# COSTS AND BENEFITS TO THE RUSSIAN FEDERATION OF THE KYOTO PROTOCOL

February 2004

**Department for Environment, Food and Rural Affairs, UK**

**Prepared by:**
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## Contents

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## Glossary

| | |
|---|---|
| AAU | Assigned Amount Unit. These units of greenhouse gas emissions can be directly traded by Annex B countries. |
| Annex B | 38 industrial countries and economies of transition listed in the Annex B of the Kyoto Protocol that have undertaken defined emission reduction commitments. Currently Belarus and Turkey are listed in Annex I of the UN FCCC but are not listed in the Annex B of the Protocol. |
| Annex I | 40 industrial countries and economies in transition listed in Annex I of the UN FCCC, with various non-binding commitments under the Convention. Annex I countries can invest in JI / CDM projects as well as host JI projects. |
| Assigned amount | Amount of emissions by a country that is permitted by the Kyoto Protocol. |
| Bubbling | Method for countries jointly to satisfy quantified emissions reductions targets. |
| CDM | Clean Development Mechanism. |
| CER | Certified Emission Reduction. These are produced by projects under the Clean Development Mechanism. |
| COP | Conference of the Parties, the overall decision making body of the UNFCCC. The latest of these was COP 9, held in December 2003 in Milan. |
| DEFRA | Department for Environment, Food and Rural Affairs. |
| EIT | Economies in Transition. |
| ERU | Emissions Reductions Units. These are produced by Joint Implementation (JI) projects. |
| ERUPT | Emission Reduction Unit Procurement Tender. Dutch government programme for procuring ERUs. |
| ETS | Emissions Trading Scheme. |
| EU | European Union. |
| EUA | EU Allowances. |
| GHG | Greenhouse gases. |
| GWP | Global Warming Potential. |
| Emissions surplus | When a country has an Assigned Amount greater than its expected emissions, this is known as emissions surplus. |
| ICAO | International Civil Aviation Organisation. |
| IEA | International Energy Agency. |
| IMO | International Maritime Organisation. |
| IPCC | International Panel for Climate Change. |
| JI | Joint Implementation. |
| KP | Kyoto Protocol. |
| LULUCF | Land Use, Land Use Change and Forestry. |
| MtC | Mega tonne of carbon. |

| | |
|---|---|
| NAP | National Allocation Plan. |
| NC | National Communication. |
| OECD | Organisation for Economic Cooperation and Development. |
| OPEC | Organisation of Petroleum Exporting Countries. |
| PAM | Policies and Measures. |
| RMU | Removal Units. Sink credits generated in Annex I countries, which can be traded through the emissions trading and JI mechanisms. |
| SBI | Subsidiary Body for Implementation, reports to the COP on implementation of the UNFCCC. |
| SBSTA | Subsidiary Body for Scientific and Technological Advice, provides advice to the COP. |
| UNFCCC | United Nations Framework Convention on Climate Change. |

# Executive Summary

The Department of Environment, Food and Rural Affairs (DEFRA) asked Cambridge Economic Policy Associates (CEPA) to make an assessment of the costs and benefits to the Russian Federation of ratification of the Kyoto Protocol. This study sets out the results of this work.

Our assessment is that the overall benefit of ratification is likely to be positive even assuming non-participation by the US, although the magnitude is uncertain and contingent on policy decisions of other Kyoto signatories.

## Economic growth and the Kyoto commitment

The size of Russia's emissions surplus will depend on the rate at which it grows its economy, and the rate at which energy intensity improves. Future growth is uncertain, and depends crucially on the extent and success of the reform programme. While President Putin has provided a challenge for GDP to double in 10 years, implying a 7.2% annual growth rate, international observers expect more modest growth, of around 4% p.a.

Russia will almost certainly have an emissions surplus in the first commitment period. Under the more modest growth projections, there will be a surplus even if energy intensity does not improve. Even under more optimistic growth projections, which we think rely on strong improvements in energy intensity, there will be a surplus. Whilst an optimistic Russian growth projection combined with an implausibly low energy intensity improvement can mathematically result in emissions reaching the Kyoto ceiling in later years of the commitment period, this combination of assumptions appears internally inconsistent and it is therefore unlikely that economic growth in the first commitment period will be constrained by the Kyoto commitment.

## Assessing costs and benefits

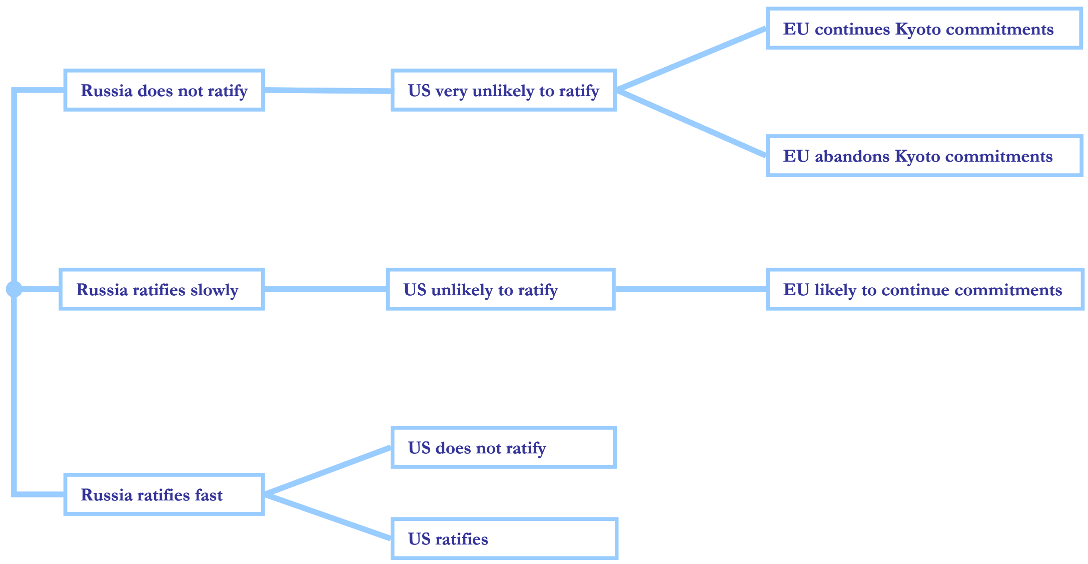
The most important quantifiable potential economic costs and benefits to Russia of signing Kyoto are:

- institutional costs associated with Kyoto compliance (beyond the costs of UNFCCC compliance);
- the value of the sale of emissions permits;
- changes to the value of oil and gas exports;
- changes to the value of exports of energy intensive products;
- the benefits from additional investment in the Russian economy from Joint Implementation (JI) projects.

The value of these effects depends on assumptions made. In order to understand the impact of ratification by Russia it is necessary to understand what would happen in the absence of ratification, as well as the various possible effects of ratification. Important determinants include assumptions about EU behaviour in the absence of ratification, as well as US engagement in the climate change process.

To understand the effect of different assumptions, we have developed eleven scenarios capturing different assumptions about the most important variables. For now we focus on the selection of scenarios set out below.

*Figure 1 – Diagram of focus scenarios*




These focus scenarios assume that Japan and Canada honour their obligations if Kyoto enters into force, but do not deliver on their targets if it is not.

We have not quantified costs and benefits beyond the first commitment period of the Kyoto Protocol. Although we expect that our qualitative conclusions for the first period would be unchanged by considering future commitment periods, further work would be needed to establish this. The scale of Russian gas resources and the scope for relatively low cost emissions abatement suggest that full participation in the future regime would continue to be beneficial.

## Compliance

The costs to Russia complying with formal Kyoto requirements are not strongly scenario dependent. Our assessment of the current status of compliance shows that there are some significant compliance gaps. Inventories of GHG emissions exist, but the quality of these needs to be improved and the routine reporting requirements need to be met. There is not currently a registry, although Russia is not alone in that.

Compliance is not, however, likely to be a major issue. Our detailed assessment concludes that it may cost approximately US$330,000 to establish institutional compliance regime, and US$250,000 - US$290,000 annually to maintain it. This is small in the context of other benefits and costs from ratification. Furthermore, some of these costs would anyway be incurred to comply more fully with Russia's existing UNFCCC obligations or indeed any international regime for controlling greenhouse gas emissions.

**Emissions trading**

Estimates that trading would be worth many billions to Russia were based on an assumption that the US will participate in trading, and buy the Russian surplus. If the US is not a participant, the price of carbon will be much lower, the actual value depending on assumptions about decisions by other governments and in particular the EU as to whether they would buy the surplus, and Russia and Ukraine about how much they would sell.

In the real world, it is reasonable to assume that there will be direct emissions trading with Russia by governments (possibly including EU governments), as well as acquisition of JI units under the EU Emissions Trading Scheme. On this basis our estimates of purchases of carbon from Russia range from US$0.3bn to US$2bn p.a.. We regard a figure of up to US$1bn as more likely. If US were to participate, our modelling shows an indicative value of approximately US$4bn p.a.

**Impact on fossil fuel export revenues**

Oil and gas is crucial to the Russian economy. In 2003 oil and gas exports exceeded US$70bn[1] and are projected to increase, with or without ratification.

Kyoto ratification would however affect oil and gas differently. It would tend to reduce *projected* global oil consumption and hence prices compared to scenarios without ratification. We estimate that without the US the impact on prices and volumes would reduce the *projected* Russian oil export revenues by around 0.2% - 1.4% over the first commitment period. US involvement in Kyoto would increase this to 1.5% - 5%.

Adoption of the European ETS is likely to have a substantial positive impact on Russian gas exports, increasing gas demand by several percent and revenues by more than the possible loss from oil exports. Assuming the European ETS continues irrespective of ratification, this gain will occur anyway, so the direct impact of ratification on gas demand appears less significant, and dependent mostly upon the implications for Japanese gas imports from Russia. But if failure to ratify to led to the ending of the EU ETS, a substantial reduction in European gas demand relative to the base case is likely, with associated costs.

Ratification would therefore help ensure higher gas revenues, by reinforcing the EU ETS, and could have two further strategic benefits for Russia in the area of natural gas. Firstly, it might improve its trading status with EU partners, and a greater reliance on Russian gas would not be seen to jeopardise security of supply, so gas supply might increase. Secondly, it could encourage Japan to forge strategic links with Russia, potentially investing in a pipeline to export Russian gas to Japan.

[1] Russian State Customs Committee (2004)

**Restructuring and JI**

Massive investment is needed in the Russian energy sector. IEA and Russian officials estimate of the order US$250bn over the next ten years.. While increased domestic energy prices will increasingly enable Russian energy companies to finance this from existing resources, it is likely that foreign investment will also be needed.

The Kyoto reduction targets will not in themselves prompt investment in the energy sector – as noted above, Russia is likely to have an emissions surplus. The incremental impact of Kyoto on energy sector restructuring and its modernisation can come from Joint Implementation (JI). While JI projects are often thought to be relatively small, there is in fact no reason why a substantial proportion of these investment needs cannot be met through JI projects.

The value impact of JI can arise in three ways. Firstly, there is the direct value of the investment. Secondly, companies making JI investments may make other investments in the energy sector that they would not otherwise have made. Thirdly, and potentially most importantly, the establishment of the legal and institutional framework necessary for JI investment could significantly improve the enabling environment and attract further investment, with large spin-off benefits on the rest of the economy if mechanisms are developed to reduce the political risks associated with JI investments compared to other foreign investments.

The potential value of JI to Russia is very uncertain. In the current investment climate, the volume and value of JI is likely to be limited. But if action is taken by Russia and other Annex B countries to facilitate JI investment, its volume and value could be very substantial.

## The overall benefit to Russia

Our overall qualitative assessment of the costs and benefits to Russia for the four different scenarios are set out in Figure 2 below. The assessments are relative to a base case scenario, in which Russia does not ratify, but the EU maintains its climate change mitigation commitments. If non-ratification led to the EU abandoning its commitments, our assessment is that there would be an overall negative impact on Russia mainly because projected gas demand in Europe would be lower, reducing the value of Russia's gas exports.

The corresponding quantitative assessments summarised in Figure 3. The estimates are of course heavily dependent on assumptions made and these are described in the main body of the report.

*Figure 2 - Summary qualitative benefits and costs of Russian ratification*

| Scenario | Emissions trading | Fossil fuel exports | Energy intensive exports | Joint Implementation | Overall |
|---|---|---|---|---|---|
| Russia doesn't ratify – EU abandons commitments | | − | − | | − |
| Russia doesn't ratify – EU maintains commitments | | | | | Base case |
| Russia ratifies slowly | + | −− | + | + | − / + |
| Russia ratifies fast, US doesn't ratify | + | −− | + | ++ | − / ++ |
| Russia ratifies fast, US ratifies | ++++ | −−− | ++ | ++ | +++ |

*Key: + and − are a qualitative representation of positive and negative values for the effects, with the number of symbols indicating the size of the effect.*

*Figure 3 - Indicative costs (−) and benefits (+) of ratification–average impact per year of first commitment period, US$bn*

| | **Emissions trading** | | **Fossil fuel exports** | | **Energy intensive exports** | | **JI benefit** | | **Total** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** |
| Russia doesn't ratify – EU abandons commitments | 0 | 0 | -1.0 | -0.1 | -0.2 | 0 | 0 | 0 | -1.2 | -0.1 |
| Russia doesn't ratify – EU maintains commitments | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Russia ratifies slowly | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 0.7 | -0.3 | 1.8 |
| Russia ratifies fast, US doesn't ratify | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 1.4 | -0.3 | 2.5 |
| Russia ratifies fast, US ratifies | 4 | 4 | -4 | -1.2 | 0.1 | 0.3 | 0.2 | 2.1 | 0.3 | 5.2 |

On balance our assessment indicates that the overall value of ratification is likely to be positive. It is, however, possible that, with a low value to emissions sales and the losses from lower oil export revenues exceeding the combined value of JI and emissions trading, the direct value of ratification to Russia could be negative. Estimates of the benefits at the upper end of our ranges are contingent on the policies of other Kyoto signatories. In particular, decisions on whether to buy emissions surpluses from Russia, either explicitly or implicitly, and policies to encourage JI projects in Russia. The latter is also contingent on Russian policies to facilitate inward investment.

Were the US to ratify, the benefits to Russia would be higher. The emission permit sales and probably gas exports would increase, more than offsetting the substantially increased loss to oil export revenues.

In addition to the quantified benefits of ratification, there are some important strategic benefits:

- Russia's status as a trading partner of the EU would improve. This could increase the perceived security of Russian gas supplies, facilitating an increase in demand for Russian gas.

- The likelihood of Japan negotiating strategic links with Russia would increase, investing in gas pipeline infrastructure to allow it to import Russian gas to help it meets its Kyoto commitments and increase its energy security in general.

- The JI process could be used as a lever to enhance the competitiveness of substantial parts of the Russian economy.

# PART I - METHODOLOGY

# 1. INTRODUCTION

## The Kyoto Protocol and its ratification

The Kyoto Protocol was adopted in 1997 to address the impact on climate change of anthropogenic (i.e. human produced) greenhouse gas emissions. This is to be achieved by quantitative targets for limitation (relative to 1990 levels) on the emission of 6 greenhouse gases[2], initially for developed countries only. The Protocol set targets for emissions reductions for the period 2008-2012, with a commitment to opening negotiations on further reduction commitments by 2005. Flexibility mechanisms are included to allow Protocol commitments to be met at least cost. These include the emissions trading, and project based mechanisms for transfer of credits on an approved basis - Joint Implementation (JI) projects, aimed at projects between Annex I countries, and Clean Development Mechanisms (CDM), allowing Annex I countries to invest in emission reduction projects in developing countries.[3]

The Protocol will come into force when:

- it has been ratified by at least 55 countries; and

- these countries must represent at least 55% of the industrial world's greenhouse gas emissions in 1990.

Further details of the Protocol are set out in Annex 1.

At the time of writing the Protocol had been ratified by 121 countries (not including Russia) that account for 44.2% of developed nations' 1990 GHG emissions. However, meeting the second requirement will require Russia to ratify the Protocol, since the US (representing 36% of emissions) has withdrawn its support from Kyoto and there is no other plausible combination of countries to meet the second requirement.

There is at present some uncertainty around Russia's intentions. Russia's leaders, including President Putin and Mr Tsikhanov, the deputy economy minister responsible for Kyoto, have declared a number of times that Russia is moving towards ratification. On the other hand, Mr Putin has recently (during his opening speech to the World Conference on Climate Change) used less definitive language on Kyoto than he has in the past, and Mr Illarionov, a senior adviser to President Putin, declared on December 2, 2003 that "This protocol can't be ratified", claiming that the Protocol would harm Russia's economic development.

Clearly an analysis of the costs and benefits of ratifying the Kyoto Protocol to Russia would be helpful to engage in this debate in Russia, and this report by Cambridge Economic Policy Associates for the Department of the Environment, Food, and Rural Affairs (DEFRA) project is designed to help clarify this issue.

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[2] Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Countries can choose 1995 as the base year for emissions of fluorinated compounds.

[3] See glossary for difference between Annex B and Annex I countries. At present only Belarus and Turkey are in Annex I and not in Annex B.

## 2. SCENARIOS

In order to understand the costs and benefits to Russia of ratifying the Kyoto Protocol, it is necessary to set out the consequences of ratification in the context of counterfactual assumptions about what would happen in the absence of ratification.

Neither is straightforward. What happens in the absence of ratification will depend on numerous factors, including whether other countries abide by their commitments if the Protocol does not have legal force, and in what way. Likewise, the effect of ratification depends on many factors.

To understand the wide range of potential outcomes resulting from ratification or non-ratification, we have developed scenarios which capture the main elements affecting the value to Russia of ratification. The most important factors that change between the scenarios are:

- Whether Russia will ratify.

- If Russia ratifies, whether it does so quickly, or slowly. Fast ratification would facilitate foreign investment in GHG reducing projects in Russia.[4]

- Whether the US ratifies. This is unlikely at present but it is not impossible, and could be influenced by the outcome of US elections in November of 2004. In the medium term, the Russian ratification could demonstrate that the Kyoto mechanisms are working, and increase pressure for a change of stance by the US.[5]

- EU behaviour in the absence of ratification. It currently appears that the EU will maintain their commitments in the absence of ratification. But it is possible that failure of Russia to ratify would lead the EU to abandon the EU ETS. (We have assumed that Canada and Japan do not comply with their commitments in the absence of Russian ratification).

- EU attitude to purchasing surplus units. Subject to the negotiation of a mutual recognition agreement between the EU and Russia, the EU ETS will allow companies affected by targets set in the National Allocation Plans to purchase surplus emissions. EU countries themselves will be able to purchase emission surplus without such an agreement, and the likelihood of this will increase near the end of the first commitment period if it becomes clear that they are having difficulty in meeting commitments.

- OPEC's response. Oil demand will continue to rise for the time horizon covered by this report, with or without Kyoto's entry into force. The ratification of the

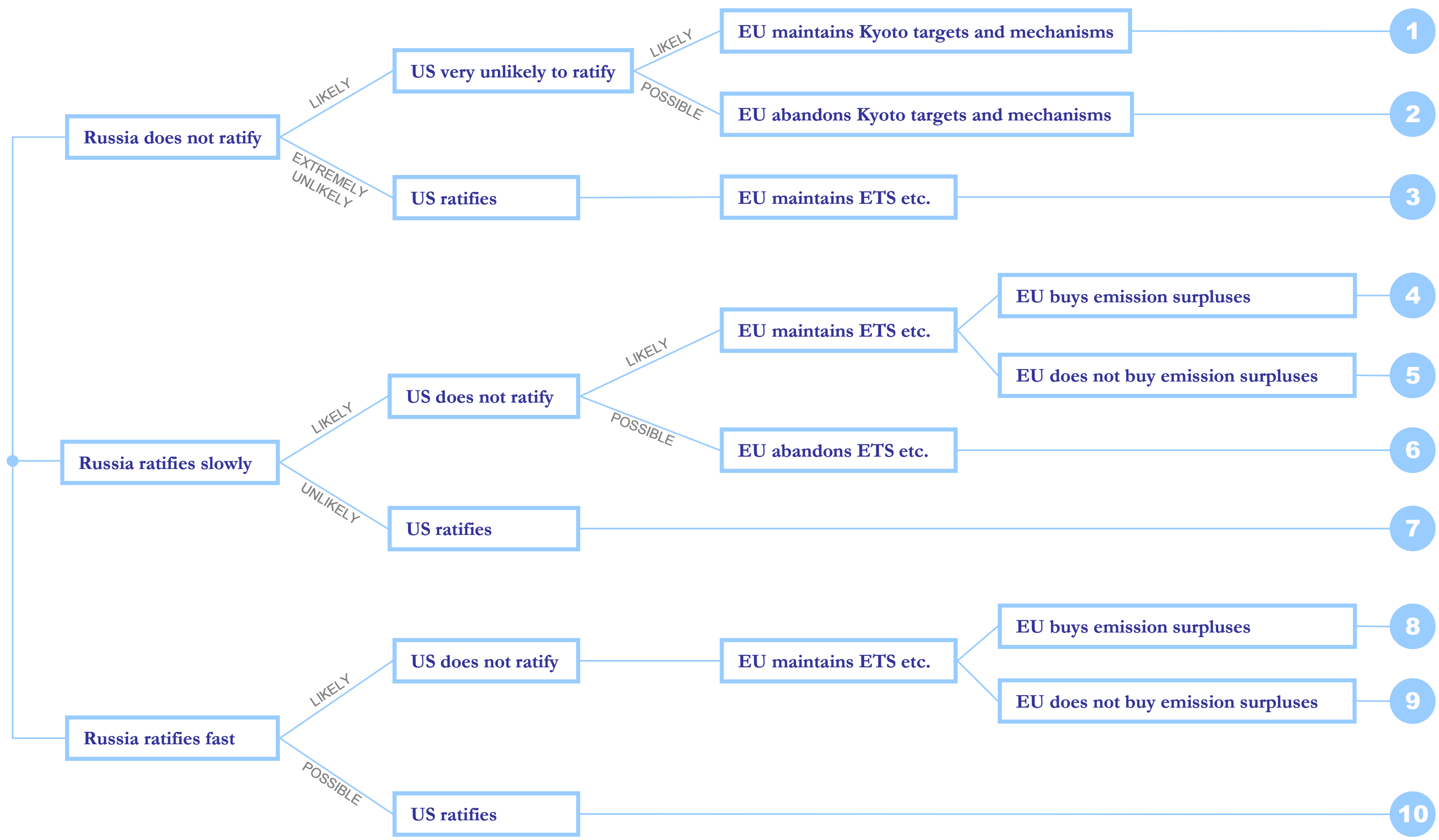
[4] As a guide, we consider Russian ratification of the Kyoto protocol a year from submission of this report (i.e. before end-March 2005) as fast, and ratification beyond then as slow.

[5] There is also a possibility that there may be demand from non-federal level US structures (at the State level for example) to engage in the climate change mitigation process even if the US does not ratify the Protocol. At this stage it is uncertain whether this demand will in fact manifest itself, what its levels will be and in what form would these participates be willing to purchase Russian emission surpluses, and so we have not considered this in our scenario analysis.

Protocol is, however, likely to reduce the projected rate of oil demand growth and place downward pressures on oil price, something which could adversely affect Russian fossil fuel exports. On the other hand oil producers could respond to these pressures through supply side measures which would increase the price and reduce any fossil fuel related losses to Russia from ratification.

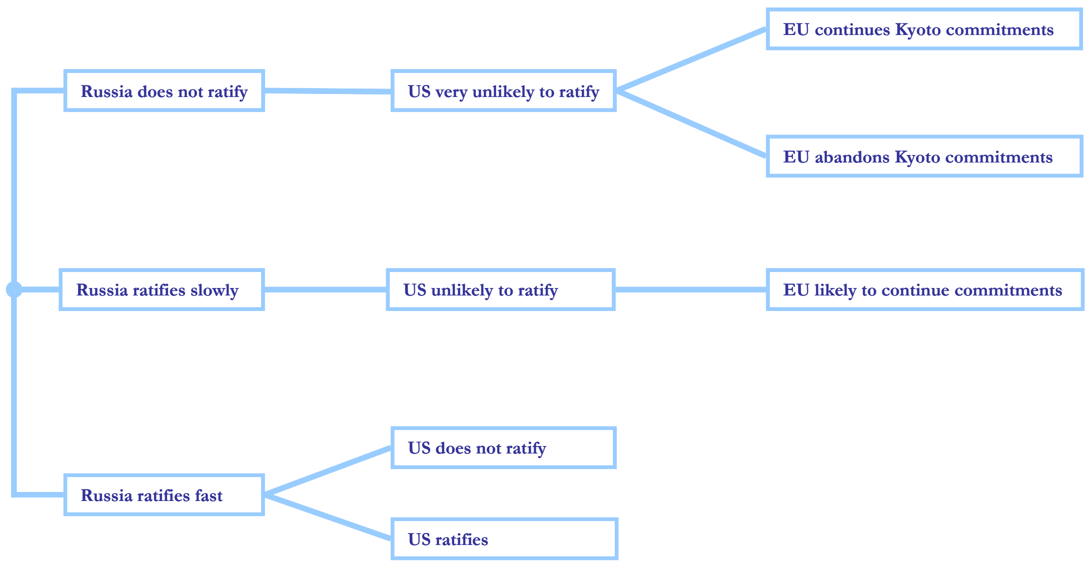
Figure 4 illustrates the relationship between these factors, and how we have used them to create a number of scenarios.

*Figure 4 - Scenarios of ratification and associated decisions*



Although the scenarios cannot be other than a simplistic representation, we believe that they capture some of the most important factors determining the costs and benefits of ratification to Russia, and therefore provide a useful framework for the discussion of the various costs and benefits of ratification in later chapters. In doing this we will make an assessment of costs and benefits for all of the scenarios, but we will focus on a restricted set of scenarios which we regard as more likely. These are set out in Figure 5.

*Figure 5 - Diagram of focus scenarios*



# 3. ASSESSING THE BENEFITS AND COSTS OF RATIFICATION

## Benefits and costs of ratification

Ratification of the Kyoto Protocol by Russia would lead to the following costs and benefits:

- **Direct costs of compliance**. This includes maintenance of the relevant registries of emissions, associated institutions, and other administrative costs associated with compliance with the detailed terms of the Protocol.

- **Sale of surplus emissions allowances**. It is widely expected that Russia's emissions during the first commitment period will be lower than its Assigned Amount, and that it will be able to sell these emission surpluses to other countries. In addition the cost of reducing emissions in the Russian Federation is likely to be lower than that in many other countries. The transfer of these surpluses provides additional revenue to Russia, and the value of these is the difference between the international price of emissions reduction units and the cost of the abatement measures in Russia.

- **The effect on energy exports**. Implementation of Kyoto is likely to change the demand for and price of fossil fuels. Global oil demand and prices are likely to be lower in scenarios with ratification compared to those without. In contrast, demand for gas, which is less carbon intensive, is likely to rise compared to projections for scenarios without ratification.

- **A gain from exports of energy intensive exports**. It is likely that the price of carbon in Russia would be lower than for many countries to which it exports. This means that it will be able to export energy-intensive products at lower cost than other countries, which would be a gain from implementation of Kyoto mechanisms.

- **The costs and benefits of restructuring and modernisation of the Russian economy**. Ratification could lead to restructuring and modernisation that might not otherwise occur, that would have benefits over and above the emissions credits that are created. We consider that the main benefit attributable to Kyoto could be the additional investment that could arise through Joint Implementation projects, and we assess the prospects for this in Russia and the value that it might bring to the Russian economy.

There are a number of other potential costs and benefits which the Russian government could consider as part of a ratification decision. These include the impact of ratification on health and the environment. The benefits of a cleaner environment linked to greater energy efficiency are potentially substantial, and ratification would be consistent with further policy moves in the direction of a cleaner environment, although in the absence of other supporting policies the direct health and environmental benefits from ratification itself, are unlikely to be large.

## Approach to assessing benefits and costs

The value of most of these benefits and costs is dependent on the scenario which is assumed, and other factors. Particular issues that are important include:

- **The development of the Russian Economy**. The volume and price of emissions credits available for sale will depend on the rate of growth of the economy. In addition, the way in which the economy grows will affect emissions – more radical reform will improve efficiency, lowering GHG emissions for the same level of GDP.

- **Policy decisions by other governments**. The value of emission credits depends not just on the deficits of other countries, but also the way in which other countries allow interaction with Russia. For example purchase of Russian emissions surplus by EU companies affected by the EU ETS is subject to a mutual recognition agreement.

- **Strategic Behaviour**. The emissions market will not be a perfect market, in particular if governments retain control of trade and do not allocate all emissions units to companies. Restricting sale of emissions credits can increase the price.

- **Whether Kyoto mechanisms will be implemented if Russia does not ratify**. If Russia does not ratify (assuming that the USA continues its policy of non-ratification), then the Kyoto Protocol will not have legal force. It is possible, though, that countries that have already ratified will use the mechanisms established under the Protocol, despite the absence of a legal requirement deriving from it. For example, the European Union emissions trading scheme might continue without ratification, though this is not certain.

The complexity of the interaction between the factors above, and the scenarios makes it very difficult to model completely the impact of ratification. Many models have been created and used to assess the value of partial impacts of Kyoto ratification. But while these models are generally complete and detailed in some aspects, they are unable to take account of other crucial aspects affecting the impact of Kyoto, such as US participation, or political decisions of other participants. Our approach, therefore, is to assess the factors which determine the impact of Kyoto on the above costs and benefits. We then form judgements of the likely impact using economic data and evidence.

We have examined models used in the literature as well as carried out a modelling exercise of our own. We use the results of these models to inform our judgements of the value of the likely impacts, but do not rely on the quantitative results of individual models given the enormous uncertainties.

# PART II - COMPLIANCE

## 4. APPROACH TO ESTIMATING COMPLIANCE COSTS

In this part of the report we provide an estimate of the cost of establishing and maintaining the domestic institutions to comply with Kyoto. This is not straightforward because Russian administrative costs are not transparent, and real costs are difficult to estimate. In addition, alternative institutional arrangements can be used to achieve compliance, and we have to make an assumption about the way that Russia would choose to comply. This means that any estimate of total costs cannot be considered to be definitive, but can only provide an indication of the scale of costs involved.

Our assessment is based on a literature review focusing on Russian analyses, with appropriate international comparisons. In addition, interviews have been conducted with Russian experts who have conducted studies on establishing domestic compliance institutions and representatives of the federal administration aware of the costs of administration.

In the remainder of this part we:

- set out the compliance requirements that must be met by countries ratifying Kyoto;
- assess the extent to which Russia already complies;
- identify the gaps in the current arrangements; and
- estimate the additional costs needed to comply.

# 5. Introduction to Kyoto Compliance

The Kyoto Protocol to the UN Framework Convention on Climate Change has a comprehensive and rigorous compliance system. There is a Compliance Committee made up of two branches - a Facilitative Branch and an Enforcement Branch. The enforcement branch has the power to determine consequences for Parties not meeting their commitments. In case of non-compliance, Party must draft a compliance action plan. There are sanctions of non-compliance, the most important of which is losing eligibility to participate in the mechanisms.[6] However the facilitative branch provides advice and assistance in order to promote compliance, and the Committee may also mobilize financial and technical resources to help Parties comply.

The Kyoto Protocol, in combination with the UNFCCC establishes the following domestic activities and requirements that deliver compliance:

- domestic Policies and Measures (PAMs) which reduce or limit GHG emissions according to the national commitment (Articles 2 and 3 of the Protocol);
- inventories of national GHG emissions and removals (Articles 4 and 12 of the Convention, Article 5 of the Protocol);
- establishment of a national GHG registry (Article 5.1 of the Protocol);
- calculation of the AAU (Article 7.4 of the Protocol);
- reporting to the Secretariat of the UNFCCC: National Communications (Article 12 of the Convention) including supplementary information to demonstrate compliance (Article 7.4 of the Protocol); and
- passing a review of an international expert team (Article 8.1 of the Protocol).

## Elements of domestic compliance systems

### Domestic PAMs

Domestic PAMs may include coordinated activities in various sectors of the economy. Implementation of PAMs is the main aim of the Kyoto process, and all Annex I Parties have committed to them. In theory even if GHG emissions have declined dramatically and remain below the base year level (which is the case in many economies in transition), domestic emission reduction or limitation activities and programmes are still required. This is because the emission reductions achieved by implementing the Kyoto mechanisms have to be supplemental to domestic actions in Annex I countries (Articles 6.1, 12.3 and 17 of the Protocol). In practice, however, there are no sanctions to enforce the implementation of PAMs. These activities have to be reported in National Communications, and the Marrakech Accords Part II, G, p.27, states that Parties have to demonstrate that domestic actions constitute a significant element of the effort made.

[6] Further details available from the UNFCCC website.

**Inventories of GHG emissions**

Inventories of GHG emissions and removals are the basis of measuring compliance. All the compliance requirements discussed below are related to them. The IPCC has published a set of guidelines to assist nations develop their national inventories. The Revised 1996 IPCC guidelines provide methodologies at different levels depending on national circumstances for estimating emissions.  The 2000 IPCC Good Practice Guidance, which works together with the Revised 1996 IPCC Guidelines, assists with producing inventories that are unbiased and minimise uncertainties. These guidelines also established that an inventory should summarise methods and reference data used, and introduced quality assurance/quality control procedures again taking national circumstances into account in estimating emissions.

The Common Reporting Format (CRF), which is aimed at standardising reporting of Annex I Parties from 2000, is designed so that inventories contain all sources and sinks; and are consistent over the years, transparent (i.e. possible to replicate), comparable between countries.

A National Inventory Report has to be delivered in order to provide information about national approaches to the internationally agreed methodologies. In addition, some other specific requirements apply to establishing a national inventory, such as that a single national authority has overall responsibility for the implementation of inventory. Certain guidelines have to be used when making adjustments to inventory methodologies under Article 5.2.

Removals by sinks have been divided into two categories under Kyoto: Article 3.3 accounting for afforestation, reforestation and deforestation caused by land-use change and forestry activities; and Article 3.4 to take account of additional emissions or removals by agricultural soil and land-use change and forestry which a Party may choose to use or leave out of its accounting for the first commitment period.

**National registry**

A National registry contains the information of GHG inventories and their status compared to national commitments under Kyoto. Registry information includes the assigned amounts, as well as ERUs, CERs, AAU transfers and RMUs. The registry is also a means to manage transfers of ERUs, CERs and AAUs when implementing the Kyoto mechanisms. Description of the national registry is required as supplementary information under the Article 7.2 of the Protocol attached to National Communication.

**Calculation of assigned amounts**

The calculation of assigned amounts is based on the inventory and establishes the basis for verifying compliance. Implementation requires that:

- a GHG inventory, including Land Use, Land Use Change and Forestry (LULUCF), has been submitted covering the period since 1990;
- the base year for HFCs, PFCs and $SF_6$ has been selected;

- the initial assigned amount has been calculated; and
- a description of national system for GHG emission estimation and national registry has been submitted.

**Reporting to the Secretariat of the UNFCCC**

Reporting to the Secretariat of the UNFCCC is important in order to inform the other Parties of the domestic activities which deliver compliance under the Protocol. Annual GHG inventories and periodic National Communications are the main means of reporting. GHG inventories are required to be reported in the CRF, and a National Inventory Report (NIR) is required to be submitted by 15 April each year.

**Other information**

Supplementary information under Articles 7.1 and 7.2 of the Protocol has to be included in the national reporting. This information consists of the following:

- estimates of emissions and removals under Articles 3.3 and 3.4 of the Protocol;
- net changes of emission due to afforestation, reforestation and deforestation;
- assigned amount of ERUs, CERs, AAUs and RMUs;
- changes in the national system or registry;
- adjustments to inventory estimates under Article 5.2;
- implementation of Article 3.14 i.e. minimisation of adverse effects to international trade; social, environmental and economic impacts on other Parties, especially on developing countries;
- information on the implementation of the Kyoto mechanisms or source of information available;
- description of the national registry;
- institutional arrangements and decision-making procedures to coordinate participation in the Kyoto mechanisms;
- the Base year for HFCs, PFCs and $SF_6$;
- demonstrable progress by 2005 (Article 3.2 under the Protocol);
- PAMs implemented and elaborated to reduce or limit emissions (Article 2 under the Protocol);
- domestic legislative arrangements, enforcements and administrative procedures;

- technology transfer under Article 10 of the Protocol; and
- additional financial resources provided under Article 11 of the Protocol.

## Compliance and participation in the Kyoto mechanisms

One reason why Russia may wish to ratify is the potential revenues from hosting projects under the Kyoto mechanisms, as discussed later in the report. The Marrakech Accords (FCCC/CP/2001/13/Add.2) introduce two different levels of compliance for the Annex I Parties. Full compliance allows an Annex I Party to participate in all the Kyoto mechanisms, and Track Two compliance that allows an Annex I Party to participate Joint Implementation (JI) only under a special supervision of the UN FCCC. Full compliance requires that the Party:

- is a Party to the Kyoto Protocol;
- has calculated its Assigned Amount;
- has in place a national system of GHG inventories;
- has in place a national GHG registry;
- has submitted the most recent required inventory, national inventory report and the CRF; and
- has submitted supplementarity information.

All this has to be implemented according to the required guidelines and rules.

Track Two compliance would still allow a Party to implement JI projects, however, a JI supervisory committee has to verify the reductions achieved and this would tend to make the JI procedure more bureaucratic and slow. Track Two compliance still requires that the Party:

- is a Party to the Kyoto Protocol;
- has calculated its Assigned Amount; and
- has in place a national GHG registry.

Figure 6 summarises the difference between full and partly compliance requirements.

*Figure 6 - Full and Track Two compliance*

| | **Full compliance** | **Track Two compliance** |
|---|---|---|
| Ratification | x | x |
| Calculation of AAUs | x | x |
| GHG inventory system | x | |
| GHG registry | x | x |
| Reporting | x | |
| Supplementarity information | x | |
| Verification of reduction by supervisory committee | | x |

*Source: FCCC/CP/2001/13/Add.2.*

# 6. Current status of Kyoto compliance in Russia

## Policies and Measures

Russia has reported a set of PAMs in its national communications, however, problems with implementation have been reported too (see for instance the Expert review of the Second Russian National Communication FCCC/IDR.2/RUS).

The Third National Communication mainly reports on PAMs that are planned to be implemented in the energy sector. Activities on the enhancement of carbon sinks have also been mentioned. Though the document underlines the importance of coordinated action, the PAMs probably do not yet comprise a coherent set of GHG reduction measures. According to a Russian official, the federal target programme "Energy Saving in Russia for 1998-2005" has been cancelled and replaced by the federal target programme "Energy Efficient Economy".

## Inventories

The Russian Federation has published three National Communications (NC) - the First in 1995, the Second in 1998 and the Third in 2002. The First NC focused mainly on reporting $CO_2$ and $CH_4$, however, some figures on $N_2O$ were made available. Sources of information seem to be federal level statistics.

In the First NC, apart from some sinks figures, which were from 1993, only the base year 1990 emissions were reported. No estimates of uncertainties of these figures were presented, and source categories were very general.

The Second NC also focused mainly on $CO_2$, $CH_4$ and $N_2O$. Some figures were, however, provided for other GHGs, and in particular $CF_4$, $C2F_6$, HFC, and PFC. In addition, figures for years 1990 – 1994, and some figures for year 1995 were provided. Emissions, however, of $CO_2$ were only provided until 1994. Source categories however were not specified sufficiently. The emissions were only divided between static sources, the industrial sector (figures specified only for cement and aluminium production), agriculture, and forest sinks/emissions. Emission factors and uncertainty estimates were not provided.

The Third NC provides figures of 1990-1999 for $CO_2$, $CH_4$, $N_2O$ and a lump figure for PFC, HFC and $SF_6$. Source categories are more detailed than in the previous NCs: energy sector, industrial processes, solvents and other product use, agriculture, land-use change and forestry, and waste. These are the categories required in the CRF, so here the Third NC demonstrates progress in the national reporting though not all background information required is available nor are the subcategories of the source categories reported. Unchanged from the previous two NCs, the Third NC does not report on emission factors or uncertainty estimates.

The CRF has not yet been used by Russia. The National Inventory Reports (NIR), which explain the national approaches to the IPCC guidelines and describe the national inventory process and practises, have also not been submitted.[7]

Overall the Russian government administration is divided into the federal and regional level. Regarding climate change issues, it was decided that the federal level will be the principal actor, with responsibilities to the international community. Regional activities are deemed voluntary. Therefore the federal level has dominated the overall national climate policy including official reporting of GHG inventories. The regional level is, however, extremely important from the point of view of GHG inventories. The detailed data required by the IPCC methodologies may not be available within the federal level statistical institutions. It is the regional administrations that collect data which mostly fulfils the requirements of the Revised 1996 IPCC Guidelines[8].

There have been voluntary GHG inventory activities in the Russian regions since 1999. Figure 7 lists the regions that have implemented or are planning to implement GHG inventories on voluntary basis. If the listed regions finished and maintained their GHG inventories, some 12.5% of the country's regions would be covered. The percentage of the volume of industrial production and the population of the Russian total is shown in the table to demonstrate the relative importance of the current regional efforts. Figure 7 also shows that only some of the regions are updating their inventories (ongoing activities), and quite a few completed their activities some years ago. The planned inventories reported by Leneva (2002: 21) in Saratov, Kemerovo, Karelia and Moscow oblast (region) have not been implemented so far and therefore have not been included in Figure 7. According to Russian experts interviewed[9], this is due to the lack of clarity on the Russian ratification of the Kyoto Protocol. Investing in regional inventories is becoming less attractive because there are no guarantees that any Kyoto projects will be implemented in the future. However, there are also some regions where new inventories are being initiated by the Ministry of Natural Resources.

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[7] www.unfccc.de

[8] Leneva, (2002: 21)

[9] Russian experts interviewed in Moscow in January 2004. Please see the list of experts interviewed in the list of references. Further refered to as *Russian experts*.

*Figure 7 - Status and importance of regional GHG inventories in Russia*[10]

| Regions | Start of inventory | Years of GHG inventory | Status of inventory activities | Share of total Russian population % 2001 | Share of total Russian industrial volume % in 2001 |
|---|---|---|---|---|---|
| *Novgorod* | 1999 | 1990 – 2001 | Ongoing | 0.49 | 0.41 |
| *Sakhalin* | 2000 | 1990 – 1999 | Finished | 0.41 | 0.56 |
| *Chelyabinsk* | 2000 | 1990 – 1999 | Finished | 2.52 | 2.90 |
| *Khakassia* | 2000 | 1990 – 1999 | Finished | 0.40 | 0.25 |
| *Archangelsk* | 2000 | 1990 – 2002 | Ongoing | 0.99 | 0.74 |
| *Nizhny Novgorod* | 2001 | 1990 – 2001 | Finished | 2.50 | 2.14 |
| *Sverdlovsk* | 2001 | 1990 – 2001 | Ongoing | 3.16 | 3.57 |
| *Leningrad* | | | Planned | 1.15 | 1.26 |
| *Vologda* | | | Planned | 0.90 | 1.50 |
| **TOTAL** | | | | **12.52** | **13.33** |

*Sources: Leneva (2002: 21-22); Goscomstat (2002a) - Rossiiskii Statistitseskii Jezhegodnik (2002: 82-83); Goscomstat (2002b) - Promishlennost Rossii (2002: 49-51).*

Some private companies have implemented their GHG inventories outside the government activities. The best known of these is the electricity giant RAO UES Rossii which has implemented an inventory of $CO_2$, $CH_4$, $N_2O$ and $SF_6$ for 1990-2000, and the inventory is being annually updated[11]. An expert review team concluded that the RAO UES inventory was good quality and the methodology was consistent with the Revised 1996 IPCC Guidelines[12]. RAO UES has also adopted some of the improvements suggested by the Expert Review: according to Russian experts further measures to estimate emissions from transport have been adopted recently.

Popov (2000, 145) reports that Gazprom had an existing emission monitoring systems which could be extended to cover GHGs. According to Russian experts, Gazprom has implemented a GHG inventory but it has not been published. There are plans to implement an Expert Review of the Gazprom inventory similar to the RAO UES 2001 Expert Review. Also other companies have implemented GHG inventories, for instance Solombala and Arkhangelsk pulp and paper mills' inventories have been reported by the Arkhangelsk regional administration.[13] According to Russian experts the Aluminium giant RusAl has also implemented an inventory. Most big companies would have the relevant data, but it appears not to have been made available so far.

[10] The table summarises figures for the regions that have implemented or planned to implement GHG inventories at the regional level. Federal level statistics are sill the main source for GHG data as presented to UNFCCC.

[11] Zelinsky (2003), Russian experts.

[12] Edf & CPPI (2001: 32). Russian experts.

[13] Environmental Investment Center (2002: 8)

## Registry

The Registry is a national log of emission balances and transfers of emitting rights between countries. No registry exists in Russia so far, though this is probably the case in many other countries as well. A wide study on a registry system for national level emissions trading has been conducted by the Russian Regional Environmental Centre[14], however this is not directly linked to national compliance but to internal organisation of emissions trading.

## Reporting

National reporting i.e. drafting National Communications and reporting annual GHG inventories is the responsibility of the Federal Service of Russia for Hydrometeorology and Environmental Monitoring (Roshydromet), together with the Institute of Global Climate and Ecology. As reported earlier, the Russian Federation has submitted three National Communications (NCs) to date. These fulfil the requirements of the Convention, however, their quality has not been adequate from the Kyoto Protocol compliance point of view. Generally the quality of the GHG inventories has been poor, they have not been implemented and reported annually, and the data has not been reported in the Common Report Format, nor have the National Inventory Report been submitted.

According to Russian experts, Roshydromet drafts the sectoral chapters for the National Communications and then collects comments from the relevant sectoral ministries. Russian experts criticise this procedure and argue that the information would be more accurate if the sectoral ministries drafted the sectoral chapters and the Roshydromet coordinated the exercise. It is clear that no agency can cover all the ground required by the NC, and consequently, better coordination would improve the quality of national reporting.

The Kyoto Protocol requires supplementary information to be added to national reporting. Not all of these categories are relevant to Russia and none of them require difficult additional tasks. Fulfilling the reporting of supplementary information is simply a matter of taking these criteria into account when drafting NCs and adding a number of chapters to accommodate these requirements.

[14] Berdin & Leneva (2002)

## 7. ADDITIONAL COMPLIANCE NEEDS

In this chapter we refer to the difference between the organisation and quality of current national climate change administration processes and those required by the Kyoto Protocol as a "gap". However, it has to be recognised that this does not apply to the requirements set by the Convention, which may be fulfilled by the current level of performance.

### GHG Emissions

As the discussions in later parts of this report illustrate, it is very unlikely that Russia will experience compliance problems due to the growth of GHG emissions during the first commitment period. Russian GHG emissions are likely to stay below the 1990 level until 2012 without the need to implement any further PAMs.

### Policies and Measures

Some PAMs have been introduced and reported as a domestic GHG reduction strategy in the National Communications. Even though problems have been experienced with the implementation of these PAMs, this is unlikely to influence the Russian compliance. Due to the collapse of economic activity in the 1990s, and therefore of GHG emissions, domestic emission reduction activities are not crucial to Russia during the first commitment period. Consequently, PAMs can be probably regarded as a reporting formality.

### Inventories

GHG inventories have been implemented for years 1990 – 1999 though their quality is not yet consistent with the IPCC guidelines. This is mostly because the calculations are based on federal level data which is too aggregated. Whilst good quality federal level background information is available for many sectors (such as data on energy production and consumption), the involvement of the regions is crucial in order to obtain data to the level of detail data required by the UN FCCC.

#### Energy sector

Energy production and consumption are recorded well in Russia. This is required by the 1996 Law on Energy Saving (Federal Law N28-F3). Consequently, it is quite easy to estimate emissions from the energy sector. However, the quality of data on energy use of transport, and municipal and residential fuel consumptions is considered low[15]. More work therefore needs to be done in these elements of the sector. In addition, there is no data available of the amount of associated gas flared by oil producers and the amount of coal-bed methane that is emitted to the atmosphere[16]. Sydnes (2001) has made a rough estimate that the Russian flaring could be as much as 60 – 70 billion cubic meters of gas

[15] Leneva (2002:38)
[16] Russian experts.

annually (producing 120-140 Mt $CO_2$). This gas could potentially be used as a fuel, however, its extraction and transport to the market is not profitable on the current gas prices. According to Russian experts the situation is likely to change with the price reforms in the gas sector and the consequent rise in gas prices. Annual GHG emissions of coal mine methane in Russia have been evaluated to be some 32 Mt $CO_2e$[17]. According to Russian experts the lack of accurate data on both associated gas and coal mine methane emissions may cause problems with GHG inventories.

**Industrial processes**

The activity data of industrial processes are in general quite well monitored and available on federal level. However, according to Leneva (2002: 26, 38) some problems with identification of the types of industrial processes may occur. In addition, data on HFC, PFC and $SF_6$ emissions are not available.

**Sinks**

Leneva (2002: 24-25) reports that the International Forestry Institute in Moscow has been working on the Russian LULUCF inventories and can acquire relevant data from the official forest inventories. However, the quality of these regional forestry inventories varies and the forestry statistics data are not consistent with the IPCC requirements, and achieving compliance on LULUCF inventories would require extra work with the existing data, particularly if Russia elected to use Article 3.4 activities.

**Waste**

There are no federal statistics on waste sector. However, the amount of landfills is manageable on the regional level and therefore it would be possible to collect the data required. Consequently, achieving compliance on waste emissions also requires some extra work on data collection and analysis. The role of regions is crucial on this sector.[18]

Agriculture is the most problematic of the emitting sectors in Russia because relevant data is not being collected. The structure of Russian agriculture has changed dramatically since the collapse of the Soviet Union. Workers were allowed to leave state farms, and animal ownership has gone into private hands, with no available statistics. According to Leneva (2002: 27) no data on livestock has been collected since the disintegration of the Soviet Union and the data on use of mineral fertilisers is missing. Soil carbon changes have not been estimated since 1980. Russian experts believe that agriculture is not a big problem in the Russian inventories because it is quite a small category, about 4% of the total (based on the figures available in the Third NC, p.10).

Leneva (2002: 25-30) reports that the availability and quality of activity data is sufficient for uncertainty of 5-10% in 80-90% of the data required. Consequently, implementing an inventory consistent with the Revised 1996 IPCC Guidelines would not require any major data collection. Also Russian experts argue that it would be possible to implement GHG inventories in Russia that are consistent with the IPCC Guidelines. Indeed, for instance the Arkhangelsk regional inventory has been implemented following the IPCC

[17] Schultz (2003)
[18] Russian experts.

guidelines, and the Arkhangelsk inventory report recognises that the source categories become much more accurate when using local level data[19]. This has been supported also by Leneva (2002: 21): the Novgorod inventory has proved that in practice all data required by the IPCC 1996 guidelines is available on the regional level.

Leneva (2002: 20-21) reports that the national information system on GHG inventories has been improved in 2001, and that it currently includes activity data for different sectors of national economy. A suitable version of IPCC software has also been developed which should make it possible to produce inventories according to 1996 IPCC revised guidelines and using the Common Reporting Format. In addition, there is a plan to develop the system to comply with the 2000 IPCC Good Practice Guidelines. In addition country-specific emission factors have been further studied on agriculture and forestry sectors.

Even though there are obvious gaps in the inventory data, most of the missing data should be possible to collect. A regional approach will be crucial here. Another issue to consider is the evaluation of compliance: there is always room for improvement in every inventory, methodologies can be developed further and more detailed data can be added. However, it is unlikely that a perfect inventory will be required to achieve Kyoto compliance in the very beginning of Kyoto implementation. In addition, economies in transition are likely to be regarded as somewhat special cases.

## Registry

No registry has been established so far, however, Russian experts argue that it is quite an easy task. Such a national log would also enable Russia to make international transactions on state level. Registry can be operated on federal level only if no national emissions trading will be established. Russian experts presume that software for establishing a registry will be available free of charge from the UN FCCC secretariat. Establishing a national registry is quick and even though no plans to establish a registry exist so far, its establishment is unlikely to cause problems from Kyoto compliance point of view. Running a registry would require some 2-3 people to operate it.

Establishing a registry requires implementation of GHG inventories in order to find out which figures the registry should be based on. This is also required for calculating the Assigned Amount which is one of the tasks of the registry.

## Reporting

The main gaps in reporting are the following:

- GHG inventories are not yet being reported annually;
- GHG inventories are not being reported in the required Common Reporting Format;
- no National Inventory Reports on the inventory methodology are being submitted; and

[19] Environmental Investment Center (2002: 25)

- the quality of the sectoral reports would be improved by better coordination.

The main problem lies in the low availability and quality of data that need to be reported. GHG inventories are not being reported annually because the inventories are not implemented annually. The same applies for the use of the CRF – it requires more data than are available. Consequently, reporting itself is unlikely to be a problem if it was better coordinated as long as the quality of GHG inventories is improved. It would also be helpful to reorganise the sectoral data collection process by involving the relevant governmental bodies and institutes in the process of drafting the NC at earlier stage.

Some of the required supplementary information has already been reported by Russia, such as the base year values for HFCs, PFCs and $SF_6$. All that is missing can be easily added to the NC so this category should not cause problems to Russian compliance.

## Summary

Figure 8 summarises the status of the current national climate change administration and highlights the shortcomings as compared to the Kyoto requirements. There is still enough time to rectify the situation, but the fact that Russia has not ratified the Kyoto Protocol has naturally slowed down the national preparations for its implementation. Significant expenditure on compliance measures is unlikely before announcement of ratification.

*Figure 8 - Status and gaps of the Russian Kyoto compliance mechanism.*

| Compliance requirement | Status | Gaps |
|---|---|---|
| *Policies and measures* | Some have been established and reported. | Probably fulfils requirements. |
| *Emissions limitation* | Well below 1990. | Fulfils requirements. |
| *GHG inventory* | Has been started but quality not as required by the UNFCCC. Potential in the regions. | Does not fulfil the requirements as it stands. But regional inventories probably able to deliver compliance level data. Some problems remain. |
| *Registry* | No registry established. | Does not currently fulfil requirements but relatively easy and quick to establish. |
| *Reporting* | No annual inventories submitted, no required formats used, sectoral reports inadequate. | Does not fulfil the requirements but if the quality of inventories improved, reporting would not be a problem. |

# 8. COSTS OF KYOTO COMPLIANCE IN RUSSIA

The cost calculation reported here is based on a variety of sources. Where possible, it is based on figures prepared by Russian climate change experts in published papers, supplemented by discussions.

Estimates are made separately for:

- the cost of establishment;
- maintenance costs when only inventory work is undertaken; and
- costs when both inventory and National Communications are required.

## Assumptions and limitations

The Russian government will probably use civil servants for implementing the work required for achieving compliance. Consequently, the expenses are based on the monthly salary of a Russian civil servant expert working in the public sector. This figure varies regionally, depending on the economic performance of the region and its geographical location. In the Soviet Union salaries used to be slightly higher in the remote Northern areas - which is still the case in many regions. The average monthly salary of a civil servant employed by the federal authorities varies between US$200 – US$400, and would not exceed US$500. While some regions may pay their civil servants up to US$1,000 per month others pay much less. Consequently, it seems sensible to use higher level federal salary of US$450 as an assumption.

If external (especially foreign) consultants were used instead of Russian civil servants, the expenses would naturally increase. However, the only relevant use for foreign consultants would be the development of GHG inventory methodology which is not an annual, but an occasional process.

The salaries in Russian institutes are somewhat higher than in the civil service. Institutes are also more likely to charge overheads to cover the costs of their premises etc. Therefore, this calculation assumes 3 short development projects of GHG inventories by Russian expert institutes at monthly rate of US$1,500 per expert.

Overheads for the public sector include working space, equipment such as computers and software. These elements should be calculated separately in the public sector. Working space tends to be provided by the state, so no extra expenses have been calculated in the compliance budget. Expenses of buying some new computers have to be added to the calculation, because many Russian civil servants have inadequate computers for analysing the data required by the tasks of compliance. The rate used in the calculation is US$900 per computer and US$200 per basic software package. Additional material costs have been allowed for the GHG inventory team.

## Inventories and the subsidiarity principle

Currently the GHG inventories that Russian government is publishing are based on estimates that are made by a Moscow-based federal level institute the Roshydromet. Calculations are based on federal statistics and no data is being collected on regional level especially for the inventory. Consequently, there are gaps in the data and significant uncertainties for some sectors.

Because public administration should aim at the most efficient solution, it seems that some kind of division of responsibilities between federal and regional levels would be necessary. Here the subsidiarity principle should be applied – i.e. the level of administration that has the easiest access to the required data should be given the task to collect it. In practice, the federal level could keep implementing most parts of the energy sector and industrial process inventories, while for instance waste and forestry sectors would probably be the most efficient and accurate if implemented by the regions.

Consequently, in the calculation all sectors have been allocated some man-months on the federal level for coordination and running the inventories, and when necessary the sectors have been allocated man-months for data collection and analysis in the regions as well. In addition, independent expert institutes have been allocated time for studies to develop methodologies as follows:

- Energy sector: 6 months for associate gas flaring, 6 months for coal-bed methane data collection methodologies.
- Waste: 3 months for data collection and analysis methodology.
- Agriculture: 6 months for data collection and analysis methodology.
- LULUCF: 6 months for applying the Russian data that is inconsistent with the IPCC methodology.

Full-time positions have been allocated to the federal level for coordinating the inventory and educating and advising the regional data collection.

## Registry

We have assumed that the registry, would be a simple electronic log to coordinate international transfers, either needs to be developed domestically or bought / received other way from another country. According to Pearson (2004), the EU is currently preparing its own registry system for the EU emissions trading scheme, and there is an ongoing project to assist the accession countries with this task. The registry system developed is being offered to them on discount rate. Such an arrangement may be applied in the case of Russia. On the other hand, the Russian experts expect the UN FCCC Secretariat to provide the registry log free of charge. In the calculation some time has been added for Russian IT experts to develop a simple account registry. This assumption is based on the view of person responsible for the development of the UK registry. If a simple registry system was for sale, the allocated funds could alternatively be used for buying it. Salaries for two experts to operate the log have been included in our cost estimate.

## Reporting

Currently, the Roshydromet is responsible of national reporting. Sectoral federal bodies are involved only in commenting the draft produced by the Roshydromet. Involving the sectoral federal bodies by allocating them time to draft the relevant chapters instead of the Roshydromet would improve the quality of reporting. In addition, a better quality GHG inventory will provide a firmer basis for national reporting.

The calculation recognises two different types of years: a year when National Communication has to be submitted and a year when only annual inventory is required. The costs of these years are slightly different. Time to the sectoral bodies to contribute to the National Communication has been allocated only for the relevant year, and central coordination work load in an inventory only year is half of the work load of a National Communication year.

## Calculation of costs

The parts of the tables with grey background are establishment costs and costs that occur only in NC (National Communication) year such as updating and replacing old computers. They will not be required annually. In the total calculation the costs of the establishment year, NC year maintenance and inventory only year maintenance have been calculated separately.

### Inventories

*Figure 9 – Inventory costs allocated to federal level.*

| | Man-months | $ 450 / month | Computers + software | $ 900 + $ 200 / set | Travel costs | Material costs |
|---|---|---|---|---|---|---|
| Coordination | 12 | 5400 | 4 | 1100 | 3000 | 4000 |
| Education | 12 | 5400 | 1 | 1100 | 8000 | 10000 |
| **Sectoral Inventories** | | | | | | |
| Energy Sector | 3 | 1350 | | | | |
| Education | 12 | 5400 | | | | |
| Waste | 2 | 900 | | | | |
| Agriculture | 2 | 900 | | | | |
| LULUCF | 2 | 900 | | | | |
| *Sub total* | | *$15,750* | | *$5,500* | *$11,000* | *$14,000* |
| **NC year TOTAL** | | | | | | **$46,250** |
| **Maintenance year TOTAL** | | | | | | **$40,750** |

*Figure 10 – Inventory costs allocated to regional level.*

| | Man-months per region | Man-months total regions | $ 450 / month | Computers | $ 900 + $ 200/set | Travel $ 300 / region |
|---|---|---|---|---|---|---|
| Coordination | | | | 15 | 1100 | |
| Education | | | | | | 26,400 |
| **Sectoral Inventories** | | | | | | |
| Energy Sector | 1 | 88 | 39,600 | | | |
| Industrial Processes | | | | | | |
| Waste | 1 | 88 | 39,600 | | | |
| Agriculture | 1 | 88 | 39,600 | | | |
| LULUCF | 1 | 88 | 39,600 | | | |
| Sub total | | | $158,400 | | $16,500 | $26,400 |
| **NC year TOTAL** | | | | | | **$201,300** |
| **Maintenance year TOTAL** | | | | | | **$184,800** |

*Figure 11 - Time allocated to independent institutes.*

| | Man-months per region | Travel $ 300 / region |
|---|---|---|
| **Sectoral Inventories** | | |
| Energy Sector | 12 | 18000 |
| Industrial Processes | | |
| Waste | 3 | 4500 |
| Agriculture | 6 | 9000 |
| LULUCF | 6 | 9000 |
| **TOTAL** | | **$40,500** |

*Figure 12 – Explanations of sectoral inventory costs.*

| | |
|---|---|
| **Energy sector:** | Data mostly exists.<br>*federal:* running inventory<br>*regional:* collecting data on energy consumption on municipal, residential and transport sectors<br>*Independent institutes:* studies on associate gas flaring and coal-bed methane |
| **Industrial processes:** | Data exists.<br>*federal:* running inventory |
| **Waste:** | Data does not exist.<br>*federal:* coordinating data collection<br>*regional:* data collection<br>*independent institutes:* development of methodology |
| **Agriculture:** | Data does not exist.<br>*federal:* Analysis of federal statistics, running inventory<br>*independent institutes:* development of methodology |
| **LULUCF:** | Data exists but inconsistent with IPCC.<br>*federal*: running inventory<br>*regional:* filling in gaps on existing data<br>*independent institutes:* development of methodology |

## Registry (federal level only)

*Figure 13 - Registry costs allocated.*

| | **Man-months** | **$450 / month** | **Computers + software** | **$ 900 + $ 200** | **Travel costs** |
|---|---|---|---|---|---|
| Development | 3 | 1350 | | | |
| Maintenance | | 10,800 | 3 | 1100 | 2000 |
| Sub total | | 12150 | | 3300 | 2000 |
| **Establishment year** | | | | | **$17,450** |
| **NC year TOTAL** | | | | | **$16,100** |
| **Maintenance year TOTAL** | | | | | **$12,800** |

*Figure 14 - Reporting costs allocated.*

| | Man-months | $ 450/ month | Computers + software | $ 900 + $ 200 | Travel costs |
|---|---|---|---|---|---|
| a) Coordination - NC year | 24 | 10800 | 2 | 1100 | 4000 |
| b) Coordination - only inventory | 12 | 5400 | | | 4000 |
| | | | | | |
| **Cooperating Sectoral Inventories** | | | | | |
| Energy | 3 | 1350 | | | |
| Industry | 3 | 1350 | | | |
| Agriculture | 3 | 1350 | | | |
| LULUCF | 3 | 1350 | | | |
| Waste | 3 | 1350 | | | |
| | | | | | |
| Sub total sectoral authorities | | 6750 | | | |
| Sub total NC year | | 17550 | | 2200 | 8000 |
| Sub total only inventory year | | 5400 | | | 8000 |
| **NC year TOTAL** | | | | | **$27,750** |
| **Maintenance year TOTAL** | | | | | **$13,400** |

*NC year TOTAL: Coordination a) + cooperating sectoral authorities. Maintenance year TOTAL (only inventory): Coordination b).*

## Total costs

*Figure 15 - Total costs in different types of years.*

| | | |
|---|---|---|
| **a) Inventories establishment year total** | $288,050 | Incl. Independent institutes' studies |
| **b) Inventories maintenance year total** | $225,550 | No new computers |
| **c) Inventories NC year** | $247,550 | New computers |
| **d) Registry establishment year total** | $17,450 | Incl. Registry development |
| **e) Registry maintenance total** | $12,800 | No new computers |
| **f) Registry NC year** | $16,100 | New computers |
| **g) Reporting NC year total** | $27, 750 | New computers and sectoral authorities involvement |
| **h) Reporting only inventory year total** | $13,400 | No new computers |
| **Establishment year + NC TOTAL** | **$333,250** | **[a)+d)+g)]** |
| **Maintenance NC year (new computers)** | **$291,400** | **[c)+f)+g)]** |
| **Maintenance inventory only year** | **$251,750** | **[b)+e)+h)]** |

## Conclusion

There is relevant expertise in Russia, and a domestic compliance system would be relatively quick to establish. The most difficult problems with achieving compliance are related to data collection. Data are missing from waste and agricultural sectors, however, these sectors are small and therefore unlikely to be a major impediment to Russian compliance. Emissions from associated gas flaring and coal mine methane which are not recorded either could however, potentially cause non-compliance. LULUCF could also potentially cause problems if sinks under Art 3.4 were elected.

The main findings are that achieving compliance under Kyoto would be possible and at a relatively small cost. This is principally due to low labour costs in the Russian public sector.

- A Russian domestic compliance system would cost around US$330,000 to establish.

- Annual maintenance of the system would be somewhat cheaper. This is expected to be some US$250,000 in a standard year when only inventories are implemented. In years when the National Communication is drawn up, the maintenance cost would increase to some US$290,000. This figure also includes the updating of computers.

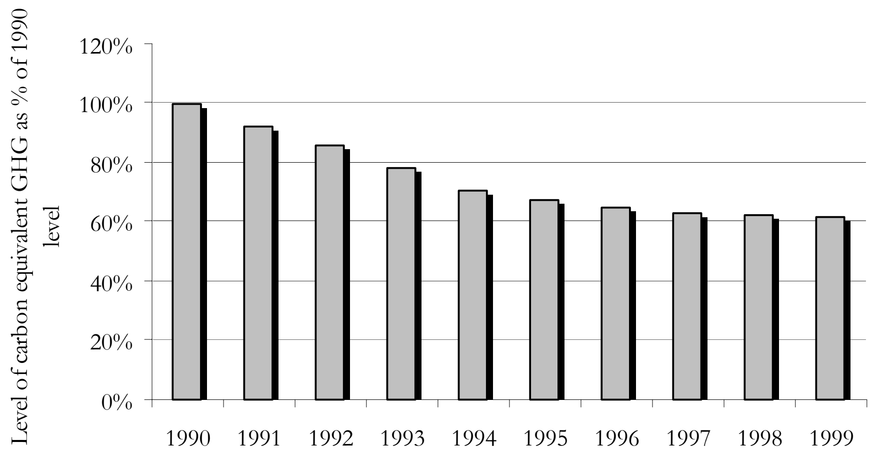
While these figures are only estimates, they do provide relatively good guidance on the cost levels. For example, the difficulty of estimating corruption costs, which will almost certainly be incurred, should be noted. Other costs which may arise, however, are likely to have at most a very limited impact on total costs.

# PART III – EMISSIONS TRADING

# 9. THE SIZE OF RUSSIA'S EMISSIONS SURPLUS

Under the Kyoto Protocol, Russia's permitted allowed emissions level is about 831 MtC[20]. With the decline in economic activity in the 1990s (see Annex 2 for further details), emissions fell sharply, as illustrated below.

*Figure 16 – Decline of GHG emissions in Russia compared to 1990 levels*[21]




At present, therefore, there is a substantial emissions surplus compared to the Kyoto target, and a key issue for determining the potential benefit of ratification is the extent to which this will narrow – or potentially disappear and turn into a deficit – by the time of the first commitment period (2008 to 2012). In this chapter, we examine the potential size of the surplus in the first commitment period.

## Determinants of the surplus

The level of Russia's future emissions is determined by the relationship:

C = GDP x E/GDP x C/E

where C represents the units of carbon equivalent of GHG emissions, GDP is Gross Domestic Product, and E is total domestic energy consumption. The size of Russia's surplus therefore depends on:

- The rate of growth of GDP. This will depend on a number of factors, including the success of the reform programme, and the development of oil prices.
- The energy intensity of the economy (E/GDP). This will depend partly on the mix of industries in the economy (service industries will consume less energy per unit of GDP than heavy industry), as well as the efficiency of those industries.

[20] The permitted carbon emission levels are equivalent to the Russian 1990 emissions of carbon. The Russian Third National Communication (2002) estimates that Russian emissions in 1990 were 3050 Mt $CO_2$ equivalent, which is equivalent to 831 MtC equivalent. (Mt = million tonnes). See Annex 5 for conversion factors from $CO_2$ to carbon.
[21] Third National Communication of the Russian Federation, (2002).

- The rate of production of GHG for a particular level of energy demand (C/E). This depends mainly on the fuel mix.

To illustrate the impact of these variables on the emissions surplus, we have developed a range of scenarios for the above variables, and using a simple model we project carbon emissions for the Russian Federation over the next 20 years. The model used is very similar to the one used by the Russian government in its Third National Communication submitted to UNFCCC in 2002. See Annex 4 for a brief overview of the model.

## The importance of reform

Forecasting economic growth in a country like Russia is difficult. The turbulent economic history of the last decade removes any reliable base from which to extrapolate conditions within the economy, and the recent (relative) political stability and legislative reforms are still too fragile to add a degree of certainty to future development.

A key determinant of future growth prospects is the extent to which economic reform measures will continue to be implemented. These include:

- Continued improvement to corporate governance, to facilitate foreign investment.
- Reforms of the Russian economy in general and reform of the energy sector in particular. These include liberalisation of energy prices on the domestic market, breaking up of monopoly structures and removal of heavy energy subsidies.
- Incentives for growth in fixed capital formation, essential for greater energy efficiency of the Russian industries.
- Structural reform of the economy - shift from heavy, energy intensive industries to service industries.
- International political and trade relations, in particular economic relations with the EU and the US, the terms of Russian accession to the WTO, liberalisation of international energy markets etc.

The implementation of reform measures and their effectiveness is by no means certain. For example, plans have been made to reform the electricity sector for many years which have not been implemented, so the prospects for the current proposals remain unclear.

Sustainable economic growth and energy intensity are inextricably and *inversely* linked. Fast growth of the economy is likely to be achieved only if there are improvements in energy efficiency, and vice versa. Given the importance of the reform, and the relationship between growth and changes in energy intensity, we have developed two groups of scenarios to project possible size of Russian GHG emissions during the first commitment period:

- Reform scenarios, assuming reform takes place, with faster growth and greater changes in energy intensity.

- Non-reform scenarios, in which the status quo continues, with sluggish growth and only limited improvements in energy intensity.

## Economic growth

A recent and influential Russia growth projection is set out in the Russian government's latest version of the Russian Energy Strategy until 2020[22] (August / September 2003). The energy strategy paper provides a detailed presentation of assumptions and analysis of possible scenarios over the next 15 to 20 years, and is currently the document that plays an important part in informing Russian economic policy. This includes growth projections of between 2.7% - 6.2%, with a moderate annual growth scenario of 4.3%. An additional target growth rate has been set by President Putin, who has increased the pressure on the government by setting it a challenge to double Russian GDP by 2010, which would require a sustained growth rate of 7.2% per year for 10 years (from the year 2000, when the target was set).

These official long term projections are seen by most western commentators as optimistic, despite the recent strong growth reported. The International Energy Agency, in the World Energy Outlook 2000, projects Russia's economic growth at about 2.9% per year for the same 20 year period. More recent estimates from the World Bank place expectations for growth over the next few years in the area of 4% to 5% annually, but with little certainty of longer term growth trends.

Analysis done by the World Bank on impact of oil prices on Russian GDP growth show that GDP growth rates of more than 4% to 5% have only been realised when the oil price has significantly increased during the year[23]. This implies that the achievement of 6.2% growth (or even the 7.2% target) on a sustainable basis, would require oil prices to continue to rise on the international markets, something which is unlikely to be sustainable in the long run. In the absence of major oil price rises, a growth level of this magnitude could only be achieved by exceptionally effective and rapid implementation of reforms across the whole economy, a considerable rise in productivity levels and reductions in energy intensity of the economy. While general conditions exist for these reforms to be implemented – given the buoyant economy, considerable cash reserves and a legislative chamber closely towing President Putin's policy line – the pace in the last few years has not been fast enough.[24]

### Economic growth projections

For our three reform scenarios, we assume annual growth rates of 2%, 4%, and 6% pa. The 4% central case is in line with World Bank projections, the higher 6% scenario is consistent with more optimistic official Russian projections, while the 2% scenario implies either less effective reform measures and/or declining fossil fuel prices.

For our non-reform scenarios we assume annual growth rates of 0%, 2%, and 4%. It is possible that some growth could occur through more efficient use of existing capital equipment without significant further investment, and this, combined with increasing fossil fuel prices, lies behind the more optimistic scenario.

In addition to these scenarios, we have made a projection of emissions using Putin's challenge assumption of 7.2% pa growth to 2010 and beyond.

[22] Russian Energy Strategy until 2020
[23] World Bank (2003a)
[24] Analiticheskii Bankovskii Zhurnal (2003)

## Energy intensity

Together with other transition countries of central and eastern Europe, the Russian economy has historically been one of the most energy intensive in the world. The levels of energy intensity have been 2.3 times greater than the world's average and up to 3.1 times the average level in the EU.[25] Russian energy intensity levels have actually been going in the opposite direction to the international trend. Over the last 20 years the worldwide average levels of energy use for GDP growth levels of 1% have been around 0.4%, with energy intensities reducing on average by 19%. In Russia, energy intensity has actually increased by 18% in the period of 1990 to 1998. Reducing energy intensity is therefore of paramount importance to the Russian economy in the context of sustainable economic growth.

There are two related aspects of economic restructuring reforms needed for Russia to reduce the energy intensity of its economy:

- reforms of the energy sector; and
- increased fixed capital formation, i.e. investment in the energy and other sectors of the economy.

The pace and degree of reforms as well as the related level of investment will determine the rate of reduction in energy intensity within the Russian economy. For a more detailed discussion about issues related to the Russian energy sector see Annex 3.

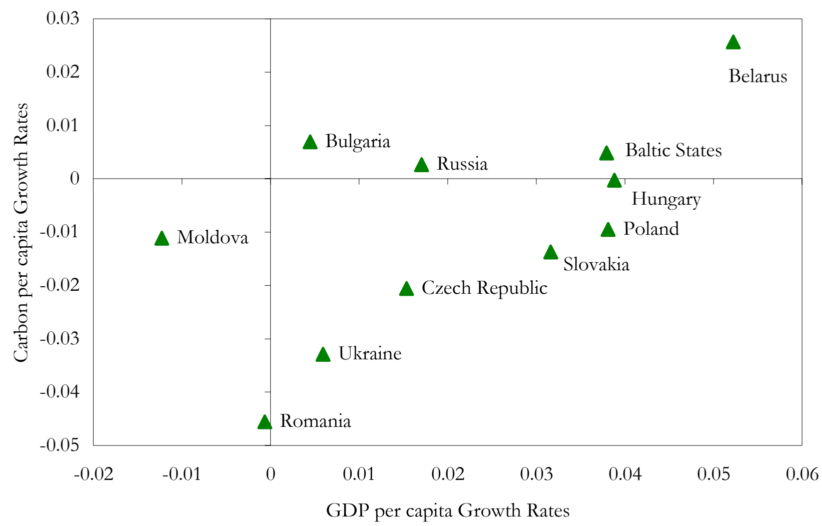
### Energy intensity projections

The pace and intensity of reform will determine the rate at which energy intensity can be improved. Other central and eastern European countries have managed to grow in the last decade without emitting more carbon per unit of output, and some have reduced absolute emission levels.

Figure 17 shows a selection of countries with economies in transition. Hungary, Poland and the Baltic states (aggregated) for example have experienced a GDP growth per capita of around 4% on average with very little change in carbon emissions. Due to the short time period in question, it is unlikely that the low levels of carbon emissions growth are in any major way influenced by reductions in carbon intensity of fuels used (switching electricity generation from coal to gas for example is likely to take much longer than five years). Assuming then that for most countries the carbon intensity levels are generally stable over this period, the GDP growth rates of 4% with no change in growth of carbon emissions implies a rate of energy intensity reduction of about the same magnitude

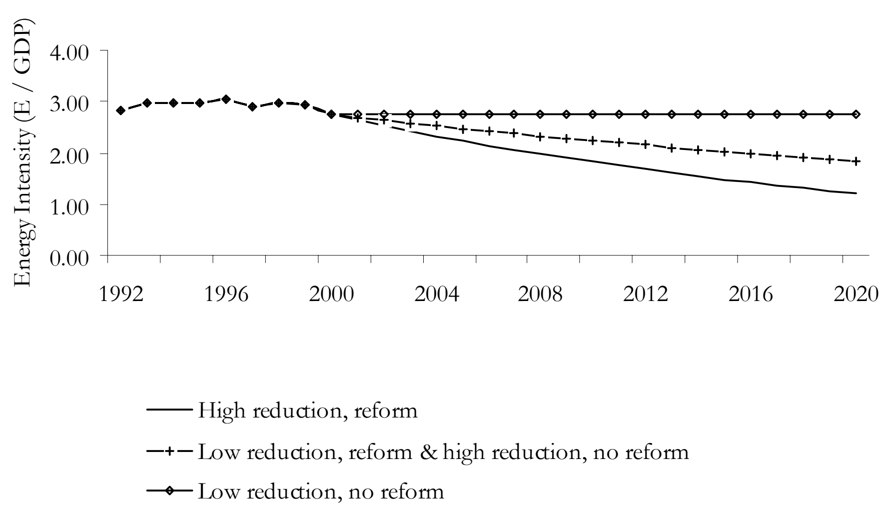
[25] Russian Energy Strategy until 2020 (2003)

*Figure 17 - Per capita GDP growth rates versus per capita carbon growth rates, 1995 - 2001*[26]




The data presented therefore implies that 4% energy intensity reduction per annum is a plausible target in our reform scenario, with 2% p.a. as a lower end projection. In the absence of reform, it is still plausible that some modest improvements in energy intensity will occur. Our non-reform energy intensity projections are therefore 0% and 2% per annum. Figure 18 outlines the energy intensity reduction assumptions for our scenarios.

*Figure 18 – Energy intensity reduction projections until 2020*




[26] Michael Grubb (2004)

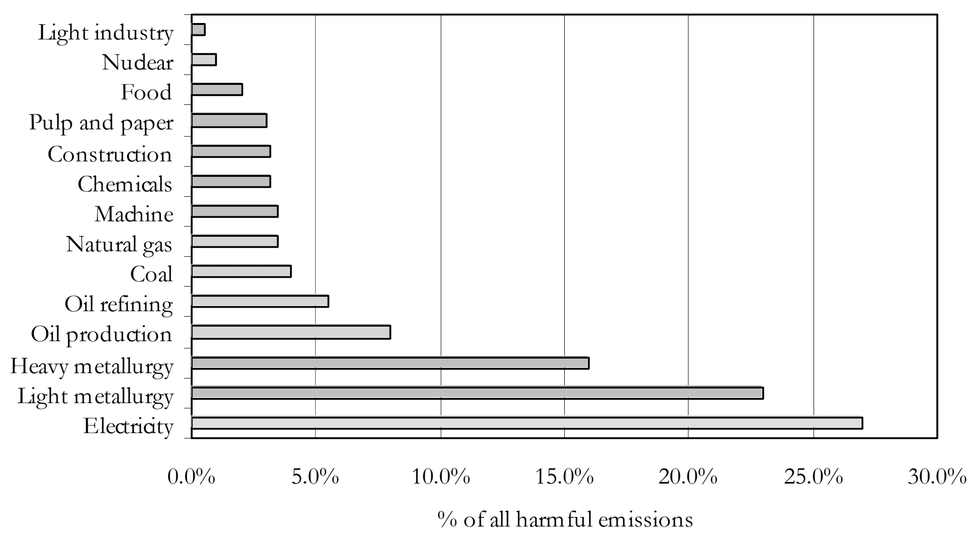
## Carbon intensity

The Russian Federation energy sector, in comparison to some of the other central and eastern European countries, has a relatively low carbon intensity level. According to a study by Fankhauser and Lavric[27] Russian fuel switching potential (i.e. switching from carbon intensive fuels such as coal to those with lower carbon emissions such as natural gas) is relatively low. The main reason for this is that natural gas (a low emitter of carbon as compared to coal) forms about 50% of Russia's current fuel mix. In addition non fossil fuels, mainly nuclear, form about 9%. In 1998 its fuel mix was only 10% to 15% more carbon intensive than the EU average, whereas Romania was 106% and Poland and Bulgaria were around 30%.

The Russian energy sector is nevertheless responsible for producing over 90% of all man made greenhouse gas emissions and about 50% of all harmful emissions in Russia.[28] Figure 19 sets out the percentage breakdown of all harmful emissions by sector in 1999, with the energy sectors distinguished. The correlation of GHG emissions with other harmful emissions is qualitative evidence that the health benefits associated with a less carbon intense economy could be significant. The results of one recent study which tried to value these benefits is summarised in Annex 7.

In analysing the potential for fuel switching, it is therefore sufficient to restrict our analysis to the energy sector.

*Figure 19 – Percentage Breakdown of Emissions* by Sector in 1999*




** Emissions include: SOx, CO, NOx, Methane, VOCs and Particulate matter.* *Source: IEA*

### Carbon intensity projections

In the Russian Energy Strategy until 2020, it is envisaged that there will be only a limited change to carbon intensity of energy generation over the next 20 years. The reasons for

[27] Fankhauser and Lavric (2003)
[28] IEA (2002)

this are that a modest rise in use of renewables is offset by a planned switch from gas to coal (see Figure 20 below for more details). While it is possible that further switching to renewables might occur, for the purposes of these projections it is appropriate to assume that there is no change in carbon intensity over the modelled period (in line with the Russian government's own projections).

*Figure 20 – Projections for the development of Russia's fuel mix and its impact on carbon intensity*

| Growth in carbon intensity | Reduction in carbon intensity |
|---|---|
| • A decline of natural gas in the fuel mix from 50% today to 49% in 2010 and 46% in 2020.<br>• A rise in coal production and usage from 19% today to about 20% in 2020.<br>• A rise in the use of oil and its derivatives from 20% today to 22% in 2020. | • An increase in hydro and nuclear power generation within the fuel mix from 10.8% today to 12% in 2020.<br>• A modest increase in the use of renewable energy, especially in regions furthest from the centre. |

*Source: CEPA, based on Russian Energy Strategy until 2020*

## Emissions scenarios

We have projected Russian GHG emissions in the first commitment period for a number of scenarios, based on the discussion above. A summary of the GDP growth and energy intensity assumptions for our scenarios is set out in Figure 21 below.

*Figure 21 - Economic scenarios used for Greenhouse gas emission projections*

| Energy Intensity reduction | High reductions | Low reductions |
|---|---|---|
| Reform | 4% | 2% |
| Non-Reform | 2% | 0% |

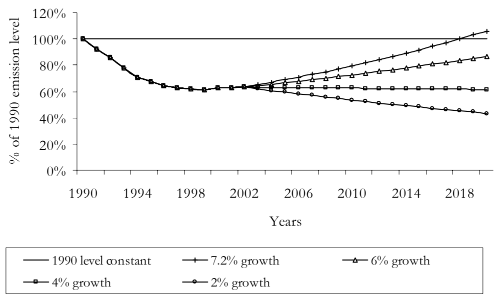
| GDP Growth | Optimistic | Moderate | Critical | Putin's challenge |
|---|---|---|---|---|
| Reform | 6% | 4% | 2% | 7.2% |
| Non-Reform | 4% | 2% | 0% | n/a |
| Russian official projections | 6.2% | 4.3% | 2.7% | n/a |

*Source: CEPA*

Figure 22 shows scenarios which assume a significant level of reform in the energy sector as well as in the economy as a whole. The shaded area represents the 2008 to 2012 five year period, i.e. the first commitment period.

*Figure 22 – Reform scenarios*

4% energy intensity reduction p.a.




2% energy intensity reduction p.a.

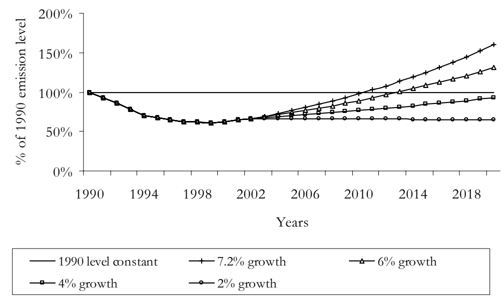
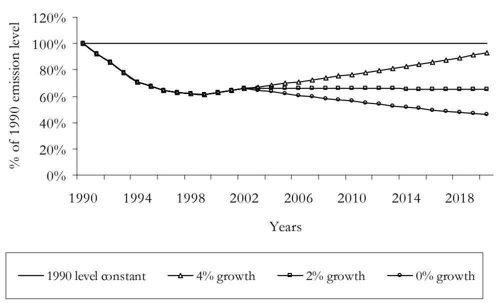


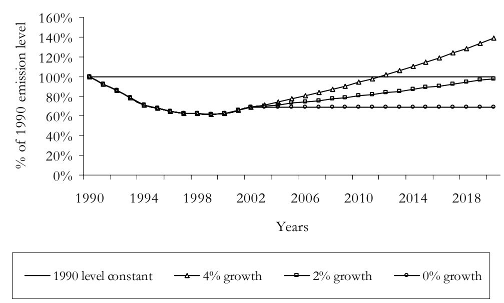

Figure 23 shows scenarios which assume very low or no level of reform in the energy sector or in the economy as a whole. The shaded area represents the 2008 to 2012 five year period, i.e. the first commitment period.

*Figure 23 – Low level of reform scenarios*

2% energy intensity reduction p.a.




0% energy intensity reduction p.a.




The figures reflect the model assumptions that the level of GHG emissions is directly related to the economic growth, after taking into account any tendencies for reductions in energy intensity and carbon intensity of energy used.

There are three main observations that can be made from these charts:

- If reform does not proceed, and economic growth is therefore limited, Russia will retain an emissions surplus during the commitment period.
- If reform does proceed, but economic growth is in line with international expectations, then again Russia will retain an emissions surplus.
- Whilst the charts show two out of fourteen modelled scenarios where Russia exceeds its 1990 emissions levels (i.e. 7.2% GDP growth and 2% energy intensity reduction, and 4% GDP growth and no energy intensity reduction) the likelihood of these actually happening is extremely low. The ability of the economy to grow at these rates without energy intensity improvements that are greater than 2%

and 0% respectively will be very unlikely. The level of energy waste that this would entail would itself be a significant constraint on Russian ability to grow.

This analysis highlights the areas where there may be different perceptions between international observers of Russia, and Russia's internal view. Externally, it appears that realistic projections are for a surplus. But Russia is more optimistic about its prospects than the rest of the world and it feels justified in this by the stronger economic performance achieved in 2003 than was expected internationally. Under its more optimistic assumptions, it believes that it will get closer to the 1990 level and potentially (but unlikely) exceed it. While the growth assumptions for these scenarios appear very optimistic, in a country in transition such as Russia, they may not be impossible, as other countries have demonstrated strong growth over sustained periods (e.g. China). But growth without significant improvement in energy intensity is very unlikely.

# 10. THE VALUE TO RUSSIA OF EMISSIONS TRADING

Kyoto mechanisms (see Annex I for details) in principle allow Russia to sell:

- any surplus of its assigned amount over actual emissions in the commitment period; and
- additional emission reductions that it can achieve at lower cost than other countries.

The value of this emissions trading depends on numerous factors, including:

- the size of Russia's surplus;
- the design of the mechanisms for trade; trading rules – which mechanisms allow trading of the emissions surplus;
- strategic behaviour in the market; and
- the potential for CDM.

This chapter assesses the factors determining the value of the surplus. We then summarise the results found in the literature, and set out the results of our own modelling analysis of the value of trading to Russia, and finally draw conclusions for the likely value of the surplus.

Our analysis shows that very high level of sales of Russian emissions allowances on the international market is unlikely and that greater income could probably be achieved at lower levels..

## The size of the surplus

In the previous chapter, we set out scenarios for the future development of Russia's emissions, expressed as a percentage of 1990 levels. This showed that under most scenarios considered plausible by western observers, Russia will have an emissions surplus available for sale.

Our projections of the surplus are set out below.

*Figure 24 - Russian surplus of greenhouse gas emissions (Mega tonnes of carbon equivalent), 2008 – 2012, assuming significant implementation of reforms*

| Energy intensity reduction | Economic growth | | | |
|---|---|---|---|---|
| | 7.2% | 6% | 4% | 2% |
| High: 4% | 207 – 131 | 248 – 206 | 311 – 314 | 368 – 406 |
| Low: 2% | 95 – (-65) | 143 – 30 | 218 – 169 | 285 – 286 |

*Source: CEPA*

*Figure 25 - Russian surplus of greenhouse gas emissions (Mega tonnes of carbon equivalent), 2008 – 2012, assuming little or no reforms implemented*

| Energy intensity reduction | Economic growth | | |
|---|---|---|---|
| | 4% | 2% | 0% |
| High: 2% | 218 – 169 | 285 – 286 | 347 – 384 |
| Low: 0% | 110 – (-13) | 189 – 136 | 261 – 261 |

*Source: CEPA*

## Trading mechanisms and emissions surplus

The Kyoto Protocol created three flexible mechanisms to allow countries to meet their commitments at least cost: emission trading, where countries directly exchange assigned amount units (AAUs); "joint implementation" (JI), where a country invests in a project in another country, and gains a reduction in AAUs as a result; and clean development mechanisms (CDM), is relevant to projects in non-Annex I countries, and can therefore be ignored in the discussion of this chapter.

As described, "direct" emission trading is undertaken by countries, and indeed governments can strike agreements to make these trades. Countries can also establish a framework that allows companies to effect trades of AAUs. Ideally, the end result of allowing countries and companies to trade should be the same. In practice they may not be.

JI is effectively an alternative mechanism for allowing a trade of AAUs, but instead of a direct purchase, a country buys the units through an investment, and part of the return on that investment accrues in the form of credits that reduce the assigned amount of the investing country. Again, rules can be established by countries so that companies can directly invest in JI projects to buy emission units that can be used in an emissions trading mechanism. However, the structure of JI means that a JI project cannot be a purchase of emissions surplus, but must relate to a real project to reduce in emissions.[29]

The structure of these various mechanisms, and the way that governments choose to implement them, means that in reality there is no single value to emission units. The value of units depends on who is selling, and in what form. Emission units are "tagged" through the mechanism of the registration, and government rules mean that exchanges of different types of units may not be possible. It is, however, likely that pressures on developed countries to meet their Kyoto targets may lead to the establishment of greater linkages between these different markets.

This means that the value of Russia's surplus will not be determined by a perfectly competitive market, but by markets subject to rules that are yet to be created.

The value of Russia's emissions surplus will therefore depend on:

- whether governments will directly purchase AAUs;

[29] Although it may be possible to create a structure that looks like a JI project that is in effect a transfer of emissions surplus.

- whether established trading mechanisms will allow the purchase of emissions surplus, directly or indirectly, through the method of linking with other markets;
- the volume made available.

The impact of decisions by governments will be discussed below. A detailed analysis of government involvement in GHG markets is discussed in Natsource (2003).

## Potential buyers of the surplus

At present, the USA and Australia are very unlikely to ratify the Protocol, although Australia has indicated that it will meet its commitments. This means that the main potential buyers of emissions surplus are the EU member states, other European countries (i.e. Norway and Switzerland), Japan and Canada.

### European Union

Under the Kyoto Protocol agreement, the EU 15 (the current 15 member states) entered a burden sharing arrangement and reduce the EU wide emissions of GHG by 8% (as compared to its 1990 level) over the period from 2008 to 2012.

*The EU ETS*

The EU is establishing an internal carbon Emission Trading Scheme (ETS). The ETS covers CO2 emissions from large combustion plant which will trade allowances allocated to them under the National Allocation Plan (NAP) which Member States are currently developing. Installations covered include those involved in energy activities, production and processing of ferrous metals, mineral industry and cement production. It is expected that about 10,000 institutions from within the (enlarged) EU will participate in the ETS, which is scheduled to begin operations in January 2005. The implication of this is that an EU specific carbon currency will emerge – EU Allowances or EUAs. The scheme allows linkage to other trading schemes via negotiated mutual recognition agreements so if Russia itself established a cap and trade system, this could in principle be linked to the EUTS.

*The Linking Directive*

In order to further reduce the costs of emission reductions within the EU, increase the liquidity of the European carbon market and link the new trading system into the Kyoto Protocol, a new amendment to the EU ETS, the 'Linking Directive', has been adopted. The Linking Directive allows operators in the EU, covered by the EU ETS, to use emission reduction units (ERU) and certified emission reduction credits (CERs), obtainable through JI and CDM projects respectively, in meeting their obligations under the EU ETS. In addition to further reducing the costs of emission reductions, the Linking Directive is intended to encourage JI and CDM investments by EU based companies into developing countries (through CDM) and countries like Russia, Ukraine, Romania and Bulgaria (through JI). From 2008 Member States must set a limit in their

National Allocation plans on the use of CERs and ERUs by operators, to ensure that their supplemetarity obligations are respected.

*Direct purchases*

On January 7, 2004 the European Commission presented eleven criteria that Member States should use to draw up their NAPs. Some are obligatory and some optional. The criterion most relevant for the Russian Federation is the requirement that "the total quantity of allowances to be allocated for the relevant period shall be consistent with the Member State's obligation to limit its emissions pursuant to Decision 2002/358/EC and the Kyoto Protocol ... Prior to 2008, the quantity shall be consistent with a path towards achieving or over-achieving each Member State's target under Decision 2002/358/EC and the Kyoto Protocol."[30]

NAPs apply to the traded sector and therefore are only a contribution to meeting countries' Protocol targets. Countries will need to take other measures – including, if they wish, purchase AAUs through bilateral agreements with other countries in order to meet their individual Kyoto targets.

Statements by the EC Commissioner responsible (Wallstrom) have however supported the position, that "ungreened" surplus AAUs should not be used by EU countries to meet Kyoto targets. Policies adopted by individual EU countries announced so far, such as the Dutch CERUPT and ERUPT programmes also support the assumption that EU countries will not be able to purchase Russian emissions surplus. However there are no legal requirements which would prevent EU Member States from buying surplus AAUs and using them to meet their targets.

**Canada**

The Canadians are subject to the same political concerns as other countries about buying 'ungreened' AAUs from Russia. If the Canadian government does decide to purchase AAUs as a means of meeting its Kyoto targets, it is most likely that any major purchases would be concluded on a negotiated basis between the Canadian and Russian governments. Informed commentators point out that at present it appears that political constraints on the Canadian government are likely to place considerable downward pressures on the level of any negotiated price[31], although this situation could change in future closer to the end of the first commitment period.

Panellists at a recent conference debating issues related to the ratification of the Kyoto Protocol, expressed views that there is a real possibility for Canada to link into the EU ETS. Given that the Russian emissions surplus cannot be converted directly into the European carbon currency, the Canadian demand for Russian emissions surplus would then be suppressed as Canadian companies begin trading on the EU ETS).

[30] Department for Trade and Industry, UK (2004)
[31] Grubb et al (2003)

### Japan

Japan has taken on very ambitious GHG reduction targets, in particular taking into account the high energy efficiency levels already existing in the country. In fact, analysts point out that Japanese business feels somewhat misled by the Kyoto process - targets in Japan tend to be used to signal direction as oppose to mandatory obligations.[32] In addition to this, the exact sharing of obligations between the industry and the government is still to be worked out, which is worrying the industry players.

The prolonged economic stagnation in Japan is making it even more difficult to persuade the sceptics concerned about the economic well-being of Japan that firm targets, let alone resource transfers to Russia for example, would be in Japanese interests. At the same time though there has been active interest by Japanese companies in exploring the JI options with Russia as a way of reducing GHG targets. This trend is being strengthened by the Japanese desire to forge better energy links between the two countries – something that Japan is very much committed to doing, given instability in the Middle East.

### Uncertain demand for emissions surplus

The above analysis indicates that:

- the EU may not be a major buyer of Russian emissions surplus;
- the demand for emissions surplus from Canada and Japan may be weak initially; and so
- it is most likely that the benefit to Russia of the desire of countries to achieve their targets in the short term through international trading will occur through the project based mechanism of JI.

In the longer term, government purchases of emissions surplus are likely to occur as it becomes the only way for them to meet their commitments.

## Strategic behaviour

There is an enormous volume of literature on the strategic nature of trading in the emissions markets. A review of many of these studies is contained in Barnard et.al. (2003). These studies focus on the potential for suppliers of surplus emissions (and in particular Russia and Ukraine) to restrict the supply of credits to the markets, to raise the price of these credits.

Conclusions from these studies include:

- Russia has an incentive to delay the sale of emissions surplus. Growth in demand, and/or potential rejoining the system by USA will mean Russia may be the only major source of AAUs.

[32] Grubb et al (2003)

- Consideration of emissions surplus sales and fossil fuel markets together may give Russia an incentive to release additional credits, so that fossil fuel export demand is maintained. The impact of trading of emissions on fossil fuel demand is considered further below.

- With the USA out of the Kyoto Protocol, a series of studies conclude that it is optimal for Russia and Ukraine to sell only about 50% of their surplus emissions quota so as to keep the price high, while not curtailing the fossil fuel demand too much.

- Russia is likely to consider the effects that restricting sale of GHG permits will have in increasing the demand for higher levels of JI projects, as the only flexible mechanism open to many installations covered by the EU ETS.[33]

In the real world not only strategic behaviour but also willingness to buy will determine the extent to which surplus emissions quota can be sold.

## Projected JI and CDM

JI and CDM are ways in which Annex B countries can achieve their targeted emission reductions. Strictly, because JI is only possible among Annex I countries, it is simply another form buying credits from countries that could normally trade with each other, and so emission market modelling implicitly includes JI as a form of trading. CDM is different though: it provides an alternative mechanism to absorb excess emissions from Annex B countries.

The Linking Directive allows for the use of project credits as they become available. As a result CERs may be used under the prompt start from 2005, and ERUs from 2008, under the JI Decision. Member States and operators are, under the Directive, required to refrain from the use of credits from nuclear energy. The Commission will report on necessary requirements on the use of credits generated from sinks in the CDM in 2006. The risk of Kyoto not entering into force is a factor preventing companies actively from investing in JI.

At present, the only active participants in JI and CDM are the World Bank Prototype Carbon Fund (PCF) and the Dutch government. The total possible supply of JI and CDM estimated to date is relatively small, and reported estimates of projects accounting for between 200-300 Mt $CO_2$ equivalent (or 54 to 81 Mt carbon equivalent) have been made.[34] In another estimate, a Point Carbon study for Asian Development Bank indicates that planned CDM procurement until 2012 is currently about 100 Mt $CO_2e$ (or about 28 Mt carbon equivalent). The study goes further to say however, that judging from key actors' (e.g. Japan, Italy, Spain etc.) distance to their Kyoto targets and (at least in the case of Japan) the high domestic abatement costs, this number is likely to increase.[35]

[33] Moe, A., Tangen, K., (2000)

[34] Dutch Minister of Economic affairs quoted in Point Carbon (2003, Nov 21).

[35] Point Carbon (2003b).

In our analysis, we have included modest assumptions about CDM. However, it should be noted that JI could potentially be more valuable than the above discussion indicates (see Part IV below).

## Results of other published modelling work on emissions trading

Many studies of the potential development of emissions trading have been published to analyse the impact of the Kyoto mechanisms. A summary and review of 25 of these models is set out in Springer (2003), and this section draws heavily on this paper.

Springer classifies the models used into four categories:

- "integrated assessment models", which examine physical and social process;
- general equilibrium models, "top-down" models that capture the impact of energy policy on other sectors;
- emission trading models, like the CERT model analysed in greater detail below;
- neo-Keynesian macroeconomic models, another form of top-down model; and
- energy system models, "bottom-up" models which have a detailed representation of the energy sector.

Most of the modelling work that has been done includes the US as one of the participants of the Kyoto mechanism. If all countries can trade, including non-Annex B countries, it is found that:

- Estimated permit prices range from US$1 – US$22 / tonne $CO_{2.}$, (or from about US$4 to US$80 / tonne of carbon).
- The average permit price is US$9 / tonne $CO_2$, (US$33 / tonne carbon).
- Total permits traded range from 1214-3428m tonnes $CO_2$, (331 – 935m tonnes of carbon).

The trading of the non-Annex B countries is equivalent to an assumption that the CDM mechanism is efficient. Restricting trade to Annex B countries has the following effects:

- Permit prices rise, with an average price of US$27/tonne $CO_2$, (US$99 / tonne carbon).
- The range of prices is also very large, with the lowest estimate being US$3/tonne $CO_2$, (US$11/tonne of carbon), and the highest US$71, (US$260 / tonne of carbon).

These results show the wide range of estimates of the future of emissions trading depending on the model used and detailed assumptions made. However, the permit price estimates are not useful, as they include the US as a potential purchaser of emissions surplus.

Without the US, all studies which have undertaken such an analysis indicate a substantial fall in permit prices. These range from US$0 – US$12/tonne $CO_2$, (US$0 - US$44 / tonne carbon). In combination with the limits on credits from sinks, the conclusion drawn by Springer from the review of the literature is that the "permit prices approach zero". This result has prompted analysis of potential oligopolistic behaviour by the major sellers of permits – Russia, Ukraine, and Eastern European countries. In these cases, the supply of emissions surplus is restricted, and the permit price is estimated to be in the range US$7-12/tonne $CO_2$, (US$26-US$44 / tonne carbon)

## CEPA Modelling of Trading using The CERT Model

In addition to reviewing the studies done, we undertook a modelling exercise of our own to make a quantitative assessment of the value that emissions trading might have for Russia. To do this we have used the Carbon Emission Reduction Trading (CERT) model. This uses an assessment of the projections of emissions by groups of countries under a business-as-usual scenario, their Kyoto targets, and the estimated costs of reducing emissions to make an estimate of the equilibrium price of emission units. The model can also be used to test different assumptions about strategic behaviour. Further details of the model and our analysis are set out in Annex 4.

CERT, in common with many other models, makes a number of implicit assumptions about the way in which the market will work, as well as the underlying technical parameters and costs driving the market. In particular, in the model there is no distinction between trading of emissions credits undertaken by companies through emissions markets, by countries at the level of AAUs, or in the CDM and JI markets. In the real world, these distinctions are important, and as noted above in the discussion of trading mechanisms, there can be different prices in the different markets, but the model does provide a useful guide as to the price at which Russia could sell AAUs, and the factors determining that price.

### Scenarios modelled

We have modelled three different types of scenarios concurrently:

- **Growth Scenarios** – we assess the impact of alternative scenarios of economic growth and energy / carbon intensity. Of the 14 growth / energy intensity scenarios discussed in Chapter 9 above, we have selected 4 of the more plausible combinations of economic growth and energy intensity assumptions.

- **Emissions surplus Trade Scenarios** – we also assess the impact of alternative scenarios of emissions surplus trading. These scenarios demonstrate how an export cap has the effect of reducing supply of credits and thus pushing up the equilibrium price, given that demand has to be met (i.e. all the Annex B countries are legally obligated to meet their emissions reductions targets).

- **Market Structure Scenarios** – finally we consider how a variety of market structure scenarios impact on the benefit to Russia. These scenarios inform the key result established during modelling – i.e. how the equilibrium price falls and thus the benefit to Russia reduces as a result of the EU's potential non-participation in the emissions trading market. This is tantamount to a substantial contraction of the demand-side of the market, simply by assumption. As a result, analysing the "all countries trading" market structure scenario gives results where there is both a substantial demand side, and a substantial supply-side in the potential market.

Figure 26 below sets out the assumed GDP growth and energy intensity reduction parameters of the 4 growth scenarios used to structure our analysis. They relate to the scenarios discussed in Chapter 9 above.

*Figure 26 - Growth scenarios used for CEPA's CERT analysis*

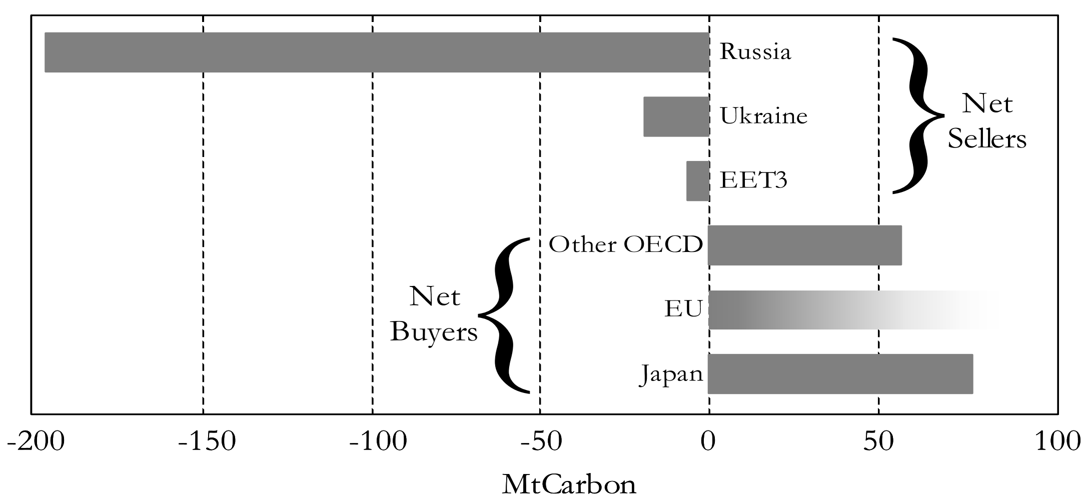
| | Reform – moderate | Reform – Putin's challenge | No reform - moderate | No reform – critical |
|---|---|---|---|---|
| Growth | 4% | 7.2% | 2% | 0% |
| Energy Intensity | 2% | 4% | 2% | 0% |

*Source: CEPA*

**Demand and Supply in the Market**

The CERT modelling output is significantly influenced by the CEPA growth modelling results in that emissions projections in 2010 are below the Kyoto target for all four growth scenarios. The key consequence of this is that Russia is a net supplier (seller) of credits at lower cost than the sum of the other suppliers (Ukraine and the EET3), in all four growth scenarios. The situation where Russia is a net demander (buyer) of credits is not modelled as none of our growth scenarios simulate this result. Figure 27 below indicatively shows the net demanders and suppliers of emissions credits in the market[36].

*Figure 27 – Annual abatement requirement*

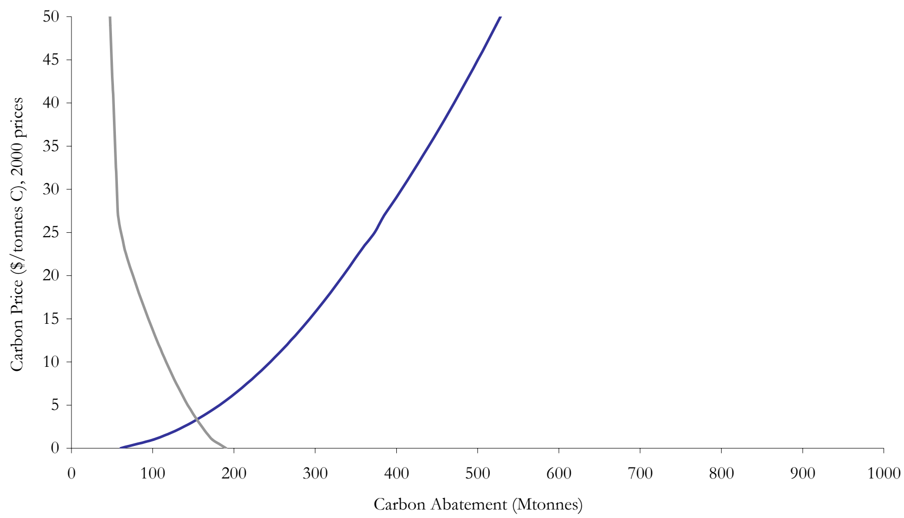



*Source: CEPA calculations and CERT modelling*

[36] Based on the *reform – moderate* Russian growth scenario. Excludes the USA. Other OECD comprises Australia, New Zealand, Canada, Norway and Switzerland. EET3 comprises Croatia, Bulgaria and Romania. EU includes EU15 plus the 8 accession countries. EU demand level is shown as being uncertain due to the potential influence of JIs, national allocation plans, and the EU ETS.

Figure 28 below details illustrative supply and demand schedules which derive the world equilibrium price of emissions credits and the quantity of carbon abatement traded in the market.

*Figure 28 – Illustrative demand and supply of GHG offsets*




The upward sloping curve is the supply of credits in the market derived from the summated marginal abatement cost curves of the individual groups (explained in Annex 4), and the downward sloping curve is the world demand for carbon reduction at each price). This sample graph depicts the scenario that results in the greatest net benefit to Russia from the sample of 48 scenarios – i.e. the *no reform - moderate* growth scenario (2% annual growth, 2% annual reduction in energy intensity) combined with a 20% export cap on emissions surplus trade, with all country groups trading (i.e. including the EU). The intersection of the two curves establishes the equilibrium price, which, at US$3.3 per carbon tonne of abatement, is very low in this scenario.

**Results**

The emissions surplus trade and market structure scenarios are analysed concurrently under the 4 growth scenarios above. A full analysis of our results is set out in Annex 4, with a summary set out in the Figure 29 below.

*Figure 29: Summary of CERT model results*

| | Benefit to Russia ($m) | | Equilibrium Price ($/tonnes C) | | Exports [surplus] (Mtonnes C) | | Domestic costs of trade ($m) | | Assumptions required to maximise benefit | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Growth Scenario** | Lower estimate | Upper estimate | Lower estimate | Upper estimate | Russia | Sum of other net suppliers | Russia | Sum of other net suppliers | Export Cap? | EU Req'd? |
| **Reform – moderate** | 0 | 243 | 0.0 | 4.0 | 73 [192] | 58 [14] | 47 | 82 | Yes, 20% | Yes |
| **Reform – Putin's challenge** | 0 | 245 | 0.0 | 4.2 | 70 [169] | 61 [14] | 52 | 91 | Yes, 20% | Yes |
| **No reform – moderate** | 0 | 255 | 0.0 | 3.3 | 89 [284] | 53 [14] | 36 | 63 | Yes, 20% | Yes |
| **No reform – critical** | 0 | 254 | 0.0 | 3.5 | 85 [260] | 54 [14] | 39 | 67 | Yes, 20% | Yes |

*Source: CERT modelling and CEPA calculations.*

All four growth scenarios result in an upper limit equilibrium price of US$5.9 per carbon tonne when the 100% export cap (i.e. 0% emissions surplus trading) is simulated. However, to avoid confusion, this result is not reported in the range of equilibrium prices as this high price is not actually associated with Russia maximising its benefit. The reason that an equilibrium price is established despite there being a 100% export cap, is that emissions surplus trading does not result in any overall reduction in global emissions - therefore, if there is a complete restriction on emissions surplus trading there is still a demand, supply and therefore equilibrium price for carbon abatement in the CERT model.

In addition to Figure 29 above, Annex 4 contains the detailed results of CERT modelling. The key observations are as follows:

- For Russia to benefit from emissions trading, the EU almost certainly has to be a participant in the Annex B country trading system. The inclusion of the EU in the global trading system (i.e. allowing the EU to purchase emissions surplus) raises the value of credits and thus the potential benefit to Russia.

- With 100% emissions surplus trade, the value of the benefits to Russia under a wide range of scenarios is zero. This is because without the US, there is insufficient net demand for credits to absorb the surplus of Russia and Ukraine, and require abatement at positive cost to set a higher value to carbon. However 100% trade in emissions surplus is very unrealistic; in practice bilateral deals between countries at an agreed price are far more likely.

- Restriction of emissions surplus trade typically raises the market equilibrium price of carbon, but despite this, the potential value to Russia is not large.

In order for Russia to benefit from emission trading without the inclusion of the EU in the market, one, or a combination, of the following would be required:

- the successful pursuit of extremely aggressive GDP growth targets, combined with aggressive energy intensity reductions;

- the strict global implementation and enforcement of tight export caps; and/or

- the USA to re-enter the potential emissions credits trading system.

All of the above results also assume that the other Annex-B countries continue to produce emissions at current levels, and that only 10% of CDM projects are successfully realised.

*Estimated Price and Potential Benefit to Russia Including the USA in the Trading System*

Our analysis suggests that the market price for emissions credits will be between US$0 and US$5/tonne carbon across the various scenarios, given that the USA has withdrawn from the Kyoto Protocol. For the comparative purposes, we have carried out a brief modelling exercise to ascertain what the equilibrium price and subsequent benefit to Russia would be if the USA was part of the trading regime.

Under the first scenario, we have assumed that the world demand for carbon abatement would come from the Japan, Canada, Australia, New Zealand, Switzerland, Norway and the EU20, and would total approximately 200 MtC in 2010. Under the second scenario, we have assumed that the world demand for carbon abatement would come from the USA, Japan, Canada, Australia, New Zealand, Switzerland, Norway and the EU20, and would total approximately 670 MtC in 2010. For both scenarios we have assumed (i) Russian GDP growth of 4%; (ii) Russian energy intensity reduction of 2% (i.e. the reform – moderate growth scenario); and (iii) 60% of supply-side country's emissions surplus is available for trade.

*Figure 30 – World equilibrium price and potential annual benefit to Russia (excluding and including the USA) in the year 2010*

| **Scenario** | **World equilibrium price ($/tonne C)** | **Potential benefit to Russia (US$m)** |
|---|---|---|
| Excluding the USA from the global trading system | 1.3 | 161 |
| Including the USA in the global trading system | 25.1 | 4,390 |

*Source: CEPA calculation and CERT modelling*

The significance of the USA withdrawing from the Kyoto Protocol is immediately clear. It would be the major demand-side participant in the potential emissions trading market and as such the market all but collapses when it is excluded from trading. Consequently, the world equilibrium price falls dramatically upon USA exclusion, as does the potential benefit to Russia from emissions trading.

**Comment**

Numerous assumptions have been made to run the CERT model, so the results cannot be taken as a definitive assessment of the likely development of emissions trading. Nevertheless, the results, and a comparison to other models do provide insights in the determinants of emission values using the simplistic assumption of a perfectly competitive emissions market.

## Modelling Conclusion

Modelling results indicate that if there is unrestricted global trading in emissions then Russia is unlikely to derive much benefit from emissions trading because supply of emission credits would exceed demand. Therefore, if Russia is to be a net monetary beneficiary of a trading system, explicit change to the parameters of trading would be required to ensure significant value. As our modelling shows, the use of export caps could be used to provide sufficient restriction on supply to drive up the equilibrium price to a level necessary for Russia to cover its domestic trading costs, and thus realise a profit from trading.

This assumes that Russia will have a surplus to sell. While this will seem wholly rational to the remainder of the Annex B countries, the Russian Government may be reluctant to accept that their projected GDP growth levels will not be realised.

The results from this modelling exercise confirm the result from the published literature that the carbon price in the absence of the US is very low. Our estimate of the price with restrictions to emissions surplus sales is at the low end of the range of estimates of prices made by models assuming oligopolistic behaviour by Russia. This is probably a result of detailed model assumptions such as the way in which the EU participates in emissions trading.

## Banking

Under the terms of the Kyoto Protocol, emissions surpluses not used in the first commitment period can be carried forward to future commitment periods. There is therefore a value to these unused surpluses, although we have not quantified this because:

- It is not yet clear whether there will be a second commitment period – although ratification and hence entry into force would increase the likelihood of there bring one.

- The value of surpluses will depend on numerous unknown factors, including the commitments of Russia and other countries further to reduce emissions. If surpluses were expected in the second period, the value of these banked credits would not be used until the third period.

- The risks associated with this value suggests that they should be discounted at a high discount rate.

Clearly, though, it is possible that there could be an additional benefit from these credits.

## Value of emission trading to Russia

Although our modelling exercise, as well as the results of other models, indicates that the price for Russian AAUs is likely to be very low, this would not be a realistic basis for assessment, as with a price close to zero Russia will have no incentives to sell its emissions surplus. In the real world, rather than in the stylised economic modelling that we have done, it does seem likely that carbon deals will be done between Annex B countries and countries with surpluses.

Our analysis is that while demand for emissions surplus is very weak now, it may potentially intensify near the end of the first commitment period (i.e. close to 2012) from countries who were unable to meet their Kyoto targets through internal abatement policies or JI / CDM mechanisms. At this stage, it is highly unlikely that a 'free' market mechanism will determine the price of the AAUs to be traded. These trades will most probably take place within a framework of political negotiations, linked to a number of other economic and geopolitical questions.

To give an idea of what these values may be, we have provided projections for two potentially negotiated prices in US$/tonne carbon (these prices would be approximately US$2 / tonne and US$5 / tonne when converted into $CO_2$ equivalents). The figures are provided for a range of globally negotiation levels, which for simplicity assumes that Russia negotiates to supply an aggregate percentage of the global carbon abatement reduction (as oppose to bilateral deals). We have assumed that the world demand for carbon abatement would come from Japan, Canada, Australia, New Zealand, Switzerland, Norway and the EU20, and would total approximately 200 MtC in 2010. The percentages in Figure 31 are applied to this amount.

*Figure 31 - Estimated Negotiable Revenues*

| US$ / tonne C | **Potential negotiated % of global carbon abatement requirement** | | | | |
|---|---|---|---|---|---|
| | 10% | 20% | 30% | 40% | 50% |
| 7.5 | $0.15bn | $0.30bn | $0.45bn | $0.59bn | $0.74bn |
| 20 | $0.40bn | $0.79bn | $1.19bn | $1.58bn | $1.98bn |

*Source: CEPA calculation and CERT modelling*

The actual revenues achieved in the government to government trading are uncertain, and will depend on future attitudes to surplus purchases, and whether these can be made politically acceptable. The behaviour of Ukraine will also be important.

We think that $7.5/tonne carbon equivalent and $20/tonne carbon equivalent provide reasonable indicative range for the prices within which deals might be struck. These reflect the needs of sellers to achieve a positive price, and are still well below the likely international carbon price. With a range of percentages of global carbon abatement set at between 20-50%, this gives a realistic range for the sales of carbon through this method at between $0.3bn - $2.0bn p.a.

## 11. INDIRECT EFFECTS OF EMISSIONS TRADING

The introduction of carbon emission restrictions and the associated trading of allowances increases energy costs in particular for users of fossil fuels. In the previous chapter we noted that the price of emission units will depend on the location and nature of those units. We have identified two main effects of these global developments which have the potential significantly to affect Russia:

- The increased cost of using fossil fuel will change world demand for oil and gas, changing the value of Russia's energy exports.

- The existence of Russian surplus emissions may mean that the marginal cost of energy use in Russia is lower than elsewhere, so it could increase its production of energy intensive products, increasing the value of its exports.

The impact of ratification by Russia clearly depends on what would happen in the absence of ratification. Is a non-Kyoto world one in which no measures for GHG mitigation are taken? This seems unlikely. In particular, at this point it is likely that the EU will enforce GHG targets on its industry, with or without Kyoto. It could therefore be argued that there will be a relatively limited indirect impact unless the US joins Kyoto, although in practice ratification could help forge significant strategic economic links, not only with Europe by also Japan and Canada This will be considered in the discussion below.

### Energy exports

The impact of putting a cost on GHG emissions will reduce the overall demand for fossil fuels. But there will be different demand effects on different fuels because of differential carbon content. In particular, electricity produced from gas releases less carbon per kWh produced than oil or coal.

The overall result of this is that projected (though not absolute) demand for coal and oil would be expected to fall, but that the change in projected demand for gas could well increase, although whether demand falls or rises depends on own and cross-elasticities of demand, and empirical and modelling studies are needed to establish this.[37] There will also be different effects in the short and long term as investment in electricity generation plant by energy-intensive industries responds to new price differentials.[38]

In the following subsections we first discuss the effects on the oil market of ratification, and then consider the effect on gas markets, and make an overall assessment of the possible impact on the value of Russia's fossil fuel exports.

#### Oil markets

Barker et. al. (2001) reports work undertaken for the IPCC to assess the likely impact of measures to mitigate climate change, and it contains a survey of numerous analyses of

[37] For example, see Holtsmark (2003).

[38] A detailed analysis of the impact in the power sector is given by Reinaud (2003).

these potential impacts. As with the estimates of the value of emissions permits (see discussion above), a wide range of types of model have been used to make these estimates, including macroeconomic models and specific energy sector models, and detailed assumptions, such as the treatment of non-$CO_2$ gases do differ between the models. Figure 32 sets out a summary of these estimates. Estimates have been made of the impact of Kyoto ratification with and without emissions trading, but we report only the estimates made with trading below. All these studies show that emissions trading leads to lower impact on oil production.

*Figure 32 – Impact of adoption of Kyoto Protocol on projected oil production and revenue assuming US participation*

| **Study** | **Impact on world *projected* oil demand** | **Comment** |
|---|---|---|
| Pershing (2000) review of models | 7-13% decline | In trading scenarios only. Survey of other model results |
| McKibben et.al. (1999) | 7% decline | 25% reduction reported with no trading |
| Lindholt (1999) | 10-22% production decline by 2010 | |
| Rosendahl (1996) | | Reduction in value of OPEC oil wealth by 33-42%, and non-OPEC oil wealth by 40-54%. |
| Berg et. al. (1997) | | Fall of value of OPEC oil wealth by 20%, 8% for non-OPEC. |
| Donovan et al (1997) | 3.7-5.9% volume reduction by 2010 | Notes that limited substitution available in transport. |
| Ghanem et.al. (1998). | 17.9% loss of revenue | In trading scenarios. |
| Bartsch & Müller (2000) | Production decline of 3-5%, revenue fall of 12% | |

*Source. Derived from Barker et.al. (2001).*

Work undertaken for Statoil by CICERO[39], using the CICERO model, appears to be most up to date and relevant, basing its analysis on an up to date assessment of the EU ETS, although it does assume US participation. In this analysis, oil demand falls by 5-7% below projected levels. Oil prices fall only 2-3%. But OPEC producers' strategic behaviour means that they bear the brunt of the falls in output, to minimise impact. Other producers reduce output by 1.6-2.1%, and their revenues fall by 3.5-5%. All these ranges are reductions below projected increases, not absolute reductions.

The models used have estimated a wide range of potential impacts of GHG mitigation schemes. These are caused in part by the very different structure of the models, but different detailed assumptions about the way GHG mitigation policies would be implemented are also made in each model. Pershing (2000) notes that none reflect cost mitigation measures that could be taken to lessen the impact, such as the use of sinks,

[39] CICERO (2004)

and that in general the cost estimates made are therefore overstated by these models. These estimates also assume US participation in Kyoto.

What, more realistically, does this mean for the impact on oil prices of ratification decisions? We assume that Kyoto with US participation would lead to an oil price decline of approximately 3%, in line with the CICERO study, and consistent with a global demand decline of 6% below projected levels and a price elasticity of 0.5. The impact on Russian projected revenues could therefore be in the range 3-5.5%, including a volume and a price effect.

To estimate the impact on prices of alternative scenarios, we estimate what the oil demand reduction would be as a proportion of the reduction if the US were to participate, by an examination of regional and global oil demand. Although these impacts are at the bottom end of the range of estimates in the published literature, some commentators are concerned that large estimates are not plausible, as it implies a large reduction (of around 10%) in oil demand by Annex B countries compared with "business as usual" scenarios. We have therefore used a 1.5% reduction in oil revenues as the lower end of our range of estimates for the impact including US participation, with a 5.5% impact as the upper end.

Compared to the status quo, Russian ratification combined with EU not purchasing emissions surplus involves a reduction in oil use by Annex B countries excluding US, Australia, Russia and EU25, which represents 17% of demand of Annex B countries (see Figure 33 below). This implies that oil prices would be approximately 0.3-0.8% lower than they otherwise would be. If we assume that OPEC acts as swing producer, this would mean that Russia would receive lower prices, but on unchanged export volumes. Details of the percentage impact and value impact on exports are set out in Figure 33 and Figure 34.

*Figure 33 - Oil and gas demand for Annex B countries*

| Country | Oil demand | | Gas demand | |
|---|---|---|---|---|
| | % global demand | % of Annex B countries | % global demand | % of Annex B countries |
| USA | 25.4 | 41.4 | 26.3 | 36.9 |
| Australia | 1.1 | 1.8 | 0.9 | 1.3 |
| EU 15 | 18.0 | 29.4 | 15.2 | 21.3 |
| Canada | 2.5 | 4.1 | 3.2 | 4.5 |
| Japan | 6.9 | 11.3 | 3.1 | 4.4 |
| Russia | 3.5 | 5.7 | 15.3 | 21.5 |
| Ukraine | 0.4 | 0.7 | 2.8 | 3.9 |
| Other Annex B countries | 3.5 | 5.7 | 4.2 | 5.9 |
| Total Annex B countries | 61.3 | 100.0 | 71.2 | 100.0 |

*Source: BP Statistical Review of World Energy*

*Figure 34 - Illustrative impact on oil revenues of ratification decisions, per annum*

| | US doesn't ratify | | | US ratifies |
|---|---|---|---|---|
| | EU doesn't buy emissions surplus | EU buys emissions surplus | EU doesn't keep Kyoto commitments | |
| Russia ratifies | -0.3% – -0.8% | -0.03% – 0% | N/A | -5.0% – -1.5% |
| Russia doesn't ratify | 0%<br>Status quo | N/A | 0.4% – 1.6% | -5.0% – -1.5% |

*Source: CEPA estimates*

## Gas markets

Global gas demand has been rising, partly as a result of increased energy demand, but also as a result of a large increase in the use of this fuel for power generation. This trend is expected to continue, with global gas demand currently expected to grow at around 2.4% p.a. to 2030, according to the IEA. Russia's exports are also expected to rise.[40]

Implementation of Kyoto has two opposing effect on gas demand:

- it reduces energy demand, reducing demand for gas; and

[40] Shell Vice President for Russian, Caspian Region and Southeast Europe Martin Bakman actually expects that Russian exports of gas to Europe will double over the next 20 years (quoted on www.Pravda.ru on October 29, 2003). Whether demand for Russian gas in the EU will drop or not is a subject of much debate.

- the low carbon content of gas gives the potential for increased demand for gas, as electricity production and other energy use is switched away from coal and oil and into gas.

This means that the direction of the impact must be determined empirically. Most market commentators in Europe believe that the substitution effect, i.e. the latter of the two, dominates, both in the short term (because of the switch to gas in the electricity merit order), and the in the long term (as coal / oil power stations are replaced).

The range of estimates for the impact on gas markets is wider than for oil. In Barker et al (2001), the models surveyed estimate an impact ranging from -36.4% to +15%. The well thought through modelling by STATOIL and SNF[41] projects a fall in the middle of this range, with gas demand falling by 2-3%, and European gas prices falling by 3%, compared to the scenario without Kyoto.

Our base case scenario is that Russia does not ratify, but that the EU ETS continues. This means that if Russia ratifies it would have no substantial impact on European gas demand relative to the base case. However if failure to ratify meant that the EU ETS did not continue, there would be a reduction in EU gas demand.

If Russia ratifies, the change to Russian gas demand would be from other Annex B economies which Russia could sell gas to, which would primarily be Japan. The relatively low demand for gas from Japan, means that this effect is likely to be small, though positive. There may, however, be a strategic change in Japan, which could begin to engage with Russia about increased investment in gas infrastructure to develop a market. Given that that the EU buys more than half of Russia's oil and 62% of its gas exports[42], diversification of its buyers is considered by Russia as an important target. It is also possible that European beliefs about Russia as a secure trading partner would improve, facilitating increased European gas demand.

If the EU were to engage in emissions surplus trading, this would allow an increase in EU energy demand, without necessarily changing the pattern of fossil fuel demand. This would increase EU gas demand, giving a small positive impact on gas exports.

If the EU were to abandon the EU ETS, energy demand would rise, but the pattern of the fossil fuel demand pattern would change (compared to the base case projection). If we assume that the substitution effect dominates, gas demand would fall. We understand that modelling results undertaken by ICF Consulting indicate electricity production from gas, with an associated increase in gas demand of 6-7% (with the higher figure associated with accession countries to the EU also participating).

These effects are summarised in Figure 35 below.

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[41] Globalization and energy is a joint project between STATOIL and the Foundation for Research in Economics and Business Administration (SNF). The purpose is to present key features of importance for the long-term development in the world economy, and to enable the user to retrieve information that can help in assessing the future market situation in vital markets. Further details on: http://www.snf.no/statoil/global/

[42] Times online, October 22, 2003

*Figure 35 – Impact of ratification decisions on gas demand*

| | EU – no emissions surplus trade | EU – emissions surplus trade | EU abandons Kyoto |
|---|---|---|---|
| Russia in | • EU demand – no change.<br>• Japanese gas strategy<br>• Russia trading relationship with EU improves | • EU demand – small increase in gas demand<br>• Japanese gas strategy<br>• Russia trading relationship with EU improves | N/A |
| Russia out | Status quo | N/A | Reduced EU gas demand of 6% – 7% compared to status quo because of fuel substitution. |

*Source: CEPA*

Ratification decisions will also have an impact on prices. Gas contracts have prices that are mainly linked to oil prices. It is possible that this will change prior to the first commitment period, and that new contracts will be struck with different indexation clauses. As a base case, we assume that oil-linked pricing will continue.

**Strategic behaviour**

There is a possible link between the sale of surplus emission permits, and fossil fuel demand:

- By exercising its monopoly power in the market and restricting supply of its emissions surplus, Russia will raise the value of GHG permits now but also, and more significantly, in the future (i.e. nearer 2012).

- By restricting the supply of emissions surplus onto the international market Russia may, however, be curtailing demand for its fossil fuels.

A number of studies have been done to try and project the potential linkages between emission trading and fossil fuel demand.[43] The studies look at the interdependence of demand for Russia's fossil fuels and its sale of surplus emission permits. It is argued that if Russia restricts its sale of surplus emission permits too much, it will reduce international demand for gas, reducing the value of Russia's exports.

In the model of Hagem et.al (2004), there is a two-way link between fossil fuel and GHG permit prices. It is argued that the combined exercise of market power in emission permit and gas markets could lead to an increase in gas exports.

As noted in the previous chapter, modelling Russian strategic behaviour in an emissions trading market will only be relevant to the extent that emissions surplus purchase occur.

[43] See for example Holtsmark, B. (2003), Hagem et al (2004)

These models reinforce the conclusion that there is a very large range of potential outcomes, depending on the precise assumptions made about market behaviour.

**Conclusions on fossil fuel exports**

Models of the impact of GHG mitigation do indicate an important effect on oil markets, with an expected reduction in volumes and prices. However:

- The impact of GHG mitigation measures, and Kyoto in particular, are small when compared to the volatility inherent in the markets as a result of changing OPEC behaviour and other uncertainties such as uncertainty over whether Iraqi oil supplies will resume in the near future and how the fragile political and security situation in the Middle East and Venezuela will develop. The wide range of quantitative estimates mean that any individual estimate of the impact must be treated with caution, especially as important aspects of implementation of Kyoto (such as failure of the US to ratify, or the details of the linkage mechanism between the EU ETS and other schemes) are not reflected appropriately in most of the literature.

- Strategic changes, such as investment by Japan into Russia could be important likely impacts of ratification decisions.

Our estimates of the impact of ratification decisions on energy exports are set out below.

*Figure 36 – Illustrative annual impact on Russian energy exports of ratification decisions. US$bn p.a.*

| | **US doesn't ratify** | | | **US ratifies** |
|---|---|---|---|---|
| | EU doesn't buy emissions surplus | EU buys emissions surplus | EU doesn't keep Kyoto commitments | |
| Russia ratifies | -0.7 – -0.2 | -0.1 – 0.0 | N/A | -4.0 – -1.5 |
| Russia doesn't ratify | 0<br>Status quo | N/A | -1.0 – 0.1 | -4.0 – -1.5 |

*Source: CEPA estimates*

## Energy intensive exports

The likely GHG emissions surplus means that in the first commitment period, the marginal cost of emissions in Russia will effectively be zero. This provides Russia with a cost advantage in the production of energy-intensive goods compared to other Annex B countries, where emissions trading regimes and other ways of restricting GHG emissions will provide an additional direct or indirect marginal cost of energy production.

The impact of this is potentially large, with Russia's most important energy intensive goods valued at US$22.8bn.[44]

[44] Russian State Customs Committee (2004)

*Figure 37 – Value of exports of energy intensive products (US$bn, 2003)*

| | Exports to non-FSU countries | Exports to FSU countries | Total |
|---|---|---|---|
| Metals | 16.2 | 1.2 | 17.4 |
| Pulp and paper | 4.9 | 0.5 | 5.4 |
| **Total** | **20.9** | **1.7** | **22.8** |

*Source: Russian State Customs Committee (2004)*

### Valuing the carbon cost advantage

Valuing this effect is not, however, straightforward, because of the numerous factors that affect each industry:

- the difference between the carbon price in other Annex B countries, and the zero carbon price in Russia;
- the volume and value of energy-intensive exports in Russia;
- the effective carbon content of those exports;
- whether or not a carbon tax is imposed on energy intensive products;
- the proportion of production of products in non-Annex B countries, with low carbon prices themselves; and
- the elasticity of demand and supply.

Some studies have quantified the annual value of the carbon cost advantage as highly as US$4.9bn, which seems implausibly high.[45]

Our approach to valuation of the impact for particular products is to:

- assess the carbon content of exports of two main groups of energy-intensive products;
- assess the value of that content, using an assumption about the difference between Russian carbon price and that faced by its international competitors; and
- assess the proportion of production that is met by competitors with a higher price for carbon.

### Estimates of value impact

We have estimated the value impact for two major energy intensive product groups: aluminium, and ferrous metals. Russia exported around 3m tonnes of aluminium in

[45] Dudek et al (2004)

2003, with a $CO_2$ content of 10.5 tonnes/tonne of aluminium.[46] With a value of $CO_2$/tonne of US$5 – US$15, this implies a carbon value of US$150 – US$470m. We estimate that exports of ferrous metals account for a further carbon value of US$100-US$290m. Russia would not keep all this value, as it will still face competition from non-Annex B countries: adjusting for this, based on the proportion of global production in ratifying Annex B countries, gives the reduced values set out in the table below.

*Figure 38 - Illustrative value of impact of ratification decisions on major energy intensive products*

| | EU abandons Kyoto | EU only | EU, plus Canada and Japan | US plus EU, Canada, Japan |
|---|---|---|---|---|
| | Carbon price low everywhere | Carbon price high in EU, low elsewhere | Carbon price high in EU, Japan, Canada | Carbon price high in all Annex B countries |
| Russia in | N/A | N/A | $30 - $90m | $90 - $260m |
| Russia out | -$60 - $180m | Status quo | N/A | $90 - $260m |

*Source: CEPA estimates*

Our estimate of the value impact on aluminium and ferrous metal exports, which account for around half of energy intensive exports, is relatively modest, and at a maximum is around US$250m. There would also be an effect from other products, but this would be smaller, and we judge would be unlikely to increase these estimates by more than 50%.

[46] World Aluminium (2004)

# PART IV – RESTRUCTURING AND MODERNISATION

# 12. The impact of Kyoto on restructuring and modernisation

The Russian government is attempting to implement a programme of economic reforms to improve the productivity of the economy, and its growth prospects. With increased growth, combined with improved efficiency, there will be an increase in GHG emissions compared to today's levels, but as has been identified in Chapter 9 above, it is unlikely that Kyoto commitments will be breached in the first commitment period.

This means that companies' decisions to increase efficiency and reduce GHG emissions will be based on their own costs (excluding a cost for carbon), and the emission reduction target will not provide a constraint requiring additional reductions.

So emissions reductions targets will not provide a catalyst for all the restructuring that needs to be undertaken. So what impact will Kyoto have?

In our view, the main additional mechanism that can have an effect on the economy (the energy sector in particular), and its restructuring and modernisation is the Joint Implementation (JI) mechanism. This part of the report therefore discusses the prospects for JI in Russia, and the direct and indirect impact that it could have on restructuring.

# 13. PROSPECTS FOR JOINT IMPLEMENTATION IN RUSSIA

## Experience to date

To date there has been no JI activity in the Russian Federation.[47] Many projects have been discussed and many projects have reached late stages of the approval process but not one, to our knowledge, has actually been implemented. Sponsors have been frustrated by the uncertain mandates of their counterparts in Russia and the lack of clarity in government's position.

Despite expressing concerns about the institutional uncertainties in Russia at COP 7, one of the biggest buyers of GHG emission reductions that has been interested in Russian JI projects has been the Dutch government, through its Emission Reduction Unit Procurement Tender (ERUPT) programmes. The last ERUPT 3 tender had a number of project applications from Russia which are being considered now. These are:

- a proposal to change the fuel from coal to gas, and other efficiency improvements at Amursk CHP Plant-1; and
- energy efficiency improvements and greenhouse gas emission reduction at OJSC Kotlas Pulp and Paper Mill.

Implementation of these will depend on the Russia authorities' support and, of course, on ratification.

## Current status of demand for JI project participation

The demand for JI projects will be led by the EU, Japan and Canada. The strength of EU's demand will depend on: (i) the level of Member States' public procurement, and (ii) demand from operators under the EU ETS, as determined by National Allocation Plans. The situation is less clear in Japan and Canada. Japanese demand will depend on Japanese need for credits, as well as on political relations between the two countries and on the extent of Japan's desire to develop the Russian fossil fuel supply market. Canada has plans for a trading scheme.

A number of demand opportunities are driven by the governments of the EU countries, who are establishing various funds to invest in JI and CDM projects.

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[47] Lecocq, F., Capoor, K., PCF plus Research (2003)

*Figure 39 - Announcements of JI activity by EU member states*

| Country | Details |
|---|---|
| Netherlands | The Netherlands government has recently (September 2003) signed a Memorandums of Interest with tree Russian regions Omsk, Vologda and Kostroma, on GHG reducing projects. The Netherlands has also opened a new, and fourth, ERUPT tender procedure. (Senter, 2003) |
| Italy | Italy has announced that it will open a specific tender for projects in the Russian Federation, focusing mostly on energy efficiency projects. (Point Carbon, 2003) |
| Austria | Austria opened a JI tender as of December 2003, which will expire at the end of September 2004. Eligible projects will be in the field of heat and power, renewables, landfill gas and waste, energy efficiency etc. (Point Carbon, 2003) |
| Finland | The Finnish government has identified over 50 potential JI projects in transition countries it is interested in. In addition to significant funds spent on improving Finish administration's capacity to deal with JI projects, a €10m is being invested in the Prototype Carbon Fund for investment in JI and CDN projects. (Point Carbon, 2003) |
| Netherlands / EBRD | The Netherlands and the EBRD have set up a new Carbon fund to invest in JI emission reduction projects in Central and Eastern Europe. In 2004 - 2006 the fund will invest €32 million in climate-friendly projects. (EBRD, 2003) |
| Germany | KfW, the German Bank for small to medium size enterprises, and the German federal government are opening a Carbon fund which has an envisaged volume of €50m to invest in JI and CDNM projects. (Point Carbon, 2003) |
| Denmark | The Danish government announced plans to invest €27m annually in emission reduction credits over 2004 – 2007. The funds will be divided between CDM and JI equally. (Point Carbon, 2003) |

There is also evidence of demand form private sector buyers. Some examples are given in Figure 40 and Figure 41 below.

*Figure 40 – Japanese industry's interest in JI projects in Russia*

| Nippon Steel Company and the Sumitomo Commercial Investments Corporation |
|---|
| According to recent (February, 2004) reports in the media (Russian Itar-Tass and Point Carbon), Nippon Steel Company and the Sumitomo Commercial Investments Corporation are considering 283 million US dollars JI investment into repairing and modernising some of Gazprom pipelines in Russia. The preliminary studies carried out indicate that reductions of GHG could be as much as 5 Mt of $CO_2$ equivalent. This equals up to 8 per cent of the annual emissions of the Nippon Steel Company, and almost 1 per cent of all the emissions of the Japanese industry.<br><br>The investment can only take place if Russia ratifies the Kyoto Protocol.<br><br>*(Source: Point Carbon)* |

*Figure 41 – German industrial interest in Russian JI projects*

| Ruhrgas |
|---|
| During a carbon-business forum at the Moscow climate conference, German gas supply firm Ruhrgas announced plans to further extend its financing of a Russian gas pipeline overhaul programme, expected to cut emissions equivalent to 5m tonnes of carbon dioxide per year by 2007. Other EU firms also confirmed interest in cooperating with Russian companies.<br><br>Ruhrgas and the other western firms are hoping to gain credits for emissions cuts they achieve under the Kyoto protocol's joint implementation (JI) scheme. In return Russia would save resources, increase export potential and modernize its infrastructure.<br><br>*(Source: Point Carbon)* |

## Supply of ERUs from JI projects

Russian industry appears to have recognised the potential for JI and is hoping to explore the opportunities it may provide. The Dutch ERUPT 4 programme, recently opened, has received 12 out of the total of 44 expressions of interest from the Russian Federation.[48]

Individual Russian companies, notably RAU UES, have spent a great deal of time and resources in preparing projects that could be the subject of JI. According to Anatoly M. Zelinsky, Member of Board and advisor the CEO, RAO UES has identified more than 300 projects which are aimed at improving energy effectiveness and efficiency of its holding. Out of these, there is a shortlist of 27 potential JI projects, with Project Design Documents prepared for 9 of these.[49]

A number of industries and groups of companies are emerging with the aim of lobbying the Russian government to support the Kyoto Protocol. The most prominent of these is the National Carbon Union which includes RAO "UES", the Ministry of Transport, RusAl, MDM – Bank as members. In 2003 a number of largest Russian corporations began to coordinate their activity within the framework of special working group of the Economic Department of the President of the Russian Federation.

Significantly, the members of the Union are interested in the immediate creation of a Russian emission allowances market and are prepared to bear the costs related to its formation, which may include:

- making inventories of GHG by market participants;
- establishing corporate and national systems of monitoring;
- registration, certification and verification of GHG emissions reductions; and
- arranging special trade areas.[50]

RAU UES in particular has been very interested in benefiting from the international emission trade and JI. RAO UES' emits 29% of Russia's GHG emissions, and 3% of

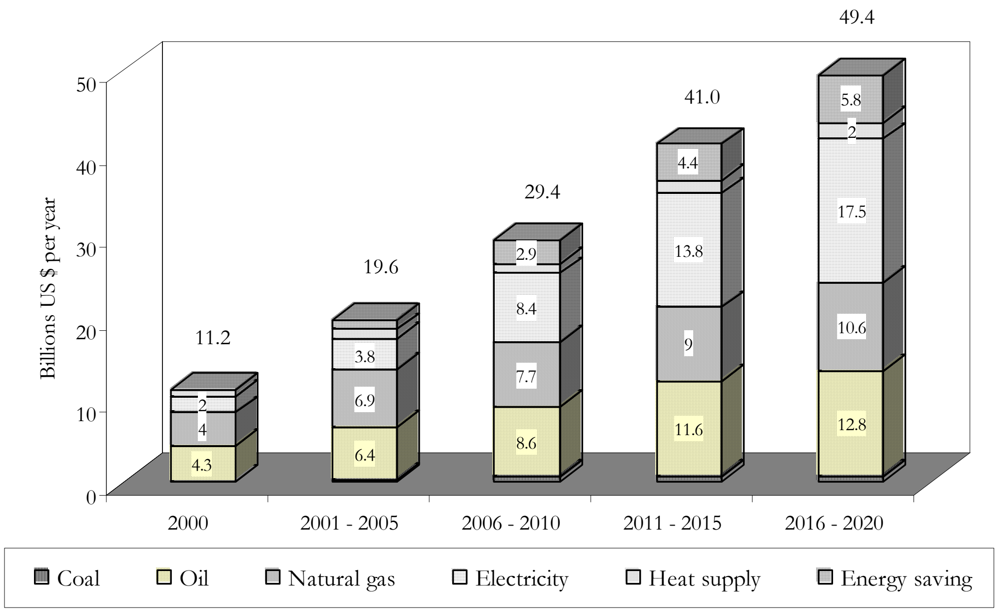
[48] see Senter (2003)
[49] Zelinsky (2003)
[50] Vasiliev, S.V. and Safanov, G.V., (2003)

global emissions. Its interest, further shown through its commitment to the Global Greenhouse Gas Register, is therefore extremely important.

## The potential for Joint Implementation

As discussed above, the investment needs of the Russian energy sector are enormous, with IEA estimating that US$700bn will be needed over the next 20 years, and US$250bn over the next 10 years. Projections of investment, by sector, are illustrated below in Figure 42.

*Figure 42 – Russian energy industry investment needs, US$bn*




*Source: Pluzhnikov & Runova (2003).*

To date, JI project agreements have been relatively small, and received wisdom appears to be that JI could therefore only account for a relatively small proportion of the investment needs. But there is no inherent reason why a larger proportion of the investment needs could not be defined as JI. Much investment in gas and electricity infrastructure will have important, identifiable, associated emission reductions.

At this stage, it is not possible to find a good estimate of the scope for this investment to fall with JI definitions. Whether these additional investments will materialise and what their magnitude is likely to be will depend on issues which include:

- If and (importantly) when the Russian Federation ratifies the Kyoto Protocol. (As mentioned earlier experience shows that JI projects on average yield ERUs only after 3 to 5 years of operations, which means that the window for starting projects whose ERUs could be used in the first commitment period is closing fast.)

- How quickly and effectively Russia meets the Kyoto compliance and monitoring requirements, including whether international verification will be needed for monitoring of ERUs and the magnitude of transaction costs involved in this process.

- The pace and depth of reforms in the energy sector and enabling environment in general (as discussed above).

- Instruments and mechanism that the governments of the EU / Japan / Canada etc. are prepared to introduce to make JI more acceptable and feasible for their industries?

- The price of GHG permits under the EU ETS, and whether Canada and Japan establish trading systems linked to the EU ETS.

- Details of the National Allocation Plans and their acceptance by the European Commission. The NAPs in accession countries will be of particular importance, as they will decide how much of the GHG emission surpluses currently present in these countries will be eligible for EU ETS trading (i.e. will a Polish industrial complex get a lot more credits under the Polish NAP due to the presence GHG surpluses in Poland).

- The growth of the CDM market and its ability to satisfy the demand for emission reduction units.

- To what extent would investment from the US and other non-Kyoto signatories crowed-out investment through JI (due to its potentially cumbersome bureaucratic procedures).

Russian sources indicate that a total of US$1-2bn[51] could be invested in carbon projects. But we think that this is conservative, and given the size of investment needed in the Russian energy and energy-intensive industries, many additional projects could potentially be classified as JI investments. Therefore, an indicative maximum of US$5bn, only 2% of required investment, seems very plausible. This figure would be reduced, perhaps to US$2.5bn, if Russia were to ratify, but the decision to do so were delayed.

[51] Berdin et.al. (2003).

# 14. The value of Joint Implementation (JI)

## Direct value

The main direct benefit of a Joint Implementation investment is that it is investment that would not have taken place otherwise in Russia. Projects chosen to be undertaken as JI are likely to be different from those that are taken by Russian industry on their own account. JI projects will be those which lead to the greatest reduction of emissions per US$ of investment, rather than those with the largest economic value. JI investment is, therefore, unlikely to crowd out other planned investments.

## Changing the pace of reform?

The Russian government is intent on pursuing its reform programmes, in particular for the energy sector, with or without Kyoto, and as soon as possible. Progress in implementing reform could, however, be improved were Kyoto to be signed.

If Russia is to ratify the Kyoto Protocol, it may be forced to introduce reforms slightly faster than it would have done otherwise. Reforms such as greater transparency in the energy (and potentially other sectors) and better reporting and monitoring capability would be needed as part of Russian compliance responsibilities for Kyoto.

Greater integration of the Russian energy sector with those of other countries, through economic and technical cooperation to cut GHG emissions, could be a source of valuable capacity building and learning which could speed up the restructuring process.

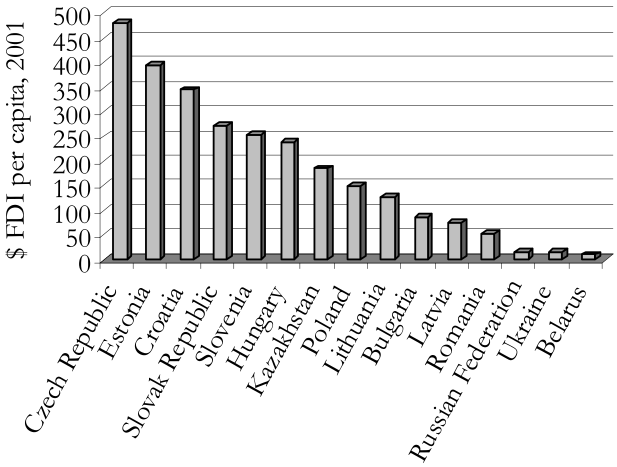
In general, however, these are fairly weak links from the point of incremental additionality that Kyoto ratification would bring to the reform process. The pace of reform and improvements in the enabling environment are far more dependent on the political will of President Putin and his ability to push the reforms through, as well as the nature of the relationship between the Kremlin and the main energy sector participants.

## Improving the prospects for FDI

### FDI and Russia

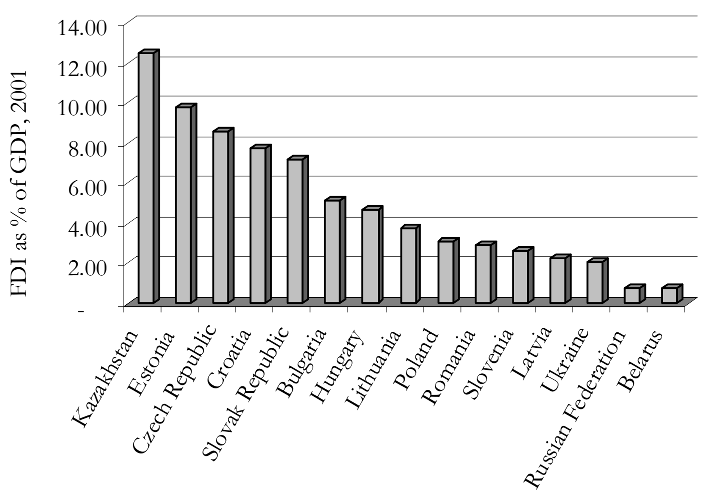
Historically Russia has had one of the lowest rates of FDI among the Annex B countries that are classified as economies in transition countries. Figure 43 and Figure 44 compare FDI per capita and as a percentage of GDP for these countries.

*Figure 43 – US$ of FDI per capita, 2001[52]*




*Source: World Development Indicators*

*Figure 44 – FDI as percentage of GDP, 2001*




*Source: World Development Indicators*

Currently only 13% of total investment into the energy sector originates from outside Russia, and of that 95% goes into the oil industry. There is practically no FDI into the

[52] The list also includes Kazakhstan. Upon ratification of the Kyoto Protocol by Kazakhstan and its entry into force, Kazakhstan becomes an Annex B Party for the purposes of the Protocol, but will remain a non-Annex I Party under the Convention.

electricity sector or other industries in general[53]. By April 2003, cumulative FDI since 1991 was just under US$20bn, compared to US$350bn for China.

FDI made up only 5% of domestic fixed capital formation.[54] The growth in domestic investment (primarily powered by high fossil fuel prices on international markets) and some growth in FDI has improved the rate of capital formation in the last few years but much more needs to be done. Figure 45 illustrates the dynamic of capital formation over the last 12 years, and Figure 46 shows the relatively small percentage of FDI in gross capital formation from 1994 to 2001.

*Figure 45 – Historical growth pattern of Russian capital formation*[55]

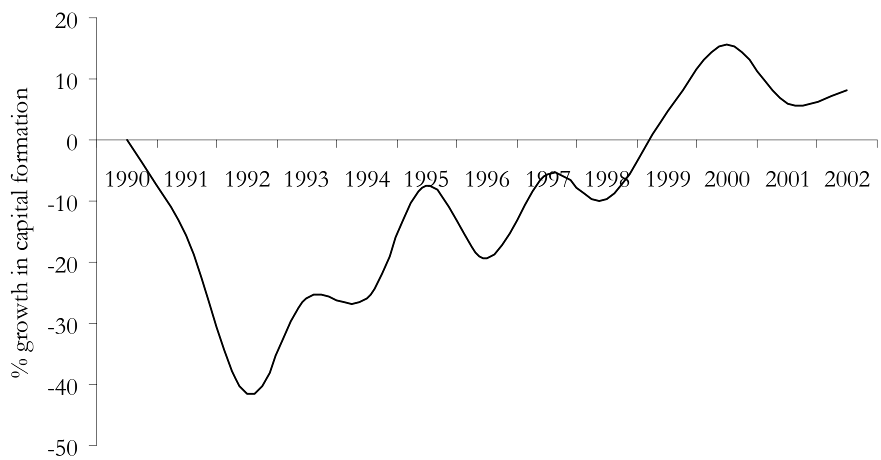
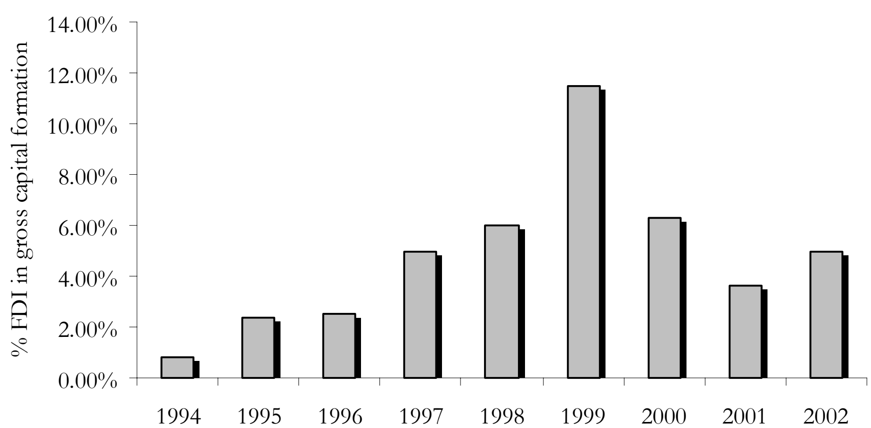



*Figure 46 – Percentage of FDI in gross capital formation*[56]




Regardless of whether Kyoto is ratified, the Russian government and the energy industry in particular are working hard to reverse this trend and implement reforms that would

[53] Russian Energy Strategy until 2020
[54] Bush (2003)
[55] Bush (2003)
[56] Bush (2003) and World Development Indicators

attract more FDI[57]. Both the government and industry are, however, evaluating whether Kyoto, and its flexible instruments – notably JI - would deliver any additional FDI that would not have otherwise been forthcoming.

**JI facilitating FDI?**

Could JI improve this situation? We think that it could, for two main reasons:

- Private investors in JI projects will establish links with Russia, the infrastructure within their company to make investments, and are therefore likely to find investment opportunities that they otherwise would not have, and be prepared to act on them.

- The reforms and changes to the legal framework necessary to accommodate substantial JI investment could have substantial benefits in the improvements for all types of investment.

How large could these effects be? We have suggested an indicative maximum of US$5bn of JI investment could be identified over the first commitment period. An indicative maximum of US$5bn for incremental FDI investment on top of this also seems plausible, for the value of investments that investors would make in the energy and related sectors. These indicative figures reflect the combination of estimates by the National Carbon Union in Russia and our own assessment of the situation. But if the creation of the JI process has an effect on the rest of the economy, the associated impact could be far larger.

It should, however, be noted that while JI projects are expected to generally have a positive impact on FDI, there are some constraints. Figure 47 summarises the overall picture.

[57] Funded by the World Bank, RAU UES has recently embarked on a project to development guarantee mechanisms that would improve FDI flows into the electricity sector.

*Figure 47 – Possible positive and negative impacts of Kyoto on FDI to Russia*

| Possible positive impact on FDI | Possible constraints on JI as an FDI lever |
|---|---|
| • A positive price on EU ETS for GHG permits achieved via JI will enhance the commercial returns on investment project.<br>• Involvement of both Russian and investing firm's governments in the transaction improves the risk profile of the project.<br>• Apart from Ukraine, Russia has one of lowest GHG abatement costs of Annex I countries.<br>• Russian government may be more supportive of JI versus other investment as: (i) JI investment is specifically aimed at modernising the processes and equipment of Russian industries; (ii) greater GHG allowances on the EU and other markets will stimulated demand for Russian fossil fuels. | • Increased bureaucracy, such as ensuring additionality, verification and certification of emissions, related to implementing a JI project may hinder growth of investment.<br>• Difficulties and transaction costs involved in calculating the baseline scenario of Business as Usual in JI projects, especially as international verification will most probably be needed for every project.<br>• Additional risks involved for investors are: the yield of ERU, the price level of ERU on the EU ETS / worldwide, effects of negotiations related to the next commitment period. |

## Valuing the contribution of JI

How much is this incremental investment worth? The impact of investment has additional benefits over and above the investment itself, and the value of this can be approximately assessed using a Keynesian multiplier which we judge to be in the range 1.3 - 1.7, giving a net value of 0.3 -0.7 multiplied by the investment made. We have suggested that JI investment for the first commitment period, with fast ratification and without the US could be in the range $1-5bn in total, with an additional $1-5bn of non-JI FDI. We estimate that this investment would have a value of US$0.1-1.4bn for each year in the first commitment period. This could potentially increase to US$0.2-2.1bn with US participation

These figures must, of course be treated with caution, but they do give an illustration of the order of magnitude value that JI could bring.

*Figure 48 – Incremental Potential JI investment scenarios over the first commitment period*

| | US out | | US in | |
|---|---|---|---|---|
| | Non-JI FDI | JI investment | Non-JI FDI | JI investment |
| Russia in – fast ratification | $1-5bn | $1-5bn | $1.5-7.5bn | $1.5-7.5bn |
| Russia in – slow ratification | $0.5-2.5bn | $0.5-2.5bn | $0.6-3 bn | $0.6-3bn |
| Russia out | 0 | N/A | 0 | N/A |

*Figure 49 – Value of additional investment per year of first commitment period*

| | US out | US in |
|---|---|---|
| Russia in – fast ratification | $0.1-1.4bn | $0.2-2.1bn |
| Russia in – slow ratification | $0.1 – 0.7bn | $0.1 - 0.8bn |
| Russia out | 0 | 0 |

# PART V – CONCLUSIONS

## 15. THE VALUE OF KYOTO TO RUSSIA

Under all plausible scenarios for growth of the Russian economy, Russia will have surplus emissions. This means that ratification of Kyoto by Russia would not directly constrain ambitious growth plans of the current Russian administration. In addition, the cost of compliance with Kyoto is relatively low.

Our analysis also shows that the view that ratification would bring automatic and significant benefits needs to be carefully assessed. In particular:

- Without US ratification, the international price for AAUs will be low, and will be contingent on bilateral political agreements.

- The projected value of Russian oil exports would increase less than would otherwise have been the case. The main gains from increased gas exports would occur anyway, assuming the EU ETS continues irrespective of Russian ratification.[58]

- Russia would gain from the sale of energy intensive products, but the impact of this would be relatively small.

- Russia could gain from international investment, including the JI mechanism, and the sums involved could be large. The value of these to Russia, though, would be a fraction of the total investment.

- There may be a number of strategic benefits such as improved strategic energy linkages with Europe and Japan It would be very difficult to quantify these important effects, and we have not done so.

Figure 52 sets out a summary of these costs and benefits, under the 10 scenarios identified in Chapter 2. The estimates are of course uncertain, but our assessment is that in the scenarios with Russian ratification, and without US ratification, and assuming low value of sales of emissions permits, the overall value to participation compared to the status quo is relatively small but positive. The positive effects of JI, and improved energy intensive exports are offset by the loss from oil exports. A higher value for sales of emissions permits, contingent on political decisions, would obviously increase the positive balance.

In the scenarios with US participation, the benefit improves. There would be an increased loss from oil exports, but this would be more than offset by higher emission permit sales, principally to the US. Full US participation is of course unlikely although ratification and entry into force might increase the likelihood of activity at the state or entity level in the US. These effects are summarised for our five focus scenarios in the figures below.

[58] If Russia does not ratify, gas exports would be lower in the unlikely alternative scenario that the EU does not maintain its Kyoto commitments. Russian ratification, therefore effectively insures against this possibility.

*Figure 50 – Focus scenarios*

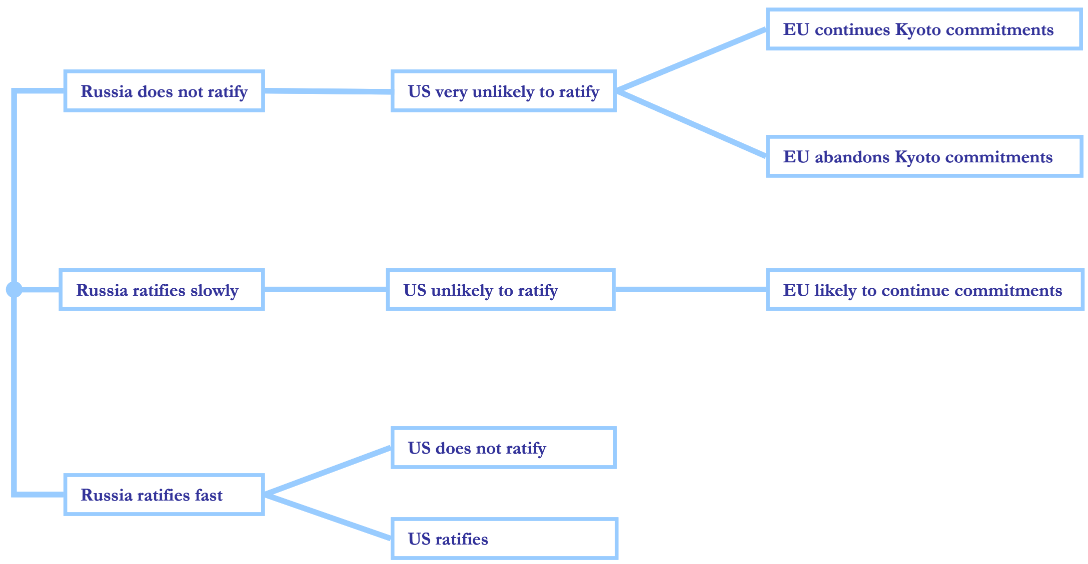



*Figure 51 - Indicative costs and benefits of ratification - average impact per year of first commitment period – US$bn*

| | Emissions trading | | Fossil fuel exports | | Energy intensive exports | | JI benefit | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High | Low | High |
| Russia doesn't ratify – EU abandons commitments | 0 | 0 | -1.0 | -0.1 | -0.2 | 0 | 0 | 0 | -1.2 | -0.1 |
| Russia doesn't ratify – EU maintains commitments | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Russia ratifies slowly | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 0.7 | -0.3 | 1.8 |
| Russia ratifies fast, US doesn't ratify | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 1.4 | -0.3 | 2.5 |
| Russia ratifies fast, US ratifies | 4 | 4 | -4 | -1.2 | 0.1 | 0.3 | 0.2 | 2.1 | 0.3 | 5.2 |

This small benefit of ratification is partly because of our status quo assumption that the EU continues with the EU ETS. If failure of Russia to ratify were to lead to the EU ending this system, and carbon pricing not favouring gas, there would be a significant decline in Russian gas exports to Europe, reducing the value of its fossil fuel exports. So if Russian sales of gas to Europe were contingent on ratification, the value of ratification to Russia would be higher. It should also be noted that whether or not the ETS continued in the absence of ratification, Russia's status as a trading partner of the EU would be harmed, and this could lead indirectly to a reduction in gas exports.

The key assumption driving the conclusion that ratification would be small is the assumption that emissions permits sales would have a low value. This is a conclusion of the economic analysis. But pragmatic politics might override the economic analysis, and individual governments could decide to negotiate to acquire AAUs with Russia, but not in a market based mechanism. If this were to happen, and sufficient value of AAUs were sold, then the value of ratification would increase.

At present, Russian scepticism about the economic value of its participation in Kyoto is principally related to the high level of uncertainty, from the Russian perspective, of any benefits actually accruing. Action by Kyoto signatories would be necessary for Russians to be convinced that the economic benefits of ratifying will be significant and more certain than they are today. This could involve commitments to purchase credits, possibly framed as investments in Russian energy or energy intensive industry which would reduce emissions. It could also involve the creation of investment or investment guarantee funds to provide support to private sector investments in JI and related projects. Action in other, linked areas, could be considered, for example in respect of some particular Russian interests in the WTO accession negotiations, the Energy Charter Treaty, or long term gas contracts. Further work is needed to establish the scale of potential investment, the likely targets for this investment, and the precise mechanisms that would facilitate engagement by the private sector in this process.

Our analysis indicates that key issues associated with ratification are:

- Crystallising potential value from emissions permits sales. As noted, without value from emission permit sales, the value of ratification is marginal. Specific agreements involving emissions trading could greatly enhance the value of ratification.

- EU gas demand. The positive price for carbon in Europe as a result of the European ETS is a reason for increased gas demand from Russia. Failure to ratify could damage the country's trading status with the EU, because of concerns about security of supply and the continued globalisation of the gas market Ratification would increase confidence in this, facilitating further investment in the associated infrastructure.

- Japanese gas demand. In our analysis, we have not assumed a major change in the pattern of energy demand in Japan. But if it is to meet Kyoto targets, Japan may make a strategic change to lower carbon energy sources, and could agree to substantial investments necessary to purchase large gas volumes from Russia. The benefits of this could be substantial.

- Getting leverage from JI mechanisms. We have identified direct benefits from the JI mechanisms. But the process of getting JI projects started, and ensuring that the necessary legal framework is in place to give international private investors confidence to invest in these projects could have very large spin off benefits, that would facilitate the restructuring of the whole Russian economy.

- Facilitating US engagement with climate change process. The value to Russia of US participation is large, and it is possible that future US participation could happen if Kyoto mechanisms are seen to work, and US decides it needs to engage with the climate change process again. Fast ratification would facilitate this.

*Figure 52 – Indicative value of costs and benefits from ratification US$*

| Scenario number | Russia In? | US In? | EU ETS etc? | EU buys emissions surplus? | Description | Emissions trading | | Fossil fuel exports | | Energy intensive exports | | JI benefit | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | High | Low | High | Low | High | Low | High | Low | High | Low |
| 1 | | | ✓ | | Kyoto fails, some countries including EU keep to commitments. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | | | | | Kyoto fails, only very limited commitments kept. | 0 | 0 | -1.0 | 0.1 | -0.2 | 0 | 0 | 0 | -1.2 | -0.1 |
| 3 | | ✓ | ✓ | | Kyoto implemented, but without Russian participation. | 0 | 0 | -4.0 | -1.2 | 0.1 | 0.3 | 0 | 0 | -3.9 | -0.9 |
| 4 | ✓ - slowly | | ✓ | ✓ | Kyoto implemented slowly without US, EU buys emissions surplus | 0.3 | 2 | -0.1 | 0 | 0 | 0.1 | 0.1 | 0.7 | 0.3 | 2.8 |
| 5 | ✓ - slowly | | ✓ | | Kyoto implemented slowly without US. | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 0.7 | -0.3 | 1.8 |
| 6 | ✓ - slowly | | | | Kyoto implemented slowly, but EU mechanisms fall apart because of delay | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 0.7 | -0.3 | 1.8 |
| 7 | ✓ - slow | ✓ | ✓ | | Kyoto implemented quickly with US | 4.0 | 4.0 | -4.4 | -2.4 | 0.1 | 0.3 | 0.1 | 0.8 | -0.2 | 2.7 |
| 8 | ✓ - fast | | ✓ | ✓ | Kyoto implemented quickly without US, EU buys emissions surplus | 0.3 | 2.0 | -0.1 | 0 | 0 | 0.1 | 0.1 | 1.4 | 0.3 | 3.5 |
| 9 | ✓ - fast | | ✓ | | Kyoto implemented quickly without US. | 0.3 | 1.2 | -0.7 | -0.2 | 0 | 0.1 | 0.1 | 1.4 | -0.3 | 2.5 |
| 10 | ✓ - fast | ✓ | ✓ | | Kyoto implemented quickly, facilitates US joining. | 4.0 | 4.0 | -4.0 | -1.2 | 0.1 | 0.3 | 0.2 | 2.1 | 0.3 | 5.2 |

# Part VI – Annexes

# ANNEX 1. THE PROVISIONS OF THE KYOTO PROTOCOL

## The UNFCCC and the Kyoto Protocol

The United National Framework Convention on Climate Change (UNFCCC) entered into force on 21 March 1994 following agreement at Rio de Janeiro in 1992. This has the objective of achieving a "stabilisation of atmospheric concentrations of greenhouse gases at levels that would prevent dangerous anthropogenic (human-induced) interference with the climate system". The UNFCCC sets a framework for international collaboration to address climate change issues, and in particular it:

- Establishes institutions. A Conference of Parties (COP) is the decision making body of the convention, which meets annually. Other bodies report to the COP on science and technology, and implementation (the Subsidiary Body for Scientific and Technological Advice, SBSTA and the Subsidiary Body for Implementation SBI). A permanent secretariat has also been established.

- Provides for countries to report to the Convention on climate change issues. In particular, Annex I countries (see below) must submit an inventory of greenhouse gas emissions each year, which are subject to review by experts. Non-Annex I countries are also required to report information, but this is less detailed, and not subject to the same review procedures.

The UNFCCC and subsequent accords fell short of setting targets for emission reductions. The Kyoto Protocol to the United Nations Framework Convention on Climate Change ("the Kyoto Protocol") was agreed on 11 December 1997 by the parties to UNFCCC. The Protocol is a development of the Convention, and when ratified will impose legally binding emissions targets on industrial countries, as well as other conditions.

Before the Protocol can enter into force, it must be ratified by 55 parties to the Convention. These 55 parties must include sufficient Annex I countries to encompass 55% of the GHG emissions by all Annex I countries.

## Definitions

### Groups of countries

The Protocol defines the following groups of countries:

- Annex B countries. 38 industrial countries and economies of transition listed in the Annex B of the Kyoto Protocol that have undertaken defined emission reduction commitments. Currently Belarus and Turkey are listed in Annex I of the UN FCCC but are not listed in the Annex B of the Protocol.

- Annex I. 40 industrial countries and economies in transition listed in Annex I of the UN FCCC, with various non-binding commitments under the Convention. Annex I countries can invest in JI / CDM projects as well as host JI projects.

- EIT countries. The Economies in Transition countries are industrial countries emerging from communism, and include the Russian Federation, the Baltic States, and other central and eastern European countries.

- Non-Annex I countries.

*Figure 53 –List of Annex I countries and Annex B countries*

| **Annex I** | **Annex B** | **Annex B targets** (% of base year or period) |
|---|---|---|
| Australia | Australia | 108 |
| Austria | Austria | 92 |
| Belarus | | |
| Belgium | Belgium | 92 |
| Bulgaria | Bulgaria* | 92 |
| Canada | Canada | 94 |
| Croatia | Croatia* | 95 |
| Czech Republic | Czech Republic* | 92 |
| Denmark | Denmark | 92 |
| Estonia | Estonia* | 92 |
| Finland | Finland | 92 |
| France | France | 92 |
| Germany | Germany | 92 |
| Greece | Greece | 92 |
| Hungary | Hungary* | 94 |
| Iceland | Iceland | 110 |
| Ireland | Ireland | 92 |
| Italy | Italy | 92 |
| Japan | Japan | 94 |
| Latvia | Latvia* | 92 |
| Liechtenstein | Liechtenstein | 92 |
| Lithuania | Lithuania* | 92 |
| Luxembourg | Luxembourg | 92 |
| Monaco | Monaco | 92 |
| Netherlands | Netherlands | 92 |
| New Zealand | New Zealand | 100 |

| Annex I | Annex B | Annex B targets (% of base year or period) |
|---|---|---|
| Norway | Norway | 101 |
| Poland | Poland* | 94 |
| Portugal | Portugal | 92 |
| Romania | Romania* | 92 |
| Russian Federation | Russian Federation* | 100 |
| Slovakia | Slovakia* | 92 |
| Slovenia | Slovenia* | 92 |
| Spain | Spain | 92 |
| Sweden | Sweden | 92 |
| Switzerland | Switzerland | 92 |
| Turkey | | |
| Ukraine | Ukraine* | 100 |
| United Kingdom | United Kingdom | 92 |
| United States of America | United States of America | 93 |

** The Economies in Transition countries*
*Source: UNFCCC.*

**Greenhouse gases covered by the Protocol**

Six greenhouse gases are covered by the Protocol[59]:

- Carbon dioxide ($CO_2$);
- Methane ($CH_4$);
- Nitrous oxide ($N_2O$);
- Hydro fluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Sulphur Hexafluoride ($SF_6$).

The volumes of emissions can be aggregated making use of 100 year "global warming potentials" (GWP) estimated by the International Panel for Climate Change (IPCC). The GWP is the IPCC's estimate of the impact of a gas relative to the impact of carbon dioxide, which has a GWP of 1. This combination means that carbon dioxide accounted for over 80% of emissions in 1990, making it the most important greenhouse gas.

## Commitments

The Protocol commits each Annex B country to the following:

- An individual target for allowable greenhouse gas emissions in the period 2008-12. The target for each country is referred to as an Assigned Amount, and the period is referred to as the first commitment period. The aggregate

[59] For further details of the sources of greenhouse gases and emissions trends see e.g. Grubb et. al. (1999), table 3.1, and Annex A of the Kyoto Protocol.

commitments as agreed in Kyoto would lead to a total reduction in greenhouse gas emissions to 5.2% of 1990 levels.[60]

- To make "demonstrable progress" to meeting limits by 2005, and to submit a progress report by 1 January 2006.

- To implement climate change policies and measures that will have a mitigating effect on climate change. The measure are not specified, and the working of the Protocol states that measures such as improving energy efficiency, protecting and enhancing sinks and reservoirs of greenhouse gases, promoting sustainable forms of agriculture, researching new technology for renewable energy and carbon sequestration, reduction and phasing out market imperfections and fiscal incentives in greenhouse gas emitting sectors, reforms in relevant sectors, additional reform over and above those already required by international agreement in the transport sector, and limiting methane emissions in waste management and production, transport and distribution of energy.
- To work with relevant international parties[61] to control emissions from aviation and marine bunker fuels.

## Mechanisms

The Kyoto Protocol provides three main mechanisms which give countries flexibility in the way that they can meet their commitments, to allow this to be done at least cost:

- emissions trading;

- Joint Implementation (JI); and

- the Clean Development Mechanism (CDM).

In addition, there are two other ways that give countries flexibility as to how they could meet their targets:

- Bubbling

- Banking

These mechanisms are described below.

### Emissions trading

If one Annex B country is able to meet its commitments more cheaply than another, the countries can trade so that the overall cost of meeting the reduction target is lower than it would otherwise be. This can be achieved by the transfer of:

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[60] Parties are able to choose whether 1990 or 1995 will be used as the base year for emissions of HFCs, PFCs, and $SF_6$.
[61] The International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO).

- Assigned Amount Units (AAUs). A sale of an AAU would directly reduce the allowed emissions by the selling country, and increase it for the purchasing country.

- Certified Emissions Reductions (CERs) which are obtained from projects under the Clean Development Mechanism (CDM – see below).

- Emission Reduction Units (ERUs) which are obtained from joint implementation projects (JI – see below).

- Removal Units (RMUs) arise from $CO_2$ sinks.

**Joint Implementation**

Annex B parties may agree jointly to undertake projects that either reduce emissions or increase removal of greenhouse gases using sinks. These agreements between Annex B countries are known as Joint Implementation projects. It is expected that most of these would take place in EIT countries, such as the Russian Federation. JI projects produce Emission Reduction Units (ERUs), which are deducted from the aggregate amount of the host country, and added to the aggregate amount of the investing country.

A JI project must:

- have the approval of all the parties involved, including the governments of both countries;

- lead to emission reductions that would not have occurred without the project; and

- meet other detailed rules as set out in the Marrakesh Accords.

Ensuring compliance of JI projects is done under two procedures:

- Track one projects are used when the host country meets all eligibility requirements. In this case, the country can use its own procedures to determine the quantity of emissions saved (i.e. the amount of ERUs produced).

- Track two projects may be possible when track one eligibility criteria are not met. In this case, the project design is evaluated by an independent organisation, which establishes the base level of emissions for the project to use as a reference, and against which emission reductions will be measured. The ERU verification procedure can also be used by track one projects.

**The Clean Development Mechanism**

The CDM is similar in concept (but different in detail) to JI, but it is a provision for Annex I countries to invest in projects in non-Annex I countries.

Russia cannot be a host for CDM projects, and given Russia's situation, it is unlikely to invest in CDM projects, and is therefore not relevant to the discussion in this paper.

### Banking

If a country's emissions are below the aggregate amount, the difference can be carried over to a new commitment period after the expiry of the first in 2012. However, there are limits to this: it will not be possible for credits from sinks to be carried forward, and the carry forward of credits from JI projects will be limited to 2.5%.

### Bubbling

This provision allows countries to agree to meet their commitments jointly, by aggregation of their Assigned Amounts. This provision remains in force for the duration of the first commitment period.

It is expected that the EU member states will be the only countries to use this provision. It remains possible, however, for the Russian Federation to join a bubble with other countries.

## Compliance

Clearly, the provisions of the Protocol need to be monitored, and the document sets out a number of measures for this including:

- The creation of a national system for estimating greenhouse gas emissions and removals. This must be in place by 2007, and the structure of it will build on existing arrangements under the UNFCCC.

- Creation of a national registry for recording transactions of the various units that can be used to adjust Assigned Amounts.

These will be subject to review by expert teams, as will the annual data provided to the Compliance Committee of the UNFCCC. In addition, countries will need to provide information on polices implemented to meet emissions targets, and data on land use.

## Institutions

The implementation of the Kyoto Protocol will be monitored using the same institutional framework as the UNFCCC.

# ANNEX 2. THE RUSSIAN ECONOMIC DEVELOPMENT TO DATE

## Russian economic development to date[62]

The Russian Federation has recorded an impressive estimated 7.3% economic growth in the year 2003, exceeding the most optimistic international expectations. Russia's growth over the period 1999 – 2002 was also strong, averaging 6.4%, and over this period it also achieved:

- investment growth of 8.5%;
- relative stability in the exchange rate, with only -2.2% currency depreciation;
- a current account surplus of US$34.5 billion;
- reduction of poverty levels from 40% in 1999 to 27% in 2002;
- a post-Soviet peak of hard currency reserves at US$77 billion.[63]

Figure 54, Figure 55 and Figure 56 below show key economic variables for the Russian Federation between 1995 and 2002.

[62] Unless otherwise referenced, the data presented has been compiled from: (i) The World Bank (2003), *"Russian Economic Review, August 2003"*, The World Bank, www.worldbank.org.ru; (ii) Bush, K., (2003), *"Russian Economic Survey – September 2003"*, Centre for Strategic and International Studies, Washington, D.C.; The World Bank (2003), *"Russia. Development Policy Review"*, The World Bank, Poverty Reduction and Economic Management Unit, Europe and Central Asia Region, Washington, D.C.
[63] The Guardian, 21.01.2004.

*Figure 54 – Key Macroeconomic Variables, 1995 – 2002*

| | Annual Averages 1995-98 | Annual Averages 1999-02 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|
| GDP and other major indicators | | | | | | |
| Real GDP (% change) | -2.9 | 6.4 | 6.4 | 10.0 | 5.0 | 4.3 |
| Investment Growth | -11.3 | 8.5 | 5.3 | 17.4 | 8.7 | 2.6 |
| Consumption Growth | -1.3 | 5.1 | -3.5 | 12.8 | 5.9 | 6.95 |
| Industrial Production Growth | -2.8 | 7.8 | 11.0 | 11.9 | 4.9 | 3.7 |
| Real Wage (% change) | -7.7 | 19.7 | -22.0 | 20.9 | 20.6 | 16.2 |
| CPI (% annual change) | 69.3 | 36.0 | 85.6 | 20.7 | 21.5 | 16.0 |
| Current Account Surplus (US$ bln) | 4.5 | 34.5 | 24.6 | 46.8 | 34.8 | 31.7 |
| International trade and exchange rate | | | | | | |
| Export Growth (% change) | 5.8 | 2.8 | -1.7 | 9.1 | 1.3 | 2.6 |
| Import Growth (% change) | 0.5 | 5.7 | -28.5 | 20.2 | 14.2 | 12.0 |
| Real Exchange Rate Depreciation (%) | -27.2 | -2.2 | 34.8 | -25.5 | -15.3 | -2.9 |
| Federal budget and fiscal position | | | | | | |
| General Government Budget Surplus (% of GDP) | -7.9 | 0.8 | -3.6 | 2.9 | 3.0 | 0.9 |
| Revenues (% of GDP) | 34.1 | 36.1 | 34.0 | 38.1 | 37.8 | 36.0 |
| Gross Reserves e.o.p (US$ bln) | 15.6 | 31.2 | 12.5 | 28.0 | 36.6 | 47.8 |
| External Debt (% of GDP) | 41.4 | 61.9 | 90.4 | 62.4 | 49.8 | 45.1 |
| Debt Service (% of exports) | 7.9 | 12.7 | 11.5 | 10.0 | 12.9 | 16.4 |

*Source: World Bank & CSIS*

*Figure 55 – Percentage change in key macroeconomic variables, 1992 – 2002*

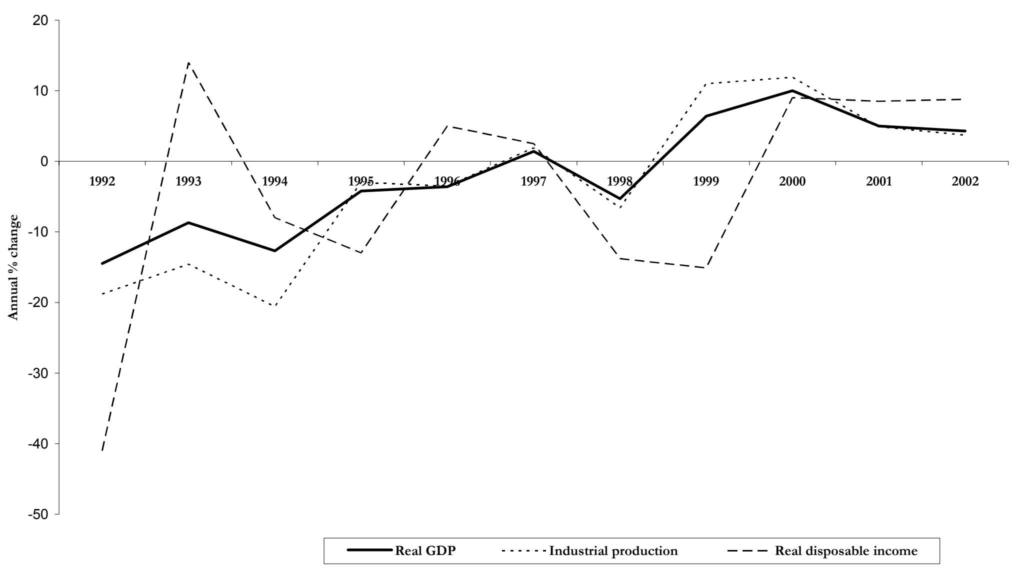
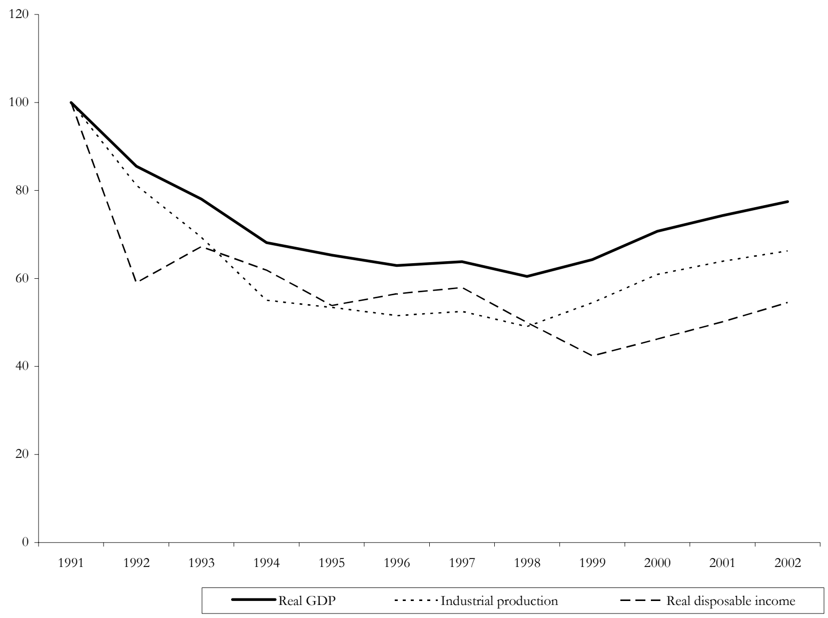


*Figure 56 – Change in levels of key macroeconomic variables, 1992 – 2002, with 1991 as base year*




Russian economic recovery has been a result of a combination of favourable external conditions on the one hand and relative political stability and successful implementation of far reaching reforms across different sectors in the economy on the other.

## Some external factors

The single most important external factor in Russian economic growth and budgetary consolidation has been a persistently high price for Russian crude oil on the international markets.[64] In addition, further strengthening of other commodity prices (petroleum products, natural gas, metals etc.) increased the profitability of the export sector and revived the ailing federal budget. Over the years in question the production of oil grew faster than domestic consumption thereby increasing the export potential.

In addition to strong commodity prices, initial depreciation of the Rouble after the 1998 financial crisis improved the terms of trade for many Russian companies, and encouraged import-substitution activities. While this exchange rate advantage has been reduced significantly, the recent strengthening of the Euro against the dollar helped to limit real appreciation of the rouble (for exports to the European markets).

[64] Russian export gas prices are linked to oil prices and therefore an increase in oil prices will reflect positively on Russian gas export earnings as well.

## Some domestic factors

- **Political stability.** In contrast to the Yeltsin era, Putin's presidency has been marked by a greater cooperation between the Kremlin and the legislature (Duma) enabling a relatively efficient implementation of laws to support the reform process.

- **Fiscal position and tax reform.** Significant progress has been made in reforming the chaotic tax system. Clearer guidelines and better controls have meant a significant increase in revenue from the increased export earnings and wage growth. Greater pressure on the energy monopolies to pay taxes has contributed to the better federal balance sheet. In parallel, greater financial discipline on the federal level have ensured that the federal budget has been in surplus and a healthy reserve is building up.

- **Cash payment discipline and hardening of budgets.** An increase in cash payment discipline, at the government level as well as in the private sector, has monetised the economy and introduced hard budget constraints on many public and quasi-public entities. Pressures on energy monopolies to pay taxes have been supplemented by granting of greater freedom to them to reduce supplied to consistently non-paying customers.

- **Corporate governance and foreign direct investment protection.** Improvements in corporate governance have been reported (through a greater number of bankruptcy procedures for example) and monitoring of firms has increased.

# ANNEX 3. THE RUSSIAN ENERGY SECTOR

The energy sector is probably the most important sector in the Russian Federation. At the same time, it is plagued by immense problems that some commentators and industry insiders predict could result in a severe energy crisis in the very near future. Recognising this, the Russian government has embarked on a wide ranging programme of reforms with the aim to rehabilitate the sector and integrate it further internationally, in a technological and economic sense. The sheer enormity of the task will require a great deal of political will, significant improvements in the enabling environment, an increase in domestic and especially foreign investment, and a series of favourable external circumstances.

## The importance of the Russian energy sector

It is hard to overstate the importance of the energy sector to the economic prosperity of the Russian Federation. The energy industry as a whole accounts for about one quarter of national GDP, one third of all industrial production, and the same level of the consolidated budget of the Russian Federation. It also makes up about one half of the federal budget, exports and hard currency earnings.[65] In 2002, energy exports (oil and natural gas) made up 42% of total export income.[66]

Russian sensitivity about the well-being of its energy sector, in particular its export potential, is demonstrated by various calculations of GDP sensitivities to the international oil price:

- The World Bank representative in Moscow estimates that an increase in 1% in the world oil price triggers a 0.07% increase in Russia's GDP.[67]

- Bush (2003) estimates a greater sensitivity, indicating that assuming all other thing being equal, each US$1 deviation from the average price of Urals Blend from the assumed price of US$21.50 per barrel, changes the GDP growth by one third of a percent.

The Russian authorities are expecting the energy sector to remain of critical importance and are projecting a steady increase in exports. In the latest official projections, Russian fossil fuels and electricity exports, given oil price range of about US$18 to US$20, are expected to rise by 23% to 25% by the year 2010 and by 25% to 30% by 2020. With oil prices of close to US$30 per barrel, energy exports are expected to grow at approximately 30% - 35% and 45% - 50% respectively.[68]

As the energy intensity of the Russian economy in general (being two to three times the OECD) demonstrates, the sector is also one of the most important factors of production. In addition to its importance to the industry, the energy sector provides a lifeline to the population. About 30% of Russians live in areas where January temperatures range between -15 and -40 degrees centigrade, while large communities still

[65] Russian Energy Strategy until 2020
[66] Bush (2003)
[67] Moscow Times, August 21, 2003
[68] Russian Energy Strategy until 2020

exist in the Russian permafrost, which makes up 59% of its territory. Failure to deliver heating and electricity to these areas would have a very high human cost.

## The challenges facing the Russian energy sector

The Russian government is currently facing extraordinarily large problems in the sector. These can be divided into structural / physical and economic[69]:

### Structural / Physical

The physical infrastructure of the Russian energy sector is severely rundown.

- On average, capital assets within the energy sector are depreciated by more than 50%. This is true even in the most developed European parts of Russia. In only 3 to 4 years industry experts predict that the electricity and heat generating and transmission assets will start breaking down in the majority of Russian regions. A potentially dangerous energy crisis is looming.

- The depreciated state of the assets is principally explained by low level of capital formation during the later period of the Soviet Union and in particular during the 1990s. Capital formation in the sector as a whole had fallen by two to six times during the last decade.

- The age of the assets makes the efficiency of existing production capacity extremely low. The problems of frequent breakdowns and lack of spare parts are exacerbated by low production discipline and motivation of the workforce.

- Lack of technological innovation has left the Russian energy sector far behind its competitors in the West. In addition, renewable energy is practically not utilised at all (less than 1% of all energy output).

The Russian energy sector has an added burden of having to build and maintain long transport links, over very inhospitable territory. This is relevant for all primary fuel production and delivery, as well infrastructure within population centres. According to the Deputy Energy Minister fuel piping is on average 22 years old with Greenpeace estimating losses of 17 to 20 million tonnes of oil into the environment. Another study quoted by the St. Petersburg Times claims that the number of breakdowns per kilometre of central heating pipelines is 30 times higher than in the West.

### Economic

The most important economic problem affecting the Russian energy sector is the high level of subsidies for the users of energy. Apart from distorting prices on the domestic energy market and causing inefficiencies in all aspects of energy use in the country, heavy subsidies are one of the major obstacles to greater investment in the energy sector.

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[69] Sourced from a number of source, including the Russian Energy Strategy until 2020, RAO UES publications, Bush (2003) etc.

Figure 57 and Figure 58 show the scale of effective subsidies for power and gas (Source: World Bank). The effective subsidy is defined by the World Bank as the "difference between statutory tariff, adjusted for cash collection, and the true economic cost of service."

*Figure 57 – Effective subsidy for power, 1998 – 2002 (per quarter)*

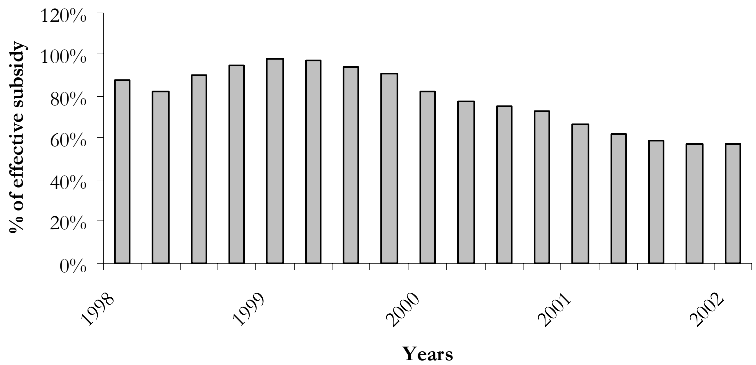
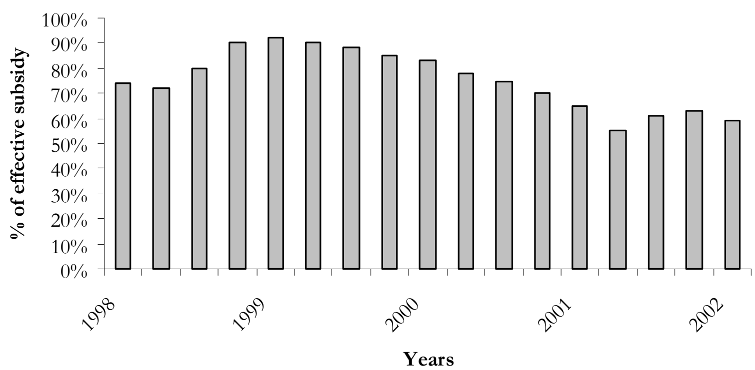



*Figure 58 – Effective subsidy for gas, 1998 – 2002, (per quarter)*




The Russian government is subsidizing the price of energy on the domestic market through limiting the price itself and tolerating non-payment for energy services - this is particularly common in case of energy use by providers of public services. The effects from artificially low energy prices include:

- Subsidizing old and inefficient enterprises and processes encourages inefficient energy use and delays the necessary industrial reforms. Little incentive is given to reduce the very high energy intensity in the economy as a whole.

- Low financial surpluses in the energy sector are starving it of badly needed investment capital. Most of Russian industrial and energy sector investment comes from internal sources (see discussion below).

- The price reforms are essential in improving the quality and reliability of electricity and heating supplies to the population, as generation and transmission assets are improved and losses are cut. More efficient operations and possible greater competition have the potential to reduce the price for the population in the medium to long run.

Progress has been made, as Figure 57 and Figure 58 show. Tighter fiscal discipline has strengthened cash collection, and close links between regional governments and businesses, through which non-payment deals for political purposes were made, are being dismantled. Real prices faced by the population at large for energy products have also been increasing gradually. While the World Bank estimates that the cash collection rate is drastically improved, RAU UES in contrast has indicated that non-payment problems are still widely present. True economic cost though is still not reflected by the artificially low prices.

## Tackling the challenges - restructuring and modernisation of the energy sector

The successful restructuring of the energy sector will require two major activities to be pursued by the Russian government, with the second of the two closely depending on the successful implementation of first.

- implement energy sector price, regulation and legal reform; and
- incentivise greater domestic and foreign investment.

### Sector reforms

The transition process has led to some successes. For example payments for electricity are now primarily made in cash rather than through barter arrangements that were common previously. Tariff rises mean that energy prices which previously were 95% below cost are now estimated to be only around 50% below costs. But the industry still faces major challenges in the years ahead. In particular, the quality of the infrastructure has deteriorated significantly, and this poses risks of supply shortages in the future, despite the apparent excess generation capacity shown in statistics.

The challenge remains to bring prices charged on the domestic market closer to real economic costs of producing and delivering the energy services. The progress in this field is slow due to concerns about the effects on population and on what Russians refer to as strategic industries and sectors (e.g. military, health care, education).

In addition to price reforms, it is widely understood that the large natural monopolies will need to be broken up and robust and transparent regulatory and legal frameworks established to deal with the new structure of the sector. Transparency in the sector and economy as a whole needs to be improved and arbitration powers of independent judiciary strengthened to protect investors. Fiscal regimes will have to be made clearer and good practice corporate governance introduced, such as international accounting standards. It will be important to keep reducing commercial and political risks in general and to support the domestic insurance industry and allow foreign insurance companies to enter the Russian market.

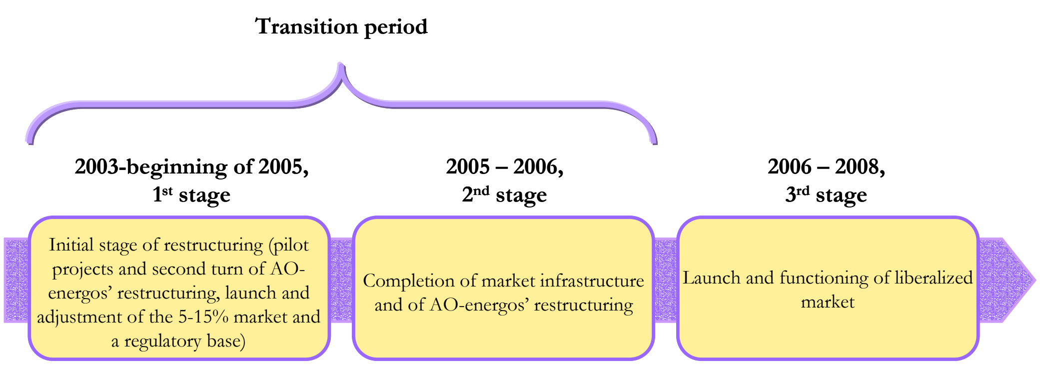
**Investment**

Successful implementation of reforms mentioned above is crucial in creating an environment conducive to increasing domestic and foreign investment into the sector.

The estimated investment requirements necessary to sustain domestic demand, expand exports as envisaged by the sector strategy as well as modernise the critically depreciated domestic production / generation capacity are very large. The International Energy Agency estimates that close to US$700 billion will be needed over the next 20 years, with about US$270 billion of this until 2010[70]. The latest official figures from Russia are broadly in agreement with these estimates, if a little higher in some sectors (e.g. oil).

There are a number of sources that could be used for this investment. Domestically, probably the biggest source is the industry itself. The current implicit energy subsidies are tying up vast resources, some World Bank estimates suggest that as much as US$32 billion was tied up in subsidies. A price reform programme could realistically only release a part of these as prices reflecting full economic costs are unlikely to be reached in Russia for some time to come. The low rate of private savings in banks[71], historically high levels of capital flight, low recovery rates of bad loans and general reluctance of commercial banks to lend to the real sector[72] in general means that significant foreign direct investment (FDI) is needed to enable Russia to meet its energy sector development needs.

*Figure 59 – Planned stages of reform in the electricity market*[73]




70 IEA (2003)
71 It is estimated that about $16 billion are held 'under the mattress' by the public at large.
72 Prior to 1998 banks could earn up to 180% on Treasury Bonds and had therefore little incentive to invest elsewhere in the Russian economy.
73 Adopted Anatoly M. Zelinsky (2003)

*Figure 60– Reform of the Electricity sector*

The Russian electricity industry has been in a process of transition for over ten years. This has involved restructuring, the creation of a new regulatory framework, partial privatisation of major electricity companies, and the creation of a form of wholesale electricity market.

In order to further improve efficiency of the electricity industry, and also to facilitate private sector investment in the sector, the Russian government has approved a package of reforms, which paves the way for further fundamental restructuring of the sector. Major elements of the reforms include:

- The separation of the natural monopoly segments of the industry (transmission and distribution) from the competitive segments (generation and supply).
- The separation of the national transmission company from UES (already established as a subsidiary of UES) by 2006.
- The restructuring of regional energy companies ("Energos"), with separation into different types of business. Distribution companies will be combined into a few inter-regional distribution companies.
- The development of a competitive wholesale electricity market, covering between 5-15% of the market in an initial transition phase. A market operator, a non-profit making organisation to administer the market, has already been established as a subsidiary of UES.
- The establishment of a number of wholesale generation companies, formed from the existing generation assets of UES, which will compete in the newly created wholesale electricity market.
- Protection of households and other customers through mandatory direct contracts. In the longer term, full retail competition is envisaged.

These reforms clearly reflect those that have taken place in many countries around the world. They are complex, and are likely to take many years to implement in Russia, creating an uncertain environment for investors.

# ANNEX 4. A MODEL OF RUSSIAN CARBON EMISSIONS

We developed a relatively simple model to project estimated GHG carbon equivalent emissions by the Russian Federation under different scenarios of economic growth and energy intensity reductions. The modelling work is very similar in its nature to that used by the Russian government in its Third National Communication submitted to UNFCCC in 2002.

Our model is based on the following relationship:

**C = GDP x E/GDP x C/E**

Where:

- **C** represents GHG emission in units of carbon equivalent;
- **GDP** is Gross Domestic Product; and
- **E** is total domestic energy consumption.

The *Energy intensity* of the economy is a ratio of total domestic energy consumption over gross domestic product (i.e. E / GDP) and the *carbon intensity* is taken as the volume of GHG produced (in carbon equivalents) for a particular level of total domestic energy consumption (i.e. C / E).

The two variables used in the model to project carbon equivalent emissions of GHG are changes in GDP and energy intensity. Carbon intensity has been assumed not to change (see Chapter 9 above).

**Sources of data**

World Development Indicators database was used as a source for data on:

- the value of Russian GDP in billions of US$ (base year 2000) up to the year 2002; and
- the value of total domestic energy use, in Mt coal equivalents, up to the year 2000[74].

The data for the volume of Russian GHG emissions, in Mt of carbon equivalent, was obtained from the Russian Third National Communication submitted to UNFCCC (data is provided until and including the year 1999).

[74] World Development Indicators did not have details of total domestic energy use beyond the year 2000.

**Modelling calculations**

The model uses the following sequence of calculations to arrive at the projected GHG emission levels:

(i) The energy intensity ratio, up to the year 2000, is calculated in Mt of coal equivalent domestic energy use over GDP in billions of US$.

(ii) Various GDP growth rate assumptions (see scenarios below in Figure 61) are used to project the value of GDP in billions of US$ from 2002 onwards.

(iii) Varying energy intensity reduction rates (see scenarios below in Figure 61) are used to project the value of the ratio E / GDP from the year 2000 onwards.

(iv) Domestic energy use from the year 2000 onwards is calculated by multiplying the projected value of the energy intensity ratio and projected GDP in billions of US$. The rate of growth / decline in energy use is then calculated from this.

(v) Change in carbon intensity of energy used is assumed to be zero, and therefore the rate of growth in energy use is assumed to be the same as the rate of growth of GHG emissions.

(vi) Projected emission levels for the years 2000 and onwards are therefore calculated by applying projected GHG emission growth rates to the data on GHG emissions obtained from the Russian Third National Communication to UNFCCC.

Scenarios of the rates of GDP growth and energy intensity reduction are shown in Figure 61 below:

*Figure 61 - Modelling scenarios*

| Energy Intensity reduction | High reductions | Low reductions |
|---|---|---|
| Reform | 4% | 2% |
| Non-Reform | 2% | 0% |

| GDP Growth | Optimistic | Moderate | Critical | Putin's challenge |
|---|---|---|---|---|
| Reform | 6% | 4% | 2% | 7.2% |
| Non-Reform | 4% | 2% | 0% | n/a |
| Russian official projections | 6.2% | 4.3% | 2.7% | n/a |

# ANNEX 5. THE CERT INTERNATIONAL CLIMATE CHANGE MODEL

The Carbon Emission Reduction Trading (CERT)[75] model has been used to inform the assessment of the potential value to Russia derived from either ratifying or not ratifying the Kyoto Protocol. CERT is a computational framework used to present and analyse different scenarios in the GHG offset trading market. Various switches and assumptions have been used as inputs to simulate the different test scenarios in order to obtain a series of possible outcomes in the market. The significant value derived from using the CERT model comes from its ability to model and compare these indicative scenarios.

## Qualifications and limitations of the CERT Model

The CERT model is used as it allows us:

- to compare the costs and benefits accruing to signatory countries/regions under the fully autarkic scenario (i.e. where no emissions trading takes place) with a variety of trading scenarios;
- to factor in/out a number of 'real world' idiosyncrasies, e.g. the omission of the Untied States from the market, the impact of the European ETS, the inclusion/exclusion of non-Annex B countries from the market;
- to analyse different Russian growth scenarios in order to establish demand for carbon abatement during the target compliance time period; and
- to establish a world market price for carbon abatement under various emissions surplus trading scenarios.

However, the CERT model does not allow us:

- to profile changes in demand for carbon abatement across the time series – i.e. establishing the time path leading to the 2010 business as usual levels of carbon abatement demand (this is done using a separately developed CEPA model);
- to model particularly complex interdependencies and causality between various types of economic activity;
- to make very robust absolute forecasts – CERT will provide useful indicative comparative statistics between scenarios; and
- to obtain a equilibrium market price that has a low variance between scenarios

## Tailoring the CERT Model

We have tailored the existing generic CERT model prior to running the various scenarios outlined below to ensure that simulated results are generated in the correct context. The

[75] The CERT model was developed by Grutter Consulting on behalf of the NSS Programme of the World Bank.

generic CERT model is run by comparing 2 scenarios simultaneously – a "reference" scenario and a "new" scenario. It then uses switches and parameter adjustments to tailor the reference and/or new scenarios.

## Benchmarking the New and Reference Scenarios

At the high level, the reference scenario is taken to be the autarkic situation where no emissions trading takes place at all. Under this situation, Annex B countries still have an obligation to reduced their carbon emissions according to their pre-defined Kyoto target, but have to fully internalise the costs of doing so. The reference scenario has been tailored to reflect the non-existence of the carbon abatement market – i.e. there is no equilibrium price, and no buyers or sellers of emissions credits.

The autarkic situation is modelled by applying the following switches to the reference scenario. It has been assumed that:

- there is a 0% CDM implementation rate;
- there is 0% emissions surplus trade;
- no imports (0% import ceiling) of the assigned amount;
- no exports (0% export cap) of the assigned amount; and
- all prices are in US$2,,000.

As a basis for modelling scenario idiosyncrasies in a market context (i.e. where trading does take place), the following switches have been applied to the new scenario in order to create an open trade scenario benchmark to which the parameters of the different sets of scenarios are applied. It has been assumed that:

- there is a 10% CDM implementation rate;
- there is 100% emissions surplus trade (i.e. no export cap, although this is a variable which is adjusted during scenario testing);
- there is no import ceiling;
- there is a US$1 per carbon tonne transaction cost;
- there is 2% of CERs generated going to the Adaptation Fund;
- there is no monopolistic behaviour amongst the supply side Annex-B countries in the market; and
- all prices are in US$2,000.

## Benchmarking the "Real World" Assumptions

We have also tailored the existing CERT model to fully incorporate current "real world" characteristics regarding participation in the potential market. They are:

- Including Russia as a standalone state.
- Excluding the US from the potential market has been simulated simply by setting all of its parameters to zero. This assumption holds during all scenario testing.
- Including the EU and its European Trading System (ETS) to varying degrees, with and without excess EU emissions trading.
- Including the Ukraine as a standalone country.

## Marginal Abatement Cost Curves

In order to, for example, net out Russia from Former Soviet Union (FSU) group in the generic CERT model, the parameters of the quadratic FSU marginal abatement cost (MAC) curves have to be adjusted. The MAC curve is equivalent to each group's aggregate supply schedule of carbon abatement at different prices, and each group's MAC's position relative to other groups' MACs ultimately determines whether that country group is a buyer or seller of emissions credits in the model. In general, countries with low marginal carbon abatement costs (due to it currently producing carbon emissions below their assigned amount) relative to the other Annex-B groups, will be the supply-side (sellers of credits) of the market, and vice-versa.

It is assumed that when Russia is disaggregated from the FSU its MAC will shift up by an amount that retains its status as a seller in the market. The magnitude of this shift has been established by adjusting the FSU's quadratic MAC parameters in inverse proportion (in order to insure an upward shift of its MAC) to the ratio of Russia's 1990 $CO_2$ emissions to the aggregate of Russia, Ukraine, Latvia, Lithuania and Lithuania's total 1990 $CO_2$ emissions[76].

Factoring in of the European Trading System (ETS) has been carried out by applying the same procedure to the various relevant MACs, and combining that with the 3 market structure scenarios, which form 1 of 3 sets of scenarios.

## The 3 Sets of Scenarios

The methodology used in simulating the emissions trading market involves running 3 sets of scenarios concurrently:

- a set of 4 hypothetical growth scenarios;

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[76] Emissions levels taken from Table 3.3 pp82 of "The Kyoto Protocol, A Guide and Assessment" Michael Grubb with Christiaan Vroijk and Duncan Brack, 1999. These figures establish a ratio of 647.0 to 865.8, or 1 to 1.338, thus implying that Russia accounts for 74.7% of total FSU emissions at 1990 levels. This percentage is assumed to hold constant across the time series during modelling.

- a set of 3 hypothetical market structure scenarios specifically reflecting the 20 EU countries' (as of May 2004) and the remaining non-EU Annex B countries' degree of participation in the hypothetical market; and

- a set of 4 emissions surplus trade scenarios.

These 3 sets of scenarios are described using the figures below.

*Figure 62 – Growth Scenarios*

| Scenario Name | Description | Projected annual GDP growth (%) | Change in Energy intensity (%) | Projected Emissions (Mtonne of Carbon) |
|---|---|---|---|---|
| **Reform - moderate** | Strong GDP growth over the 10-year period combined with a marked decrease in energy intensity in the economy. | 4.0 | -2.0 | 638 |
| **Reform – Putin's challenge** | GDP growth requirement to meet President Putin's 10-year plan to double Russia's GDP from its level in 2000. Ambitious energy intensity change requirement consistent with Putin's target GDP. | 7.2 | -4.0 | 661 |
| **No reform - moderate** | Growth estimate based on an historic approximation for developed economies combined with a modest energy intensity change, according to the IEA, for developed economies. | 2.0 | -2.0 | 546 |
| **No reform – critical** | Zero growth and zero energy intensity change. Scenario equivalent to the status quo in 2000 persisting across the 10-year period[77]. | 0.0 | 0.0 | 570 |

The growth and energy intensity parameters have been inputted into the CEPA emissions projection model to obtain four projected carbon emissions levels, under the four growth scenarios, for Russia in the year 2010 (shown in right hand column of Figure 62). These carbon emissions projection outputs from the CEPA emissions projection model have in turn been used as inputs into the tailored CERT model under the various market structure scenarios[78]. These market structure scenarios are described in Figure 63 below.

[77] The 10-year period referred to throughout is from 2000 to 2010 (i.e. up to the middle of the 2008-2012 Kyoto Protocol target window).

[78] The United States is included in CERT as an Annex B country, but has been removed during all simulations. All structural scenarios exclude trading with non-Annex B countries, although they are assumed to still contribute to emissions reductions through CDMs. The "trade without EU" market structure scenario assumes that the EU achieves its emissions target exclusively through JIs between EU member states.

*Figure 63 – Market Structure Scenarios*

| Scenario | Structural Description |
|---|---|
| **All countries trade** | *Potential carbon abatement demand-side country groups*<br>• The EU (including the eight May 2004 accession countries) is included as a single country<br>• Japan is included as a single country<br>• Australia, Canada, Iceland, New Zealand, Norway and Switzerland are included a single country<br>*Potential carbon abatement supply-side country groups*<br>• Russia is included as a single country<br>• Ukraine, Lithuania, Latvia and Estonia are included as a single country<br>• Croatia, Bulgaria and Romania (East European Transition Economies, or EET) are included as a single country |
| **Trade without EU** | *Potential carbon abatement demand-side country groups*<br>• Japan is included as a single country<br>• Australia, Canada, Iceland, New Zealand, Norway and Switzerland are included a single country<br>*Potential carbon abatement supply-side country groups*<br>• Russia is included as a single country<br>• Ukraine, Lithuania, Latvia and Estonia are included as a single country<br>• Croatia, Bulgaria and Romania (East European Transition Economies, or EET) are included as a single country |
| **Trade without EU and EET** | *Potential carbon abatement demand-side country groups*<br>• Japan is included as a single country<br>• Australia, Canada, Iceland, New Zealand, Norway and Switzerland are included a single country<br>*Potential carbon abatement supply-side country groups*<br>• Russia is included as a single country<br>• Ukraine, Lithuania, Latvia and Estonia are included as a single country |

The growth and market structure scenario sets are also run concurrently with a set of 4 emissions surplus trade scenarios. These effectively apply an export cap on countries that have an excess of emissions surplus, i.e. the mega carbon tonne difference between a particular country's assigned amount according to its Kyoto target, and its actual emissions level. The 4 emissions surplus scenarios are presented in Figure 64. An export cap of 0% has not been simulated as this would result in the non-existence of a market:

*Figure 64 – Emissions Surplus Trade Scenarios*

| Emissions surplus scenario | Description | Export cap |
|---|---|---|
| Closed Restricted | Emissions surplus trading not permitted. | 0% |
| Open Restricted | Emissions surplus trading permitted but substantially constrained. | 20% |
| Open Moderate | Emissions surplus trading permitted but partially constrained. | 60% |
| Open Liberal | Emissions surplus free trading. | 100% |

The 3 sets of scenarios are then run concurrently to produce a total of 48 results (4 growth scenarios multiplied by the 3 market structure scenarios multiplied by the 4 emissions surplus trade scenarios). Each of the 48 results includes 2 elements - a total benefit to Russia in US$m, and a world equilibrium price for emissions credits in US$ / tonne of carbon.

## Implications of scenario design on results

The nature of the 3 sets of scenarios means that there are 3 general economic effects influencing the market outcome in each instance. These are:

- **Growth Effects** – the CEPA emissions projection modelling discussed above resulted in two broadly similar sub-sets of emissions levels in 2010. The balance of the assumed GDP growth effect and the energy intensity change effect projects similar carbon emission levels between (i) the optimistic and the critical growth scenarios, and (ii) the Putin's Challenge and the Moderate growth scenarios.

- **Emissions Surplus Trade Effects** - the emissions surplus trade scenarios demonstrate how an export cap has the effect of reducing supply of credits and thus pushing up the equilibrium price, given that demand has to be met (i.e. all the Annex B countries are legally obligated to meet their emissions reductions targets)[79].

- **Market Structure Effects** - the market structure scenarios demonstrate how the equilibrium price falls and thus the benefit to Russia reduces as a result of the EU's potential non-participation in the emissions trading market. This is tantamount to a substantial contraction of the demand-side of the market, simply by assumption. As a result, analysing the "all countries trading" market structure

[79] The calculation of emissions surplus trading is based upon calculating the emissions surplus amount and permitting the percentage fixed as zero cost supply in the market.

scenario gives results where there is both a substantial demand side, and a substantial supply-side in the potential market.

Throughout the discussion which follows, each growth scenario is analysed in terms of the above 3 general economic effects. All scenarios are modelled by assuming that monopolistic (collusive) behaviour does not take place, hence monopoly behaviour cannot necessarily be sited as a reason for a high price when output is restricted.

The 100% export cap (i.e. 0% emissions surplus trading) has the same effect on the equilibrium price and benefit to Russia across all four growth scenarios. Emissions surplus trading does not result in any overall reduction in emissions. Therefore, if there is a complete restriction on emissions surplus trading there is still a demand, supply and therefore price for carbon abatement.

## Reform - Moderate Growth Results

*Figure 65 – Optimistic Growth (4.0% GDP growth, -2.0% change in Energy Intensity)*

| **Emissions surplus Trade (%)** | **All countries trade** | | **Trade without EU** | | **Trade without EU or EET** | |
|---|---|---|---|---|---|---|
| | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) |
| **0** | 168 | 5.9 | 77 | 3.5 | 166 | 5.9 |
| **20** | 243 | 4.0 | 109 | 2.0 | 175 | 3.0 |
| **60** | 161 | 1.3 | 0 | 0.0 | 0 | 0.0 |
| **100** | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

*Figure 66 – The Monetary Benefits to Russia (Reform -Moderate Growth Scenario)*

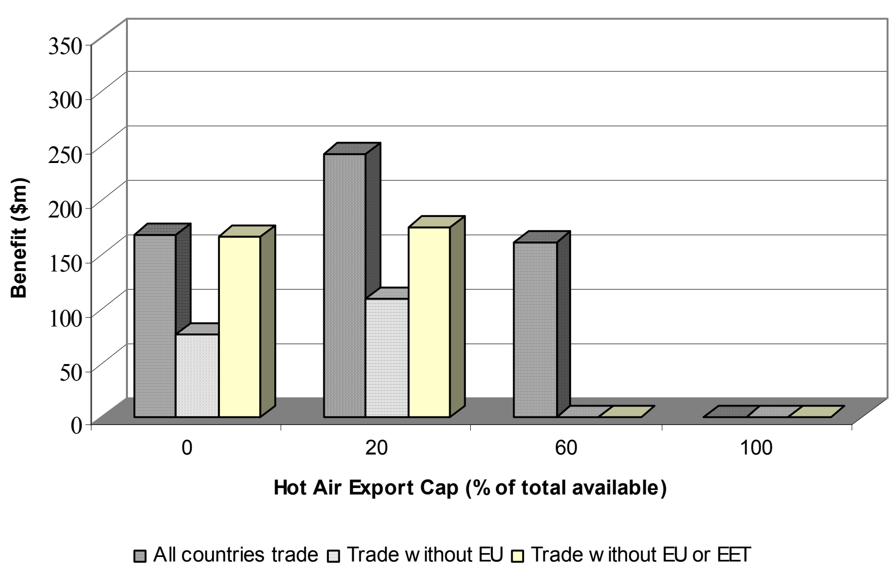
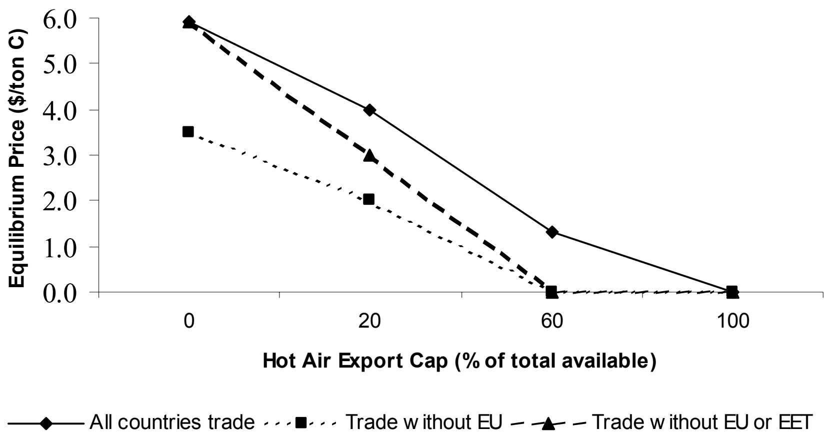


*Figure 67 – World Equilibrium Price (Reform - Moderate Growth Scenario)*




## Reform – Moderate Growth Effects

The effect of simulating *reform - moderate* growth is that Russia has a relatively small amount of emissions credits to trade compared to the amount it has under the *no reform - moderate* and the *no reform - critical* growth scenarios. This is due an assumed improvement in Russia's energy intensity (its production processes and methods have become very energy efficient thus Russia has reduced its emissions levels in real terms compared to its no reform-critical growth emissions levels), but coupled with strong GDP growth coming at a cost in terms of increased net emissions. Therefore, the improvement in energy intensity is partially cancelled out by the strong GDP growth.

### Emissions Surplus Trade Effects with Reform - Moderate Growth

Figure 66 and Figure 67 above show that the benefit to Russia is reduced to zero if there is either a loose or non-existent export cap. Therefore, a high price simply reflects scarcity of emissions surplus in the market. Higher revenue and thus benefit is obtained as a result of the high price, but at a restricted traded volume. The upward price effect is apparently enough to dominate the downward effect on traded volumes when all countries trade.

### Market Structure Effects with Reform - Moderate Growth

The *no reform – moderate* results show that as the number of market participants is restricted, the demand for credits reduces, and the equilibrium price and the benefit to Russia reduces. When the EU is a participant in the market, there is some benefit to Russia from emissions trading, but as soon as the EU exits the market the benefits rapidly disappear as the demand side rapidly contracts to the point of collapse. The key implication of this result is that without the EU, the market is all but non-existent - demand for emissions credits from Japan and Canada etc. is insufficient for there to be any benefit to Russia without the crucial export cap. The effect of the EU withdrawing from the market is particularly important given that the US has withdrawn from the

Kyoto Protocol and is therefore excluded as a demand-side participant from the model. The benefits to Russia also increase if the EET3[80] does not participate in the market. This is due to there being a reduction in the supply of credits (thus driving the price up) as a result of the exclusion of the EET3.

The figures above also show the interdependence between the growth scenario design effects and emissions surplus trade scenario design effects. If there is completely liberalised emissions surplus trade, the benefit to Russia is still zero even if the EU is included as part of the trading regime. This is an interesting result as EU participation in the market is insufficient to prevent a market collapse if there is no export cap.

The benefit to Russia increases when the EET countries are not participants in the market. This is evidence of a monopolistic effect where-by the number of supply-side participants has reduced, thus allowing Russia to benefit from increased demand for its surplus (given that the demand-side participant countries still have to meet their assigned amount). However, again this only applies when there is an export cap.

## Reform – Putin's Challenge Growth Results

*Figure 68 – Reform – Putin's Challenge Growth (7.2% GDP growth, -4.0% change in Energy Intensity)*

| **Emissions surplus Trade (%)** | **All countries trade** | | **Trade without EU** | | **Trade without EU or EET** | |
|---|---|---|---|---|---|---|
| | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) |
| **0** | 168 | 5.9 | 77 | 3.5 | 166 | 5.9 |
| **20** | 245 | 4.2 | 101 | 2.0 | 178 | 3.3 |
| **60** | 230 | 2.0 | 113 | 1.0 | 113 | 1.0 |
| **100** | 180 | 1.0 | 0 | 0.0 | 0 | 0.0 |

[80] Croatia, Romania and Bulgaria

*Figure 69 – The Monetary Benefits to Russia (Reform – Putin's Challenge Growth Scenario)*

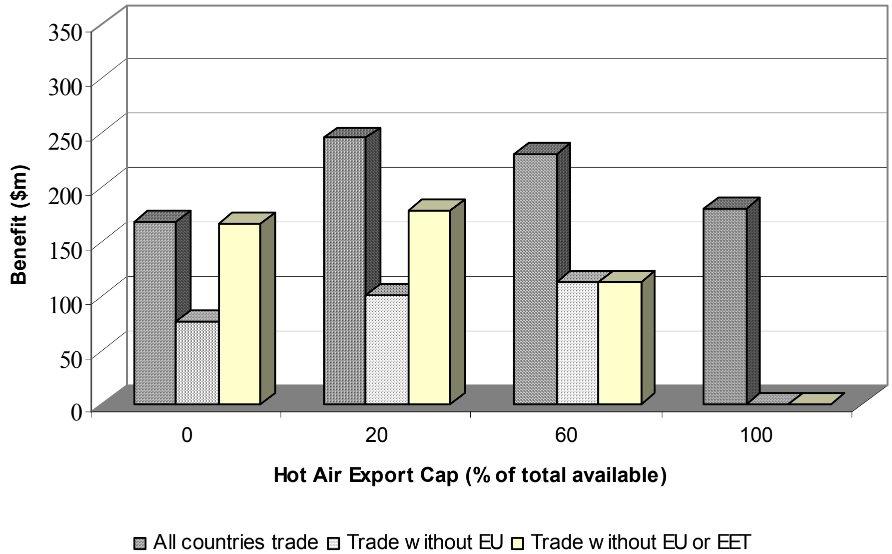
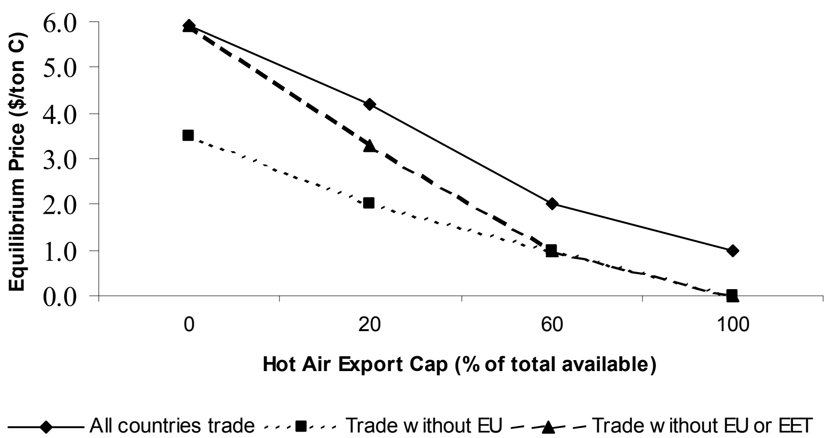



*Figure 70 – Equilibrium Price (Reform – Putin's Challenge Growth Scenario)*




**Reform – Putin's Challenge Growth Effects**

The effect of simulating the *Putin's challenge* level of growth is that Russia has a reduced amount of emissions credits to trade compared to the amount it has under the other growth scenarios. This is due to the aggressive estimates of Russia's GDP growth substantially outweighing the aggressive improvement in projected energy intensity. The growth effect on the market in this instance is to restrict the amount of surplus Russia is able to sell, resulting in a higher market price and thus benefit to Russia.

**Emissions Surplus Trade Effects with Reform – Putin's Challenge Growth**

Loosening the export cap has the effect of reducing the equilibrium price, reflecting the greater availability of credits in the market. The benefit to Russia is seen to decline as it generates less revenue as a result of the lowering price, except in the case where there is a total (0%) restriction on emissions surplus trading. However, crucially the reduced amount of Russian emissions surplus available for sale is sufficient for Russia to benefit without having to implement an export cap. This is a clear example of Russia benefiting from trading its reduced supply of emissions surplus as a result of the *Putin's challenge* growth projection – while it benefits from a total restriction on emissions surplus trade, it would increase its benefit by relaxing the export cap, although again only if the EU participates in the market.

### Market Structure Effects with Reform – Putin's Challenge Growth

The *Putin's challenge* growth scenario results are unique amongst the set of 4 growth scenarios modelled as part of this study. Again, as in the other growth scenarios, the EU dropping out results in the market collapsing. However, the role of the export cap in determining the market outcome has changed. This time, assuming EU inclusion, there is still a significant benefit to Russia when there is no export cap on emissions surplus trading. Therefore, the *Putin's challenge* growth scenario provides the clearest example of the importance of both strong Russian macroeconomic fundamentals, and EU participation in the trading system. While Russia does benefit without the EU under the export cap scenarios, the benefit can be significantly increased by including EU participation, even without an export cap.

## No Reform - Moderate Growth

*Figure 71 – No Reform - Moderate Growth (2.0% GDP growth, -2.0% change in Energy Intensity)*

| Emissions surplus Trade (%) | All countries trade | | Trade without EU | | Trade without EU or EET | |
|---|---|---|---|---|---|---|
| | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) |
| **0** | 168 | 5.9 | 77 | 3.5 | 166 | 5.9 |
| **20** | 255 | 3.3 | 99 | 1.4 | 146 | 2.0 |
| **60** | 182 | 1.0 | 0 | 0.0 | 0 | 0.0 |
| **100** | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

*Figure 72 – The Monetary Benefits to Russia (No Reform - Moderate Growth Scenario)*

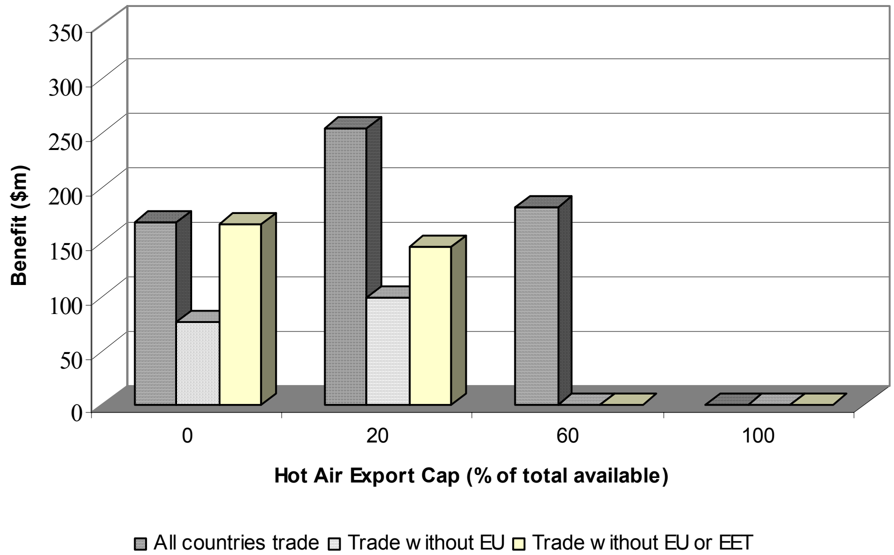
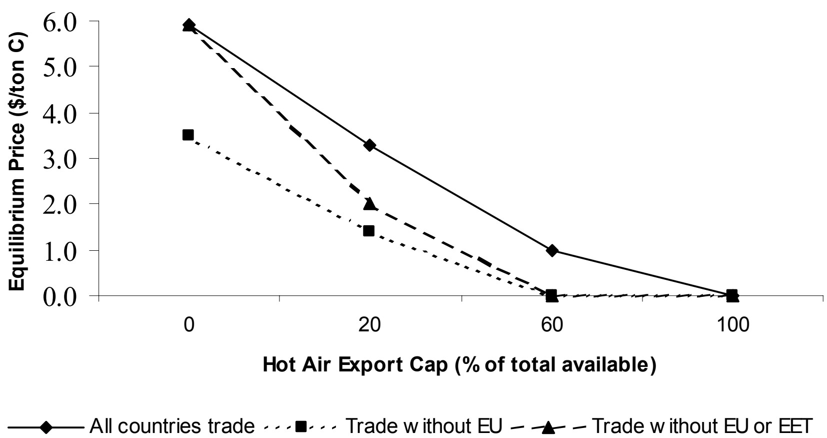



*Figure 73 – World Equilibrium Price (No Reform – Moderate Growth Scenario)*




## No Reform - Moderate Growth Effects

The *no reform-moderate* growth scenario modelling provides similar Russian benefit and equilibrium price projections as the *reform-moderate* and the *no reform – critical* growth scenarios discussed above. In this scenario, Russia has a greater amount of surplus to sell as a result of a conservative level of growth combined with a conservative improvement in energy intensity. Russia's positive GDP growth and energy intensity gains haven't come at the same cost in terms of increased emissions as is evident under the *Putin's challenge* or *reform - moderate* scenarios, they have come at a different cost – the flooding of the market with credits. This results in the equilibrium price being driven down, thus reducing the benefit to Russia.

**Emissions Surplus Trade Effects with No Reform - Moderate Growth**

With the additional amount of credits available for sale on the market, the potential influence of the export cap on the market outcome is increased – i.e. it is now necessary to effectively implement an export cap in order for Russia to benefit at all from emissions *trading*. There is such a large amount of emissions surplus available for sale at the more relaxed export cap levels that the equilibrium price quickly reduces to zero, and thus Russia no longer benefits from trading. Although again, if the EU participates, there is still a benefit at the 60% emissions surplus export cap.

**Market Structure Effects with No Reform - Moderate Growth**

The flooding of the market with credits has resulted in slightly less importance being placed on EU participation, although it is still critical in terms of the potential to maximise the benefit to Russia. Under the *no reform - moderate* growth scenario, not even EU participation can provide a net benefit to Russia if there is no export cap.

## No Reform - Critical Growth Results

*Figure 74 – No Reform - Critical Growth (0.0% GDP growth, 0.0% change in Energy Intensity)*

| **Emissions surplus Trade (%)** | **All countries trade** | | **Trade without EU** | | **Trade without EU or EET** | |
|---|---|---|---|---|---|---|
| | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) | Benefit ($m) | Price ($) |
| **0** | 168 | 5.9 | 77 | 3.5 | 166 | 5.9 |
| **20** | 254 | 3.5 | 112 | 1.7 | 155 | 2.2 |
| **60** | 167 | 1.0 | 0 | 0.0 | 0 | 0.0 |
| **100** | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

*Figure 75 – The Monetary Benefits to Russia (No Reform - Critical Growth Scenario)*

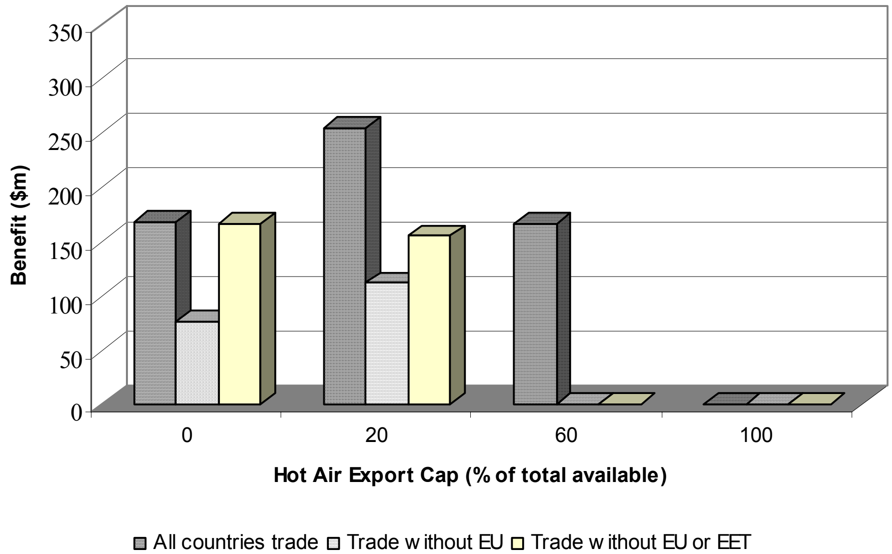
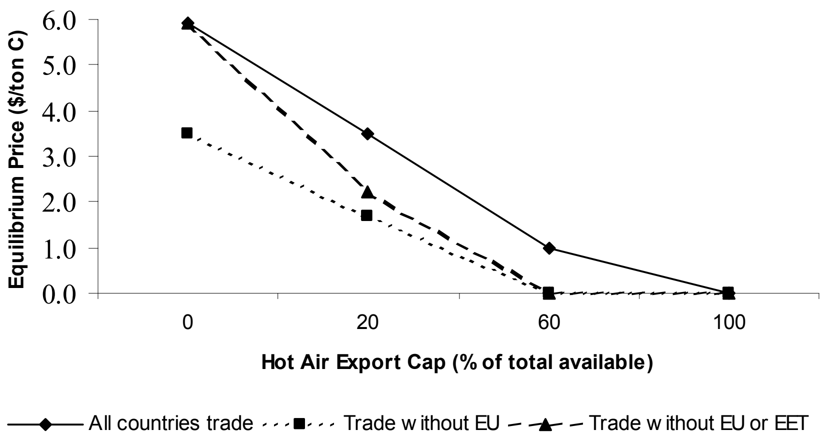



*Figure 76 – World Equilibrium Price (No Reform - Critical Growth Scenario)*




## No Reform - Critical Growth Effects

The effect of simulating *no reform - critical* growth is that Russia has a large amount of emissions credits to trade compared to the amount it had under the *reform - moderate* and *Putin's challenge* growth scenarios, and a slightly less amount than under the *no reform – moderate* growth scenario. This is due to Russia maintaining its current level of GDP (i.e. 0% growth up to 2010) and its current level of energy intensity (i.e. 0% reduction up to 2010). Given that the Russian economy contracted considerably between 1990 and 2000, the stagnant GDP and energy intensity levels are historically low – hence it is below its 1990 emission target in 2010. Although the critical growth scenario would theoretically endow Russia with a lot of credits to sell, the potential revenue benefit from emissions trading would be far from sufficient to compensate the social and economic costs of zero growth across the 10-year period.

### Emissions Surplus Trade Effects with No Reform – Critical Growth

Again, the only way Russia can benefit from emissions trading under the critical growth scenario is if it implements a strict export cap.

Figure 75 shows that potential benefits accrue to Russia when the supply of emissions surplus to the demand-side participants is substantially constrained. As the export cap is loosened, the potential benefit to Russia declines as the market quickly becomes flooded with credits, in a similar manner as in the *no reform - moderate* growth scenario.

### Market Structure Effects with No Reform - Critical Growth

Figure 76 shows that again, the inclusion of the EU is vital to Russia deriving benefit from the emissions trading regime. Again we see that the demand side collapses following the exclusion of the EU and benefits fall to zero as the world equilibrium price collapses. If there is completely liberalised emissions surplus trade, the benefit to Russia is still zero even if the EU is included as part of the trading regime, similarly as under the *reform – moderate* growth scenario.

### Conclusions on Growth Scenario Modelling

The key result to emerge from the scenario modelling is the importance of EU participation in the theoretical trading system. Without it, the demand-side of the market collapses unless a tight export cap on emissions surplus trading is implemented and strictly enforced amongst the Annex B countries. The results also show just how important the export cap is to Russia realising a benefit from trading.

Comparing the 4 growth scenarios, the Putin's challenge growth scenario emerges as being unique amongst the set of scenarios in that it is the only growth scenario under which Russia can benefit from trading without an export cap. This result indicates that there is a critical level of 2010 projected emissions beyond which an export cap is no longer required – supply of Russian emissions surplus is sufficiently restricted by its own increased carbon emissions that an export cap is not necessary for Russia to accrue benefit from trading. In order for this to happen, the EU would have to be a demand-side participant, and extremely aggressive (and therefore unrealistic) GDP growth and energy intensity reductions would have consistently to occur in Russia over a 10-year period.

# ANNEX 6. CARBON AND $CO_2$ READY RECKONER

Throughout our analysis we have referred to volumes and price in terms of carbon (C) equivalent emissions of GHG. Some of the literature refers to volumes and prices in terms of carbon dioxide ($CO_2$) equivalents. The following table provide some basic conversions of carbon values into $CO_2$ values.

The conversion (multiplication) factor employed throughout is:

44/12 - when converting volume of carbon into a volume of carbon dioxide

12/44 - when converting volume of carbon dioxide into a volume of carbon

*Figure 77 - Conversion tables*

| **Volumes (Mtonne)** | | **Volumes (Mtonne)** | |
|---|---|---|---|
| Carbon | Carbon Dioxide | Carbon Dioxide | Carbon |
| 1 | 3.67 | 1 | 0.27 |
| 10 | 36.67 | 10 | 2.72 |
| 50 | 183.33 | 50 | 13.64 |
| 100 | 366.67 | 100 | 27.27 |

| **Prices ($/tonne)** | | **Prices ($/tonne)** | |
|---|---|---|---|
| Carbon | Carbon Dioxide | Carbon Dioxide | Carbon |
| 1 | 0.27 | 1 | 3.67 |
| 3 | 0.82 | 3 | 11.00 |
| 5 | 1.36 | 5 | 18.33 |
| 10 | 2.73 | 10 | 36.67 |

# ANNEX 7. HEALTH AND ENVIRONMENT BENEFITS IN REDUCING GHG EMISSIONS

One recent study of environmental, health and other ancillary benefits of GHG reduction in Russia has been published by the Environmental Defence institute in Washington.[81]

The study examined two basic scenarios of the Russian economy and the potential GHG emissions from these. One scenario assumes low and one high levels of GHG emissions. The main pollutants the model examines are total suspended particulates (TSP), nitrogen oxide and sulphur dioxide. The difference between their low and high GHG emissions model indicate that potentially about 35,000 lives could be saved each year until 2010 from lowering emissions. The study goes on to estimate the monetary value of lives saved, by using a value per statistical life, and arrive at a figure of US$7 billion. This is the only study we have come across that deals with the potential health benefits, and therefore it is difficult to compare its findings.

The fact that Russia is one of the few industrialised countries whose population is in a sharp decline, emphasises the importance of the health issue. The expected future demographic trends and the current projected conditions of the nation's health and level of emigration, suggests that this may prove to be an important problem for Russia in the years to come. The Russian President has referred to this problem before, in his address to the nation in 2000, he referred to the annual population decline of 750,000 as a grave threat to the nation.[82] By 2015, it is expected that there will be 4 workers for every 3 non-workers.

The direct health and environment benefits to Russia from ratification, however, will be limited, unless supplemented by other policies. This is because the GHG emissions surplus means that any direct health / environmental benefits will be linked to the (currently uncertain) volume of JI projects, and more generally the increased investment in energy infrastructure leading to higher efficiency, which would be part of the overall trend to a cleaner environment. We have, therefore, attributed no costs or benefits linked to health and / or environment in our assessment of the value of ratification to Russia. Ratification would of course be consistent with further policy moves in the direction of a cleaner environment

[81] Dudek, D., Golub, A., and Strukova, E. (2003)
[82] Bush (2003)

# REFERENCES

Analiticheskii Bankovskii Zhurnal (2003), *Will Russia double GDP without high oil prices?,* Analiticheskii Bankovskii Zhurnal No 8, August 2003, www.worldbank.org.ru

Barker, Terry, Leena Srivastava, et al (2001), Sector costs and ancillary benefits of mitigation, Chapter 9 in *IPCC Third assessment report – climate change - mitigation*. IPCC.

Berdin, Vladimir & Leneva, Marina (2002), *The Development of the Basic Systems for Registration of GHG Emissions and Sinks in Russia.* [Разработка основ системы регистрации выбросов и стоков парниковых газов в России.] Russian Regional Environmental Centre.

Berdin, Vladimir, Sergey Vasiliev, Victor Danilov-Danilyan, Alexey Kokorin & Sergey Kuraev (2003). *Kyoto Protocol: politics economics, the environment.* Available at wwfw.wwf.ru.

Bernard, A., Paltsev, S., Reilly, J.M., Vielle, M., & Viguier, L. (2003), *Russia's role in the Kyoto Protocol*, MIT Joint Program on the Science and Policy of Global Change.

Berstein, L. & J. Pan (eds) *Proceedings of an IPCC Expert Meeting*, 14-15 February 2000, Technical support unit, IPCC Working Group III. Quoted in Barker et.al. (2001).

BP Statistical Review of World Energy (2003)

Bush, K. (2003), *Russian Economic Survey – September 2003*, Center for Strategic and International Studies, Washington

Department for Trade and Industry, UK (2004), www.dti.gov.uk

Donovan, D., K. Schneider, G.A. Tessema & B.S. Fisher (1997). *International Climate Policy: impacts on developing countries.* Research report 97-8, Australian Bureau of Agricultural & Resource Economics.

Dudek, D., Golub, A. and Strukova, E. (2004), *Economics of the Kyoto Protocol for Russia: The Mystery of Russian Ratification*, Environmental Defense

Dudek, D., Golub, A., and Strukova, E. (2003), *Ancillary Benefits of Reducing Greenhouse Gas Emissions in Transitional Economies*, World Development, Vol. 31, No. 10

Edf & CPPI (2001). *Independent Expert Review of the Russian Joint Stock Company – Unified Energy System of Russia. Greenhouse Gas Emissions Inventory Meethodology.* Environmental Defense & Center for Preparation and Implementation of International Projects on Technical Assistance. Moscow, Washington, New York. July 2001.

Environmental Investment Center (2002). *Energy Sector Development and Climate Change Mitigation in Arkhangelsk Oblast.* GHG Inventory and Registry Bureau.

European Commission (2003), *Proposal for a Directive of the European Parliament and the Council amending the Directive establishing a scheme for greenhouse gas emission allowances within the Community, in respect of the Kyoto Protocol's project mechanisms, European Commission*, Brussels

Expert review of the Second Russian National Communication FCCC/IDR.2/RUS, www.unfccc.int

Fankhauser, S. and Lavric, L., (2003) *The Investment climate for climate investment: Joint Implementation in transition countries*, Climate Policy, Vol. 3, Issue 4

First National Communication of the Russian Federation (1995)

Goskomstat (2002a). *Russian Industry 2002.* [Промышленность России 2002.] Moscow.

Goskomstat (2002b). *Russian statistical yearbook 2002.* [Российский статистический ежегодник 2002.] Moscow.

Grubb, M., (2004), *Russian energy and CO2 emissions and its Kyoto target: Prospects and determinants*, Chatham House, London (unpublished)

Grubb, M. et al (2003) *A Strategic Assessment of the Kyoto-Marrakech System*, Synthesis Report, RIIA Briefing Paper

Grubb, Michael, Christian Vrolijk & Duncan Brack (1999). *The Kyoto Protocol. A Guide and Assessment.* London: The Royal Institute of International Affairs.

Grütter, J.M. (2001) *World Market for GHG Emission Reductions.* Paper prepared for the World Bank's National AIJ/JI/CDM Strategy Studies programme.

Hagem, C., Kallbekken, S., Mæstad, O., Westskog, H., (2004) *Market power with interdependent demand. Sale of emission permits and natural gas from the Former Soviet Union*, CICERO Working Paper 2004:01;

STATOIL and the Foundation for Research in Economics and Business Administration (SNF) project on Globalisation and Energy, http://www.snf.no/statoil/global/

Holtsmark, B. (2003) *Russian behaviour in the market for permits under the Kyoto Protocol*, Climate Policy, Vol 3, Issue

IEA (2002). *Russia Energy Survey 2002*. Paris, OECD/IEA.

IEA (2002). *Russia Energy Survey 2002*. Paris, OECD/IEA

IEA (2003). *World Energy Investment Outlook*, Paris, OECD/IEA

Lecocq, F., Capoor, K., PCF plus Research (December 2003), *State and Trends of the Carbon Market*, The World Bank

Leneva, Marina (2002). *Possible Approaches and Next Steps for the Development of a National Inventory System in the Russian Federation.* Centre for Environmental Economic Research and Information (CEERI).

McKibben, W., Ross, M., R. Shackleton, P. Wilcoxen, (1999). Emissions trading, capital flows and the Kyoto Protocol. *Energy Journal*, Special Issue, 287 -334

Moe, A., and Tangen, K., (2000) *The Kyoto Mechanism and Russian Climate Politics*, RIIA

Moe, Arid. (2000). *Russian quota sales: not just a lot of hot air.* Cicerone 3/2004.

Moscow Times (2003), www.themoscowtimes.com

Natsource (2003). *Governments as participants in international markets for greenhouse gas commodities.* Report prepared for EPRE, IEA, IETA and IDDRI. Available at http://library.iea.org.

OECD/IEA (2003). *Renewables in Russia. From opportunity to reality.* Paris: OECD.

Pershing, J. (2000). Fossil fuel implications of climate change mitigation responses. In *Sectoral Economic Costs and Benefits of GHG Mitigation.*

Point Carbon (2003, 2004), www.pointcarbon.com

Point Carbon (2003b), *Annex I Parties' current and potential CER demand*, Point Carbon

Popov, Ilya (2000). *A Foundation for Climate Accountability: Monitoring Greenhouse Gas Emissions in Russia. The natural gas sector example.* Master's Thesis. May 2000.

World Aluminum, www.world-aluminium.org

Pravda (2003, 2004), www.pravda.ru

RAO UES (2003), www.rao-ees.ru

Reinaud, Julia (2003). *Emissions trading and its possible impacts on investment decisions in the power sector.* Paris: IEA.

Russian Energy Strategy until 2010, as confirmed by the order of the Government of the Russian Federation on August 28th 2003, (Энергетическая стратегия России на период до 2020 года, УТВЕРЖДЕНА распоряжением Правительства Российской Федерации от 28 августа 2003 г. № 1234-р.)

Russian State Customs Committee (2004), www.customs.ru

Sale of emission permits and natural gas from the Former Soviet Union

Schultz, Karl (2003). *CMM/CBM Technologies and Activities in Russia.* US EPA. Presentation in Washington 8 April 2003. Available at http://www.pi.energy.gov/US-RussiaEWG/SchultzEPA.pdf.

Second National Communication of the Russian Federation (1998)

Senter (2004) www.senter.nl

Springer, Urs (2003). *The market for tradable GHG permits under the Kyoto Protocol: a survey of model studies.* Energy Economics, 25, 527-551.

Sydnes, Anne Kristin (2001). *Introduction at the International seminar on Gas Flaring.* Presentation in Oslo 18 June 2001. Available at

The Guardian (2003), www.guardian.co.uk

The Kyoto Protocol

The Marrakech Accords FCCC/CP/2001/13/Add.2

Third National Communication of the Russian Federation (2002)

UN FCCC website. Compliance. Available at http://unfccc.int/issues/comp.html as 20 January 2004.

Vasiliev, S.V. and Safanov, G.V., (2003) *The Kyoto Protocol and Russian Business*, Bulletin Towards a Sustainable Russia, No. 25

Will Russia double GDP without high oil prices?, Analiticheskii Bankovskii Zhurnal No 8, August 2003, www.worldbank.org.ru

World Bank (2003a) *Russian Economic Report, August 2003*, www.worldbank.org.ru

World Bank (2003b). *Russia Development Policy Review.* Washington: World Bank. Available at www.worldbank.org.

World Development Indicators, (2004)

www.infccc.int

www.timesonline.co.uk (2003)

www.unfccc.de

Youri Bobylev and Jacek Cukrowski (2002). *Russia: Bank Assistance for the Energy Sector.* Washington DC: The World Bank. Available at:

Zelinsky, Anatoli (2003). Emissions Trading System in RAO UES Reform. Presentation in Milan, 8 December 2003. Available at http://www.ieta.org/About_IETA/IETA_Activities/COP9/Dec8/IETA_COP9_Dec8_RAO.ppt#2.

Pluzhnikova, O., Runova, E., (2003), *Climate Policy of the Russian Federation – what next?*, presentation given in Ottawa, 2003

Interviews:

Kokorin, Alexey. Climate Change campaigner of WWF Russia. 15 Jan 2004, Moscow.

Pluzhnikov, Oleg. Head of Department, the Ministry of Energy. 16 Jan 2004, Moscow.

Berdin, Vladimir. Researcher, Center for Project Preparation and Implementation. 15 Jan 2004, Moscow.

Rogankov, Mikhail. Chief Executive Officer, RAO UES Rossii Energy Carbon Facility. 15 Jan 2004, Moscow.

Safonov, Georgi. Researcher, Moscow Higher School of Economics and Russian Regional Environmental Center. 16 Jan 2004, Moscow.

Pearson, Lizzie (2004). Global Atmosphere Unit, DEFRA. Phone interview 23 Jan 2004.