement

An agreement between the Canadian government and domestic automobile industry representatives to reduce emissions from cars and light-duty trucks by 5.3 MtCO_2-eq by 2010. The agreement also contains provisions relating to research and development and interim reduction goals.

Climate Leaders

An agreement between US companies and the government to develop GHG inventories, set corporate emission reduction targets and report emissions annually to the US EPA.

http://www.epa.gov/climateleaders/

2.5. Technology R&D policies

2.5.1. Technology challenge

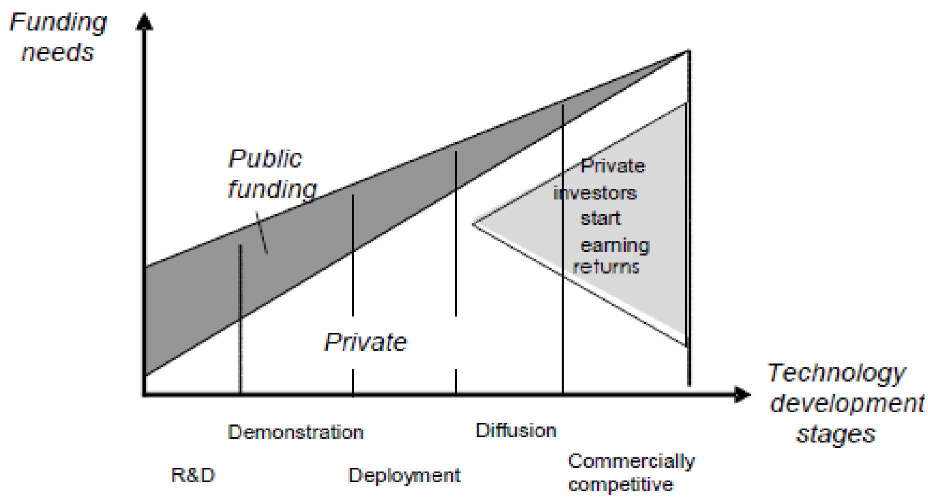
The report prepared for the Expert Group on Technology Transfer (EGTT) on *Future Financing Options for Enhancing the Development, Deployment, Diffusion and Transfer of Technologies under the Convention* (EGTT, 2009) estimates the additional financing needs for climate change mitigation technologies in the range of $262–670 billion per year, which is around three to four times greater than the current global investment levels. Of this increase, 40–60%, or an additional $105–402 billion per year, is projected to be needed in developing countries[37].

[37] *Handbook for Conducting Technology Needs Assessment for Climate Change*, UNDP 2010.

The development of low-carbon technologies will need to be supported through R&D policies. According to OECD calculations, a market-based policy that seeks to stabilize GHG concentrations at 550 ppm could provide incentives for a four-fold increase in world energy R&D spending by 2050. In practice however, pricing carbon is unlikely to be enough to spur sufficient investment in R&D because barriers to innovation are large. The most obvious barrier is political uncertainty about future climate policy, and thus uncertainty about returns on R&D investment.

Speeding up the emergence and deployment of low-carbon technologies will ultimately require increases in – and reallocation of – the financial resources channelled into energy-related R&D.

Figure 20: The roles of the public and private sectors in financing technology development



Source: FCCC/TP/2008/7: *Investment and financial flows to address climate change: An update*. Technical paper.

Therefore specific policies for boosting climate-friendly R&D will be needed, in addition to carbon pricing, for major breakthroughs in low-carbon technologies to occur.

2.5.2. Policy instruments to stimulate R&D and technology deployment

Technology-support policies provide R&D and/or technology adoption incentives. On the R&D side, they range from basic public research to direct government funding of private R&D and tax incentives, and can also strengthen intellectual property rights (IPRs). On the technology adoption side, they may include subsidies, public purchases, and legal obligations (e.g. for electricity providers to purchase a certain share of their electricity from renewable sources, which may be best achieved through market mechanisms such as "green certificates").[38] For example, in the USA, R&D tax credits to industry totalled an estimated $6.4 billion in 2001. However, industries associated with high GHG emissions did not take advantage of this opportunity in that the utility industry received only 23 million US$ (IPCC, AR4).

Possible policies could include rewarding innovation through the use of innovation prizes, and/or establishing a global fund for helping with technology transfers and rewarding

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[38] *The Economics of Climate Change Mitigation: Policies and Options for Global Action beyond 2012*, OECD 2009.

innovations, e.g. by buying out the associated patents. Such a fund is currently being negotiated in the UNFCC process and a reference to its establishment was also made in the Copenhagen Accord.

Countries pursue technological policies for a variety of reasons, including to foster innovation or to assist domestic industries in being competitive. Many countries cooperate to share costs, spread risks, enhance domestic capabilities, harmonize standards, accelerate market learning and create goodwill. However, in designing technology support instruments, it is important to ensure that public support will not be provided to installing existing inefficient technologies, locking them in for the next 30–50 years.

Relying on R&D policy alone, in the absence of a carbon price, would also not be enough to reduce emissions sufficiently. Model simulations indicate that even under very large increases in spending and very high returns to R&D, CO_2 concentration would still rise continuously, reaching over 650 ppm by the end of the century, with overall GHG concentrations reaching more than 750 ppm CO_2eq.[39] While R&D funding could help to develop new technologies, such as carbon capture and storage, it is unlikely that these will be aggressively deployed without complementary policies that place a sufficiently high price on carbon.

2.6. Interaction across policy instruments

As discussed earlier, countries will need to adopt a number of policy instruments to reach low emission development goals. Often various GHG mitigation policies are mutually reinforcing, for examples in the areas of water management, farm practices, forest management strategies and residential building standards. Climate change considerations also provide both developing and developed countries with an opportunity to look closely at their respective development strategies from a new perspective. Fulfilling development goals through policy reforms in such areas as energy efficiency, renewable energy, sustainable land use and/or agriculture will often also generate benefits related to climate change objectives (IPCC, AR4).

However, sometimes policies that overlap can generate some cost. Therefore a careful analysis of interaction between various policies under consideration should be undertaken to identify possible overlaps. For example, if a country has set a total emission-reduction objective through a national emission-trading scheme, additional policies, such as renewable, energy efficiency or biofuel targets, will not necessarily reduce emissions beyond the cap-and-trade target but may undermine cost-effectiveness and might lock-in inefficient technologies. Potentially overlapping policies should therefore only be used in situations where they can be justified on other grounds, for instance as a way to boost low-carbon technologies or improve energy security.[40]

As a general rule, different instruments should address different market imperfections or barriers and/or cover different emission sources.

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[39] Executive Summary, *The Economics and Climate Change Mitigation* – ISBN: 978-92-64-05606-0 – © OECD 2009.

[40] *The Economics of Climate Change Mitigation: Policies and Options for Global Action beyond 2012* , OECD 2009.

3. Prioritization of mitigation measures

From a wide range of policies and measures that will be considered by countries in the course of LEDS/NAMAs analysis, a few should be chosen as priorities to focus on. As noted earlier, it is important that the wider stakeholder group participates in the decision over the criteria for the prioritization and the final choice of the measures and policies to focus on. Countries use varying approaches to prioritize mitigation measures and policies. In most cases the overriding considerations are their CO_2 emission reduction potential and implementation cost.

Some studies simply use the marginal abatement cost curve to identify priority mitigation options, with the main limitation being the sole focus on technology costs. Other costs of implementation, such as establishing policy and regulatory measures, addressing implementation barriers, and structuring incentives, need to be derived through supplementary analyses of market structure and policy frameworks.
A multi-criteria impact analysis can be used to assess the economic, environmental and social impacts of various policies and to determine priority policies and measures (including for inclusion into NAMAs).

Evaluating policy instruments in an objective manner is rather challenging. First, criteria for such evaluation must be established. In this, it must be decided how much weight to assign each of the evaluative criteria, which is essentially a policy decision (i.e. which criteria should have greater weight-environmental or cost-effectiveness). In many cases it can be difficult to rank instruments in terms of their technology-stimulating effects or their cost-effectiveness. Nevertheless, it is possible to make general statements about each instrument. For example, while market-based instruments in general tend to be more cost effective than regulations and standards, the lack of functioning institutions can result in a market-based instrument being more costly to implement (IPCC, AR4).

For example, in developing countries, institutional feasibility is of critical importance, where environmental effectiveness and cost-effectiveness may be determined in large by a government's institutional capacity (IPCC, AR4). In general, the criteria that receive the most weight will be those that are assessed to be the most important in terms of each country's specific circumstances.

The IPCC AR4 uses the following four criteria to evaluate policies and instruments: environmental effectiveness, cost effectiveness and distributional effects including equity, and institutional feasibility (ease of implementation) (see Table 13 below).

Table 13: National environmental policy instruments and evaluative criteria

Instrument	Criteria		
	Environmental effectiveness	**Cost-effectiveness**	**Institutional feasibility**
Regulations and standards	Emissions level set directly, though subject to exceptions. Depends on deferrals and compliance.	Depends on design; uniform application often leads to higher overall compliance costs.	Depends on technical capacity; popular with regulators in countries with weakly functioning markets.
Taxes and charges	Depends on ability to set tax at a level that induces	Better with broad application; higher	Often politically unpopular; may be

	behavioural change.	administrative costs where institutions are weak.	difficult to enforce with underdeveloped institutions.
Tradable permits	Depends on emissions cap, participation and compliance.	Decreases with limited participation and fewer sectors.	Requires well functioning markets and complementary institutions.
Voluntary agreements	Depends on programme design, including clear targets, a baseline scenario, third party involvement in design and review and monitoring provisions.	Depends on flexibility and extent of government incentives, rewards and penalties.	Often politically popular; requires significant number of administrative staff.
Subsidies and other incentives	Depends on programme design; less certain than regulations/standards.	Depends on level and programme design; can be market distorting.	Popular with recipients; potential resistance from vested interests. Can be difficult to phase out.
Research and development	Depends on consistent funding; when technologies are developed and polices for diffusion. May have high benefits in the long term.	Depends on programme design and the degree of risk.	Requires many separate decisions. Depends on research capacity and long-term funding.
Information policies	Depends on how consumers use the information; most effective in combination with other policies.	Potentially low cost, but depends on programme design.	Depends on cooperation from special interest groups.

Source: IPCC, AR4

In the climate change strategy for Sweden, discussed earlier, the mitigation measures were prioritized according to whether they:

- provide incentives for climate measures in investments with a long life;
- lead to a switch of the energy system (to renewable energy);
- reduce energy use in the building stock (new construction, refurbishment);
- lead to increased energy efficiency in the transport sector;
- provide incentives for technological development and technology diffusion.

The UK used a yet more comprehensive set of performance criteria for prioritization of policies and measures, including[41]:

Economic (allocative) efficiency/cost effectiveness

[41] *Making the right choices for our future: An economic framework for designing policies to reduce carbon emissions*, Department of Energy and Climate Change Department for Environment, Food, and Rural Affairs, March 2009

Achieving the required emissions reduction at the lowest cost, i.e. reductions are made by adopting the least costly measures and abatement cost of removing an additional tonne of CO_2 is equal across all sources.

Administrative burden
The cost to regulated sources of demonstrating compliance (i.e. monitoring, reporting, and verification) and the cost to government of administering and enforcing the instrument.

Secondary effects
Effects beyond emissions reductions, such as double dividends, wider environmental and other co-benefits, increased technological innovation and spillovers, improved perception, improved awareness, and dissemination of technology.

Distributional equity
The degree to which alternative instruments have a progressive or regressive impact, or have different impacts on different agents/sectors/income groups and across time.

Price vs. quantity uncertainty
Uncertainty of achieving an environmental outcome (i.e. achieving a specific level of emissions reduction) compared to the uncertainty in the price, or cost, of achieving that outcome.

Flexibility vs. policy certainty
Trade-off between the flexibility to adapt to exogenous changes in technology/resource use/consumer tastes and the risk of creating policy uncertainty/regulatory capture/other perverse effects associated with a more flexible instrument.

Impact on public finance
Impact of the instrument on the exchequer, for example, market-based instruments like taxes and trading schemes could have significant implications for public finances.

Ensuring energy supply security
Maximising synergies between climate change and energy security policy such that emissions reductions are made in a way that helps the UK secure diverse and sustainable supplies of energy at competitive prices.

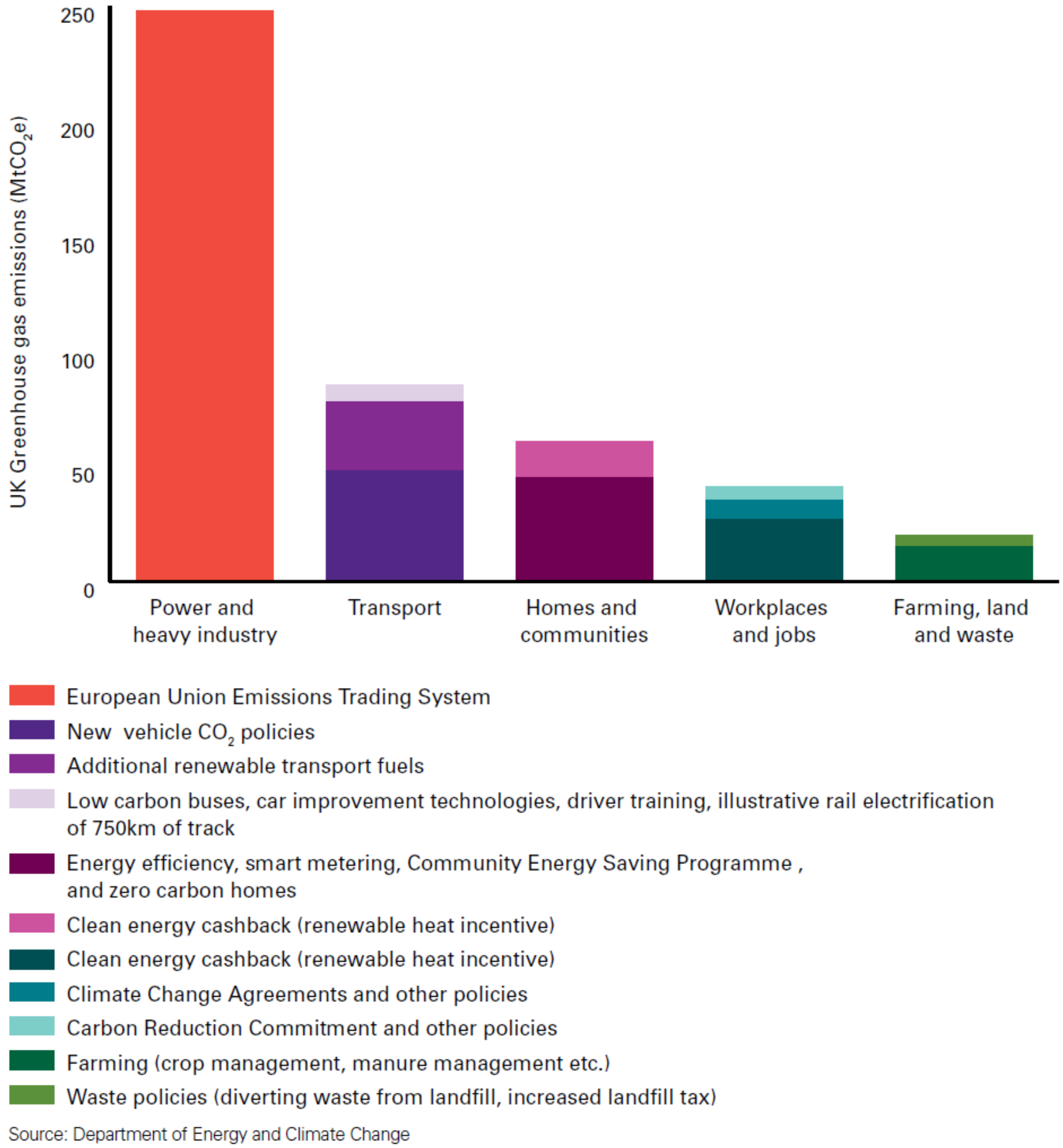
Competitiveness effects
Choosing economically efficient and cost effective interventions that reduce the potential for carbon leakage in internationally competitive sectors.

Simplicity and transparency
An important criteria for gaining business and more generally public acceptance and support for climate change policy as being fair, logical, robust, and consistent.

Figure 21 below provides an example of policies that were prioritized under the UK low carbon transition plan and their estimated impact on GHG emissions.

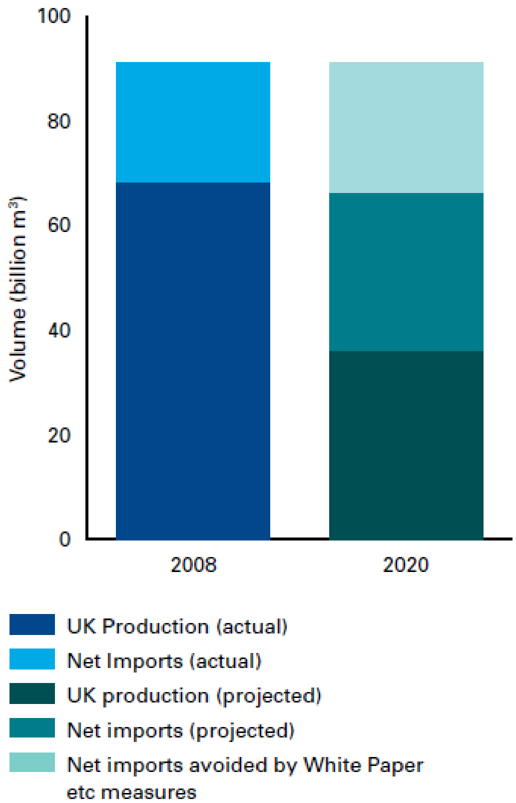
Each country can adopt its own criteria for prioritization depending on national circumstances and priorities.

Figure 21: Impact of policies planned under the UK Low Carbon Transition Plan on GHG emissions



In prioritizing mitigation measures and policies it is also important to consider their co-benefits for achieving other environmental and development goals. A common synergy is reduced local air pollution and the resulting improvement in the human health that accompanies reduction of GHG emissions, in particular in the energy sector. Furthermore, implementing LED policies often leads to increased energy independence (see Figure 22 for the UK example). In addition, implementing LEDS will often stimulate local low carbon industries such as renewable energy production, thereby creating new jobs in the corresponding sectors. It may also promote decentralization, community participation and civic engagement.

Figure 22: UK low carbon transition plan is to help reduce energy dependence



4. Quantify GHG reductions and the costs of the chosen measures and policies and formulate PAMs or NAMAs

Once mitigation measures and policies have been prioritized and a few options have been selected for implementation (or for a NAMA submission, in case external financial and/or technological or capacity-building support will be sought), the aggregate GHG emission reductions to be achieved should be determined and compared to the overall goals set earlier for the LEDS/NAMA.

Similarly, the joint costs of the chosen policies and measures should be determined and the sources of financing considered. The financing of priority measures is discussed in the next chapter.

The identified priority mitigation measures and policies essentially represent NAMAs (in the case of non-Annex I countries) or PAMs (in the case of Annex I countries). At the next step, however, countries need to determine which of these measures they would be able to implement themselves and which will require financial support.

In the absence of formal guidance on preparation and submission of NAMAs, the following information derived from the above analysis should be extracted for the potential NAMA submission:

- the sector(s) that NAMA(s) will cover or impact;
- quantified emission reduction impact of the NAMA(s) evaluated for mid - and longer term (i.e. for 2020 and 2050);
- explanation of the basis (methodology and key assumptions) for the above estimates;

- detailed description of concrete actions (selected priority policies and measures) that will be implemented;
- relationship of NAMA to the overall development and LED goals and its impact on sustainable development.

Further details that must be included in the NAMA submission concern the need for financial, technological and capacity building support, as well as the provisions for monitoring, reporting and verification of emission reductions. These issues are discussed below in Chapters 6 and 7 respectively.

Table 14: Selected examples of key sectoral mitigation technologies, policies and measures, constraints and opportunities.[42]

Sector	Key mitigation technologies and practices currently commercially available.[43]	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities (Normal font = constraints; *italics = opportunities*)
Energy supply	Improved supply and distribution efficiency; fuel switching from coal to gas; nuclear power; renewable heat and power (hydropower, solar, wind, geothermal and bioenergy); combined heat and power; early applications of carbon dioxide capture and storage (CCS) (e.g. storage of removed CO_2 from natural gas); *CCS for gas, biomass and coal-fired electricity generating facilities; advanced nuclear power; advanced renewable energy, including tidal and wave energy, concentrating solar, and solar photovoltaics*.	Reduction of fossil fuel subsidies; taxes or carbon charges on fossil fuels.	Resistance by vested interests may make them difficult to implement.
		Feed-in tariffs for renewable energy technologies; renewable energy obligations; producer subsidies.	*May be appropriate to create markets for low-emissions technologies*.
Transport	More fuel-efficient vehicles; hybrid vehicles; cleaner diesel vehicles; biofuels; modal shifts from road transport to rail and public transport systems; non-motorised transport (cycling, walking); land-use and transport planning; *second generation biofuels; higher efficiency aircraft; advanced electric and hybrid vehicles with more powerful and reliable batteries*.	Mandatory fuel economy; biofuel blending and CO_2 standards for road transport.	Partial coverage of vehicle fleet may limit effectiveness.
		Taxes on vehicle purchase, registration, use and motor fuels; road and parking pricing.	Effectiveness may drop with higher incomes.
		Influence mobility needs through land-use regulations and infrastructure planning; investment in attractive public transport facilities	*Particularly appropriate for countries that are building up their transportation systems*.

[42] Working Group III, Fourth Assessment Report, IPCC 2007.

[43] Key mitigation technologies and practices projected to be commercialized before 2030 shown in italics.

Sector	Key mitigation technologies and practices currently commercially available.[43]	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities (Normal font = constraints; *italics = opportunities*)
		and non-motorised forms of transport.	
Buildings	Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved cook stoves, improved insulation; passive and active solar design for heating and cooling; alternative refrigeration fluids, recovery and recycling of fluorinated gases; *integrated design of commercial buildings including technologies, such as intelligent meters that provide feedback and control; solar photovoltaics integrated in buildings*.	Appliance standards and labelling.	Periodic revision of standards needed.
		Building codes and certification.	Attractive for new buildings. Enforcement can be difficult.
		Demand-side management programmes.	Need for regulations so that utilities may profit.
		Public sector leadership programmes, including procurement.	*Government purchasing can expand demand for energy-efficient products*.
		Incentives for energy service companies (ESCOs).	Success factor: access to third party financing.
Industry	More efficient end-use electrical equipment; heat and power recovery; material recycling and substitution; control of non-CO_2 gas emissions; and a wide array of process-specific technologies; *advanced energy efficiency; CCS for cement, ammonia, and iron manufacture; inert electrodes for aluminium manufacture*.	Provision of benchmark information; performance standards; subsidies; tax credits.	May be appropriate to stimulate technology uptake. Stability of national policy important in view of international competitiveness.
		Tradable permits.	Predictable allocation mechanisms and stable price signals important for investments.
		Voluntary agreements.	Success factors include: clear targets, a baseline scenario, third-party involvement in design and review and formal provisions of monitoring, close cooperation between government and industry.
Agriculture	Improved crop and grazing land management to increase soil carbon storage; restoration of cultivated peaty soils and degraded lands; improved rice cultivation techniques and livestock and manure	Financial incentives and regulations for improved land management; maintaining soil carbon content; efficient use of fertilisers and irrigation.	*May encourage synergy with sustainable development and with reducing vulnerability to climate change, thereby overcoming barriers to implementation.*

Sector	Key mitigation technologies and practices currently commercially available.[43]	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities (Normal font = constraints; *italics = opportunities*)
	management to reduce CH_4 emissions; improved nitrogen fertiliser application techniques to reduce N_2O emissions; dedicated energy crops to replace fossil fuel use; improved energy efficiency; *improvements of crop yields*.		
Forestry/ forests	Afforestation; reforestation; forest management; reduced deforestation; harvested wood product management; use of forestry products for bioenergy to replace fossil fuel use; *tree species improvement to increase biomass productivity and carbon sequestration; improved remote sensing technologies for analysis of vegetation/soil carbon sequestration potential and mapping land-use change*.	Financial incentives (national and international) to increase forest area, to reduce deforestation and to maintain and manage forests; land-use regulation and enforcement.	Constraints include lack of investment capital and land tenure issues. *Can help poverty alleviation*.
Waste	Landfill CH_4 recovery; waste incineration with energy recovery; composting of organic waste; controlled wastewater treatment; recycling and waste minimisation; *biocovers and biofilters to optimise CH_4 oxidation*.	Financial incentives for improved waste and wastewater management.	*May stimulate technology diffusion.*
		Renewable energy incentives or obligations.	Local availability of low-cost fuel.
		Waste management regulations.	Most effectively applied at national level with enforcement strategies.

Chapter 6: Financing mitigation measures

The next stage requires countries to consider the financing needs associated with low-emission development strategy (LEDS) implementation in general, and the priority mitigation policies and selected implementation measures in particular. In this it is particularly important to determine which actions can be financed through internal means and which will require external support.

This chapter focuses on the steps that need to be undertaken in order to determining the needs and opportunities for financing mitigation measures, with particular emphasis on potential for external support.

Figure 23: Main steps in financing mitigation measures

1. Determining financing needs for mitigation measures and policies

Once the portfolio of priority measures has been determined, the cost of implementing the measures must be evaluated. Some data required for such assessment will be already available from the previous stages of LEDS development described earlier. The investment costs associated with installing new technologies or improvements to the existing equipment can often be derived from the marginal abatement cost curve (MACC) analysis at earlier stages. While such an approach provides a good starting point, it is important to expand the analysis to account not only for the technology related costs, but also costs associated with setting up the programmes and policies, monitoring, enforcement costs, data collection, studies, research, training and other capacity building and awareness programmes that will be incurred in order to implement the chosen measures.

In order to assist countries evaluate financing mitigation (and adaptation) measures, UNDP has prepared a *Methodology Guidebook for the Assessment of Investment and Financial*

Flows to Address Climate Change (UNDP 2009). It is available in several UN languages, including Russian, and can be accessed at http://www.undpcc.org/content/methodology-en.aspx.

The 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, and corporate and government investments in infrastructure, to government investments in education and outreach. The approach is designed to be implemented at national level, and is flexible so that it can be adapted to country-specific needs and conditions. The guidebook provides a good basis for evaluating financing needs in the context of LEDS.

Investment flow and financial flow are two of the key concepts of evaluating financing accounting as per the UNDP methodology.

An investment flow is the capital cost of a new physical asset with a life of more than 1 year, limited to new physical assets, because of climate change implications for the duration of the operating lives of the facilities an equipment purchased.

Financial flows are an ongoing expenditure on programme measures. They encompass expenditures other than those for expansion or installation of physical assets, primarily 'operation and maintenance' costs including salaries, raw materials, equipment maintenance, depreciation, utilities, rent, insurance, taxes etc.

The I&FF methodology suggests estimating financial and investment flows for both business as usual (BAU) and LEDS scenarios, so that the incremental cost of GHG mitigation policies can be determined. Such an approach helps in cases when external financial support is to be sought and the funding mechanism or donor is only prepared to cover the incremental cost of measures. Countries focusing purely on the implementation of a set of Nationally Appropriate Mitigation Actions (NAMAs) may also wish to estimate I&FF for each NAMA and, for cases where they would not be implemented, to derive the incremental cost of each NAMA and jointly of set of them.

The I&FF data that need to be collected may reside in one or more locations (e.g. national accounts, ministry records and plans, industry records, statistical agencies, utilities, research institutions etc). The methodology recommends taking a bottom-up approach to data collection and starting with the 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. Sectoral I&FF data may also be available from research organizations and academic institutions, including research organizations, private research institutions, and universities. Arrangements for interagency data sharing at this stage are still very important; therefore it is important that the institutional arrangements for inter-sectoral coordination and stakeholder engagement function effectively throughout all stages of the LEDS process.

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). However, it is highly unlikely that this information will be at the level of the sectoral scope being considered. Hence, certain assumptions based on expert judgment will need to be made. Such assumptions should be carefully documented to ensure transparency and documentation.

2. Identifying available domestic financial resources

Once the overall financing needs have been determined, countries must evaluate domestic sources of finance that are available to finance the priority policies and measures (PAMs) and/or NAMAs. Financing available from different entities (i.e. from the government, private sector or households) should be considered, including domestic equity and debt.

3. Determining the need for external financial support

On the basis of the analysis of the domestic financial resources available for implementation of LEDS, PAMS and/or NAMAs, countries should determine whether they can implement the chosen measures with their own resources (autonomous actions or NAMAs) or whether they will require external resources in the form of debt, equity or financial support through one of the available channels.

In some cases only the incremental cost of measures and policies may be covered, while in other cases donors may consider funding the full cost. In any case, if some domestic financial resources are available for the implementation of policies, it is important to quantify these resources and make the information available to potential funders, as participation of domestic resources confirms the seriousness of the country´s domestic commitment to the implementation of LEDS and NAMAs and increases the chance of obtaining additional external support.

Project Catalyst estimates that $21–54 billion of public climate finance could be needed from 2010–2012 in developing countries (excluding China which has indicated it will not seek Fast Start Finance)[44].

4. Identifying sources and opportunities for obtaining support

If it is determined that external financial support will be required to implement LEDS or NAMAs, countries need to consider what sources of support are available to them. While negotiations on the design of and support for NAMAs in the international context are still

[44] *Making Fast Start Finance Work*. Briefing paper. Project Catalyst. (7 June 2010 version) http://www.project-catalyst.info/images/publications/2010-06-07_project_catalyst_-_fast_start_finance_-_full_report_-_7_june_version.pdf

underway, some key requirements and mechanisms for obtaining support for NAMAs are already emerging.

According to the Bali Action Plan, NAMAs by developing countries can be supported by financial, technological and capacity building support. The Copenhagen Accord suggests creating a Green Fund that would, among other things, provide financial support for mitigation actions. Furthermore, a Technology Mechanism and REDD plus mechanisms that would finance actions related to technology development and transfer and actions related to avoided deforestation and forest degradation, and forest conservation respectively are currently under negotiation under the UNFCCC.

A clear distinction is made in the Copenhagen Accord between autonomous (self-financed) and supported (through external resources) NAMAs, to which different arrangements for both domestic and international measurement, reporting and verification are applied (see below). A similar distinction is made in the UNFCCC negotiations.

While negotiations on the future framework regarding NAMAs and their support are proceeding, the Copenhagen Accord made provisions for Fast Start Finance that will be available from 2010-2012. Financial support approaching $10 billion per annum for the period 2010-2012 with balanced allocation between adaptation and mitigation, has been pledged by developed countries, with $100 billion per annum envisaged from 2020 onward.

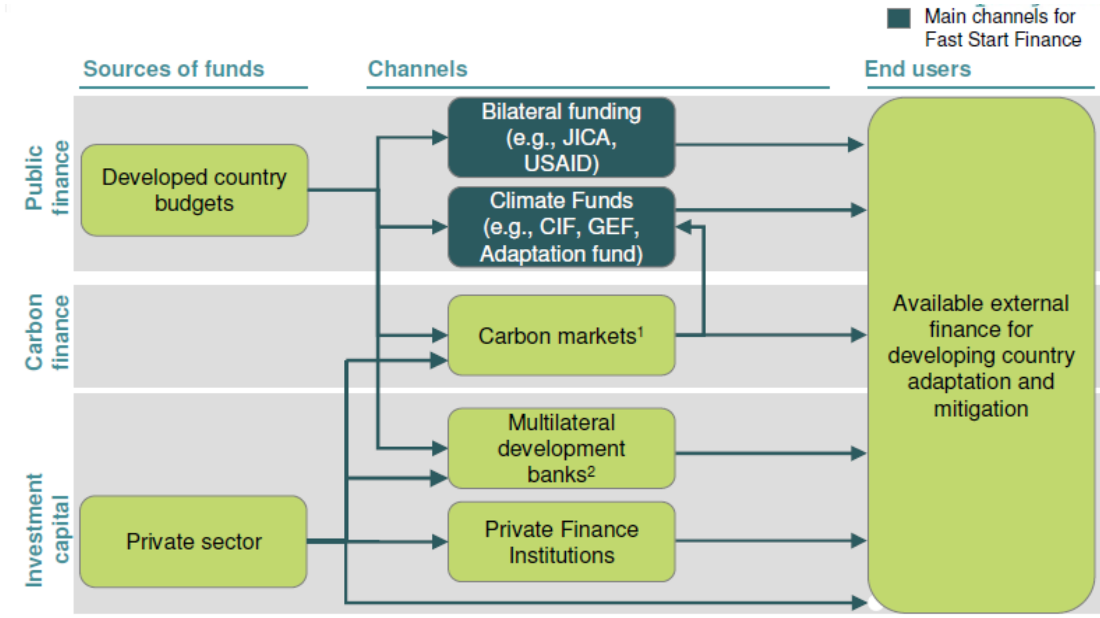
1.1. Fast Start Finance

Through the Copenhagen Accord developed countries have committed to providing additional financial support, including financing mitigation actions in developing countries. Support can also be sought through existing channels, such as various funds under the UNFCCC, international financial institutions, GEF and through bilateral channels. According to Project Catalyst, current pledges of Fast Start Finance for 2010–2012 to developing countries for adaptation and mitigation add up to a gross amount of approximately $28 billion (as at June 8, 2010). Their analysis of other sources of public climate finance in the 2010-2012 period, which are not considered by donor countries to be 'Fast Start Finance', amount to roughly an extra $4-7 billion. Publically pledged funds comprise both grants and investment capital.

It is currently difficult to precisely evaluate what proportion of the Fast Start funds will be devoted to NAMAs. Historically, more than 80% of climate funds have been directed to mitigation (including REDD). However, this balance is changing as donor countries increasingly focus on addressing adaptation concerns. The Commonwealth countries for example have recently agreed to allocate Fast Start Finance equally between adaptation and mitigation activities.[45]

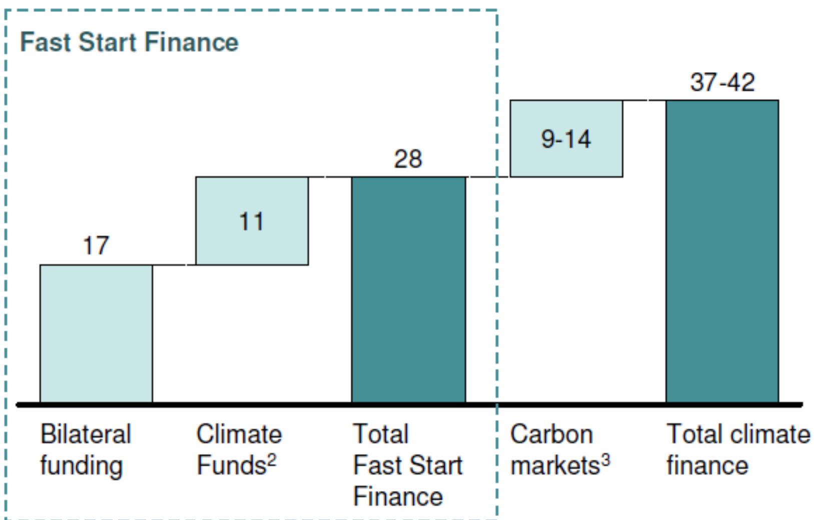
Figure 24: Main sources of, and channels for, Fast Start Finance

[45] *Making Fast Start Finance Work*. Briefing paper. Project Catalyst. (7 June 2010 version) http://www.project-catalyst.info/images/publications/2010-06-07_project_catalyst_-_fast_start_finance_-_full_report_-_7_june_version.pdf



1 Carbon markets also indirectly fund some of the intermediaries (e.g., CDM levy funding the Adaptation Fund)
2 MDBs source their funds from the private capital market. Excluded from analysis of Fast Start Finance.
SOURCE: Project Catalyst analysis

Figure 25: Current pledges for Fast Start Finance vs. other sources



1 Includes climate finance pledges of Australia, Canada, EU (EU commission and member states), Japan, Norway, and US; numbers may not sum to total due to rounding. Exchange rate from April 26, 2010 used ($1.33 to €1)
2 Multilateral funds include the World Bank climate funds, GEF, and other funds providing concessional climate-related financing; excludes general funding for the World Bank and other development bodies; share for some donor countries based on historical allocation of multi- and bilateral funding
3 Expected CDMs issued from 2010-2012 at an assumed price of EUR 10-15 per tonne CO2

Source: *Making Fast Start Finance Work*. Briefing paper. Project Catalyst. (7 June 2010 version) http://www.project-catalyst.info/images/publications/2010-06-07_project_catalyst_-_fast_start_finance_-_full_report_-_7_june_version.pdf

4.1. Other sources of financing

Countries may also consider other sources of finance for implementation of mitigation measures. Table 15 below presents different available schemes for financing mitigation.

Table 15: Sources of finance for mitigation

	International schemes	National and sub-national schemes
Public funds	ODA (multilateral, bilateral and decentralized cooperation). Multilateral funds.	Green economic stimulus. Environmental fiscal reforms. Export credits. Rebates and subsidies. Tax credits and tax free bonds. Low interest loans.
Private funds	Green equity finance. Private investment funds. Foundations. Non-governmental organisations. Global philanthropic foundations. Corporate social responsibility (e.g. MNCs).	National philanthropic foundations. Corporate social responsibility (national corporations).
Market-based mechanisms	Tradable renewable energy certificates. Carbon cap-and-trade mechanisms (e.g. CDM, JI, voluntary). Green insurance contracts. Programmatic approaches (NAMA, etc.)	Tradable renewable energy certificates. Utility demand side management DSM. Green mortgages. Tax free climate change bonds. Domestic carbon projects.
Innovative instruments	Transaction taxes (e.g. Tobin). International climate change finance initiative. Air travel levy. Global carbon tax. Debt-for-efficiency swaps. International carbon auction funds. International non-compliance fees. Efficiency penny.	Carbon taxes. Energy taxes. Auction of emission allowances. National non-compliance fees. Green investment schemes. Efficiency penny.

Source: *Charting A New Low-Carbon Route To Development A Primer on Integrated Climate Change: Planning for Regional Governments*, United Nations Development Programme, June 2009.

Table 16 gives further examples of public finance mechanisms provided by different institutions. For detailed discussion of each of these schemes see the source publications.

Table 16: Public finance mechanisms provided by different institutions

	Public finance mechanism	Direct support	Indirect support	
		International to project	International to national	National to project
Contribution to	Up-front grant - Standard technical	GEF grants Other bilateral	ODA	Investment support

investment and operation	assistance grants - 'Smart' grants	and multilateral DFIs		
	Funding during operation	Offset mechanisms (CDM) WB support	Grant linked to continuous delivery (finance +regulatory stability)	*Incremental payment to renewable *Removal of energy subsidies * Carbon tax/cap and trade scheme
Facilitating access to finance	Provision of equity - Private equity - Venture capital - long-term investment	ADB Clean Energy PE fund EIB/EBRD Sovereign Wealth Funds	EIB/EBRD support for VC fund setup costs, and co-investment in funds	Carbon Trust VC fund Transition economy VCs
	Provision of debt and equity - Loans (usually with governance conditions) - Credit lines - Equity (large projects, alongside foreign investors)	IFIs e.g. EBRD, IFC	IMF and WB loans	
	Risk coverage - Full or partial guarantee - Policy to cover all or specific causes of non performance - Other financial products	MIGA political risk insurance	WB/IFC Partial Credit and Partial Risk Guarantees	Export credit Agency guarantees

Source: *Structuring International Financial Support to Support Domestic Climate Change Mitigation in Developing Countries*, by Karsten Neuhoff, Sam Fankhauser, Emmanuel Guerin, Jean Charles Hourcade, Helen Jackson, Ranjita Rajan, John Ward. Climate Strategies, October 2009.

When determining suitable channels for financing, countries may wish to consider the geographic and sectoral focus of the potential scheme, as well as the prevailing financing instruments in terms of their suitability to the national circumstances.

4.2. UNDP Environmental finance services

UNDP helps countries to access new sources of environmental finance in the implementation of climate mitigation and adaptation projects through several environmental finance facilities. Such facilities include the Global Environment Facility (GEF), MDG Carbon Facility and the joint UN Programme on Reducing Emissions from Deforestation and Land Degradation (UN - REDD). UNDP is mobilizing environment and energy experts across the globe in three advisory platforms: ecosystems and natural resources, climate change adaptation, mitigation and energy, and ozone-depleting substances. Some of the current programmes include:

- Energy & Environment Thematic Trust Fund

A rapid response fund providing catalytic financing for capacity building and planning assistance.

- UNDP MDG Carbon Facility
  Carbon financing from UNDP supports clean energy and other CDM/JI eligible projects that help fulfil a country's Millennium Development Goals.

- UN Programme on Reducing Emissions from Deforestation and Forest Degradation
  Country-specific projects designed to provide incentives in the conservation and sustainable use of forest stocks.

- Territorial Approach to Climate Change
  Innovative partnerships and technical cooperation in sub-national governments within developing countries to transfer knowledge and direct investment suitable for low-carbon development.

- Green Commodities Facility
  Assistance directed at overcoming market barriers to the production and sale of sustainably produced goods.

- Climate Risk Finance Facility
- Assistance for public and other authorities in identifying and implementing development and risk-reduction oriented financing mechanisms supporting low-carbon and climate-resilient development at local, national and regional levels.

- UNDP/GEF Small Grants Programme
  Assistance for community-based organizations catalyzing local and regional adaptation and mitigation initiatives.

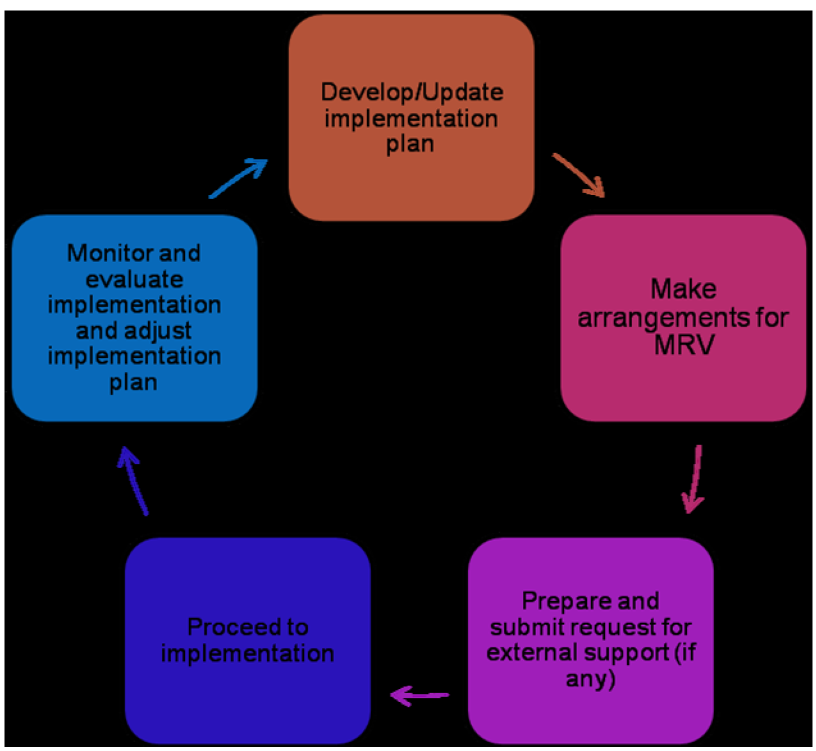
5. Links with on-going processes

When preparing the LEDS and determining financing options for NAMAs, countries should also consider ongoing programmes (e.g. the UNDP´s programming, preparation of national communications to UNFCCC, TNA, GEF 5 pipeline and other mitigation and adaptation projects) to exploit and utilize potential synergies and maximize the effectiveness of the limited financial resources available.

Chapter 7: Implementing, monitoring and MRV

Implementing a Low-Emission Development Strategy (LEDS) or Nationally Appropriate Mitigation Action (NAMA) is a challenging process, which needs to be carefully designed and well-managed to be effective. First of all, a comprehensive implementation plan is required. Then a transparent arrangement for Measurement, Reporting and Verification (MRV) of data, information and emissions is required. If external financial, technological or capacity-building support is sought then a proposal for NAMA financing should be prepared. Finally, in the course of actual implementation, an arrangement for monitoring the implementation and taking into account lessons learned is required, with the consequent refinement of the implementation plan and, potentially, the design of the LEDS or NAMAs.

Figure 26: Main steps in the implementation of LEDS and/or NAMAs



1. Implementation plans and processes for LEDS and/or NAMAs

To ensure smooth implementation it is necessary to develop a detailed implementation plan and to determine responsible agencies for each of the planned measures and a mechanism for inter-agency coordination and monitoring during the implementation stage. It is also necessary to make an arrangement that allows revising and iterating the LED strategy or NAMAs based on the lessons learnt in the course of implementation. It is advisable that the broad stakeholder group meets regularly to review progress related to the low emission development strategy and to adjust the implementation plan based on changing circumstances.

Provisions for monitoring and measurement, reporting and verification (MRV) of the actions undertaken and the resulting GHG emission reductions are critical components of the implementation plan. They should be adjusted to national circumstances, but also correspond to international best practices and standards. The implementation plan should outline clear timetables, roles and responsibilities, performance metrics and MRV arrangements (as discussed below in more detail), outreach and partnership activities, and arrangements for continuous monitoring and refinement. Development of the implementation plans need to include broader group of stakeholders and the leading agencies in the relevant sectors and at the national level.

2. Arrangements for MRV

As discussed in the previous chapter, the international requirements for the MRV system will most likely be developed and adopted by the Conference of Parties - COP in the future. In the meantime, countries undertaking NAMAs and seeking external support will need to operate without clear guidelines. However it is advisable to use the general accepted principles and procedures for the estimation and reporting of carbon emissions, and removals at national level should be specified by the IPCC Good Practice Guidelines and guidance for reporting on the international level.

Furthermore it is critical to have a clear and transparent system for accounting, recording and monitoring data and emissions, which shows the assumptions made, sources of information and data, the basis or methodology for calculations, related uncertainties etc. Such a system has several functions. First, it allows countries to have a better understanding and overview of the emission accounting process and better monitoring of a LEDS or NAMA implementation. Second, it gives external credibility to domestic efforts and increases confidence of potential funders. Finally, having a clear and transparent monitoring and recording system early on allows easier adjustment in the future to the new guidelines once adopted at the international level.

In order to monitor implementation of the LEDS/NAMAs it is important to establish performance indicators and a clear process for all involved for measuring and reporting performance. A timeframe and frequency at which data is to be submitted by the relevant agencies should be determined early in the process. A system for quality control and assurance will need to be put in place. It is important to note that reporting and monitoring should be an ongoing activity, and not just started at the end of implementation.
A cornerstone of a national monitoring and reporting system is a reliable GHG inventory that provides information on emissions in every economic sector or subsector of the country. However, since often in the submissions to the Copenhagen Accord NAMAs are framed at a sub-national (sectoral) level, national GHG emissions may not be the most appropriate metric by which to assess the implementation of NAMAs. In that case, other indicators, for example, GHG intensity, renewable energy capacity, or area reforested, may be needed.

Therefore, to measure, report, and verify NAMAs, a supplement to national inventory and national communication processes is likely to be required.[46]

When setting up MRV systems, countries should keep in mind that in some cases MRV is difficult, for example in the case of economic and fiscal policies and measures as they do not reduce emissions directly but induce entities or individuals to change their behaviour. It is difficult to identify what will be measured and reported for such a NAMA, other than the emission inventory data at national or sectoral level. Therefore, it has been suggested that in some cases, instead of focusing only on emissions, MRV for policies and measures may also include other relevant indicators, such as fuel price levels, tax levels and enforcement activities.[47] Reporting could include a description of methodologies, project boundaries, baselines and the use of emissions factors. Table 17 provides examples of the possible data requirements to design and measure sectoral NAMAs.

Table 17: Example of possible indicators for various NAMAs

Sectoral NAMAs	Absolute emissions limits	Intensity targets	Technology penetration target
Industrial sector			
Retrofit coal fired industrial boilers	Energy efficiency of boilers. Annual fuel consumption of boilers. Annual output of industries with retrofitted boilers.	Average energy consumption of new boilers. Average industrial output with retrofitted boilers.	Number of industries with retrofitted boilers. Capacity or type of new boilers.
Residual heat and pressure utilization in steel and aluminium industries.	Energy efficiency of industries. Annual fuel and/or electrical consumption in industries. Annual output of industries in the programme.	Average energy efficiency in industries before and after the programme.	Number of industries with utilization of heat and pressure. Energy savings reported by industries.
Buildings and residential sector			
Retrofit of electrical appliances in residential sector (refrigerators, lightning etc.)	Annual electricity consumption in buildings. Emissions factor for the grid or supply	Average annual electricity consumption in buildings.	Number of appliances or buildings in the programme.

[46] *Nationally appropriate mitigation actions: Key Issues For Consideration*, by Javier Blanco, Jose Garibaldi, Juan Pedro Searle & Dennis Tirpak, UNDP Environment & Energy Group climate policy series, August 2009.

[47] *Nationally appropriate mitigation actions: Key Issues For Consideration*, by Javier Blanco, Jose Garibaldi, Juan Pedro Searle & Dennis Tirpak, UNDP Environment & Energy Group climate policy series, August 2009.

	source.		
Energy saving design standards in new buildings	Annual electricity and/or fuel consumption in buildings. Emissions factor for the grid or supply source.	Average annual electricity consumption in buildings (with and without standards)	Number of buildings with new design standards implemented.
Transport sector			
New vehicle efficiency standards	Number of vehicles per type. Annual passengers or tons products transported, and distance of transportation per vehicle type. Fuel efficiency per vehicle type. Or fuel consumption of vehicles per type.	Number of vehicles per type. Fuel efficiency per vehicle type.	Number of vehicles with new efficiency standards. Total vehicles in sector/subsector.
Mass transport systems (MTS) development	Annual number of passengers transported by MTS. Distance travelled by MTS. Average fuel efficiency of MTS. Or Annual fuel or energy consumption of MTS.	Average fuel/energy efficiency of MTS compared with other transport modes. Average number of passengers transported by MT S and other modes.	Number and capacity of MTS developed.
Energy generation sector			
New investments in renewable energy generation sources.	Annual energy generated by type of source. Annual fuel consumption per type of source.	Capacity installed of each type of energy source. Country emission factor for each type of energy source.	Capacity of renewable energy generation sources. Total energy installed capacity.
Closure of small thermal generation enterprises and replacing with new generation projects.	Fuel consumption and generation of both closed thermal generation units and new projects.	Average fuel efficiency of closed generation units and new projects.	Number, type and capacity of closed thermal generation units and new projects.

Source: *Nationally appropriate mitigation actions: Key Issues For Consideration* , by Javier Blanco, Jose Garibaldi, Juan Pedro Searle & Dennis Tirpak, UNDP Environment & Energy Group climate policy series, August 2009.

On the basis of the analysis of NAMAs implemented to date, Ecofys suggests the following indicators additional to emission reductions to monitor the impact of a measure depending on the type of activity[48]:

Quantitative

- Technical: build units/capacity, number of vehicles etc.
- Financial: funds granted, investment triggered etc.
- Process: number of workshops conducted, study completed etc.

Qualitative

- Content: policy is defined and adopted, strategies are existing and comprehensive etc.
- Process: stakeholder processes in place etc.
- Institutions: responsible institutions appointed, new institutions created etc.

Table 18 below gives specific examples of indicators that could be used depending on the type of activity.

Table 18: Examples for indicators by type of activity

Type of activity	Example indicators
Data collection, studies, research	• Coverage of data sources (share in total). • Study results published.
Strategy development on national/regional and sectoral level	• Strategies are existing and comprehensive. • Stakeholder processes were in place to define strategy.
(Pilot-) Projects	• Number of projects. • Funding per project. • Built units / capacity, etc. • Number of visitors (for demonstration projects).
Definition, implementation and enforcement of regulation	• Regulation adopted by the government. • Implementing institutions named and/or created.
Capacity and institution building	• Number of workshops. • Number of participants (total, per workshop). • Participants from right target groups? • Information material published and distributed. • Institutions with clear profile (role and responsibility) established.
Provision of financial incentives	• Amount of funding provided. • Number of entities/projects that received funding. • Private investment triggered through activity.
Awareness raising/campaigns	• Information material published. • Number of activities (e.g. poster distribution, TV-adverts etc.)

Source: *Nationally Appropriate Mitigation Actions: Insights from example development*, Martina Jung, Marion Vieweg, Katja Eisbrenner, Niklas Höhne, Christian Ellermann, Sven Schimschar, Catharina Beyer, Ecofys, March 2010.

[48] Source: *Nationally Appropriate Mitigation Actions: Insights from example development*, Martina Jung, Marion Vieweg, Katja Eisbrenner, Niklas Höhne, Christian Ellermann, Sven Schimschar, Catharina Beyer, Ecofys, March 2010.

An important point to note is the need to clearly state in the LEDS and in the NAMA submission the intention of a country to use flexibility mechanisms (CDM, emission trading, joint implementation etc), and to keep transparent accounting of the movements of assigned amount units and emission reduction units (for Annex I countries) and of the certified emissions reductions (for non-Annex I countries) to avoid double counting of emission reductions. For example, if a country has established an emission reduction target under a NAMA, emission reductions achieved under an international offsetting mechanism should not count towards fulfilment of the national emission reduction target.

3. Identification of priority pilot projects

At the initial stage of implementation it might be useful to determine initial high priority pilot projects, which would serve as learning experiences and deliver results in the short-term. For countries intending to implement a limited set of NAMAs, pilot projects may encompass one of the NAMAs considered the highest priority.

The scope of the activity should be defined when selecting pilot actions to be directly supported by international climate finance. A NAMA can either have a broad scope (e.g. an emission baseline or target for an entire country) or be more narrowly defined as a sector-based or project type action (e.g. improved energy efficiency in the industrial sector, increase in forested area by certain amount or decreased deforestation, or measures for implementation of public transportation systems). NAMAs proposed under the Copenhagen Accord so far represent both broad and narrowly defined actions.

Pilot NAMAs can also encompass various types of action, including[49]:

- data collection, studies, research;
- strategy development at national/regional and sectoral level;
- pilot-projects;
- definition, implementation and enforcement of regulation;
- capacity and institution building;
- provision of financial incentives;
- awareness raising/campaigns.

When choosing the scope for pilot NAMAs, countries need to take into account their overall level of ambition and capacity to implement action in the relevant sector. A narrowly defined NAMA could be one part of a broader strategy, which could be proposed as a (unilateral and/or supported) NAMA. When a narrow approach to NAMAs is chosen, it is still important to put into the context of a wider LED strategy, plan or concept (as discussed in earlier chapters of this document) to ensure that actions are in line with national development priorities.

4. Submitting request for obtaining support

NAMAs seeking international support under the UNFCCC will be recorded in a registry along with relevant technology, finance and capacity-building support. Even though negotiations under the UNFCCC are still taking place, there seems to be consensus among parties on this point. The registry will record the NAMAs and support and facilitate the matching of

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[49] Source: *Nationally Appropriate Mitigation Actions: Insights from example development*, Martina Jung, Marion Vieweg, Katja Eisbrenner, Niklas Höhne, Christian Ellermann, Sven Schimschar, Catharina Beyer, Ecofys, March 2010.

support for proposed NAMAs by developing countries through the financial, capacity building and technology mechanisms and bilateral, regional and other multilateral sources of funding. It is suggested that proposals for supported NAMAs at the minimum should present:

- an estimate of all related incremental costs,
- indication of the type of support sought,
- an estimate of mitigation benefits (e.g. quantified emission reductions)
- the anticipated time frame for implementation.

Whether the support sought for specific NAMAs may also include support related to enhancing capacity for the design, preparation and implementation of such actions is currently being discussed.

Mitigation actions supported by international technology, financial, or capacity building support will be added to an appendix that lists NAMAs (at the moment announced NAMAs are being recorded in the Annex to the Copenhagen Accord). NAMAs enabled and supported by finance, technology and capacity-building will likely be subject to MRV at international level in accordance with guidelines to be adopted by the Conference of the Parties. Mitigation actions taken by Non-Annex I Parties on their own will be subject to their domestic MRV procedures and reported on every two years through national communications.

The current negotiating text under the UNFCCC suggests that as part of their national communications developing countries should prepare and submit to the Conference of the Parties the following elements biennially:

(a) national greenhouse gas inventories;
(b) status of implementation of mitigation actions and estimated emission reductions or removals achieved from implementation of those actions;
(c) methodologies used and assumptions made in quantifying emissions reductions or removals;
(d) information on receipt of finance, technology and capacity-building support;
(e) result of domestic verification of domestically funded autonomous actions.[50]

[50] Text to facilitate negotiations among Parties. Note by the Chair, 9 July 2010. FCCC/AWGLCA/2010/8.

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