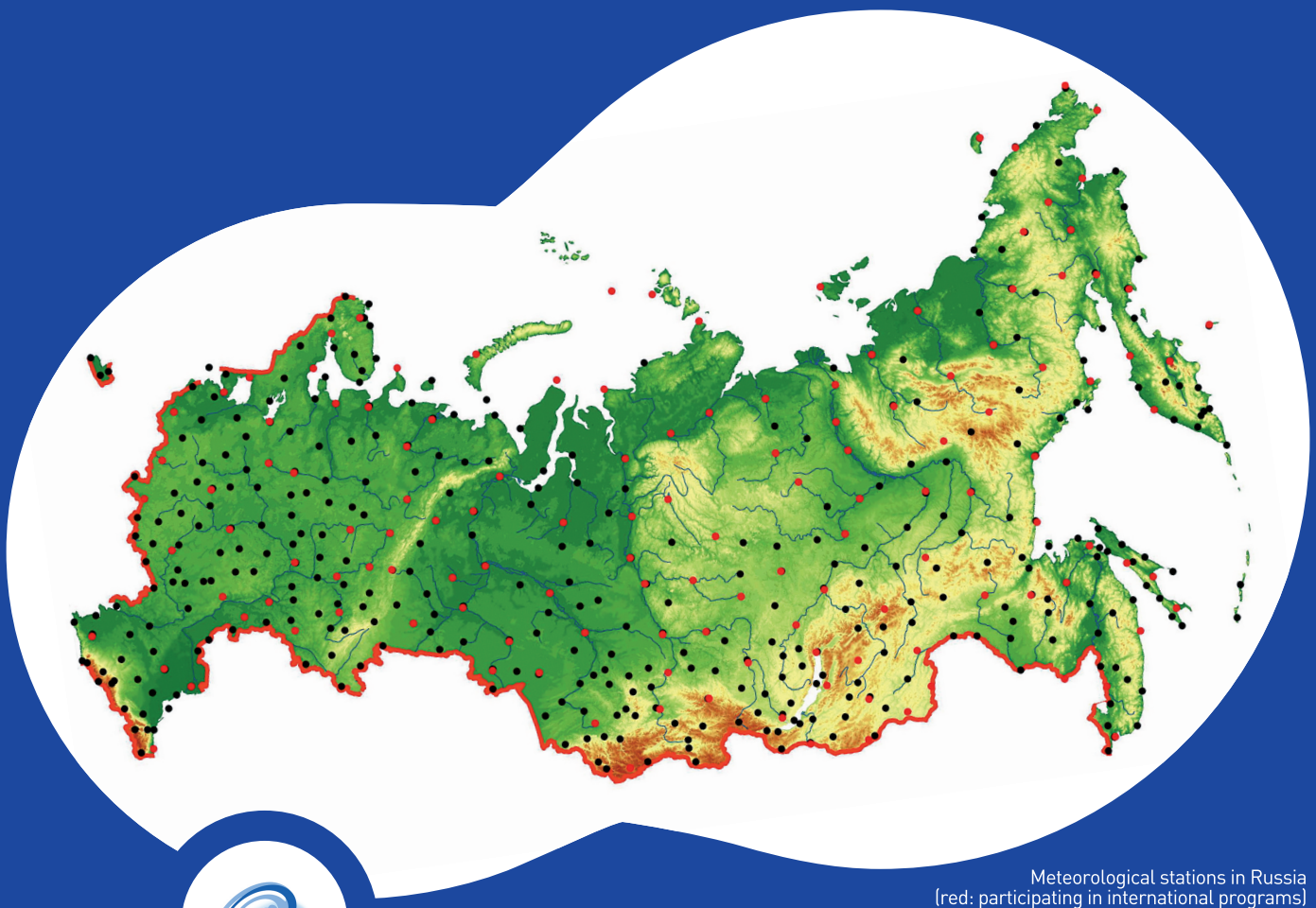
LONG-TERM OPTIONS FOR RUSSIAN CLIMATE POLICY. AN INTEGRATED ASSESSMENT

Carlo Jaeger, Valentin Meleshko, Leonid Bobylev and Dmitry Kovalevsky



Meteorological stations in Russia
(red: participating in international programs)

ECF Working Paper 2/2009

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LONG-TERM OPTIONS FOR RUSSIAN CLIMATE POLICY. AN INTEGRATED ASSESSMENT

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1. INTRODUCTION

Russia is the third largest emitter of greenhouse gases worldwide, contributing about 6% of global emissions. Against this background, Russia's ratification of the Kyoto protocol in 2004 was decisive for the protocol to become established under international law.

However, there remains strong opposition against the Kyoto protocol in Russia. It is based on the fear that Russian economic growth will be handicapped by limiting greenhouse gas emissions, that energy diversification will decrease revenues from oil and gas, and on the expectation that climate change will not be a major problem for Russia in the foreseeable future.

It seems reasonable to attribute Russia's ratification of the Kyoto protocol not only to concern about climate change but also to three other factors: first, at that time Russia wanted to join the World Trade Organisation (WTO) and the EU had made it clear that it would not support this unless Russia ratified Kyoto; second, Russia could see geopolitical advantages in strengthening ties with Europe in the years of the Bush Jr. administration, which strongly opposed Kyoto; third, Russia could expect to gain several billion € from the terms of the ratification. These terms committed Russia to avoid increasing its emissions by 2012 above their 1990 level. As the breakdown of the Soviet Union had led to emissions reductions of about one third until 2003, this left abundant emission quotas that could be sold to other countries.

At the end of 2008, no deliberate position on climate change and its consequences in the Russian Federation had been defined at the governmental level. On one hand, the relevance of climate assessment studies has never been denied by relevant government bodies. On the other hand, the climate change issue has never been considered as really important relative to other high priority problems.

However, recent support of the Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet) initiative to prepare a Russian Climate Doctrine is a good sign. Roshydromet was instructed to circulate the draft for such a doctrine to all interested agencies (especially ministries) of the Russian Federation for comments. The current report takes into account the research performed by Roshydromet and the Russian Academy of Sciences (RAS) in the preparation for a Russian Climate Doctrine.

To what extent the Russian government will define an explicit climate strategy in the foreseeable future, however, remains to be seen. As in Germany and other countries, the onset of a global financial crisis in 2008 together with the danger of a global recession as well as the decline in oil and gas prices, has made the political landscape rather less amenable to serious action on global climate change (despite interesting arguments asserting that the recession provides a unique opportunity for growth stimulation through investments in sustainable technologies).

Under these circumstances, Russia's stance towards the post-Kyoto negotiations that are currently under way is important, and far from obvious. There are promising opportunities, but also serious challenges.

2.1 The current economic situation

The global financial crisis triggered by the collapse of the American sub-prime market in 2007 has hit Russia no less than other economies all over the world (figure 1). In Russia, the combination of shrinking international credits and falling oil prices brought a decade of remarkable economic growth to an end. How the world economy and the capability for international problem solving will be affected by this crisis cannot be known at the time of writing, but there is little doubt that the repercussions will be more severe and long-lasting than with any recession since at least 1973, if not 1929. However, three facts need to be recalled with regard to Russia. First, in 2007 inflation rose from 9 to 14%, raising the specter of runaway inflation – the crisis has stopped this dangerous increase, too. Second, Russia's huge currency reserves provide it with considerable resources to deal with the economic challenges of the coming years. Third, the Russian budget is calculated with an oil price of 41$ a barrel, and while the volatility of oil prices is likely to drive them below that threshold from time to time, it is a rather safe bet that in general they will fluctuate well above it.

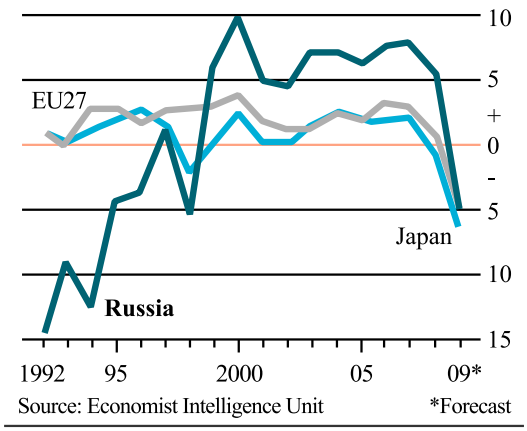

Figure 1: Real growth of GDP (% per annum) in Russia, Japan and EU27
Source: Economist Intelligent Unit

In the short run, the global financial crisis and its dampening effect on global economic growth – and thereby on oil prices – clearly presents a major challenge for Russian economic policy. But Russia will be negatively affected by this development only if key countries of the Organisation for Economic Co-operation and Development (OECD) will be affected as well. In other words, it is unlikely that the global economic turmoil will fundamentally alter the power relations between Russia and the rest of the world. And it is unlikely that oil prices will stay at low levels for long – demand will keep increasing and supply will be restricted both by natural scarcity and by limited global investment in oil extraction and refinery. Therefore, Russia may well be in a position to become more, not less wealthy in the years and decades to come (King, 2008; Sestanovich, 2008).

After the difficult economic period following the end of the Soviet Union, the Russian economy has been growing at a rate somewhat above 5% in the years from 1999 to 2008 (figure 1). While this growth was

helped by the rising oil prices of those years, it is important to realise that really massive oil price increases did not set in until 2004. The Russian economy is clearly dependent on oil and gas exports, but detailed analysis suggests that there is a solid base for Russian growth of GDP per capita to stay around 5% in the coming decades (Beck et al., 2007). There is no doubt that the Russian government will aim for even higher growth rates.

As the Russian population is declining, GDP might grow with about 1% less than GDP per capita – an alleviating factor when considering total GDP related greenhouse gas emissions later.

Russia's GDP per capita is about 10,000 € (at prices of 2005); in the Eurozone, GDP per capita is about 25,000 €. Assuming an annual growth rate of 2% for the Eurozone – consistent with the experience of the past decades – at a rate of 5% Russia would reach European levels of GDP per capita well before 2050. Goldman Sachs expects Russia to be the sixth largest economy in the world by 2050.

In order to sustain its current growth rates Russia will need to address two key problems. First, experience shows that growth depends critically on investment rates[1]. The gross investment share of GDP in Russia is quite low, however, and needs to be increased (figure 2). Beck et al. argue that "investment would have to rise significantly to maintain high growth rates in Russia" (Beck et al., 2007 p. 22). They assess that to stabilise a growth rate of about 5%, Russia will need to increase its share of gross investment in GDP from currently less than 20% to about 25%.

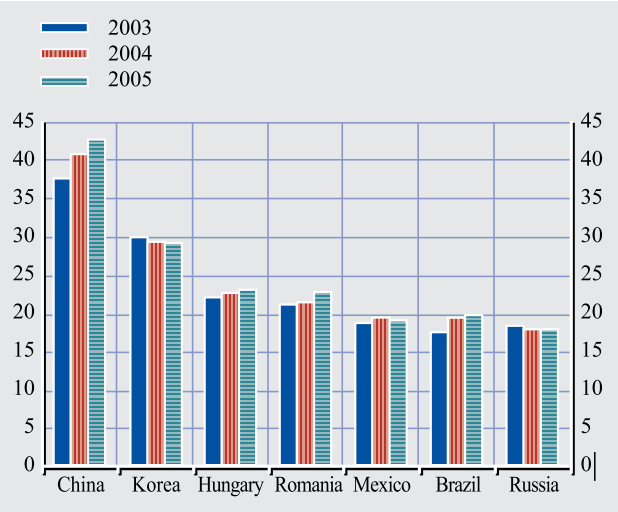

Figure 2: Share of gross investment in GDP
Source: Global Insight, quoted from Beck et al. (2007)

The second problem is public health. General health conditions, often further hampered by unhealthy lifestyles, are a serious impediment to personal well-being and to increasing labor productivity. While Russian health issues are basically separate from climate policy, it should

[1] See e.g. the classical study by Levine and Renelt (1991).

be noted that many people see a close connection between environmental protection and personal health. An example is the growing market for agricultural products from organic farming in many countries. Improving general health conditions in Russia may go hand in hand with strengthening the sensitivity to environmental issues. There is an opportunity here for the government to launch public awareness campaigns linking the themes of health and nature preservation.

2.2 Options for Russian Climate Policy

As Figure 3 shows, energy intensity (i.e. amount of energy used per unit of GDP) is about seven times larger in Russia than in Japan, and about twice as large as in Canada. It is quite plausible that in the coming years this difference will decrease.

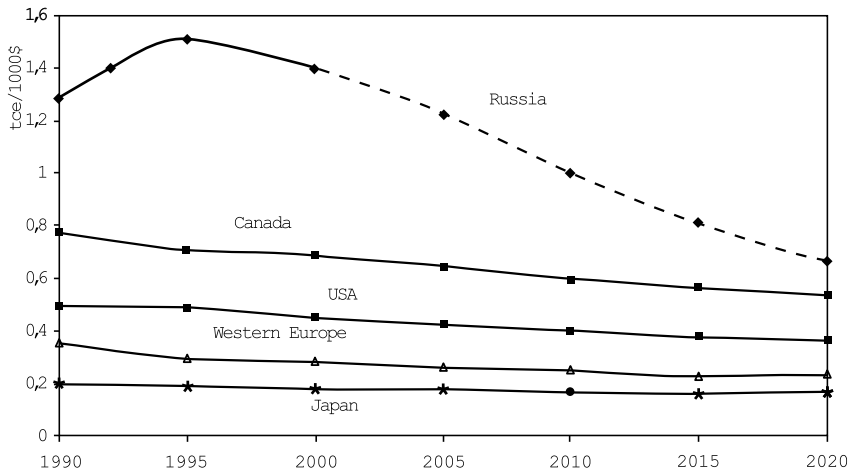

Figure 3: Energy intensity of Russia and other countries, 1990-2020
Source: Kononov et al. (2003)

Kononov et al. (2003) expect a reduction of energy intensity in Russia by about 4% per year up to 2030, in contrast to about 2% annual reduction expected for Western Europe and America. Given a growth forecast of 5% and more for Russia, this would still lead to an increase of energy use of at least 1% per year. And given the availability of fossil fuel resources, this would lead to an annual increase of CO_2 emissions by nearly 1% - the smaller increase in emissions being due to replacement of fossil fuels with relatively large CO_2 - emissions (especially coal) by fuels with somewhat smaller emissions (especially gas).

Figure 4 shows a path on which Russia could catch up with highly industrialised countries both in terms of income per capita and energy intensity. However, following this path requires a substantial increase in investment. An increase of investment is needed to decrease energy intensity as well, especially by renewing the built environment. As about 40% of Russian energy use goes into district heating

(International Energy Agency, 2006), mainly by gas, this could free a huge amount of gas that could be sold at much higher prices on export markets, possibly over a longer period of time.

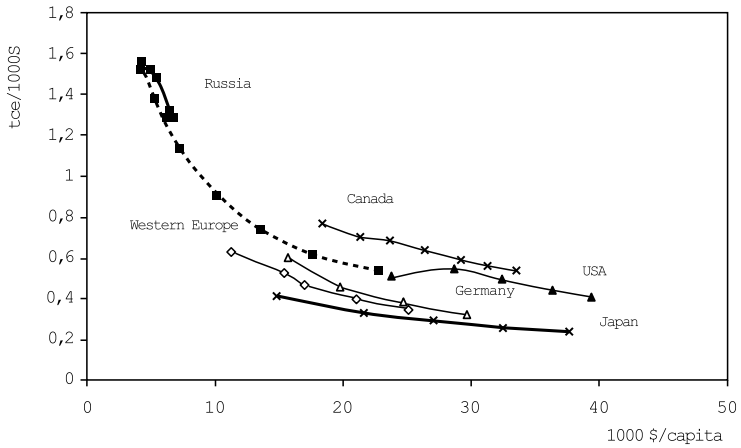

Figure 4: Energy intensity vs GDP per capita in different countries, 1990-2030 for Russia, 1980-2020 for the other countries
Source: Kononov et al. (2003)

The effect of investments is often described as the substitution of labor and possibly energy by capital. This misses, however, the crucial aspect of learning-by-doing and increased know-how resulting from investments. It has two major effects. First, labor productivity increases, so that real wages can also increase, while the ratio of labor to capital costs may remain relatively stable.

Secondly, through increasing know-how, energy can be used more efficiently and less energy intensive goods and services can be developed. In principle, higher growth can thereby be achieved with decreasing emissions. Clearly, this possibility is of crucial importance for successful climate policy. It requires the combination of incentives to increase investments with incentives to direct those investments in the direction of a less energy intensive economy. Ideally, the resulting transition would also contribute to a renewed sense of national identity by creating a widely recognised sense of excellence in new fields.

An innovative climate policy can fit this complex requirement surprisingly well. For this purpose, a suite of measures might be combined:

- Joint Implementation
- Green Investment Scheme
- Russian Emissions Trading System
- Russian Climate Fund
- Adaptation Measures:
  - Permafrost melting
  - Water shortages
  - Floods
  - Other extreme events
  - Health issues

- Mitigation Investments:
  - Energy efficiency in district heating
  - Energy efficiency in industry
  - Energy efficiency in transport
  - Gas flare
  - Pipeline losses
  - Carbon Capture and Storage (CCS)
  - Use of renewable energy sources
- Micro-economic Sectoral Measures:
  - Local industrial learning networks
  - R&D for robotics
  - R&D for advanced materials processing
  - R&D for other sectors
  - Irrigation training in agriculture

Joint Implementation projects are under way and there is a huge potential to be tapped. Green Investment Schemes have been proposed to organise sale of Russian emission permits. The starting point would be the fact that a considerable amount of permits is not needed in Russia because of the high baseline assumed for the original allocation. These permits could be sold on international markets, and the revenues invested in Russia for projects reducing Russian emissions.

A Russian Emissions Trading System is not a realistic option presently, but it could become an interesting tool for Russia in the post-Kyoto period. Revenues from such a system could then be used to create a Russian Climate Fund, providing a source to finance adaptation and mitigation measures. This would avoid the problem that standard entries of government budget cannot be earmarked for particular purposes. Adaptation measures to be financed from this fund are quite obvious.

Mitigation measures would require a combination of investment finance with micro-economic sectoral measures. The large role and low energy efficiency of district heating in Russia provide a great opportunity to reduce overall energy intensity with considerable economic gains. The challenges of maintaining and improving the pipeline system provide a major opportunity to diversify Russia's industrial structure by developing robotics and advanced materials processing. The latter can be particularly promising if applied to carbon fiber technologies.

The win-win strategy sketched so far is certainly worth pursuing. For this purpose, a sober assessment of the climate challenge from a Russian point of view is essential.

3. CLIMATE CHANGE IMPACTS FOR RUSSIA

3.1 Impacts until 2050

With increasing concentrations of CO_2 and other greenhouse gases in the atmosphere, the average temperature in Russia will increase even more than the global average. There are two main reasons: the melting of snow and ice reduces the albedo – the reflectivity – of oceans and land, thereby increasing the amount of heat they absorb, and the large thermal inertia of the oceans results in a higher temperature over continents than over maritime regions by a factor of up to two. Given the huge area of Russia, there will of course be great regional differences, but by 2050 an increase of 3 °C above the average temperature of the 20th century is likely.

Clearly, this represents a drastic climate change in Russia. It will destroy the environment on which the indigenous Arctic cultures of about 200,000 people are based. It will also destroy the habitat of many plants and animals, with polar bears being the most prominent, but by no means the only species affected. On the other hand, higher temperatures could mean higher biodiversity, with evolution generating new varieties of existing species and even new species in the course of time.

A key effect of rising temperatures in Russia will be the reduction in energy use for heating purposes. As already mentioned, about 40% of total Russian energy use goes into heating buildings by district heating, and by 2005 climate change can be expected to reduce this amount by several percentage points, yielding additional export revenues. The increased energy needs for air conditioning in southern regions of Russia are likely to be smaller in comparison.

As a result of higher temperatures, the permafrost that characterises large parts of the Russian territory can be expected to decrease. In some regions this will mean that the permafrost melting, which currently reaches one meter of depth, will then reach one meter and a half. As a result, in these regions buildings and infrastructure will need to be renewed faster than would otherwise be the case. As the affected fixed capital amounts to hardly more than 1% of total fixed capital, and the renewal will take place over several decades, this would require an increase of gross investment of less than 1%. Increased investment in general accelerates growth, but an increase from, say, 18% to 18.02% would hardly be noticeable[2]. However, in some northern areas, melting permafrost could lead to positive effects for ports and infrastructure, which could help to foster growth and investment in these regions.

Melting permafrost and increased temperature will make agricultural production competitive in areas where this is currently not the case, leading to an increase in total production. However, this effect may be offset by water scarcity in critical regions.

Globally, precipitation is likely to increase with higher temperatures, and this also holds for the vast territory of Russia as a whole. However, regional differences are large. In general, regional precipitation differences tend to be magnified, precipitation increasing in areas which today already have high precipitation, and decreasing in today's dry areas. Hydrological investigations suggest that precipitation will decrease in the south-western parts of Russia, where most current agricultural production is located. To some extent, this effect can be countered by using less water demanding crops. Given the size of the Russian territory and the experience of Russia with pipeline technology, water could also be transported by pipelines from regions where it is abundant.

On balance, Russian agriculture is unlikely to suffer reductions in total production due to climate change and may well gain from it.

As in other countries, increased variability of temperature and precipitation may well lead to increased fluctuations of agricultural output in Russia. To manage these fluctuations, a system of crop insurance will be needed, both to compensate losses of farm income and to finance food imports from other regions. Similarly, the risk of flooding increased in some regions will require suitable adaptation measures.

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[2] The relation between climate policy and investment dynamics is discussed in more detail below.

By 2050, sea-level will rise, but probably by not more than about 30 cm. This should not create great problems along the Russian coast-line.

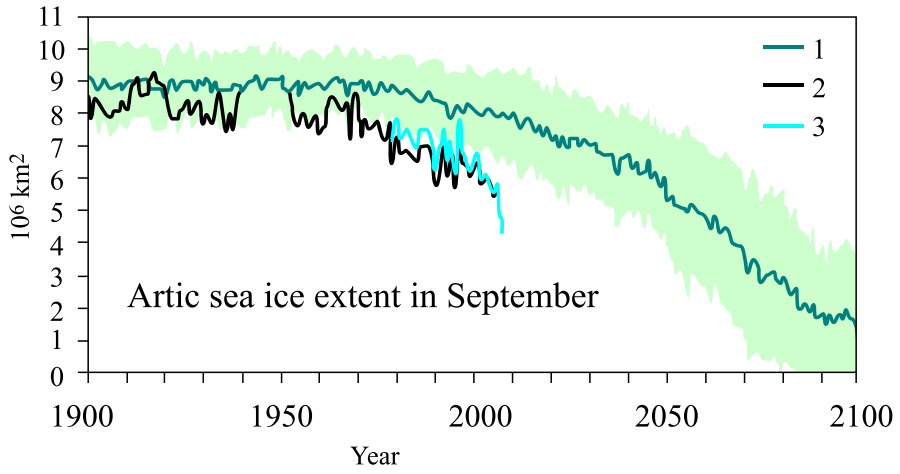

Figure 5: Sea-ice in the Northern Hemisphere as computed from the ensemble (16 members) of AOGCMs CMIP3 using SRES scenario A2 (1), and obtained from ground-based (2) and satellite observations (NSIDC data) Source: Voeikov Main Geophysical Observatory, St. Petersburg

The single most important impact of climate change in the coming decades is likely to be the melting of sea-ice (figure 5). This will facilitate exploring and exploiting the vast resources of fossil fuels to be found below the Arctic Ocean. And it will facilitate marine traffic along the northern coast of Russia.

Summing up:

- A significant part of Russia is located in the region of large (observed and projected) warming.

Favorable consequences of expected climate changes are:

- Northward shift of the boundary of comfortable habitation
- Reduction of heating season and period of energy consumption
- Improvement of ice conditions and accordingly transportation potential in the Arctic seas
- Easing of access to the Arctic shelf and of its development
- Possible increase of biodiversity as a consequence of warmer climate.

Negative consequences of expected climate changes are:

- Increase of energy consumption for air conditioning in summer in the southern regions
- Increase of occurrence of dry conditions in some regions, and excessive precipitation and flooding in other regions
- Fire risks in forestland
- Disruption of existing ecosystems, extinction of sensitive Arctic species

- Degradation of permanently frozen soil with damage to constructions and communication lines in northern regions.

As an advantage, Russia has considerable adaptation potential in comparison with many other countries and regions of the globe due to:

- The large size of the territory
- Availability of considerable water resources
- Relatively small portion of population living in areas particularly vulnerable to climate changes.

3.2 Impacts beyond 2050

Without massive reductions of global emissions, by the end of the century average temperatures in Russia are likely to increase by more than 5 °C. In the long run, this would strongly amplify both the negative and the positive effects already experienced by 2050.

There will be two major differences compared with the shorter term effects. First, permafrost melting may release significant additional greenhouse gases into the atmosphere. In particular, methane can be released both from terrestrial permafrost and from the ocean ground along the Arctic coastline. If this happens, it could increase global temperature by about 20% towards the end of the 21st century and beyond (Sample, 2005). However, if it becomes accessible, methane could also be used for commercial purposes. This could be combined with CCS – carbon capture and storage – technologies to avoid further emissions.

The second major long-term effect is sea level rise. At the current state of knowledge this represents the most serious danger from climate change to Russia. If global temperature increases by just 3 °C or 4 °C above pre-industrial levels for several centuries, melting ice from Greenland and parts of Antarctica can be expected to raise sea level by 5 and more meters in the course of the next millennia. For Russia, this would mean the loss of coastal cities, in particular Saint Petersburg, a key element of the national heritage.

3.3 Assessment of these impacts in Russia

From a purely economic point of view, the prospect of melting sea ice opens up major opportunities for Russia. Transport of oil and gas, as well as many kinds of goods and commodities, and access to natural resources in the Arctic shelf, will be greatly facilitated. These developments are likely to lead to a persistent annual increase of GDP by several percent, overriding negative climate impacts like the need to rebuild structures currently grounded on permafrost.

In a broader historic context, it should be remembered that one of the constants of Russian policy since centuries has been the struggle to get better access to the oceans of the world. And this is very likely to be realised through climate change.

In summary, a sober assessment can hardly escape the conclusion that within the time horizon of 2050, climate change, despite serious drawbacks, resonates rather well with the way Russia has defined its national interest in the past[3]. If Russia is to become a strong partner in reducing

[3] The great Russian climatologist Budyko expressed this view already before climate change became a topic of worldwide public interest.

global greenhouse gas emissions, arguments other than insisting on climate risks for Russia in the next few decades will be essential. One line of argument could emphasise the prospect of Russia strengthening its geopolitical status by contributing to the solution of a major global problem. Another argument could point to the economic and social opportunities that global climate policy can present for Russia, as discussed in the following section.

4. SOCIO-ECONOMIC PERSPECTIVES RELEVANT FOR CLIMATE POLICY

The greatest uncertainties related to climate policy are how political, economic and social developments will look like in future. In the following we outline three scenarios until 2020 against which climate policy options can be reflected.

1. *Chinese growth*

   This scenario implies growth rates of 6% and more. Besides the oil and gas sector, other economic sectors play a highly dynamic role. The earners of property income – including the state – invest 30% to 60% of their incomes in Russian businesses, accumulating productive capital together with the know-how that comes with rapidly growing investment. The state is a strong player in the economy, but consciously creates the conditions for a highly dynamic market economy – a mixture between classical mercantilist policies, the "New Economic Policy" of the early 20th century, and current Chinese developments.

2. *Neo-feudalism*

   In the second scenario, the earners of property income invest less than 30% of their income in Russian business enterprises, the rest being dedicated to luxury consumption, investment on global financial markets, and military spending. While the oil and gas sector is highly competitive, the rest of the economy operates with much lower efficiency than the globally leading economies. Economic growth proceeds at a rate somewhere between 2% and 5% while social and regional inequality increases.

3. *Nightmare*

   This is the scenario people prefer not to think about. But unfortunately it is a possibility that needs to be considered very carefully. Russia experiences a mixture of economic and political crises combined with accidents of the kind that led to World War I. Russia gets more and more involved in violent conflicts, ranging from crime and terrorism to large-scale military conflict. The economy is characterised by phases of growth similar to those of neo-feudalism, but also by phases of economic breakdown in whole regions and sectors. As a result, average growth lies between -1% and 2%, with much larger extremes in both directions. Low growth is not the most relevant problem with this scenario, but it does, of course, impact both socio-economic development in general and climate policy in particular.

Table 1 compares estimates for population, GDP, greenhouse gas emissions, and the ratios between these, for Russia, the Eurozone, and the U.S. The comparison suggests three interesting conclusions:

1) If Russia would simultaneously reach the per capita GDP of the Eurozone and its emissions intensity, it would increase GDP by a factor of 2.2, while reducing emissions intensity by a factor of 0.4; total emissions would therefore *fall* by a factor of 2.2*0.4 = 0.8, i.e. by about 20%.

2) If GDP per capita will grow at a rate of 5% in Russia and 2% in the Eurozone, they will have the same GDP per capita around 2035; to get *todays* European emissions intensity in Russia by then it would suffice for Russian energy intensity to decrease by 3.5% annually – less than the 4% expected by Kononov et al. (2003).

3) Emissions intensity in the Eurozone may well decrease by at least 2.5% annually until 2035; if by then Russia will match Europe both in GDP per capita and emissions intensity, its emissions intensity will have decreased by at least 6% annually. This is perfectly possible, especially by taking advantage of mutual technology transfer.

ca. 2005	Population (million)	GDP (billion €)	GDP per capita € (thousand €)	GHG (billion tCO_{2eq})	GHG per capita (tCO_{2eq})	GHG/GDP (tCO_{2eq} / thousand €)
Russia	140	1.5	11	2	14	1.3
Eurozone	320	7.7	24	4	12	0.5
U.S.	300	9.9	33	7	23	0.7

Table 1: Population, GDP, greenhouse gas emissions and their relations
Sources: Eurostat, 2008; European Central Bank, 2008; Economy Watch, 2008; European Environment Agency, 2006 and UNFCCC, 2004 (the figures refer to different years in the bracket 2004-2008)

Two difficulties must be taken seriously, however. First, as mentioned above, in Russia the heating of buildings uses about 40% of all energy produced. Given Russia's climate combined with its current economic conditions, it will not be easy to decrease the energy used for this purpose rapidly, even though it could happen naturally as a result of technical progress in the longer run. And second, given Russia's large fossil fuel reserves and, again, climatic conditions, a shift from fossil fuels to renewable energy sources does not look very attractive from an economic point of view. Decreasing the energy intensity of the Russian economy, therefore, should be the first priority from a climate policy point of view.

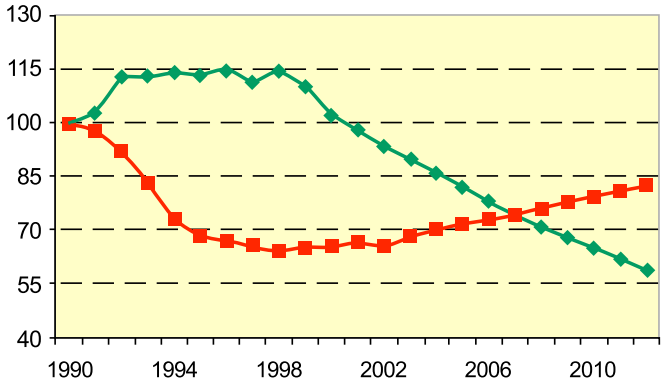

Figure 6: Russian Emissions (red) and Energy Intensity (green)
Source: Peletier et al. (2007)

In the past years, the energy intensity of the Russian economy has declined quite sharply (figure 6). As in Russia nearly all energy is produced from fossil fuels, this implies that the greenhouse gas intensity of the economy has also decreased. However, the strong economic growth of those years has meant that emissions have nevertheless kept rising. To keep emissions constant at growth rates of 5% and more, the greenhouse gas intensity of the economy needs to fall at the same rate. This is not impossible, but certainly far from trivial.

6. TOWARDS A RUSSIAN CLIMATE DOCTRINE?

In view of Russian climate policy, it is important to distinguish at least seven groups of actors:

- The policy establishment focused on maintaining and restoring social order by administrative means and, where these fail, by force
- The policy establishment focused on creating a social order based on competition and personal wealth
- The entrepreneurs closely tied to the Russian gas and oil industry
- The science and technology community
- Russian public opinion
- The financial sector
- Russia's international partners as well as opponents.

The three scenarios introduced above represent different patterns that would establish relatively stable relationships between these actors. It is important to realise that any such pattern comes with some definition of national interest and national identity.

Those countries that see climate change as an urgent challenge to be tackled in the next few decades need to acknowledge that for Russia things may well look different. The theoretical option of developing global climate policy without Russia is not really a political option. Given Russia's fossil fuel reserves, its indirect potential for greenhouse gas

emissions from its permafrost regions or through exploitation of its boreal forests, its potential for economic growth, and its geostrategic weight, this may lead to no effective global climate policy at all.

Will the widely diverging and often quite unclear views that different actors shaping Russian policy entertain with regard to climate change coalesce into a reasonably coherent political will? This depends to a considerable extent on how the Russian government and the Russian scientific community will interact with each other and with the other actors in the climate policy arena. Therefore, we give a brief outline on how this interaction has evolved up to now.

6.1 Russian science and climate research

There is considerable uncertainty in evaluating the impact of climate change on ecosystems, the economy, and on social life and national infrastructure in Russia. A combination of positive and negative consequences might be expected, particularly because due to economic growth the potential of damage from extreme climatic conditions and natural disasters may increase even without global climate change. Under these conditions, the role of science becomes highly important because it must provide federal and regional authorities with reasonable scientific assessment of climate change and its impacts. Similarly, science is needed to help designing and assessing options for mitigation and adaptation in view of expected climate change.

In the last two decades, the number of institutions participating in climate research significantly increased in Russia. This may foster the illusion that the study of climate is conducted extensively in a wide range of directions. However, as a matter of fact, the picture turns out not to be too encouraging. The main reason is the crisis in Russian science that continued for the last two decades. Beginning from the 1990s, Russian climate science stagnated for many years, gradually losing its leading position relative to previous achievements.

In addition to inadequate financial support and weakened manpower resources, government initiated a reorganisation of science by means of its division into basic research and applied science. The basic research should be conducted in the institutions of the Russian Academy of Sciences (RAS) and should be supported by federal budgets, whereas applied science should be conducted by federal agencies and should operate on the basis of economic self-sufficiency. It turned out that the climate issue was just in between these two scientific subdivisions.

There is a widely supported view among the scientific community of Roshydromet, RAS and other agencies that governmental support and management must be provided for climate research as a high priority task. This became particularly evident when global climate change and a large range of related issues began to play a remarkable role in the world political process, thus showing a potential for affecting national interests in different ways.

However, it is important to point out that there is no national system approach to the climate change issue in Russia. Instead, there is a set of poorly related projects conducted under federal and agency programs, including projects supported by the Russian Foundation for Basic Research (RFBR) and by international funds. These projects need to be further strengthened and closely coordinated. Important components of governmental support and management of relevant studies of climate change and its impacts must be:

- Development and implementation of a national policy on climate studies taking into account that they must be integrated in international research programs
- Development of scientific manpower

- Providing adequate support of research by telecommunication technologies and access to computing resources
- Development of appropriate mechanisms promoting dialogues between the scientific community and authorities of different levels responsible for policymaking.

Because of the weakening attention from government to national science in general and the significant reduction of funding for the last two decades, the Russian scientific community lost its ability to play an important role in climate studies and significantly diminished its contribution to the international process of climate change evaluation. In the 1990s, many prominent scientists abandoned their research institutions in search of jobs abroad, and at the same time many young scientists decided to stop their scientific career and move into the commercial sector. In the recent years, the expenditure for science varied at a level of 1.6-1.8% of GDP despite an approved Law on Science according to which it should be 4%.

As a consequence, the Russian scientific community lost the entire generation of scientists who could be in the prime of life at present. Due to loss of continuity, a big gap arose between older and younger generations of scientists. All these factors taken together resulted in a situation when only two scientific groups (from more than 40 institutions belonging to different agencies and performing climate studies) have the potential to conduct climate research based on the application of modern modeling tools widely used outside of Russia.

6.2 Developing a government position on the climate issue

It is important to note that no deliberate position on climate change and its consequences for the Russian Federation has been defined at the governmental level. In part, this is because the Russian government did not give such a task to the national scientific community. A good example of this is the ratification of the Kyoto protocol by the Russian Federation in the recent past without any clarification of its position, despite the negative attitude to the protocol expressed by a group of scientists from the Russian Academy of Sciences. However, the government supported the initiative of Roshydromet to prepare a Russian Climate Doctrine and according to its instruction the first draft should be circulated to all interested agencies (ministries) of the Russian Federation by the end of 2008 for their comments.

To attract attention to the climate change issue and to explain its causes and consequences in the foreseeable future to governmental and non-governmental organisations and the general public, a group of scientists from Roshydromet suggested in 2003 to initiate a periodic publication of appropriate reports in an easily understandable form. This initiative was supported by Roshydromet and scientists from the Russian Academy of Sciences. Soon after that, Roshydromet decided to initiate work on formulating an official position and developing an action plan that could be adopted by government as a Climate Doctrine.

Some thoughts setting a preliminary foundation for such a doctrine are given in the paper “Climate change and national security of the Russian Federation”, published in the Russian journal “Justice and security”, No.1-2, 2007. The preparation of the Report on climate change in Russia (vol. 1) and on the doctrine was coordinated by the Voeikov Main Geophysical Observatory in cooperation with other institutions. The work on evaluating the consequences of climate change in Russia (vol. 2) was coordinated by the Institute of Global Climate and Ecology in cooperation with other institutions. The First national report “Climate change and its consequences in the Russian Federation”, consisting of two volumes, has been published in 2008[4].

[4] The report can be downloaded at http://climate2008.igce.ru. A general summary is available in English: "Assessment report on climate change and its consequences in the Russian Federation. General summary". Russian Federal Service for Hydrometeorology and Enviromental Monitoring. Moscow, 2008.

Before this background, it is clear that the development of a Russian climate doctrine may be a rather long and complex process. Still, both Russia and the society of nations at large have a strong interest in fostering this process. Climate change is too important an issue, and Russia too important a nation, to be satisfied with the present lack of a reasonably coherent Russian view on the issue of climate change.

7. CONCLUSIONS

Under all circumstances described in the present report, the kind of cooperation needed for global climate policy will not be easy to achieve. It will require a strategy that is not only economically advantageous – by itself a major challenge – but also attractive in the role it offers Russia in the society of nations. This role should involve Russian leadership in some climate related areas, a leadership Russia could be proud of and would be respected for.

Russia does have an option for a win-win strategy on climate change. This can lead to sustainable growth of about 5% over the coming decades with emissions increasing slightly up to 2010, then being stabilised at that level for a few years, and declining at a rate of 1-2% thereafter. If highly industrialised countries achieve greater rates of emissions reduction, technological spillovers might enable Russia to achieve faster emissions reductions as well.

In fact, the strong tradition of Russia in the fields of science and engineering offer opportunities for highly promising partnerships in developing the technologies that will be needed to tackle the climate challenge. Russia has the potential to develop major breakthroughs in areas as diverse as robotics, nanotechnology, biotechnology, and computing – all of which will be needed to tackle the long-term challenge of climate change.

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[5] Given the difficulties for non-specialists to access Russian sources, in this appendix we publish material that may be useful to readers despite its somewhat preliminary character. For background and additional references see especially the end of section 6 of the present working paper.

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