Future Climate Change Policy in the Baltic States:
Looking beyond 2012

Workshop in Riga/Jurmala,
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Background Information

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1 Introduction

Under the UN Framework Convention on Climate Change (UNFCCC), agreed in 1992, developed countries aim to return individually or jointly to their 1990 levels of greenhouse gas emissions by 2000, with the goal of stabilising greenhouse gas concentrations in the atmosphere in order to avoid dangerous human interference with the climate system.

In recognition that greater reductions were needed to successfully stabilise greenhouse gas concentrations, in 1997 the international community agreed upon the Kyoto Protocol. The Kyoto Protocol aims for an overall reduction in emissions from developed country Parties to 5.2% below 1990 levels by 2008-2012 – the Protocol's "first commitment period." Since this agreement was reached, scientific assessments have shown that far greater reductions are needed to avoid dangerous climate change, and that there is little time to achieve these reductions.

Under Article 3.9 of the Kyoto Protocol, the COP/MOP is required to "initiate the consideration" of commitments for subsequent periods at least seven years before the end of the first commitment period. At the first meeting of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP 1), which took place in Montreal in December 2005, Kyoto Parties established an ad hoc open-ended working group of Parties to consider further commitments for Annex I Parties to the Protocol. This group will meet for the first time in May 2006. Parties to the Kyoto Protocol are invited to submit their views regarding further commitments to the UNFCCC Secretariat by 15 March 2006. The EU and other Parties submitted their views in March 2006.

Not all countries have the same capacity to participate effectively in the discussions and negotiations that will determine the shape of the international climate regime after 2012, given the extreme complexity of international climate change policies, and the diversity of national circumstances. Many countries may lack the human resources and the technical and administrative capacity to follow and address every detail of this process, even though the ultimate nature of the post-2012 regime may have far reaching economic consequences for these countries. Despite great differences between the New Member States of the EU (NMS), Acceding Countries (AC) and Candidate Countries (CC), there is wide agreement that these countries must strengthen their capacities to make their voices heard in the up-coming negotiations.

In this context, Ecologic - Institute for International and European Environmental Policy – is organising the workshop "Future Climate Change Policy in the Baltic States: Looking beyond 2012". The workshop is commissioned by the European Commission and is the second of a series of events. It is organised in co-operation with:

- the Institute for Sustainable Development (ISD), Warsaw,
- the Institute for Environmental Studies (IVM) at the Free University of Amsterdam,
- the Foundation for International Environmental Law and Development (FIELD), London,

- the German Institute for Economic Research (DIW), Berlin as well as a network of experts.

The workshop's aims to strengthen the capacity of the Baltic countries to prepare for and participate in the negotiations on future actions under the UNFCCC and Kyoto Protocol through

- fostering public debate on future climate change policy in these countries,
- structuring the complex discussions and providing background information,
- bringing together policy-makers and stakeholders, and
- strengthening and initiating networks between them.

After presenting some major aspects and starting points for discussion, this paper highlights the challenges posed by climate change and the most significant aspects of current and future EU climate change policies. The paper then analyses the economic opportunities and challenges of future climate change policies for the Baltic States. Finally, the paper puts forward key elements for consideration in negotiations on the post-2012 climate regime.

2 Starting points for discussion

Participants are invited to consider the following elements as starting points for discussions. There are many aspects to the negotiation of the post-2012 climate regime, and both the science and the political context are likely to evolve over the next few years. Hence this list is non-exhaustive, and intended merely to assist in framing discussions:

- Research gathered by the Intergovernmental Panel on Climate Change (IPCC) indicates that the Earth's average surface temperature will warm by 1.4–5.8°C by the year 2100, with potentially very severe consequences for the environment, economies and societies alike. All simulations suggest that temperature rise in the late 20th century can only be explained by man-made increases in greenhouse gas concentration. To avoid or mitigate these consequences, average temperature should not increase by more than 2°C above pre-industrial temperature, a target more likely to be achieved if GHG concentrations do not exceed 440 ppm CO_2-equivalent.
- To stabilise greenhouse gas (GHG) concentrations at 440 ppm CO_2-equivalent, scientists agree that further cuts in GHG emissions are required. Despite various uncertainties, the European Council has stated that for the group of developed countries, reduction pathways in the order of 15-30% by 2020 should be considered. For the long term, the European Parliament has suggested a reduction target of 60-80 % by 2050.
- The Baltic States are currently on track to meet their reduction targets under the Kyoto-Protocol. However, the bulk of these emission reductions were achieved in the first half of the 1990s. Projections of future emissions indicate that an upward trend in GHG emissions up to 2020 in Latvia and Lithuania and a stabilisation of net GHG emissions in Estonia at the level of the year 2000 is likely. In light of the reductions required to stabilise global GHG concentrations in the atmosphere - in the range of 15-30% by 2020 and of 60-80% by 2050 respectively – the Baltic States as well as the other NMS and AC will have to prepare for further GHG reductions. A EU burden sharing agreement after 2012 will be discussed in this context.
- Although the magnitude, timing and regional distribution of the impacts of global warming is still very uncertain, it is likely that global warming above 2°C will have increasingly dangerous effects, due to an increases in tropical storms, floods and monsoon variability, increases in drought frequency and heat waves, shifts in vegetation zones and loss of biodiversity, causing irreversible damages. Because of their long coastline and extensive low-lying coastal areas, sea-level rise could adversely affect the Baltic countries. While agriculture in Northern Europe, including the Baltic States, could potentially benefit from increasing CO_2 concentrations and rising temperatures, vulnerable ecosystems, such as sandy beaches and coastal wetlands might suffer considerable loss of species and habitats.

- In the light of recent sharp increases and fluctuations in energy prices, improved energy efficiency and increasing the share of renewable energies in the domestic energy mix can provide a boost to the competitiveness of Baltic economies. It is now well-established that measures that reduce GHG emissions do not necessarily entail an impediment to economic growth. Instead, these measures can lead to less fossil-fuel dependent economies, with greater energy security, decreased exposure to volatile energy prices and multiple sustainable development and health co-benefits.
- Key priorities in the short term will be to expand and strengthen resources allocated to energy efficiency improvements in households and industries and to remove institutional barriers to such improvements. The uptake of cleaner technologies, as well as the adoption of policies promoting their wider use, will play a key role in shifting to less GHG-intensive pathways.
- The Baltic States have great capacity to reduce CO_2 emissions in a cost-effective manner. Energy efficiency in the Baltic States - despite recent progress - is still considerably lower than in the EU-15 and economic restructuring provides a variety of opportunities to take advantage of investment cycles. In this context, the involvement of business actors will be essential.
- Early negotiations on post-2012 commitments will be difficult and complex. Emerging issues within these negotiations, such as technological change and the inclusion of additional sectors (international transport, deforestation), may present a great challenge for the Baltic States, given the financial, technical, and human resources needed to participate fully and effectively in these discussions.
- At the same time, the Baltic States stand to benefit greatly from investments in Joint Implementation projects under the Kyoto Protocol, and will wish to ensure that the post-2012 framework continues to provide market incentives for investments in GHG mitigation projects and clean energy projects in the Baltic States.
- The complexity of the post-2012 negotiations will require dedicated human and technical resources from NMS, AC and CC. The involvement of a range of stakeholders from government, key industrial sectors and civil society will be essential over the next few years, in order to achieve the most effective and most equitable outcomes at both the international and national levels.

Content

1 INTRODUCTION 2

2 STARTING POINTS FOR DISCUSSION 4

3 EFFECTS OF CLIMATE CHANGE IN THE BALTIC STATES AND BEYOND 7

3.1 Human-induced aspects of climate change 7

3.2 What is dangerous climate change? 7

3.3 Summary 10

4 CLIMATE CHANGE POLICY IN THE EU AND THE BALTIC STATES 10

4.1 Status of commitments in the EU 10

4.2 EU climate policy: history, instruments and the way forward 11

4.3 The situation of the Baltic States: GHG emission, sources, and trends 14

4.4 Commitments of the Baltic States under the UNFCCC and Kyoto Protocol 16

5 ANALYSIS OF THE ECONOMIC OPPORTUNITIES AND CHALLENGES FOR THE BALTIC STATES 17

5.1 Global benefits and costs of climate change policies 17

5.2 Climate Relevant Aspects of the Baltic Economies 17

5.3 Impacts of Further Action on Industrial Competitiveness 21

5.4 Kyoto mechanisms 21

5.5 Options for the Way Forward for the Baltic States 22

6 INTERNATIONAL NEGOTIATIONS ON POST-2012 COMMITMENTS 22

6.1 Status of the international debate following COP 11 22

6.2 Most significant challenges faced by the UNFCCC and Kyoto Protocol 23

6.3 What options are under discussion? 24

6.4 Technology development and transfer to support emission reductions 26

6.5 International transport: aviation and shipping 27

6.6 Initial positions of Parties and stakeholders in the Post-2012 debate 29

6.7 Issues to be resolved in the international process 30

3 Effects of Climate Change in the Baltic States and Beyond

3.1 Human-induced aspects of climate change

Global average temperature has increased in the last hundred years by about 0.7°C, the European average temperature by 0.95°C.[1] Globally, the 10 warmest years on record all occurred after 1991. Though the extent of the anthropogenic greenhouse effect is uncertain, the Intergovernmental Panel on Climate Change (IPCC) has concluded that the Earth on average will warm by 1.4–5.8°C by the year 2100, with temperatures in Europe expected to rise by 2.0–6.3°C. The European Commission has acknowledged that climate change is already happening.[2]

All simulations suggest that temperature rise in the late 20th century can only be explained by man-made increases in greenhouse gas concentration.[3] According to the IPCC, "the balance of evidence suggests that there is a discernible human influence on global climate." The concentration of CO_2 in the lower atmosphere has increased from its pre-industrial concentration of 280 ppm (parts per million) to more than 380 ppm recently, the highest level in the last 500,000 years.

3.2 What is dangerous climate change?

Article 2 of UNFCCC provides that "the ultimate objective of this Convention […] is to achieve […] stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The EU has chosen an official policy target of limiting global warming to 2ºC above pre-industrial temperatures. Any global warming above 2°C is likely to be increasingly dangerous, due to increases in tropical storms, floods and monsoon variability, increases in drought frequency and heat waves, shifts in vegetation zones and loss of biodiversity, causing irreversible damages.[4] As the impact of these negative consequences will be most severe in the Southern hemisphere, developing countries are likely to be particularly affected, aggravated by their insufficient capacities to respond and adapt to climate change.

If, hypothetically, all human-induced emissions were stopped immediately today, temperatures would still rise by about 0.7°C by the year 2100. If future GHG concentrations can be kept at about 440 ppm CO_2-equivalent (i.e. CO_2 only below 400 ppm), the probability of keeping temperature increases below 2°C by 2100 is more than 66% . If no climate policy

1 Cf. European Environmental Agency, Impacts of Europe's changing climate. 2004, Copenhagen.

2 See "Winning the Battle Against Global Climate Change", COM(2005) 35 final, 9.2.2005

3 Cf. Jones, P.D. and M.E. Mann, Climate Over Past Millennia. Reviews of Geophysics, 2004. 42(RG2002, doi: 10.1029/2003RG000143); Mann, M.E., et al., On Past Temperatures and Anomalous Late 20th Century Warmth. Eos, 2003. 84: p. 256-258.

4 EEA Draft Technical Report no. 7/2005: Vulnerability and Adaptation to Climate Change in Europe

measures are implemented, a further increase to 650–1215 ppm CO_2-equivalent is projected[5], diminishing the chance of meeting the 2°C target drastically.

3.2.1 Precipitation and temperature

Annual precipitation trends in Europe for the period 1900–2000 show a contrasting picture between northern Europe (10–40% wetter) and southern Europe (up to 20% drier). Changes have been greatest in winter in most parts of Europe. These changes are projected to continue in the future. Cold winters are predicted to disappear almost entirely by 2080 and hot summers may become much more frequent.[6] With regard to regional precipitation patterns, there is still considerable uncertainty between different climate models. For the Baltic countries, some climate models calculate almost no change in precipitation, while others suggest up to 30% more rain in the 2080s.[7]

3.2.2 Extreme events

In addition, extreme weather events, such as droughts, heat waves and floods have increased, while cold extremes (frost days) have decreased. The European summer of 2003 was extremely hot and dry.[8] In Europe, 64% of all catastrophic events since 1980 have been directly attributable to climate extremes; 79% of economic losses caused by catastrophic events result from these climate-related events. In the past decade, 1,940 people have died during floods and 417,000 have been made homeless. In 2002, 15 major floods occurred in Austria, the Czech Republic, Germany, Hungary and the Russian Federation. These floods affected one million people and killed approximately 250 persons. With temperatures rising in the future, the frequency and severity of floods and droughts are expected to increase.

3.2.3 Marine environment: Sea surface temperature and sea level rise

The main effects on the marine system are likely to be caused by an increase in sea surface temperature, especially in isolated basins. The Baltic and North Seas and the western Mediterranean have shown a warming of about 0.5°C over the past 15 years. In the future, fish catches could deteriorate due to changing water temperatures, declining fish diversity and higher acidity[9], with severe consequences for local coastal economies.

Sea levels around Europe increased by between 0.8 mm/year (Brest/France and Newlyn/UK) and 3.0 mm/year (Narvik/Norway) in the past century. The Eastern Baltic Sea rose by above the European average, with about 2 mm/year. The projected rate of sea level rise between 1990 and 2100 is 2.2 to 4.4 times higher than the rate in the twentieth century. This could

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5 Hare, B. and M. Meinshausen, How much warming are we committed to and how much can be avoided? - PIK Report No. 93. 2004, Potsdam Institute for Climate Impact Research: Potsdam.

6 Cf. European Environmental Agency, Impacts of Europe's changing climate. 2004, Copenhagen.

7 Schroeter, D., et al., Ecosystem service supply and vulnerability to global change in Europe. Science 2005. 310, pp. 1333-1337. Supporting online material, Figure S2.

8 Schar, C. and G. Jendritzky, Climate change: Hot news from summer 2003. Nature, 2004. 432(7017): p. 559-560.

9 Ibid. and http://www.climate.org/topics/climate/ocean_acidity.shtml; http://www.stabilisation2005.com/impacts/impacts_ecosystems.pdf

lead to increased flooding of coastal areas, erosion of sandy beaches and the destruction of harbour infrastructure.

Due to their long coastline and extensive low-lying coastal areas, sea-level rise could adversely affect the Baltic countries. As for Estonia[10], which is illustrative of the entire region, a number of valuable natural ecosystems will be in danger, in particular sandy beaches with high recreational value. According to an extreme scenario, the estimated relative sea-level rise by the year 2100 could vary from 0.9 m at the south-western to 0.7 m on the north-western coast of Estonia. The longest coastline section recession of 6.4 km would occur on Estonia's western coast where extensive areas of reed bed and flooded meadows would relocate land-wards or disappear. The greatest threat to the Gulf of Finland and the whole Baltic Sea is posed by the dumping site of the now out of use uranium enrichment plant in Sillamae which is situated very close to the coastline and at risk of being damaged by storms.

3.2.4 Vegetation and agriculture

The average annual growing season in Europe was lengthened by about 10 days between 1962 and 1995, and is projected to increase further in the future. The slight positive effects of temperature increase on vegetation growth are likely to be more than outweighed by an increased risk of water shortage. While agriculture in Northern Europe, including the Baltic States, is expected to potentially benefit from increasing CO_2 concentrations and rising temperatures, in most parts of Central and South-eastern Europe, agriculture will be threatened by increased water stress. During the heat wave in 2003, cereal production in the EU-15 member states dropped by about 10%, while in the Eastern European Accession Countries it dropped on average by about 20%. In Bulgaria, Croatia, Hungary, Slovakia and Slovenia, cereal production even dropped by more than 25%. Bad harvests could become more common due to more frequent extreme weather events as well as a rise in pests and diseases, possibly entailing a wider use of pesticides.[11]

3.2.5 Biodiversity

A large number of species might become extinct under future climate change. Due to non-climate-related factors, such as the fragmentation of habitats, extinction rates are likely to increase. These factors will limit the migration capabilities of species and their adaptation possibilities to respond to climate change. Northward movement of plant species (induced by a warmer climate) has probably increased species diversity in north-western Europe, but climate change has caused a decline in biodiversity in Southern and South-eastern parts of Europe.[12] Particularly vulnerable ecosystems, such as sandy beaches and coastal wetlands might suffer considerable loss of species and habitats.[13]

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10 Kont et al. (2003): GLOBAL AND PLANETARY CHANGE 36 (1-2)

11 Ibid.

12 Ibid.

13 EEA Draft Technical Report no. 7/2005: Vulnerability and Adaptation to Climate Change in Europe

3.3 Summary

To sum up, as was recently stated by the European Environment Agency (EEA), "South-eastern Europe, the Mediterranean and central European regions are the most vulnerable to climate change. Here, considerable adverse impacts are projected to occur on natural and human systems that are already under pressure from changes in land use, for example. Northern and some western regions of Europe, on the other hand, may experience beneficial impacts, particularly within agriculture, for some period of time."[14]

However, these projections suffer from a high degree of uncertainty. Projections for small regions, such as the Baltic region, are particular uncertain. As some of the possible effects could have very severe consequences, especially sea-level rise and floods, the precautionary principle calls for action, and the Baltic countries have specific adaptation needs, which could include

- improving protection of coastal areas and ecosystems from rising sea levels;
- reducing dependence of the local economy on fisheries, as fish catches may decline;
- establishing preventive measures against river floodings due to increased precipitation and possible flash floods;
- developing new agricultural crop breeds, which are more tolerant to extreme events, like droughts; and
- keeping a sufficient area share under nature conservation, in order to provide favourable conditions and flexibility for maintaining biodiversity.

4 Climate Change policy in the EU and the Baltic States

4.1 Status of commitments in the EU

Under the Kyoto Protocol, the EU committed itself to reducing greenhouse gas (GHG) emissions by an overall target of 8% below 1990 levels by 2008-2012, the first commitment period. This target only covers the 15 Member States that comprised the EU at the time when the Protocol was agreed. The EU made use of Article 4 of the Kyoto Protocol, which allows groups of countries to accept a common emission target and to redistribute that target internally ('bubbling'). Table 1 below summarises the different GHG emissions reduction targets of the old EU Member States and their implementation status.[15] Table 2 provides similar information for the Baltic States.

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[14] Ibid.

[15] Data source: Annual European Community greenhouse gas inventory 1990-2003 and inventory report 2005, available at: http://reports.eea.eu.int/technical_report_2005_4/en/EC_GHG_Inventory_report_2005.pdf. The base year for the 'old' Member States is 1990, except for the base year 1995 chosen by some States for fluorinated gases.

Table 1. Emission Reduction Commitments of EU-15 under the Kyoto Protocol

	EU-15	*Austria*	*Belgium*	*Denmark*	*Finland*	*France*	*Germany*	*Greece*
Target	-8%	-13%	-7,5%	-21%	0%	0%	-21%	+25%
2003	-1,7%	+16,6%	+0,6%	+6,3%	+21,5%	-1,9%	-18,5%	+23,2%

	Ireland	*Italy*	*Luxem-bourg*	*Nether-lands*	*Portugal*	*Spain*	*Sweden*	*UK*
Target	+13%	-6,5%	-28%	-6%	+27%	+15%	+4%	-12,5%
2003	+25,2%	+11,6%	-11,5%	+0,8%	+36,7%	+40,6%	-2,4%	-13,3%

4.2 EU climate policy: history, instruments and the way forward

4.2.1 Historical and current policies and measures

The European Commission first took initiatives to tackle climate change in 1991, when it issued a strategy to limit CO_2 emissions in different sectors. Since then, a wide set of policies and measures have been adopted, aimed at reducing greenhouse gas emissions. These include, for example:

- the **Greenhouse Gas Emission Allowance Trading Scheme** (EU ETS), which limits the total carbon dioxide emissions from almost 12.000 installations across the 25 EU Member States [16],
- the **Linking Directive**[17]**,** which connects the EU ETS with the Kyoto Protocol's project-based Joint Implementation (JI) and Clean Development Mechanism (CDM),
- the **"Renewables Directive"**[18]**,** which sets the indicative target to reach a 22% share of electricity from renewable sources by 2010 (with specific indicative targets for each Member State),
- the **Directive on the promotion of cogeneration**[19], which requires Member States to use their potential for high efficiency cogeneration,
- a green paper on **energy efficiency**[20], according to which the EU should save 20% of its energy consumption by 2020,

16 Directive on Establishing a Scheme for Greenhouse Gas Emissions Allowance Trading within the Community and Amending Council Directive 96/61/EC; OJ L275.

17 Directive amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms 2004/101/EC; OJ L338/18.

18 Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market; OJ L 283/33.

19 Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC; JO L 052, 21/02/2004.

20 Directive 2004/8/EC of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC

- a draft **end-use efficiency directive**[21]**,** which proposes mandatory targets for annual energy savings for the period of 2006-2012,
- the **Framework directive on the eco-design of energy-using products**,[22] which sets conditions and criteria for requirements related to environmentally relevant product characteristics, such as energy consumption,
- a proposal for a **regulation to reduce emissions of fluorinated gases**[23] (F-gases).

4.2.2 Perspectives of EU climate change policies

In March 2005, the European Council stated that reduction pathways for the group of developed countries in the order of 15-30% by 2020, from the baseline set out in the Kyoto Protocol (typically 1990 emission levels), should be considered. EU leaders pointed out that this reduction range "will have to be viewed in the light of future work on how the objective can be achieved, including the cost-benefit aspect". The Council welcomed the **Commission Communication** "Winning the Battle Against Global Climate Change" of 9 February 2005[24], which outlines the following core elements of the EU's future climate change policy and negotiation strategy:

- To **broaden participation**, the Commission recommends the adoption of a negotiation strategy persuading the major world emitters to comply with a binding system. In order to accelerate progress at the global level, the installation of a small discussion group including EU, US, Canada, Russia, Japan, China and India as the largest emitters is an option.

- **More policy areas should be included**, i.e. international action must be enlarged to cover all greenhouse gases and sectors, with a particular focus on emissions from aviation and maritime transport, as well as consideration of how to combat deforestation, an important source of emissions.

- Climate-friendly, **low-emission technologies must be promoted** and related research needs to be enhanced.

- **Flexible, market- and project-based mechanisms**, such as the ETS and JI/CDM should be maintained in the post-2012 system. Targets and timetables are efficient instruments, but the international negotiations should also link climate change issues with technology innovation, energy efficiency promotion, the development of low-carbon sources of energy and development policy.

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21 Proposal for a Directive of the European Parliament and of the Council on energy end-use efficiency and energy services, COM(2003) 739.

22 Directive 2005/32/EC on the eco-design of Energy-using Products

23 Proposal for a Regulation of the European Parliament and of the Council on certain fluorinated greenhouse gases; 7.3.2005, COM (2003) 492, 2003/0189/COD.

24 "Winning the Battle Against Global Climate Change", COM(2005) 35 final, 9.2.2005.

- Finally, **adaptation policies** must be included, and financial support should be provided for the adaptation efforts of the poorest and worst-affected countries.

The **European Parliament** welcomed the conclusions by the European Council, in particular the 15–30 % target. The Parliament insisted that emission targets for the long-term are needed and suggested a reduction target of 60-80 % by 2050.[25]

The **Environment Council on 9 March 2006** noted that achieving the 2°C objective will require global greenhouse gas emissions to peak within two decades, followed by substantial reductions in the order of at least 15% and perhaps by as much as 50% by 2050 compared to 1990 levels. The Council also emphasised the need to ensure that there is no gap between the first and second commitment periods and that further action must form part of a global effort by all parties (in accordance with the principle of common but differentiated responsibilities and respective capabilities).

The EU reiterated this position in its **submission to the UNFCCC secretariat** on further action on 22 March 2006. In this submission, the EU expresses its concern that delaying such a reductions would necessitate more drastic cuts in the future, increase the cost and extent of adaptation measures and lead to serious damage from climate change impacts. Concerning the process according to Article 3.9 of the Kyoto Protocol, the EU suggest, on the basis of thorough scientific and socio-economic analysis, addressing specific issues, such as

- Whether the discussion should just concentrate on the next commitment period, or take a longer term view? What should the length of future commitment periods be?
- What will the provisions for the use of flexible mechanisms be? How large will the scope of the carbon market be?
- How will sinks be treated under future commitment period(s)?
- Should there be any changes to which sectors and sources of emissions are covered (e.g. international bunker fuels, giving priority to those that contribute the most to or exhibit increasing rates of GHG emissions)?

For the open-ended ad hoc working group, the EU suggests concentrating during its first meeting on two tasks:

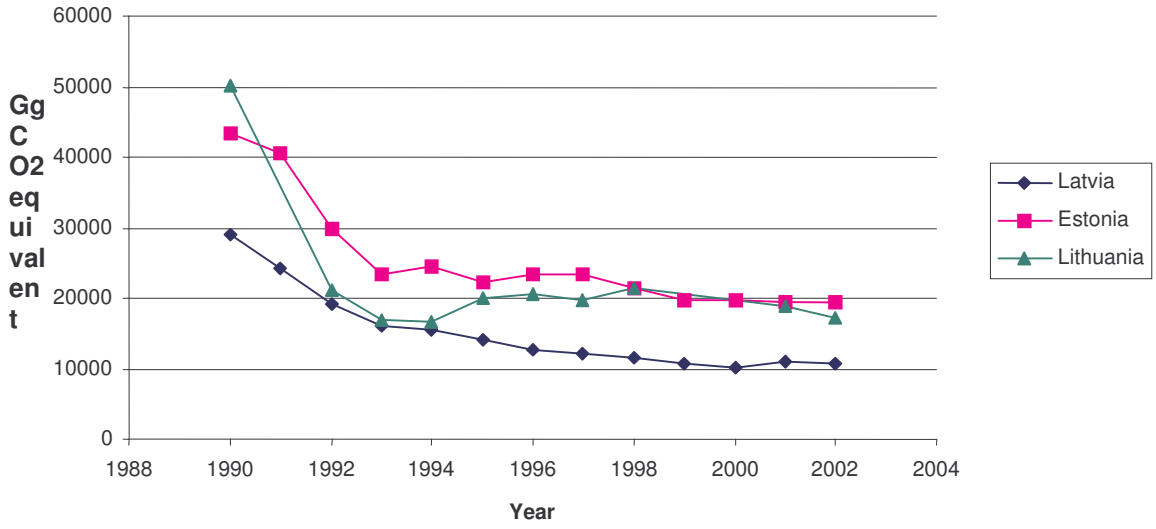
- providing an open exchange of views on the expectations of the Parties for the work of the group and
- agreeing on elements for a programme of work, including inter alia the issues to be considered by the group.

[25] European Parliament Resolution on the Communication from the Commission “Winning the Battle Against Global Climate Change” (2005/2049 (INI)) of 17 November 2005

4.3 The situation of the Baltic States: GHG emission, sources, and trends

The Baltic States experienced deep social, economic and environmental changes after the collapse of the communist block. A distinct drop in CO_2 emissions accompanied these changes. Significantly, most of these emission reductions came about in the first half of the 1990s, but emissions have more or less stabilised since the mid-1990s (see Figure 1). The current flat trend in GHG emissions is the result of a growing economy (since the mid-1990s) combined with a large increase in energy efficiency, which rose by 3% per year from 1990 to 2002.

Figure 1. Emissions of GHGs in the Baltic States (Gg CO_2-equivalent)



Source: UNFCCC, Greenhouse Gases Database

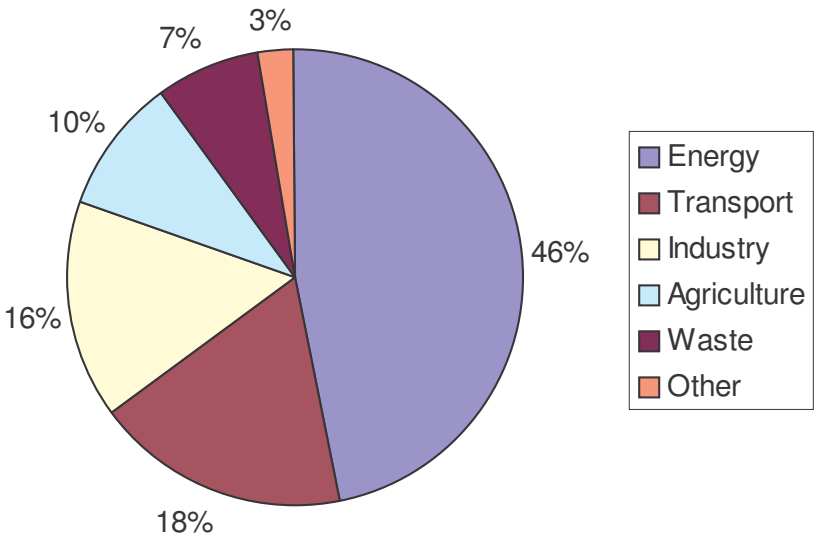
Projections of future energy use and emissions point towards an upward trend in GHG emissions until 2020 in Latvia and Lithuania and a stabilisation of net GHG emissions in Estonia at the level of the year 2000. The projections for Latvia and Lithuania, assume that GDP growth will outpace increases in energy efficiency. The carbon-intensity of Lithuania's energy use will depend on whether or not it will develop new nuclear capacity after the planned closure of its current nuclear plant in 2009.[26]

In terms of gases, CO_2 emissions form the largest share of GHGs in the Baltic States, followed by methane and nitrous oxides. The major source of CO_2 emissions is fuel combustion, followed by emissions from industrial processes such as lime and cement production. Sectors that contribute most to the emissions of GHGs in the Baltic States are the energy sector (46%), transport (18%), manufacturing (16%), agriculture (10%), and waste (7%) (see Figure 2).

[26] From: Third National Communications from Latvia (2001) and Estonia (2001), and Second National Communication from Lithuania (2003).

The Baltic States also contain important sinks for CO_2 emissions. Official figures indicate that sinks in the Baltic States sequester half of their gross CO_2 emissions (or 40% of their GHG emissions).

Figure 2. Sector shares in GHG emissions in Baltic States (2002).

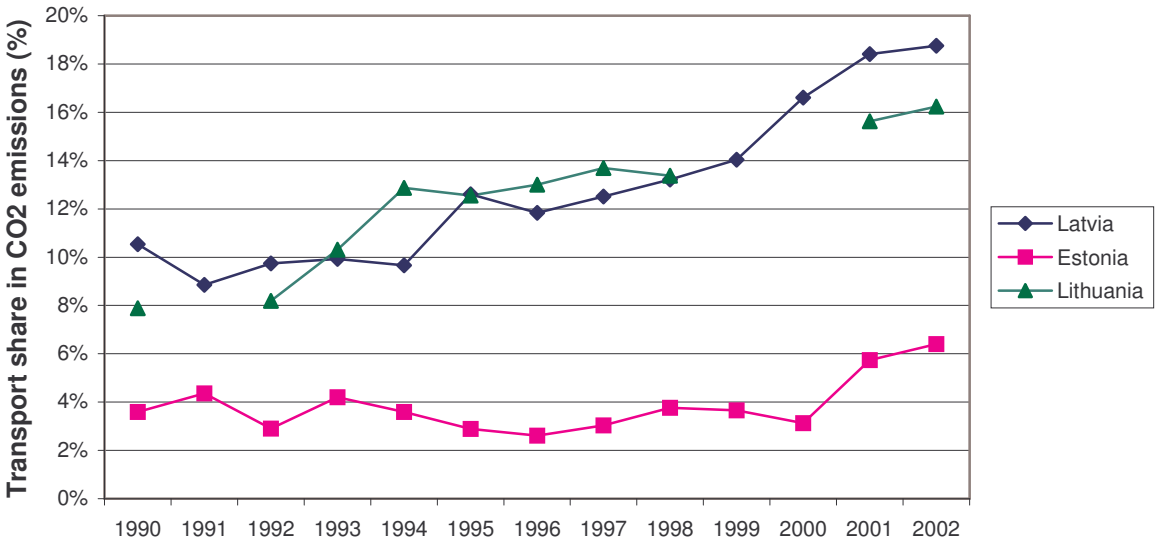


Source: UNFCCC, Greenhouse Gases Database

One of the fastest rising sources of CO_2 emissions in all European countries is (road) transport. Figure 3 presents data on the shares of transport in total CO_2 emissions in the three Baltic States. The share of transport in CO_2 emissions has increased steadily in Latvia and Lithuania from about 8-11% in 1990 to 16-19% in 2002. The share of transport in CO_2 emissions in Estonia has remained stable in the 1990s (at around 3-4 %), but has increased since then.[27]

[27] Transport-related CO_2 emissions per inhabitant are similar in the Baltic States, but Estonia's economy is the most CO_2-intensive. Hence, its lower share of transport-related CO_2 emissions in total emissions.

Figure 3. Share of transport-related CO_2 emissions in Baltic States (1990-2002)



Source: UNFCCC, Greenhouse Gases Database

4.4 Commitments of the Baltic States under the UNFCCC and Kyoto Protocol

At COP 3 in Kyoto, the Baltic States adopted the 8% reduction commitment of the EU. Commitments of the Baltic States under the Kyoto Protocol as well as recent emission data are summarised in table 2 below[28].

Table 2. Commitments of NMS, AC and CC under the Kyoto Protocol

Country	base year emissions (Mio. tons)	KP target (%)	KP target (million tons)	2003 emissions (million tons)	change base year – 2003 (%)
Estonia	43.5	- 8%	40.0	21.4	- 50.8%
Latvia	25.4	- 8%	23.4	10.5	- 58.5%
Lithuania	50.9	- 8%	46.8	17.2	- 66.2%

[28] Table 2: Commitments of NMS/AC under Kyoto Protocol: or the most recent available data: Romania – 2001, Bulgaria, Croatia – 2002; GHG emissions in CO_2 equivalents (excl. LUCF); source EEA, Annual European Community greenhouse gas inventory 1990-2003 and inventory report 2005

5 Analysis of the economic opportunities and challenges for the Baltic States

5.1 Global benefits and costs of climate change policies

Unrestricted climate change may result in a broad array of mostly negative impacts on the environment, human well-being and the economy. However, the magnitude, timing and regional distribution of impacts is still very uncertain. This makes a precise cost-benefit analysis difficult. Nevertheless, most studies agree that the marginal damages resulting from greenhouse gas emissions will increase over time. Damage estimates suggest that current mitigation measures with social costs below € 20 per ton of CO_2 eq. (or even higher) may already be justified from a global economic efficiency point of view. Over time, more expensive mitigation measures would be justified.[29]

Climate change itself may impede growth and development. This aspect is most pressing for poor countries but also for those countries that are particularly vulnerable for geographic reasons, for example because of low-lying coastal areas. For countries that actively develop adaptation and mitigation policies, the flexibility in restructuring the economy is crucial. Especially in the reforming Baltic States the opportunity to consider climate change policies in a phase of major economic restructuring is a big advantage. For the minimisation of mitigation and adaptation costs, swift adjustment of policies is paramount, including instruments for energy production and consumption, increased energy efficiency and co-ordination of action among countries. These changes could entail increased (energy) efficiency of industries, reduced dependency on foreign sources of energy, reduced air pollution, job creation and additional investment opportunities.

5.2 Climate Relevant Aspects of the Baltic Economies

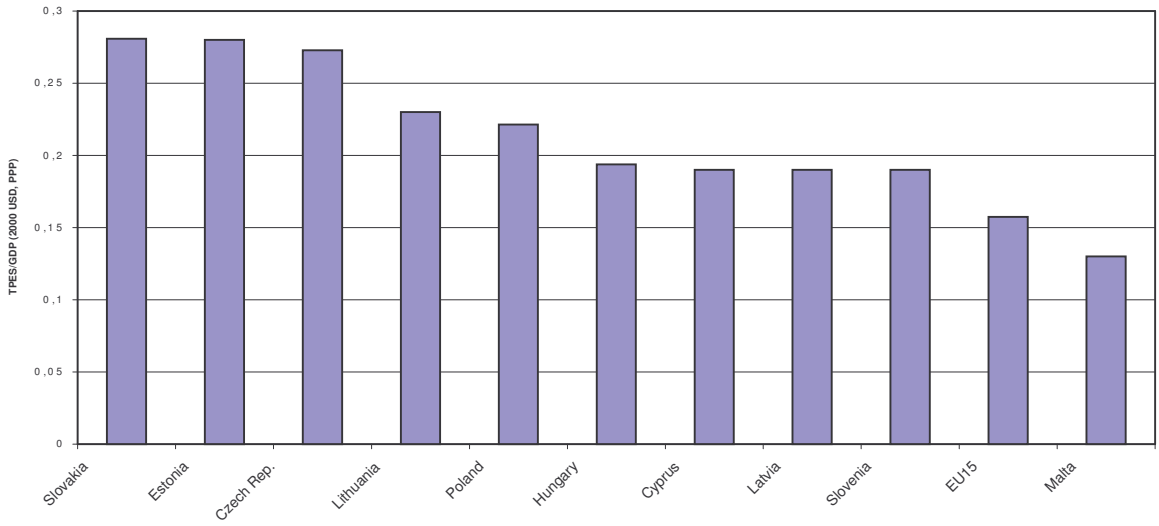
All Baltic states experienced a decrease in agricultural and industrial production compared to overall gross value added between 1990 and 2002. Instead, the countries increased their share of services sectors' output in overall Gross Domestic Product (GDP). Sectors with major relevance for climate change policies are the energy and the transport sector as mentioned in section 4.3, followed by manufacturing, agriculture and waste.

[29] See, for example, P. Watkiss (2005), The Social Cost of Carbon (SCC) Review – Methodological Approaches for Using SCC Estimates in Policy Assessment, AEA Technology Environment, UK. From an extensive review of literature, Watkiss suggests a central SCC value of € 22 per ton of CO_2 for emissions in the year 2000, with a range between € 14 and € 51 per ton of CO_2. The central SCC value and the upper and lower values of the range increase by approximately 2.9 % per year. Hence, the central SCC value of emissions in the year 2010 would be around € 25 per ton of CO_2, increasing to € 82 per ton of CO_2 in the year 2050.

5.2.1 Climate Relevant Aspects in the Energy Sector

Primary energy consumption decreased considerably in all NMS (around 20% from 1990 to 2002). The Baltic States decreased their energy consumption to an even higher extent. In Estonia and Lithuania, primary energy consumption decreased at double speed compared to the economic growth. This decoupling of economic performance and energy use is based on the strong improvements of energy efficiency, which rose by 3% per year from 1990 to 2002. Their energy input per unit of GDP, though, is still higher than in the EU-15, as can be seen from the figure below.

Figure 4: Energy Intensity of GDP in NMS, AC, CC in 2003 compared to EU-15



Source: IEA, calculations of DIW Berlin. TPES = Total Primary Energy Supply

One characteristic of the Baltic region is that it is a key transit location for Russian oil exports (for roughly 16% of Russian crude oil exports in 2004). Their own production and consumption is structured as follows:

- All three countries are net oil importers, depending on Russia (90% of supply). Regional domestic production totalled roughly 20,000 barrels per day (bbl/d) with Lithuania producing around 14,000 bbl/d and Estonia with 6,000 bbl/d. Latvia does not produce any oil domestically.
- All Baltic states also depend on gas imports (202 billion cubic feet (bcf) in 2001). Most of it coming from Russia (Gazprom).
- Estonia and Lithuania are net electricity exporters, mainly to Latvia and to northwest Russia. In 2004, Estonia generated 8.9 billion kilowatts (bkwh), most of it stemming from the Narva oil shale-fired power plants. The state electricity company Eesti Energia, was proposed for an initial public offering (IPO) in March 2005. Lithuania generated 19.8 bkwh in 2004, stemming mainly from the Soviet-era Ignalina nuclear power plant, which is supposed to be closed down in two phases between 2005 and 2009. This will probably not end the nuclear production. Lithuania has agreed to the shutdown of its nuclear

facilities due to the strong safety concerns of the EU and with over $1.5 billion in foreign aid. Nevertheless, the country has indicated its interest in developing a new nuclear facility. The proposal has received support from Estonia, which decrease its environmentally hazardous oil shale-fired electricity generation over time under EU environmental policies and is in need of other energy sources. Importing nuclear electricity from Lithuania would then serve as an alternative to imports of natural gas from Russia.

- Latvia is the region's only net electricity importer, buying from Estonia and Lithuania as well as from Russia. The country has some hydroelectric facilities, but in a dry year is estimated to be only 60% self-sufficient. Latvia is working with Estonia and Finland to develop the "Estlink" project, a 43-mile underwater cable linking the Baltic states to the Scandinavian and Nordic power grids. "Estlink" is designed to reduce regional dependency on Russia, and is expected to be completed by late 2006. ABB was selected in February 2005 to design, build, and lay, the high-voltage and undersea cable.

The net GHG emission projections in Estonia following its third Ministerial report to the UNFCCC, depend mainly on the potential technological change in shale oil combustion. Accordingly, scenarios differ considerably and if measures are implemented, the trend would be a flat and slightly decreasing one. Projections for Latvia show a slight upward trend in GHG emissions due to expected prosperity in the energy-intensive sectors. In Lithuania, the projection of GHG emissions depends mainly on the plans to close the Ingnalina Nuclear Power Plant. Natural gas consumption is the expected substitution. Together with an expected revival of the industrial sectors, this could contribute to a significant increase in emissions in the near future. In all Baltic States, therefore, there is already some pressure to take measures against a permanent rise in GHG emissions in the first commitment period in order to ensure effective long-term climate policies.

5.2.2 Climate Relevant Trends in the Transport Sector

The transport sector currently is the sector in which energy use is climbing fastest worldwide, mainly with respect to oil use. This also holds true for the Baltic States. In the light of recent economic growth and increased emissions from transport, it is projected that NMS and AC may repeat the experience of Greece, Ireland, Portugal and Spain in which high economic growth brings with it strong growth in transport and hence in greenhouse gas emissions from transport.

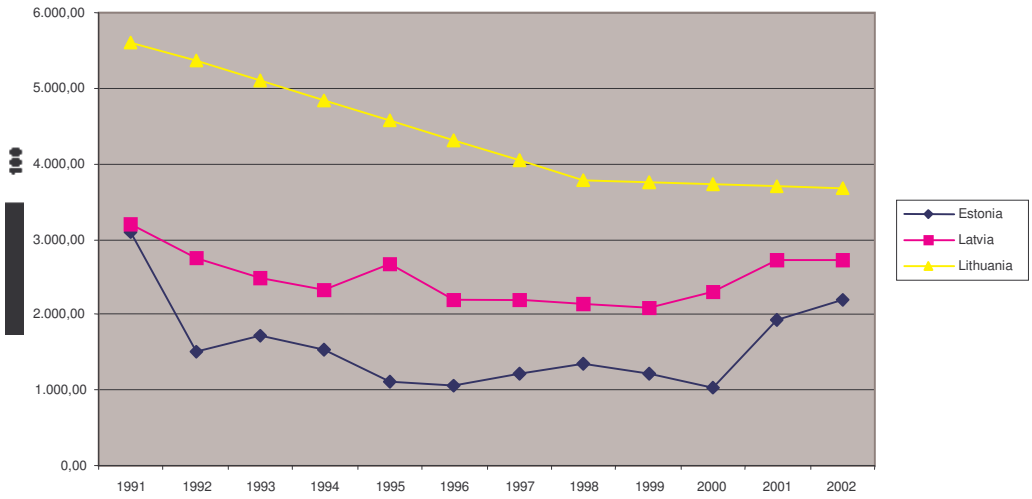
The transport sector has experienced major restructuring during the last decade, departing from a system characterised by limited private mobility, extensive use of subsidised public transportation, obsolete infrastructures and inefficient use of freight capacity. Private car ownership increased in all NMS and public transport declined. While rail freight dominated until 1999, currently the use of trucks to transport freight is increasing. Thus, these two trends determine energy demand for transportation. Road transportation is facilitated by EU financing of major European corridors. For freight transport, the Baltic States' trade relations is important. Close links already exist with the Scandinavian countries which are served by

ferryboats (including truck and rail wagon transportation). But the links are also strong with neighbouring Eastern European countries and here the major transport modes are likely to remain road and rail.

Any attempt to reduce the GHG emissions of the transport sector needs to rely on a reduction of fossil fuel usage, e.g. by increased energy efficiency, a shift in transport modes towards public transport and new technologies relying on renewable fuels. Last but not least, the dynamics in this sector, which is crucial for the integration and growth in the NMS and ACs, need strong policy guidance towards a sustainable mobility concept.

The shift of sectoral activities towards services could yield a certain degree of decoupling between freight transport activities and GDP growth.

Figure 5: GHG emissions from transport activities in Baltic States



Source: Eurostat 2006, DIW calculation

5.2.3 Benefits and costs of climate change policies for the Baltic States

Climate change is expected to induce sea level rise in the Baltic Sea region and to increase the frequency and intensity of winter storms. The combination of a higher sea level and higher wind speeds during winter and spring can be extremely damaging for coastal cities and for coastal wetlands. Flooding events, such as those experienced by the city of Pärnu, Estonia, in the winter of 2005, causing financial damages of over €22 million and immeasurable human distress, will become more frequent and intense. Valuable sand beaches, salt marshes and other wetlands may be lost.

Apart from the direct benefits, mitigation measures could also additionally benefit the Baltic States in terms of increased energy-efficiency of industries, reduced dependency on foreign energy sources, reduced air pollution, job creation, and additional investment opportunities.

Many studies have identified a vast potential for relatively cheap energy efficiency measures in NMS, AC and CC. The International Energy Agency estimates the economic potential of these energy savings could exceed 20% of total current final energy consumption in Central and Eastern European countries, including the Baltic States.[30]

5.3 Impacts of Further Action on Industrial Competitiveness

The European Union has recognised in 2005 in its Lisbon strategy, that increasing energy efficiency is one means to revitalise the European economy and to make it more competitive. The great potential for energy efficiency improvements in the Baltic States promises large benefits terms of increased competitiveness of businesses and industrial sectors, and enhanced standards of living for citizens. Recently, the sharp increase in energy prices has forcefully underlined the need for both increased energy efficiency and a shift away from (imported) fossil fuels. The International Energy Agency warns, however, that the resources allocated to energy efficiency in Central and Eastern Europe remain largely insufficient to meet this challenge.[31] European climate change policies could thus give another incentive and provide resources for further energy efficiency improvements and investments in the development of renewable energy sources.

In the longer term, Europe's competitive advantage will increase if foreign competitors are forced to catch-up with necessary mitigation measures and if early movers in Europe can supply advanced technologies and techniques to these competitors. Making sure they belong to this group of "early mover countries" could be in the interest of the Baltic States.

5.4 Kyoto mechanisms

At present, there are three so-called "Kyoto mechanisms" available for the financing of mitigation measures in the Baltic States. These include: (1) Joint Implementation, under which Annex I Parties may earn credits by undertaking emission reduction projects in another Annex I Party; (2) the Clean Development Mechanism, under which an Annex I Party may earn credits by undertaking emission reduction projects in non-Annex I Parties; and (3) international emissions trading, whereby Parties in Annex B to the Protocol may participate in emissions trading with other Annex B Parties to fulfil their mitigation commitments.

While countries' experiences with Joint Implementation projects to date have been mixed, the existence of this mechanism has certainly stimulated various projects that will reduce

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30 International Energy Agency (December 2004). Energy Efficiency in Economies in Transition (EITs): A Policy Priority. at: http://www.iea.org/textbase/papers/2004/effeit.pdf

31 Idem.

emissions and improve local conditions. To what extent Joint Implementation will remain available for the Baltic States after 2012 is not certain, but it is likely to be limited.

Detailed analysis of the European Emissions Trading Scheme (modelled upon international emissions trading under the Protocol, but operated at the level of installations) has revealed that the scheme does not threaten the competitiveness of most industrial sectors in Europe, including most energy-intensive sectors. Indeed, several sectors, such as power generation, have the potential to profit from the scheme.[32] As many energy-intensive firms in the Baltic States still have the opportunity to reduce greenhouse gas emissions at relatively low marginal costs, these firms might well become sellers of "greenhouse gas allowances" in the Emissions Trading Scheme, thereby generating additional financial resources.

5.5 Options for the Way Forward for the Baltic States

Greenhouse gas emissions in the Baltic States fell sharply in the early 1990s, but emissions have stabilised since the mid-1990s, and are expected to rise again until 2020 in Latvia and Lithuania. One of the fastest growing sources of CO_2 emissions is the transport sector. The three Baltic States are net importers of oil and gas, depending on Russian supplies.

The Baltic States do have opportunities to increase energy efficiency in production and to support public transport to reduce CO_2 emissions in a cost-effective manner. Economic restructuring provides various opportunities which can be used to take advantage of investment cycles for a more sustainable economy. Increasing energy efficiency and promoting the production and use of renewable energy will also lessen the States' dependency of external sources of energy.

The Baltic countries might try to become investor countries in the CDM in the near future. Becoming a CDM investor will, on the one hand, increase the portfolio of cost-effective mitigation measures that can be pursued, and, on the other hand, provide an option for firms to become players in the international market for mitigation technologies.

6 International negotiations on post-2012 commitments

6.1 Status of the international debate following COP 11

The Eleventh Conference of the Parties (COP 11) to the UN Framework Convention on Climate Change, which took place last December in Montreal, also served as the first Meeting of the Parties to the Kyoto Protocol (COP/MOP). There were three key outcomes from the Montreal session:

[32] See, for example, Carbon Trust (2004). The European Emissions Trading Scheme: Implications for industrial competitiveness. The Carbon Trust, London, and Reinaud, J. (2005). Industrial competitiveness under the European Union Emissions Trading Scheme. IEA Information Paper, International Energy Agency, Paris.

- **First, adoption of a series of decisions that bring the 'flexible mechanisms' (international emissions trading, the Clean Development Mechanism, and Joint Implementation) into full operation, and endorse procedures and mechanisms relating to compliance under the Kyoto Protocol.** These decisions were negotiated at earlier sessions and formally adopted in Montreal.

- **Second, initiation of a process for discussing future commitments of Kyoto Protocol Parties after 2012.** In Montreal, in 2005, the Parties to the Kyoto Protocol established an Ad Hoc Open-ended Working Group to consider future commitments of Annex I Kyoto Parties for the period beyond 2012.[33] The Protocol defines a five-year period from 2008-2012 as its "first commitment period". Under Article 3.9 of the Protocol, Kyoto Parties are required to "initiate the consideration" of commitments for subsequent periods at least seven years before the end of the first commitment period (i.e. in 2005). The Working Group will meet for the first time in May 2006, in conjunction with the 24th session of the Subsidiary Bodies to the UNFCCC. It will report to each annual COP/MOP, and aim to complete its work in time to ensure that there is no gap between the first and second commitment periods.

- **Third, establishment of a Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention**.[34] In Montreal, the broader group of Parties to the Convention agreed to begin a dialogue, to be held in up to four workshops. The Dialogue will be open to all Parties, and will allow Parties to exchange experiences and analyse strategic approaches for long-term cooperative action that include: (1) advancing development goals in a sustainable way; (2) addressing action on adaptation; (3) realising the full potential of technology; and (4) realising the full potential of market-based opportunities. The dialogue will be informed by the best available scientific information and assessment on climate change from the IPCC as well as other relevant scientific, social, and economic information. It will serve as a forum to: identify actions to promote research, development and deployment of cleaner technologies; identify ways to support voluntary actions by developing countries; and ways to promote access by developing countries to climate-friendly technologies and technologies for adaptation. The dialogue will report back to COP 12 and COP 13.

6.2 Most significant challenges faced by the UNFCCC and Kyoto Protocol

A number of key issues will need to be addressed in future international negotiations under the UNFCCC and the Kyoto Protocol:

- **How to stabilize atmospheric GHGs at an appropriate level?** Targets and actions under the climate regime must be designed to allow for early and significant emission

[33] FCCC/KP/CMP/2005/L.8/Rev.1

[34] FCCC/CP/2005/L.4/Rev.1

reductions, to increase the likelihood of stabilizing GHG concentrations at a level that will avoid dangerous climate change.[35]

- **How to secure *deeper* emission reductions by *more* countries?** In order to stabilise GHG levels as soon as possible, deeper emission reductions by more countries are needed. This requires the creation of greater incentives for all countries to participate in emission reduction efforts. What incentives can be put in place to encourage greater emission reductions by Kyoto Parties that have existing emission reduction or limitation commitments, for the next commitment period? What measures can encourage meaningful emission reduction efforts by countries that have not yet ratified the Kyoto Protocol? What incentives can lead to increased efforts by developing countries?

- **How to address adaptation?** GHG emissions that have already occurred will affect the climate system far into the future. Most countries will have to adapt to some impacts of climate change, even if emissions are reduced rapidly in the future. Developing and developed countries alike, including those of old and new EU Member States, will have to develop a systematic approach to meet domestic adaptation challenges. At the same time, at the international level, the UNFCCC requires certain developed countries (including the EU) to assist particularly vulnerable developing countries in meeting the costs of adaptation. Further arrangements for adaptation will need to be elaborated to address the needs of vulnerable countries, and consideration will have to be given to how the burden of adaptation can be shared equitably – taking into account the differentiation in responsibilities and capabilities among countries.

6.3 What options are under discussion?

Researchers outside the formal negotiating process have suggested a variety of approaches to the challenge of securing deeper emission reductions by more countries in the Post-2012 period. Various types of mitigation commitments have been proposed that may build upon or complement existing Kyoto commitments. Many are designed to offer ways to engage developing countries in mitigation efforts. Examples include:[36]

- **absolute targets** – Kyoto-like numerical targets that reflect emission limitations or emission reductions compared to emissions in a country's base-year (for example, a limitation of X% over 1990 levels, or a reduction of X% below 1990 levels). Absolute targets build directly on the Kyoto framework and lead to measurable overall reductions.

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35 see above, den Elzen, M.G.J., and Meinshausen, M., Meeting the EU 2°climate target: global and regional emission implications (2005).

36 See generally, Pallemaerts, M., Parker, C.N., Shukla, P.R., and van Schaik, L.G., The Greenland Dialogue on Climate Change: A Policy Discussion Paper (July 2005); Commission Staff Working Paper, Winning the Battle Against Climate Change, Background Paper (February 2, 2005) at 44-45; Baumert, K., Pershing, J., Climate Data: Insights and Observations, World Resources Institute (December 2004); Bodansky, D., International Climate Efforts Beyond 2012: A Survey of Approaches, Pew Center on Climate Change (December 2004).

- **carbon intensity targets** – requiring a limitation or reduction of emissions per unit of output, relative to GDP or another indicator. These can be applied to sectors or economies as a whole.
- **sector targets** – applicable to specific sectors in an economy (e.g., energy, cement, steel, transport), with the type of target differing with the characteristics of the sector.
- **renewable energy targets** – requiring a specific level of, or increase in, the generation and use of renewable energy (for example, the EC Renewables Directive aims to achieve a 22% share of electricity from renewable energies by 2010).
- **energy efficiency targets** – requiring improved energy efficiency with targets for energy-saving (for example, in industry, housing construction, or the design of energy-using products).

In addition to these types of mitigation commitments, there are a number of approaches that could be used to agree upon Post-2012 commitments:

- **top-down approaches** – overarching targets could be agreed (e.g., an overall percentage reduction for the global community to achieve) and then responsibility could be distributed among countries through multilateral negotiations;
- **a menu approach** – countries in differentiated groups (e.g., at different stages of development or with different capabilities) could be permitted to choose from among a prescribed menu of possible commitments;
- **bottom-up approaches** – countries could decide what types of commitments they are prepared to take (e.g, sector targets, a specified level of investment in technology, a specified level of installed capacity, implementation of specific policies and measures).

The Post-2012 climate regime could also allow for a **staged approach** to mitigation commitments. This could allow for differentiation among groups of developing countries, based on a set of **objective criteria,** such as historic GHG emissions, capacity to reduce emissions, GDP per capita, emissions per capita, emissions per unit of GDP, human development index, emission growth rates, or some combination of these indicators. Each group of countries could undertake different levels or kinds of participation in GHG reduction efforts at different points in time. Countries could then **graduate between stages of mitigation effort** and take on greater commitments when they reach or cross one or more thresholds. **Criteria for graduation** would be developed to allow countries to move automatically or voluntarily through levels of participation. **Incentives** for participation would be offered at different levels, to encourage countries to move through stages and increase their reduction efforts.

6.4 Technology development and transfer to support emission reductions

Technologies that may play a significant role in Post-2012 negotiations include energy efficient technologies, renewables, hydrogen, fuel cells, and carbon capture and storage.

- **Energy efficiency and energy conservation** – it is estimated that 50% of future global emissions could be eliminated through energy efficiency and energy conservation measures.[37] These include improved **building design**, improved design of **home appliances** and **industrial equipment**, more energy-efficient **transport**, and alternative technologies that either increase the efficiency of the energy conversion process or that utilise waste heat. Many of these technologies are commercially available, though some supply only small markets or suffer from market barriers, such as a lack of awareness or information. In addition to reducing emissions, energy-efficient technologies reduce fuel costs, increase energy security, and reduce exposure to fossil fuel price fluctuations..[38]

- **Renewables** – world energy demand could potentially be satisfied entirely by renewable energy sources, including **wind, hydro, solar, biomass, tidal, wave and geothermal energy**. Most of these technologies are technically viable and well-proven. Wind, hydro and some forms of biomass have already reached competitiveness with conventional energy sources, and commercial and market barriers present the main obstacles to their broader uptake. The rapid deployment of renewable energy technologies has in the past led to substantial decreases in their unit costs. For example, in the fifteen years from 1980-1995, the unit cost of energy from photovoltaics dropped by 65%; the unit cost of electricity from wind dropped by 82%, and the cost of electricity from biomass dropped by 85%.[39] While other categories of renewables still have a high cost relative to conventional energy sources, a drop in their cost can also be expected through research and development and operating experience. The removal of subsidies for competing non-renewable energy sources would also be likely to enhance the uptake of energy from renewable sources.[40]

- **Hydrogen and fuel cells** – hydrogen technologies are not well-advanced, and will not be commercially viable for some time. Nevertheless, many see hydrogen and fuel cells as an important future energy carrier. The life-cycle GHG emissions of these technologies must be considered though, because hydrogen molecules must themselves

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37 See Commission Staff Working Paper, Winning the Battle Against Climate Change, Background Paper (February 2, 2005) at 41.

38 Lithuania, Latvia and Estonia presently have a high energy intensity relative to the rest of the EU, which provides an opportunity for both cost and energy savings See Green Paper on Energy Efficiency or Doing More With Less (COM(2005) 265 final, 22 June 2005), Annex I, Figures 2 and 3, http://www.europa.eu.int/comm/energy/efficiency/ doc/2005_06_green_paper_book_en.pdf

39 Commission Staff Working Paper, Winning the Battle Against Climate Change, Background Paper (February 2, 2005) at 37.

40 The target for achieving electricity production from renewable energy sources (RES) for the enlarged EU is 21% by 2010 under the RES-E directive (Directive 2001/77/EC). Lithuania has an RES target of 7% by 2010; Latvia, 49.3%; Estonia, 5.1%. The share of RES in 2001 was for Lithuania, 4.6%, Latvia, 48% and Estonia 0.2%. The Share of Renewable Energy in the EU, Country Profiles, Overview of Renewable Energy Sources in the Enlarged EU (COM (2004)366 Final, 26.5.2004).

be produced from fossil fuels, from biomass, or from electricity (which may itself be produced from fossil fuels, etc.) and water.[41]

- **Carbon capture and storage** – this technology holds appeal for coal-dependent economies that seek to use coal in a more clean way, by capturing the CO_2 that results from industrial processes, transporting it to suitable destinations, and injecting it into underground cavities for long term storage to avoid emissions to the atmosphere. There is significant world wide underground storage capacity (most located off-shore), and the technology is already in use for certain processes, such as enhanced oil recovery.[42] However, the technology can be very expensive, depending on the distance CO_2 must be transported and the location of the storage site. It has also yet to be demonstrated that CO_2 can be safely stored underground, contained and monitored for long periods of time without leakage to the atmosphere or damage to the surrounding environment.[43] As carbon capture and storage does not reduce emissions, but merely reduces emissions to the atmosphere, it might serve as a potential bridging technology for coal-dependent economies until cleaner energy sources can be mobilised. A number of decisions taken in Montreal highlighted both developed and developing countries' interest in this technology.

Technology development and deployment are already supported by the UNFCCC framework. Under Article 4.1(c) of the Convention, Parties have agreed to cooperate in the development, application and diffusion of technologies, practices and process that control, reduce or prevent GHG emissions in the energy, transport, industry, agriculture, forestry and waste management sectors. The Kyoto Protocol's flexible mechanisms also facilitate technology development and deployment, by encouraging investment in cleaner technologies in developing countries (under CDM), and in developed countries with lower abatement costs (under JI).

For this reason, explicit agreements between countries on technology may form a suitable supplement to the existing climate regime architecture (though not an effective replacement). Such agreements might address: international research collaboration; guaranteed markets; research and development expenditures; technology targets; progressive international standards; or improvement of conditions for trade in environmentally-friendly goods.[44]

6.5 International transport: aviation and shipping

Emissions from international aviation and marine transport are becoming increasingly significant.

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41 Commission Staff Working Paper, Winning the Battle Against Climate Change, Background Paper (February 2, 2005) at 41-42.

42 Ibid. at 42.

43 Ibid.

44 Ibid. at 39.

- **International aviation emissions** from developed countries increased by 51% from 1990 to 2003.[45] The EU's emissions from international flights grew at an even higher rate, increasing by 73% from 1990 to 2003 – a rate of 4.3% per year.[46] If present growth continues, emissions from international flights from EU airports will have grown by 150% over 1990 levels by 2012.[47]
- **International maritime transport emissions** from developed countries as a whole decreased by 5% from 1990 to 2003 (mainly because of a 57% decrease in U.S. emissions since 1998),[48] while emissions from the EU-15 increased from 1990 to 2002 by about 35%.[49] These emissions are expected to increase still further as international trade expands, driving the demand for more, larger, and faster ships that consume more fuel.

The international aviation and maritime transport sectors are not regulated under the targets agreed in Kyoto. GHG emissions from domestic aviation and maritime transport activities are included in Parties' national GHG inventories for purposes of Kyoto commitments. Emissions associated with international transport are reported as part of national GHG inventory reporting, but excluded from national emissions totals and hence from Kyoto targets.

Article 2.2 of the Kyoto Protocol provides that "*Annex I Parties are to pursue limitation or reduction of emissions of greenhouse gases from aviation and marine bunker fuels, working through the International Civil Aviation Organization [ICAO] and the International Maritime Organization [IMO] respectively*." Most of the work done through the ICAO and IMO to date has involved methodologies for determining and allocating emissions, and consideration of technical, operational and market-based approaches to reduce emissions and increase GHG efficiency for aviation and maritime transport.

Future options for addressing emissions from international aviation and maritime transport are both operational and technological. These include:

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45 FCCC/SBI/2005/17, National greenhouse gas inventory data for the period 1990-2003 and status of reporting at 8; FCCC/SBSTA/2005/INF.2, Information on greenhouse gas emissions from international aviation and maritime transport at 5.

46 EU Press Release 29.07.2005, Climate change: public consultation underlines support for tackling aviation's contribution (hereinafter 'EU Press Release 29.07.2005')

47 Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, Reducing the Climate Change Impact of Aviation, COM(2005) 459 Final, 27.9.2005 (hereinafter 'COM(2005) 459 Final, 27.9.2005') at 2. Figures on international aviation differ substantially across the EU. For example, in 2003, 96% of arrivals into Cyprus were by air; 72.4% for Malta; 71.4% for the UK; and 70% for Greece. See PricewaterhouseCoopers, 'Aviation Emissions and Policy Considerations', Final Report, 23 September 2005, at 113 (Tourism and arrivals by air). For other countries, international aviation is far less a factor. In Slovenia, for example, only 0.4% of arrivals were by air. In Latvia, in 2003 7.4% of arrivals were by air; Lithuania, 5.3%; Estonia, 5.5%. Id.

48 FCCC/SBI/2005/17, National greenhouse gas inventory data for the period 1990-2003 and status of reporting at 8.

49 FCCC/SBSTA/2005/INF.2, Information on greenhouse gas emissions from international aviation and marine transport at 7.

- **For international aviation**: new aircraft; improved passenger management; improved load factors; improved air traffic management; fuel taxation; and emissions trading.[50] The EU will likely propose that aviation emissions be included in the EU Emissions Trading System for the post-2012 period, including all emissions from flights departing from the EU.[51]
- **For international maritime transport:** reducing speed; using higher quality fuels; improved voyage planning procedures that take weather factors into account; advances in hull shape, propulsion systems, injection systems and use of alternative energy sources.

6.6 Initial positions of Parties and stakeholders in the Post-2012 debate

Many factors will influence the positions that countries take in Post-2012 negotiations. These include national responsibility for past GHG emissions, present emission levels, projected emission trends, national opportunities for GHG reductions and the cost of these reductions, existing challenges in meeting Kyoto targets, and possible incentives offered inside and outside the process for active participation in a post-2012 regime. Initial positions of major actors are highlighted below:[52]

- **EU-25** – committed to Kyoto's fixed target approach, and seeks ways to deepen and broaden commitments among a larger number of players.
- **United States** – rejects Kyoto's fixed target approach, and is interested in a long-term technological 'solution' to GHG emissions, and further research and development, rather than binding emissions targets.
- **Australia** – supports 'technological' solutions, researching carbon capture and geological storage, hydrogen and fuel cells.
- **Japan** – prefers voluntary agreements, pledges and technological approaches.
- **China** – emphasises that developed countries must take the lead in addressing climate change, but has a strong incentive to improve its own energy efficiency due to its energy endowment constraints; interested in technology transfer.
- **India** – emphasises that developed countries must take the lead in addressing climate change, but interested in increased CDM opportunities and technology transfer.

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50 EU Press Release 29.07.2005; COM(2005) 459 Final, 27.9.2005.

51 EU Press Release 29.07.2005.

52 See generally Joint Declaration of the Heads of State and/or Government of Brazil, China, India, Mexico and South Africa participating in the G8 Gleneagles Summit; Commission Staff Working Paper, Winning the Battle Against Climate Change, Background Paper (February 2, 2005).

- **Emerging developing country economies (e.g., Brazil, South Africa, Korea, Mexico)** - interested in measures that provide strong incentives for actions taken by developing countries to reduce or limit emissions (for example afforestation, reforestation, or measures in specific sectors (e.g., steel, cement, transport)).
- **Least Developed Countries** – interested in adaptation measures to increase their resilience to the impacts of climate change (including droughts, floods and other extreme weather events), and in access to affordable clean energy supplies for sustainable development.
- **AOSIS** (40+ small island states) – supports Kyoto's fixed target approach; seeks broader and deeper emission reductions commitments by major emitters; seeks immediate attention to the adaptation needs of particularly vulnerable countries including small island states.
- **OPEC/Saudi Arabia** – interested in compensation for any reduction in fossil fuel consumption or prices resulting from global efforts to reduce GHG emissions.
- **Environmental NGOs** – seek immediate GHG reductions based on the Kyoto approach, with the increased involvement of non-Kyoto Parties and developing countries.
- **Financial sector and business community** – concerned about the direct impact of climate change on assets, investments and global economic performance; also aware of business opportunities created by the climate change regime, including emissions trading, investment in renewable energies and climate-friendly technologies, and new insurance and financial products that may help manage environmental risks.

6.7 Issues to be resolved in the international process

A number of **issues** will have to be considered in negotiating the Post-2012 climate regime. These include:

- **At what concentration level should GHGs be stabilised in the atmosphere?** Different stabilisation concentrations (e.g., 400 ppm, 450 ppm, 550 ppm) will have different impacts on the climate system and on vulnerable populations and ecosystems. The opportunity to stabilise concentrations at certain levels will be lost if sufficient emission reductions cannot be secured in the second commitment period.
- **What degree of effort is needed over what time frame to achieve stabilisation?** The Kyoto Protocol aimed for developed countries to reduce their emissions as a group to 5% below 1990 levels by 2008-2012. Much larger reductions are needed to stabilise GHG emissions. Neither the Convention nor the Protocol sets out a long-term reduction target, or a timeframe for meeting that target through a sequence of shorter-term milestones.
- **How should the principle of 'common but differentiated responsibilities and respective capabilities' be applied to developed and developing countries?** All

countries will have to consider how to distribute or share the mitigation burden. Kyoto targets apply to developed countries only. Should developing countries be asked to take on commitments, in view of the rapidly increasing emissions from this group? If so, when, and what kind of commitments? Should different groups of developing countries be asked to take on different kinds of commitments? What kinds of economic incentives and opportunities are needed to engage developing countries as well as non-Kyoto Parties in a global agreement, and how can these incentives be provided?

- **How long should the Kyoto Protocol's second commitment period be?** Should a second commitment period be 5 years, like the first commitment period, or longer, to provide regulatory certainty to industry and guide long-term investment decisions?

- **What types of commitments could be taken in a second commitment period?** If commitments other than fixed Kyoto-like targets are to be permitted or encouraged for some countries (e.g., carbon intensity targets, sectoral targets, energy efficiency targets, renewable energy targets, policies and measures), how can countries' different efforts from these different kinds of commitments be compared? How can overall progress measured?

- **How should technology development and transfer be achieved?** Can sufficient technology transfer occur through the flexible mechanisms or other market-based mechanisms? Or, should a supplemental technology agreement be negotiated that builds upon the Convention and the Kyoto Protocol?

- **How can equitable burden sharing for adaptation be achieved?** The Convention requires developed countries to assist particularly vulnerable countries in meeting the costs of adaptation, but provides no detail on how this is to be done. How can a secure and predictable revenue stream for adaptation be generated that draws upon the resources of all Annex I parties equitably? How can the adaptation needs of vulnerable countries be satisfactorily addressed?

- **Should anything be done to address the impacts of mitigation efforts on developing countries whose economies are heavily dependent on fossil-fuel production or consumption?** The Convention and the Kyoto Protocol require Parties to consider the impacts of measures taken to mitigate greenhouse gas emissions on developing country economies that are highly dependent on fossil fuel production or consumption. Is any action needed to address adverse impacts in a time of increasing demand and increasing oil prices?

- **What should be the role of the flexible mechanisms in a second commitment period?** The Kyoto Protocol does not resolve the scope of activities that can be included in the CDM in the second commitment period. Can the flexible mechanisms be used to create additional opportunities for cost-effective emission reductions and support sustainable development, without jeopardising the environmental integrity of the Kyoto Protocol?