BRIEFING NOTE

THE ROYAL INSTITUTE OF INTERNATIONAL AFFAIRS | Sustainable Development Programme

March 2004

Russian energy and CO_2 emission prospects: evidence from domestic analyses and international comparisons

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Summary

- ***Centrality of energy**:* The energy sector accounts for around a quarter of Russia's economy and a high proportion of export earnings, making Russia extremely cautious about any possible constraints on the sector especially given President Putin's declared goal to double GDP over ten years.
- ***Kyoto headroom:*** At the last full inventory, total greenhouse gas emissions were 38% below 1990 levels; emissions could grow 60-65% from these levels before reaching Russia's Kyoto allowance
- ***Current energy efficiency:*** By international standards Russian energy consumption is very inefficient, with energy intensity (corrected for purchasing power) 3-4 times the level in western Europe, twice that in US and 77% higher than Canada with comparable climate and geography.
- ***Impact of reforms:*** Russia's Energy Strategy argues that reform is key to economic growth and would improve efficiency, reduce energy sector growth and capital requirements; none of its scenarios bring Russia close to its Kyoto cap.
- ***International evidence:*** In the richer OECD countries, energy consumption in past decades has grown with population, not GDP. In the economies in transition, energy intensity since 1995 has improved typically at 3-4%/yr; GDP in the EU Accession countries has typically grown 3-4%/yr without emissions growth.
- ***Conclusions.*** Even with the most rapid economic growth there are no internally consistent scenarios in which Russian emissions breach its Kyoto allowance: Russia will be net seller, and the Kyoto mechanisms could help to attract foreign capital linked to energy modernisation.

Background Paper prepared for 'Russia and the Kyoto Protocol: Issues and Challenges' meeting held at Royal Institute of International Affairs on 17th March 2004.

Introduction

The biggest concern expressed in Russia about the Kyoto Protocol is the fear that Russia's target could constrain its future economic growth, particularly since President Putin declared the goal to double Russia's gross domestic product (GDP) in ten years. Energy is one of the most, if not the most, important sectors in the Russian economy accounting for around 22% of GDP and 30% of total government revenues.[1] Extreme caution about anything that might interfere with the sector's development is therefore not surprising. This note examines the prospects for and determinants of Russians CO_2 emissions in the context of its Kyoto target, drawing together internal Russian analyses and international comparative data. It closes with some broader observations about the relationship between Kyoto and the Russian petroleum sector.

Kyoto context

Russia's allocation under Kyoto was by most standards generous, but it is not widely appreciated just how large the surplus now is. Its allowance under the original agreement, to return its emissions to 1990 levels, was later supplemented by an allowance of 37MtC credits for absorption from its forests. Russia's emissions in 1999 (the most recent year of full inventory reported to the UNFCCC) were 38% below 1990 levels. So they can rise 60% from this level before breaching the Kyoto ceiling (1.6 x (1-0.38) = 0.99); Russia's allowance for managed forest credits adds an additional 5% headroom.[2]

Russian energy strategy projections

The centrality of energy means that the Russian government's Energy Strategy has been regularly updated with increasing sophistication. The 2003 Energy Strategy for the first time introduced different assumptions of GDP and energy intensity, illustrated in Figures 1 and 2.

Figure 1: Russia GDP Scenarios to 2020

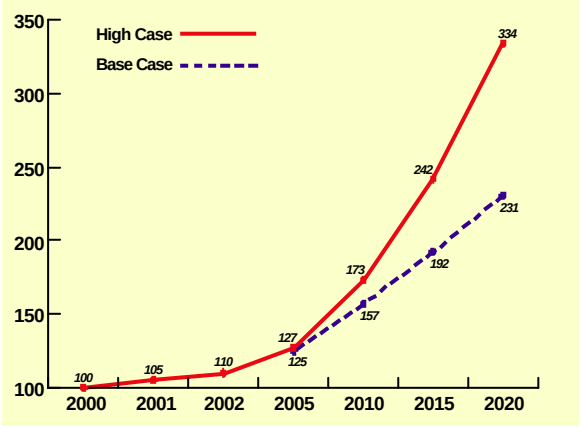
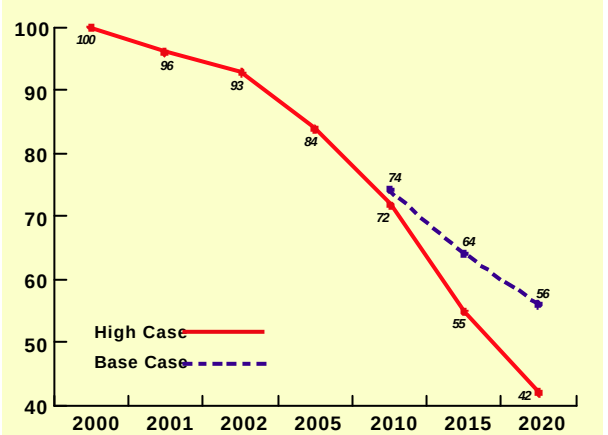


Figure 2: Energy Intensity of GDP



Source: Energy Strategy of Russia to 2020, Moscow May 2003

Figure 1 shows that between 2000 and 2020, GDP could increase more than three times in the high case (termed "optimistic variant" in the Strategy document) and more than twice in the

[1] Figures for 2000, EBRD Transition Report 2001, Table 4.1, p.79.
[2] Russia's 3rd National Communication gives overall GHGs in 1999 at 61.5% of 1990 levels, and CO_2 at 63.5%. Especially given the managed forest allowance, a rough estimate is that an increase in energy CO_2 emissions of about 60% from these levels would be compatible with Russia's Kyoto limit (1990 levels x 0.62 x (1+0.6) = 1990 levels).

base case. The energy intensity of GDP over the same period is set to fall rapidly, to 42% of the 2000 level in the high case, but at least 56% in the base case.

International comparisons of energy intensity levels

Without access to the underlying analysis, comments on the feasibility of these scenarios have to be cautious, but one basis for such rapid improvements in energy intensity of GDP is readily apparent from international comparisons of energy/GDP intensities. Comparisons based upon market exchange rates, which indicate Russian energy intensities to be many times those in western countries, need to be treated with some scepticism. But even comparisons corrected for purchasing power parities (which correct for exchange rate distortions) indicate that per unit GDP, Russia consumes about twice as much energy as the US, and four times as much as western Europe and Japan.

Such comparisons need to be treated with caution for reasons concerned with both data compatibility and the Russian geography, climate and industrial structure. Russia is a very large country with a very harsh climate; its economy has traditionally been heavily weighted towards industrial processes that consume large quantities of energy. This can explain some part of the difference between Russia's energy intensity and those OECD (Organisation for Economic Co-operation and Development) countries, but Canada is a similarly sparse, cold and resource-intensive country, and figures from the Russian Ministry of Energy show that in 2000 Russian intensity (PPP-corrected) was 77% higher than that of Canada.[3]

Interpreted in the most simple manner, this means that even if Russia were to improve its energy efficiency to match current standards in the US (or perhaps China), then a doubling of GDP would actually be compatible with a small *reduction* from present emission levels, while under European/Indian intensity levels, substantial additional reductions would occur. Russian suggestions regarding the move back towards the coal power generation are unlikely to have significant impact upon this.[4]

The impact of economic reform

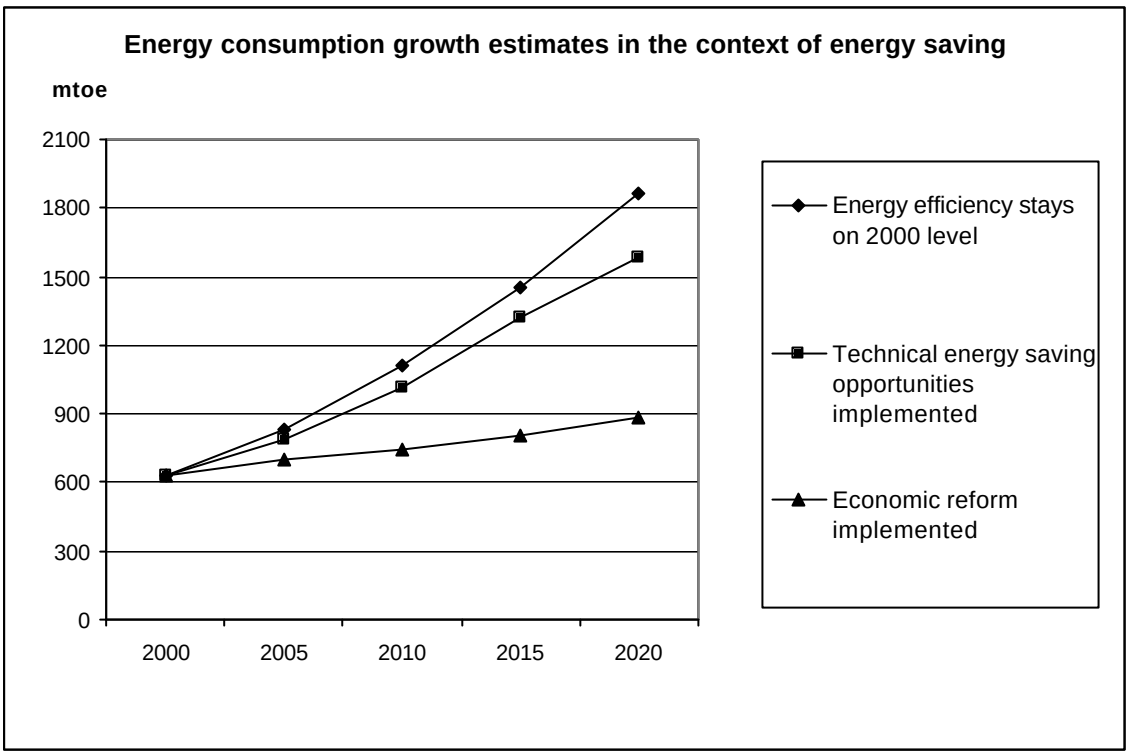
Whilst international comparisons suggest the *potential* for big improvements in energy intensity, the extent to which these are realised is likely to depend significantly on economic reforms particularly in the energy sector.

If and as market reforms are implemented and economic structures begin to change, there are indeed persuasive arguments to suggest that Russian energy intensity could fall even further and faster than assumed in the national energy strategy. The centrally planned economy of the Soviet Union was one of the least energy efficient in the world. While much progress has been made over the past 13 years, market reform in the gas and electricity industries has been slower than many other parts of the economy. This is the main reason why the Strategy shows (Figure 3) that the implementation of economic reform will see energy demand by 2020 increase only marginally from 2000; it also shows that if energy intensity were to remain at the level of 2000, energy demand would increase in line with economic growth.

[3] Figures for 2000 measured in PPP 1995 US$ from RF Ministry of Energy.

[4] While the Energy Strategy reiterates a long-standing intention to switch energy sources in European Russia from gas to coal, the price projections in the report and the capital and lead time requirements for coal plant make it hard to see this happening significantly, and certainly not on a scale that could fundamentally change the emission projections discussed here. The Strategy's own price projections show that there will be no incentive to do so until at least 2006, and even complete removal of gas subsidies is projected to result in fuel prices 36% higher than those of coal - which given the greater efficiency, low capital cost and environmental advantages and ease of transportation which gas enjoys relative to coal seem likely to dictate against large scale switching. The experience from OECD countries is that, once the switch to gas has been made – particularly in power generation – a country is unlikely to return to large scale coal use.

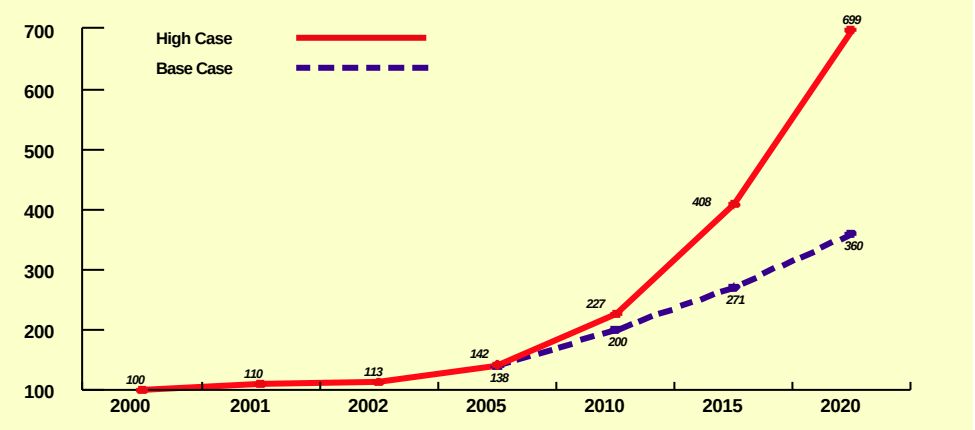
Figure 3. Impact of Economic Reform and Technical Energy Saving on Energy Consumption Growth



Source: Russia National Energy Strategy (Ibid) as adapted by Tangen et al.

How and why might such improvements occur? One of the hallmarks of the Soviet economy was the very slow turnover of capital stock which has meant that the Russian economy, even in its current state of transition, is still saddled with many industries using extremely energy-inefficient plant and equipment which are many decades old. The intended take-off of capital investment, particularly post-2010, will be one of the most important drivers of energy efficiency, because it will inevitably be associated with far more energy-efficient plant and practices.

Figure 4. Level of Capital Investment to 2020



Source: Ibid

Combining the GDP and energy intensity scenarios from Figures 1 and 2 with the data in Figure 4 strongly suggest that energy efficiency will be correlated with economic growth: the

stronger the economic growth, the more rapid the accompanying improvement in energy efficiency and reduction in national intensity.

This can be counter-intuitive for many Russian observers who tend to believe, similar to the conventional wisdom in the OECD in the 1970s, that increased economic growth required a roughly equivalent increase in energy use. Particularly for Russia, starting from such a low base in terms of energy efficiency, the opposite is likely to be the case. High levels of economic growth can only be achieved as a result of market reform and will require:

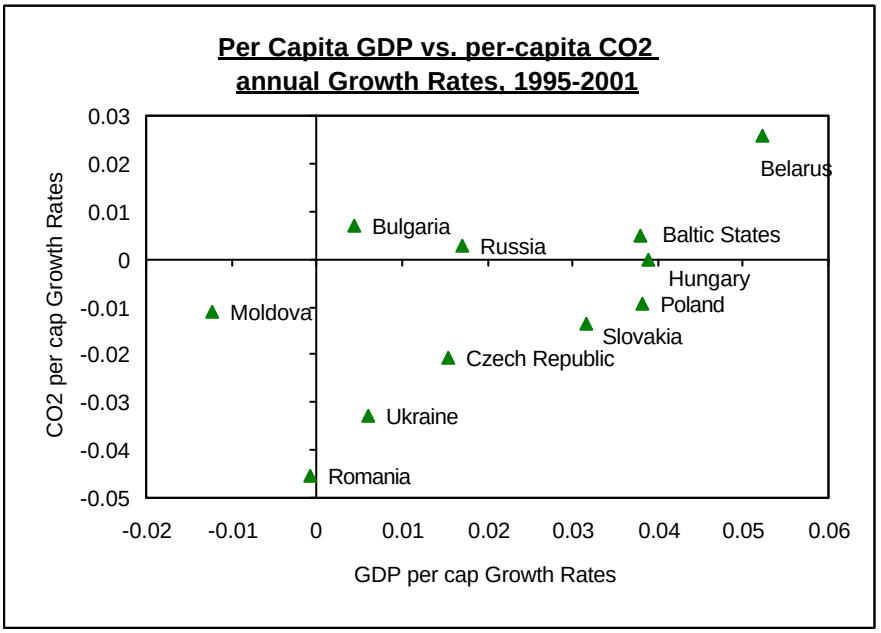
- high turnover of capital stock,
- retirement of inefficient plant,
- increasingly rapid change in industrial structure from heavy industry towards light industry and services

The result of this process is likely to be, at least in the early years, declining energy demand. By contrast, lack of market reform and slow economic growth is a scenario most likely to lead to increasing energy demand.

Evidence from other Economies in Transition

This reasoning is also supported by international comparisons with other Economies in Transition. Figure 5 plots the average economic and emissions growth rates of all the 'transition economies' in eastern Europe for 1995-2001. Whilst many of these countries sustained economic growth rates above 3% per year, only Belarus, which has so far avoided economic reforms (and about which there are significant doubts regarding economic data), has had emissions growing above 1% per year since 1995.[5]

Figure 5: Per-capita economic & emission growth rates for Economies in Transition,1995-2001



Source: Author, derived from US Energy Information Administration data

[5] In Figure 5, data for the Baltic States are aggregated to avoid special small-country effects arising from single projects or trade; there are wide divergences amongst them due to these factors.

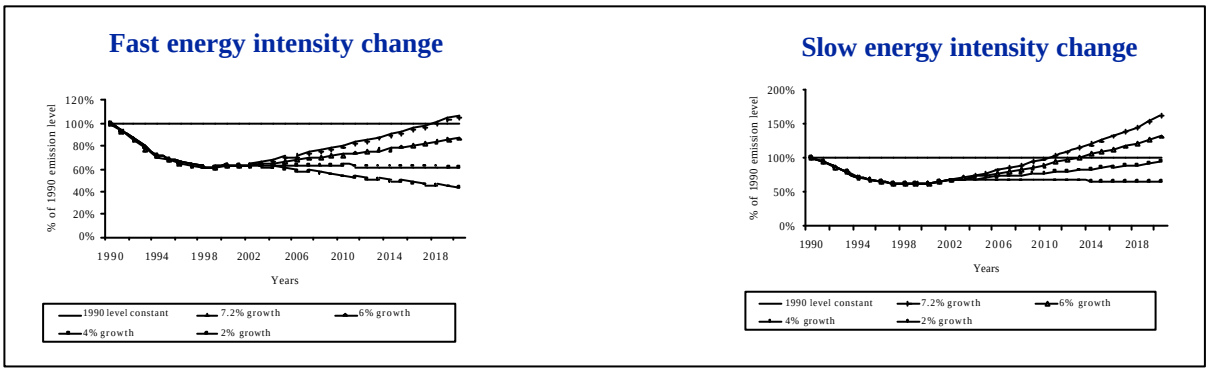
Of the rest, in the period covered by these 'post-transition' data (1995-2001), Poland and Hungary have averaged 4% per year per capita economic growth without any increase in their per-capita emissions; Slovakia exceeded 3% per year economic growth with declining emissions. Economic growth has resumed in Ukraine and the Czech Republic but their emissions have continued to decline, by more than 2% per year average since 1995. Indeed, most of the countries indicated in Figure 5 experienced carbon emission intensity improvements (CO_2 / GDP) averaging between 3% and 4% annually over the period 1995-2001, the exceptions being Russia, Moldova, Bulgaria and Belarus.

This also appears to be the experience in China, in which very rapid economic growth during the 1990s was accompanied by dramatically declining energy intensities and little growth in its CO_2 emissions.

Implications for CO_2 emission scenarios in relation to Kyoto

To explore the implications for CO_2 emissions across a wide range of uncertainties, in Figure 6 we show scenarios of reform in which different economic growth rates, ranging up to the goal of doubling GDP in 10 years, are accompanied by changes in emissions intensity at 2, 4, and 6% annually. The only case which results in Russian emissions returning to 1990 levels by the end of the Kyoto period is that in which Russia both achieves Putin's challenge of doubling GDP *and* emissions intensity improves at only 2% per year, which given the above discussion seems a highly unlikely combination.

Figure 6: Scenarios of emissions under economic growth rates of 2, 4, 6, and 7.2% (GDP doubling) for fast and slow intensity improvements.



From the diagram one can see that even in the extreme scenario (GDP doubling and slow intensity change) the potential 'shortfall' in the last couple of years is offset by the surplus available in 2008-10. Taking into account Russia's carbon sink allocation, therefore, even in this extreme scenario, Russia remains a net seller of allowances.

Conclusions and related energy-economic issues

International comparisons of both absolute energy intensities, and the trend of emissions in other transition economies, indicate that the economic reforms sought in Russia to underpin rapid economic growth would also lead to rapid declines in energy and associated emissions intensities. This combination indicates that scenarios in which Russian emissions grow substantially, let alone by 60% or more, in a decade are not credible. Indeed the economic burden of wasting so much energy would be an impediment to rapid economic development, not a corollary.

Consequently, under Kyoto's first period commitments, Russia will have significant surplus allowances. Should Russia ratify Kyoto and thereby bring the Treaty into force, these will be available to sell to the EU, Japan and Canada. Each of these is likely to need to acquire some allowances internationally to comply with their commitments, and Russia could either seek to sell allowances directly, or indirectly through investment-linked mechanisms, which may have mutual advantages.

Of course, Kyoto does raise many other important issues. There is a longer-term variant of the concern about the impact of possible future 'Kyoto caps', beyond the first-period commitments that end in 2012. However, the long term trend of emissions is to an important degree in our hands: technology studies show huge potential for continuing increases in efficient and low-carbon emitting technological and economic systems. Furthermore, all commitments post 2012 remain to be negotiated. Russian negotiators secured a good deal in Kyoto's first round commitments, and there is no reason why they should agree to an unfair deal in subsequent rounds.

Another variant of concern is about the impact on the use and value of Russia's oil and gas resources. The potential impact on energy exports is explored in more depth in another paper to this workshop, but it is important to note that action on climate change is likely to increase, not reduce, the demand for Russian gas. The European emissions trading system in particular, is likely to boost gas consumption especially in the power sector, and consequently Russian gas exports. The most detailed assessments (using the ICF European Electricity System model) suggest that the EU Emissions Trading System will boost European gas demand in the period 2008-12 by about 6%.

Finally, most analyses suggest that oil remains the fuel of choice in transport and that global growth in oil demand will increase as long as reserves are available. On a planetary scale, there is simply not enough carbon in Russian oil and gas resources to make climate change the likely constraint upon their long term development.[6]

[6] Russia's proven oil reserves contain about 5.5 billion tonnes carbon, and total estimated (explored) resources contain maybe 16 billion tonnes carbon. The total carbon in gas reserves is of similar magnitude (1 Mtoe contains about 0.8Mt carbon for oil, about 0.6Mt carbon for gas). Stabilising the atmosphere at 550ppmCO_2 would allow cumulative global emissions of around 800-1000 billion tonnes carbon total over 1990-2100, an average of about 9 billion tonnes per year (50% above current global fossil fuel emissions), about 100 times the amount of carbon in Russia's proven oil and gas reserves. Stabilising at 450ppmCO_2 would reduce the allowed carbon emissions by about 50%.

This briefing note is one of three papers prepared for 'Russia and the Kyoto Protocol Issues and Challenges' meeting held at the Royal Institute of International Affairs on 17th March 2004.

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