Kokorin A.O., Garnak A, Gritsevich I.G., Safonov G.V.

Developing Russia's economy and saving the climate

Developing Russia's economy and saving the climate. Kokorin A.O., Garnak A, Gritsevich I.G., Safonov G.V., Danish Energy Agency, Moscow, 2008, 32 pages.

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This brochure is aimed at informing a wide range of readers that are interested in the problem of climate change from a Russian perspective, such as students of environmental subjects, media and members of nature protection organisations. The brochure provides short answers to many questions related to the continuation of international actions regarding limitation and reduction of greenhouse gas emissions after 2012 – after completion of the first commitment period of the Kyoto Protocol.

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The contents, views and conclusions of the brochure are the sole responsibility of the authors and do not necessarily coincide with the views of DEA or MoE.

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CONTENT

Introduction: **Changes in the world during the past 10 years since the agreement on the Kyoto Protocol**

Ten years is a long period for the rapidly growing problem of climate change. A radical transition has taken place from climate theory to economic practice. From the political slogans and dramatic projections, the global community has turned to a more "down-to-earth" and action-oriented focus. By 2006, the necessary scientific knowledge potential has been accumulated to conclude, that with the probability of at least 90%, the climate change observed during the last decades is determined by the anthropogenic emission of greenhouse gases[1]. Of course, significant uncertainty remains about how the global and regional climate can be expected to change in the future in response to increasing man-made emissions of greenhouse gases, and uncertainty persists in many specific areas, such as the role of the ocean in the absorption of CO_2 from the atmosphere, or of methane emission resulting from thawing permafrost, etc. Amidst the uncertainty, science has already provided an indication of the climate change that should not be exceeded if we want to limit the risk of very severe and possibly catastrophic consequences for nature and human beings: 2^0C of global warming is a limit not to be exceeded[2]. If with 2^0C "only" 500 million are likely to suffer from the lack of drinking water by the middle of the century, then with 3^0C their number may grow up to 3 billion. Such a surge will be a hard blow for the global economy, and primarily for those of the developing countries. Dissemination of malaria and other "southern" infections may be expected.

Given the need to reduce anthropogenic emissions, the challenge is how to minimize the economic costs. Many economic and energy organisations have been analysing this problem.

A low-carbon scenario is an approach to global energy and economic development which to the full extent addresses the problem of preventing strongly negative impacts of climate change and at the same time promotes economic development of all countries and elimination of poverty.

In the Fourth Assessment Report of the International Panel on Climate Change (IPCC), the experts arrived at a clear finding: technologically and financially, this target can be achieved, on the condition that the global greenhouse gas emissions are at least halved by 2050 compared to the 1990 level.[3] The G8 Summit in Germany recognized the need to develop and implement such a scenario.

In Russia, top-level executives have often indicated that environmental issues and the quality of the environment will become key factors for Russia's competitiveness. As stated by the President of R.F., D.A. Medvedev, "We should take into account the growing global concerns related to changing environmental conditions and the climate and be aware that in the foreseeable future, Russian businesses may face world markets access restrictions. The pretext here will be the environmental aspects of Russia's products"[4]. Such restrictions could be driven by high levels of greenhouse gas emissions in the manufacture of particular products.

The attitude towards renewable energy is also radically changing. In 2007, global investment in renewable energy "…will account for nearly $US 70 billion. This is a huge amount. And such innovative technologies have, in fact, turned into a separate receptive and promising market. And Russia should waste no time building its business in this market"[4].

Speaking about the UN Conference in Bali, the head of the Russian delegation, Chief of RosHydroMet Alexander Bedritsky made a point that, "We proceed from the benchmark principle: to reduce the global emission by 2050 by 50% compared to the 1990 level. There is logic in it, and there is scientific rationale"[5].

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1 IPCC, 2007, Fourth Assessment Report, Synthesis Report. www.ipcc.ch.

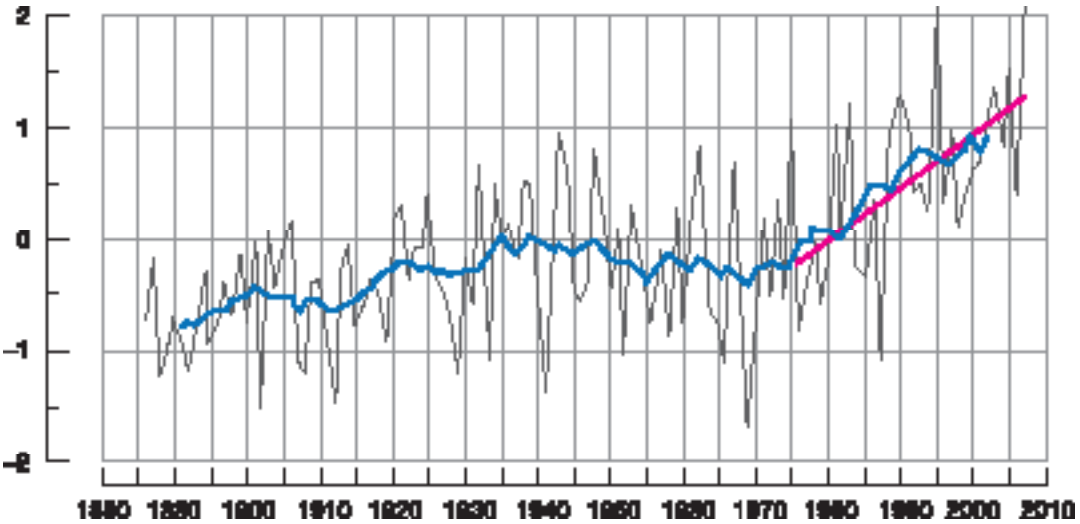
2 IPCC, 2007, Fourth Assessment Report, Working Group 2. Climate Change Impact, Adaptation and Vulnerability, www.ipcc.ch.

3 IPCC, 2007, Fourth Assessment Report, Working Group 3. Technical Summary, pages 39 and 90, and Chapter 13, page 776 www.ipcc.ch;

4 Ibid.

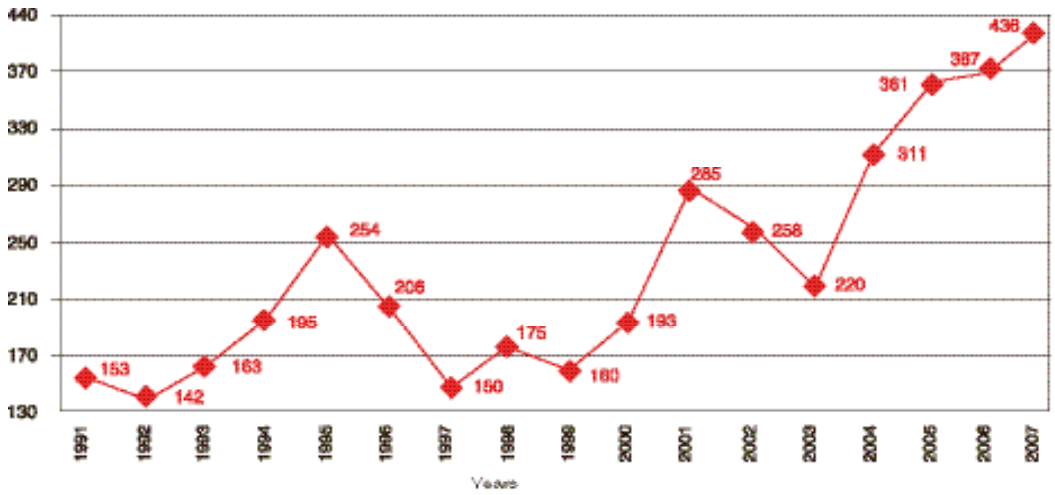
5 RIA Novosti, December 13, 2007, see also the RosHydroMet website at www.meteorf.ru.

Average temperature growth in Russia 1886 – 2007, 0C
(0 – average indexes during 1961 – 1990, blue curve – 11-years sliding averaging, red curve – line trend during 1971 – 2007)



SOURCE: REPORT ON CLIMATE ON THE TERRITORY OF RF, ROSHYDROMET, MOSCOW, 2008, – 35 P.

Growth of total number of dangerous hydrometerological facts, 1991 – 2007



SOURCE: REPORT ON CLIMATE NATURE ON THE TERRITORY OF RF, ROSHYDROMET, MOSCOW, 2008, – 35 P.

Russia can definitely make a valuable contribution to achieving the global target of a two-fold emission reduction of emission by mid-XXI century and preventing catastrophic consequences of climate change. This is how we can help the world and ourselves.

Why do we need a new international agreement for climate change and what can we expect from such an agreement?

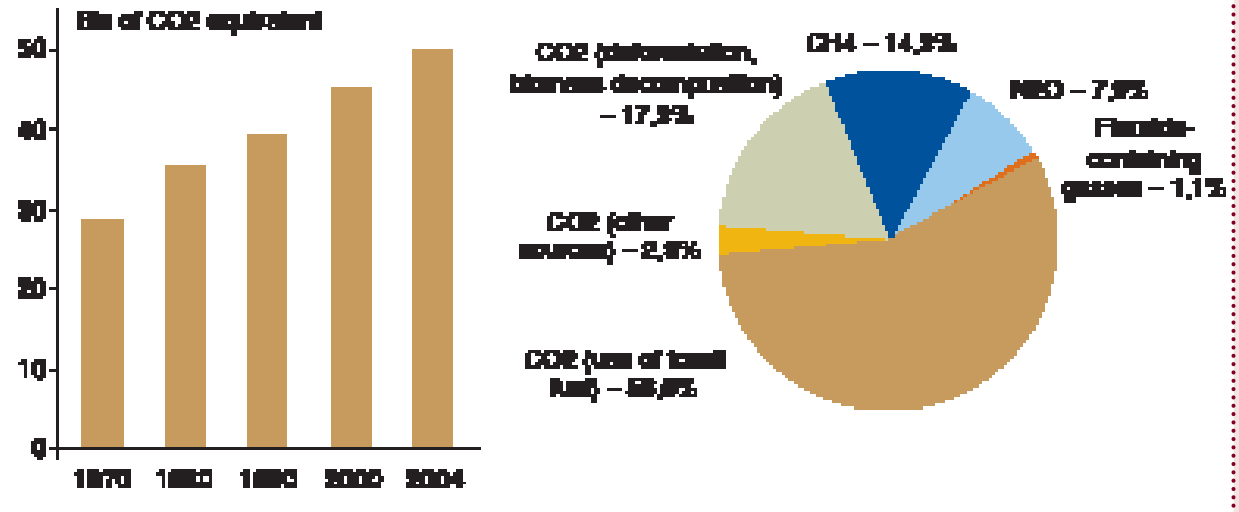
Global emissions are growing quite fast, by nearly 2 % per annum. If the above target is to be met, within 10-15 years the global emission should peak, stabilize, and then decline considerably. In this context, the goal of the new agreement is exactly to "turn" the global economy, and above all, the global energy system, towards a proper development scenario.

The Kyoto Protocol was adopted in Kyoto in late 1997 and came into effect in February 2005. The first commitment period only started in January 2008 and will last until 31 December, 2012. It might seem to be too early to think about the Kyoto continuation. However, international experience in general and with the Kyoto Protocol in particular shows that preparation of a new agreement takes at least two years, and its ratification will take another two or three years. Therefore, in 2006-2007 practical steps were made to launch the development of the new agreement, and work is progressing with a view to making a global agreement on the follow-up to the Kyoto Protocol in 2009, when Denmark will be hosting the 15th Conference of the Parties to the UNFCCC. As its point of departure, the ongoing work takes the recommendations by the IPCC that global emissions should be reduced well below 50 % of 1990 levels by 2050, and that emission of the industrialized countries as a group should be reduced by 25-40% by 2020.

The U.S. is the largest world economy and the only developed country which is not a party to the Kyoto Protocol (Australia ratified the Protocol before the conference in Bali in December 2007). Although the U.S. administration signed the Protocol, it was never ratified by the Senate, and the current president directly denounced it on the grounds of worries about the economic consequences. Since then, the climate change debate has shifted in the U.S., and many U.S. states, cities and companies are doing a lot to reduce emissions; for example, very serious energy and vehicle fuel efficiency programmes have been implemented. Furthermore, proposals for regional and national emissions trading schemes are making their way through state legislatures and Congress. It is hard to imagine the new agreement without the participation of the U.S. and other major players such as the EU, China, and Russia.

The first five years of the Kyoto Protocol is a very short period; it is important to create a framework for long-term efforts to accelerate emission reductions with a 10-20-year perspective or longer.

Dynamic and structure of GHG emissions



SOURCE: IPCC, 2007, FOURTH ASSESSMENT REPORT. WWW.IPCC.CH

In general, the new agreement should:

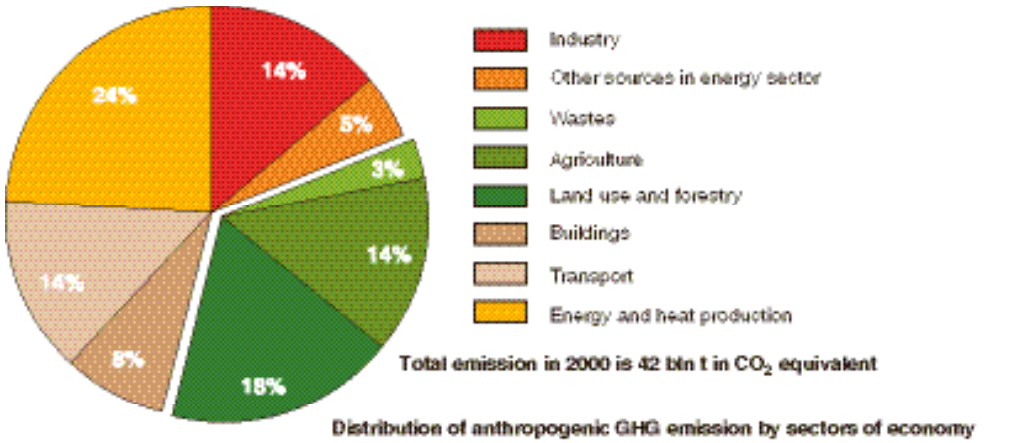
Demonstrate to the world that the problem can be and is being addressed.

Assure businesses that economically efficient solutions will be found and the investments in clean technologies are not going to be wasted.

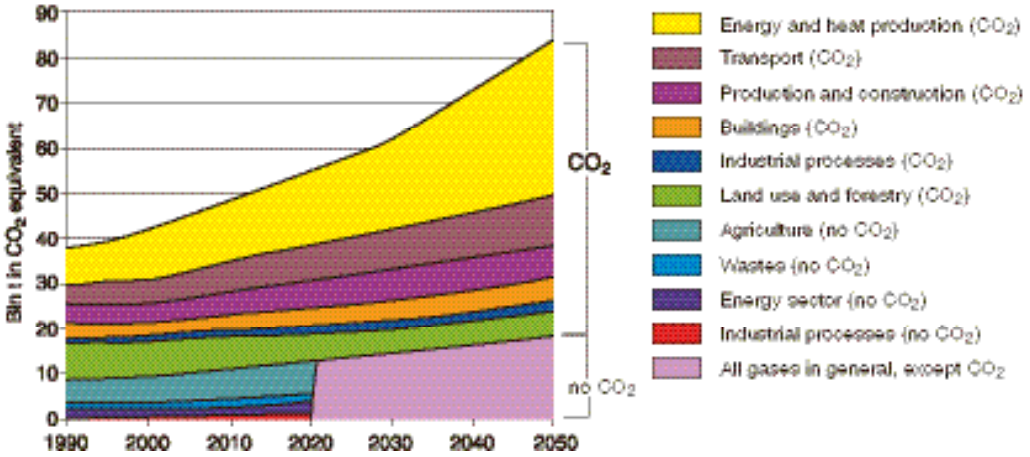
Convince governments that the burden of expenses and efforts will be fairly shared among countries, i.a. by providing financing and technology transfer to developing countries.

Provide assistance to the people, especially from the poorest countries and the most vulnerable regions, for the adaptation to climate change impacts such as draughts, floods, hurricanes, heat waves, etc.

Distribution of global CO_2 emissions by sectors of economy



Distribution of anthropogenic GHG emission by sectors of economy in the past and future (without measures for its reduction)



SOURCE: THE ECONOMICS OF CLIMATE CHANGE. 2006, THE STERN REVIEW. NICHOLAS STERN. CABINET OFFICE – HM TREASURY, UK, WWW.STERNREVIEW.ORG.UK (RUSSIAN SUMMARY AT WWW.WWF.RU)

The role and status of the Kyoto Protocol implementation and the development of the carbon market

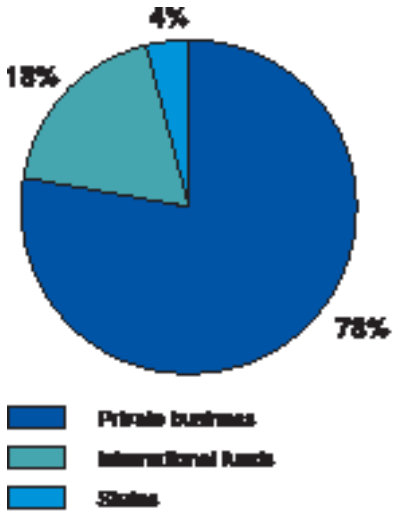
The major outcome of the Kyoto Protocol is likely to become its role as a "catalyst" for climate activities in general: Demonstrating that a global carbon market can raise sizeable funding for emission reductions; mobilising the private sector; global development of energy efficiency technologies and renewable energy; support for scientific research and education; and attraction of attention to the climate change problem. All this provides a policy and economic framework for the post-2012 international agreement. The Kyoto Protocol has been extensively criticized for its weakness and for the fact that compliance with its requirements limits GHG concentration growth in the atmosphere only insignificantly. However, in reality there were only two alternatives: either the step-wise approach of Kyoto, or no comprehensive agreement and postponed action.

The major economic outcome of the Kyoto is the creation of the fundamentally new so-called carbon market for trading in GHG emission reductions. At this point, the market is based mainly on two "pillars": On the demand side, mainly the EU and on the supply side, the international system of projects to reduce GHG emissions. Within the EU, the Emissions Trading Scheme puts a cap on the emissions of the most emissions-intensive industries and at the same time allows additional emissions if emission reduction credits from projects are imported from other countries. In addition, the national governments of several EU countries are buying emission reduction credits to comply with their national obligations under Kyoto. The scheme covers all 27 EU member states, and other countries such as Norway and Switzerland are planning to join. However, Russian companies have no direct access to the EU ETS, and it is unlikely that they will get it before 2020. For Russia, China, India, and other countries, the project mechanisms of the Kyoto Protocol have become "a window to Europe".

Article 6 of the Kyoto Protocol deals with Joint Implementation Projects in the "Economies in Transition". Article 12 deals with similar projects under the Clean Development Mechanism for developing countries. According to the Articles 6 and 12, an investor from a developed country can invest in an emission reduction project in another country. After project certification by the UNFCCC and verification of the project results and after the corresponding national bodies have issued the emission credits, the investor can use these units to cover his obligations to reduce emissions or just sell on the units on the carbon market.

Categories of customers of carbon market in 2007

(in percentage of total volume in t CO_2 equivalents)



SOURCE: IPCC, 2007, FOURTH ASSESSMENT REPORT. WWW.IPCC.CH

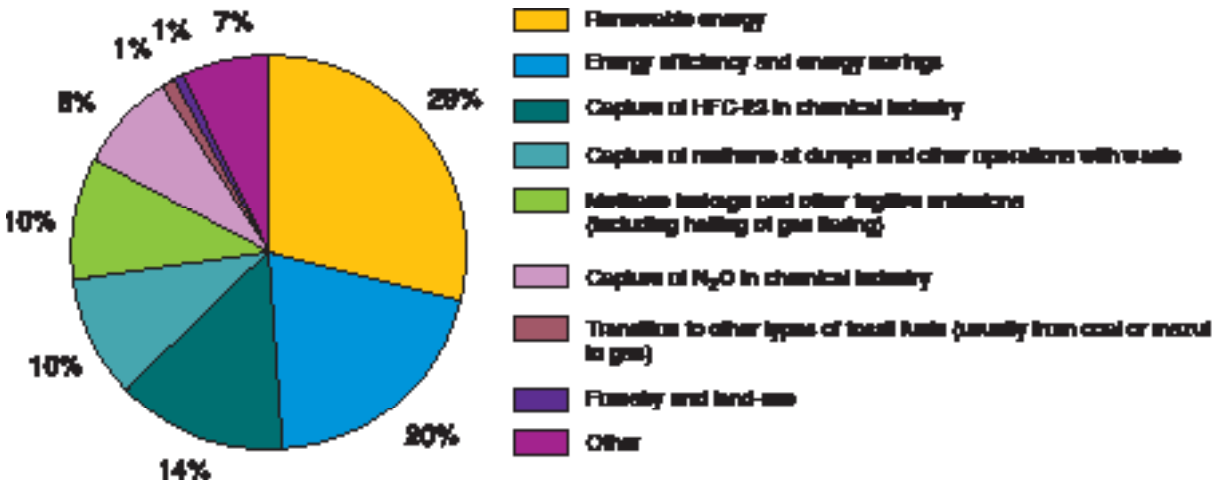
The Kyoto Protocol requires 38 developed countries to keep their GHG emission level during 2008-2012 at or below 95% of GHG emissions level in the base year 1990 (or 1989). For the EU-15 countries, the obligations is 92%, USA – 93%, Japan and Canada - 94%, Russia, Ukraine and New Zealand - 100%, Norway - 101%, Australia – 108% and Island - 110%. However, USA refused to ratify the protocol. After agreement on the Kyoto obligation of the EU; a burden sharing agreement was agreed between Member States: Germany and Denmark will reduce emissions by 21%, UK by 12.5%, France and Finland have a 0% target, while Portugal, Greece, Spain, Ireland and Sweden got permission to increase emissions. Quantitative obligations of developing countries were not discussed. During the first commitment period, it was very difficult to change established UN stereotypes and traditions and to achieve quantitative obligations even from wealthy countries such as South Korea, Singapore, and Argentina, to say nothing of China and India, where GDP per capita is much lower than in Russia.

Turnover of carbon markets in 2007

	M Euro	Growth against 2006	M. t CO2	Growth against 2006
Total (EU ETS, CDM, JI and other)	40 000	80%	2700	64%
CDM market (article 12 of Kyoto Protocol)	12 000	200%	947	68%
JI market (article 6 of Kyoto Protocol)	326	243%	38	81%

SOURCE: POINT CARBON, 2008. WWW.POINTCARBON.COM

Categories of customers and carbon market project types in 2007(in percentage of total volume in t CO_2 equivalents)



SOURCE: POINT CARBON, 2008. WWW.POINTCARBON.COM

By 2012, the Kyoto Protocol is expected to generate more than 3 thousand projects with around 4 bn. t CO2 overall emission reduction and at least US$ 30 bn. in climate investments.

The flagship role of the private sector and of renewable energy projects has become an important new feature of the carbon market. While two or three years ago, government agencies or international foundations were the major buyers (for example, the World Bank), in 2007 the private sector discovered the profitability of these investments, and its contribution reached 78%.

On the other hand, the "classic" inter-governmental emissions trading under Article 17 of the Kyoto Protocol is developing slowly, although some efforts are being made. Central and East European countries have developed their regulatory framework for trading in Assigned Amount Units (AAUs), and there are even some examples of small-scale deals. These efforts are actively promoted by the World Bank under the concept of "Green Investment Scheme", which links the sale of emission allowances to investments in climate-friendly projects and programmes. However, these emission reductions cannot be used in the EU trading scheme, and so they are not interesting for the private business sector. Inter-governmental trading in AAUs faces political and image barriers. The public opinion in potential purchasing countries is negative towards spending taxpayers' money on buying surplus emission reductions from transition economies which are not necessarily the result of emission reduction efforts. This is exactly the reason why efforts are made to make the scheme "greener" and to develop a hybrid version of projects and emissions trading.

Status of implementation of the Kyoto Protocol in Russia

The fact that it was exactly the ratification of the Kyoto Protocol by Russia that allowed it to come into force on February 16, 2005 is well-known. It is also known that Russia's emissions are substantially lower than its commitments, and the emissions growth is not so rapid as to question the ability of Russia to meet its emission reduction commitments.

In 2005, GHG emissions in Russia were 2.289 million tons of CO_2 equivalent or 71.3% of the 1990 level. These values were accurately calculated and recently passed international revision at the UNFCCC[6].

Although emissions have been increasing during this decade, a reduction of 25% in GDP emissions intensity (CO_2 emission from fuel combustion per unit of GDP) was experienced between 2001 and 2007. This positive trend may be expected to continue in the future. By 2012, GDP energy intensity is expected to equal 60% of the 2001 level.

Therefore, the Russian economy is to some extent "autonomously", without special climate or environmental targeting, developing in the right direction, although this is basically done through the elimination of some outrageous losses and the implementation of the simplest and least-cost measures. In the future, it will be impossible to do without special efforts aimed at energy efficiency improvements, energy conservation, and renewable energy development.

While the brochure was already being printed, Russia has on May 19, 2008 officially presented the data of GHG emissions for 2006, which clearly reflected negative tendencies of Russia's economic development that were forecasted earlier by experts. Economic growth parameters are presented below in the chapter "GHG emissions in Russia: structure and scenarios".

What is going on in Russia with its other obligations under the Kyoto Protocol? The "National system for the estimation of emissions and sinks of greenhouse gases" has been developed and is functioning in RosHydroMet. Russia is regularly submitting to the UNFCCC its reports on GHG emissions. There are about 75 Excel tables for each year from 1990 till 2005 in accordance with UNFCCC requirements[7].

The Ministry of Natural Resources hosts a Registry "Kyoto Protocol Units", which was tested for compatibility with the international Registry of the UNFCCC, and is completely ready to serve the Kyoto Protocol activities. Besides, each Party to the Kyoto Protocol must calculate and account for its base year (1990) emission values (including the land-use sector and forestry, where, in particular, the soil carbon loss, CO_2 absorption by forests, the impacts of wood harvesting, wood fires, etc. are accounted). In 2007, Russia submitted a special report on the progress in meeting the Kyoto commitments, and in February 2008 successfully justified all its provisions and emission values[8].

In other words, Russia has successfully proceeded through all the stages of preparation for the beginning of the first Kyoto Protocol commitment period (2008-2012).

A very important, although, strictly speaking, non-mandatory, aspect includes the development of the national system for review and approval of Joint Implementation Projects.

At the beginning of 2008, the preparations of standards for Joint Implementation Projects were completed. Since March 10, the RF Ministry of Economic Development and Trade has launched official calls for proposals for JI Projects. There are good reasons to expect a quick approval of the Russian projects by the Government and future international registration.

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6 Report of the review of the initial report of the Russian Federation FCCC/IRR/2007/RUS, 18 February 2008. www.unfccc.int

7 National report on cadastre of anthropogenic emission from sources and suction of GHG not regulated by Montreal protocol during 1990-2005, Moscow, Roshydromet, 2006 Common Reporting Format (database of RF during 1990- 2005, presented to UNFCCC in April 22, 2007). www.unfccc.int.

8 Report of the review of the initial report of the Russian Federation FCCC/IRR/2007/RUS, 18 February 2008. www.unfccc.int

The JI market is developing with a three to four-year delay compared to the CDM market. There is currently only one registered project (implementation of new technologies in the Podolsk cement factory in Ukraine). However, 133 projects have been submitted to the UNFCCC, of which more than 70 are from Russia[9]. There are projects in 40 regions in Russia with emission reductions in 2008 – 2012 of about 130 million tons CO_2 equivalents, and the total volume of attracted climate change finance amounts to 1 bn. Euro.

A specific characteristic of Joint Implementation Projects in Russia is the large number of projects aimed at the elimination of methane leakages in gas distribution networks. Such projects are very cost-effective and provide good social and environmental impacts. They visibly demonstrate the positive role of the Kyoto Protocol to the people. Reduction of emissions of HFC and other industrial gases is another type of low-cost projects.

However, the above types of projects are sometimes called "low-hanging fruit". Their potential will soon be exhausted both in Russia and in the whole world, and it will be necessary to shift to more costly, but much more wide-ranging activities. Energy efficiency, energy- and resource-saving projects will have a leading role to play here.

In 2008, with financing provided by the Japanese Government, the World Bank launched it's Carbon Finance Development Project, which aims at merging the project approach with the "classic" trading in emissions allowances. Under the approach known as the Green Investment Scheme, it is assumed that emissions trading will take place in the framework of intergovernmental agreements, while spending of funds will be "tied up" to a certain portfolio of projects and measures focusing on greenhouse gas emission reduction.

Reduction of GHG emissions in Europe

Decoupling, i.e. breaking the link between economic development and greenhouse gas emissions will be necessary in the future to satisfy at the same time environmental imperatives and the need for development. Although no country has yet been able to fully break the link, important progress has been made in Europe.

In 2007, the European Council supported an integrated climate and energy policy with three main elements:

EU has committed unilaterally to reducing GHG emissions by 20% in 2020 compared to 1990 levels and to reducing by 30% if other developed countries commit to similar reductions.

A binding target to increase the share of renewables in consumption to 20 % by 2020, with a minimum of 10% share of biofuels in transport consumption (target by 2010 is 5.75 %).

A European Strategic Energy Technology Plan to support development of climate-friendly energy technologies.

In addition, plans aiming at reducing energy use by 20% by 2020 were adopted[10]. This will require significant efforts both in terms of behavioural change and additional investment. Among the obstacles to the realisation of the potential are legal and financial barriers as well as the lack of internalisation of external costs in current tariff structures and pricing policies, where a strong incentive to use less energy is missing.

Overall, the EU countries collectively are on track to reach their Kyoto target. Total EU greenhouse gas emissions were equal to 5 177 Mt CO_2-equivalents in 2005. This is around 8% lower than 1990 levels. However, there has been a tendency towards slightly increasing emissions over the past five years. The emissions in the old Member States have not decreased significantly, and additional policies and measures will need to be implemented to achieve the Kyoto target[12]. .

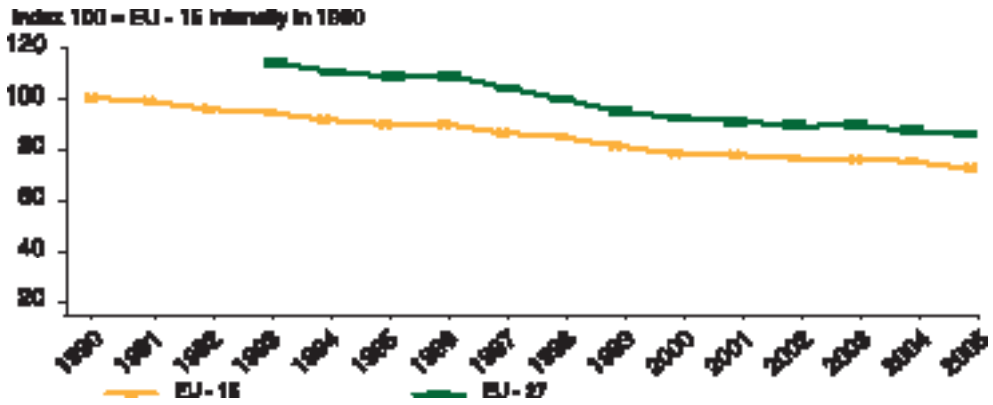
On the other hand, the emissions intensity per GDP is steadily decreasing. The emissions intensity is composed of two elements: The energy intensity, i.e. the use of energy to produce one unit of GDP, and the emissions intensity of energy production. These can be further disaggregated by economic sectors.

A decreasing GHG intensity of energy production in the EU has compensated for an increase in energy

9 http://ji.unfccc.int/JI_Projects/Verification/PDD/index.html

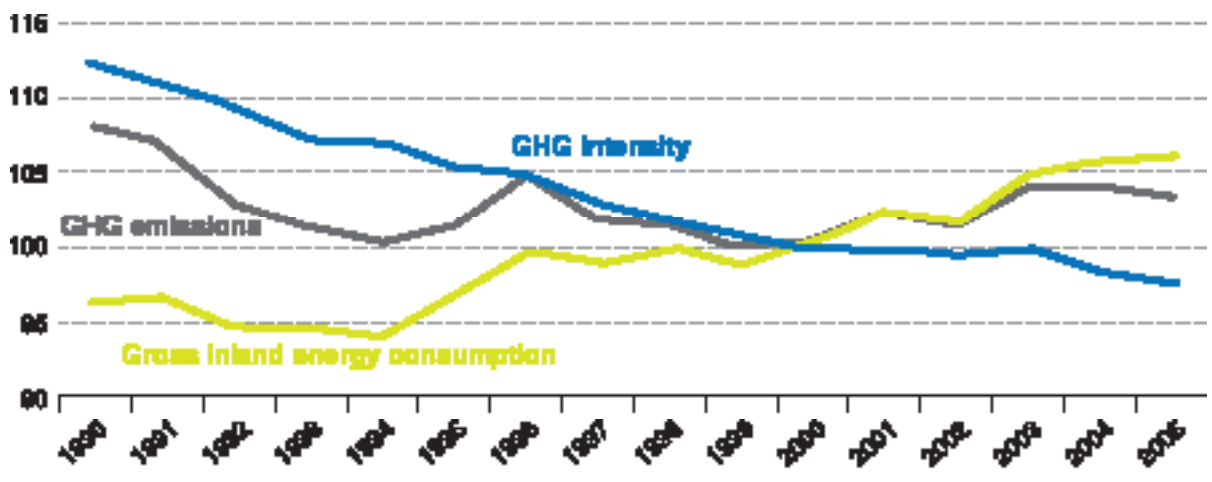
10 Action Plan for Energy Efficiency: Realising the Potential. COM(2006) 545

Change in emissions intensity of EU15 and 27 from 1990 (100 is emission intensity in EU15 in 1990)



SOURCE: EEA GREENHOUSE GAS EMISSION TRENDS AND PROJECTIONS IN EUROPE 2007

Emission intensity of GHG emissions per GDP unit, energy consumption and GHG emissions in EU in 1990-2005 (100 is indexes for 2000)



SOURCE: EEA GREENHOUSE GAS EMISSION TRENDS AND PROJECTIONS IN EUROPE 2007.

consumption, which has been rising since the mid-1990s and increased by 1.1% annually between 2000 and 2005 [11].

Industry and services have improved the most, while household energy consumption per capita in 27 EU countries has increased with improved living standards. Transport energy consumption showed only a very limited decoupling from economic growth as a result of increasing transport offsetting the technical efficiency improvements made.

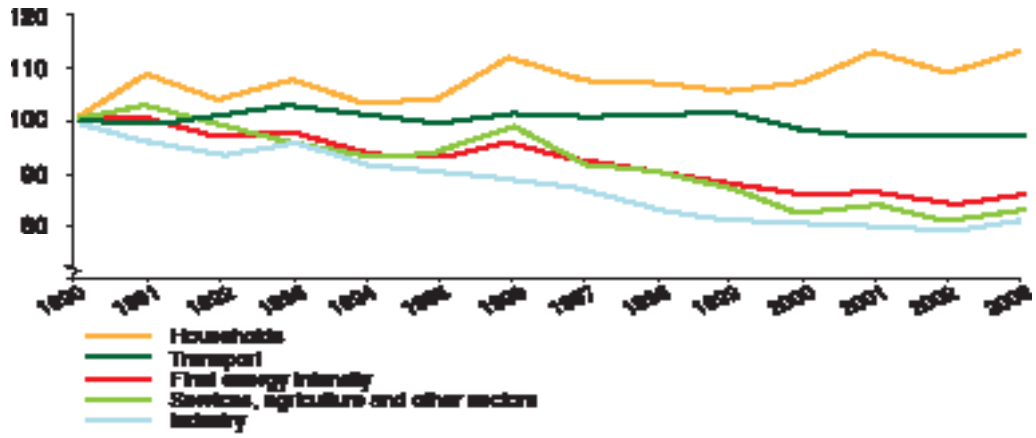
Examples of successful reduction of GHG emissions in Denmark

Energy efficiency in Denmark

For decades, originally spurred by the oil crisis of the early 1970's, there has been a targeted energy conservation

[11] IEA (2005): The experience with energy efficiency policies and programs in IEA countries

Development in GDP, energy, and energy intensity in EU
(100 is indexes for 1990)



SOURCE: EEA (2006): ENERGY AND ENVIRONMENT IN THE EUROPEAN UNION, EEA REPORT NO 8/2006

effort going on in Denmark. Energy savings are being pursued also for non-climate purposes, as they contribute to growth and business development while increasing security of supply.

Denmark is moving towards the implementation of its Kyoto Protocol obligations, although the targets for GHG reductions are challenging – a reduction by 21% from the 1990 level on average during 2008-2012. In order to achieve this, Denmark is participating in the international project mechanisms of the Kyoto Protocol, but the main contribution is achieved through the implementation of domestic measures.

Denmark has the lowest energy intensity ratio[12] in the EU. Gross energy consumption has only increased by 5.8% from 1990 to 2007 (0.3% per year), although GDP grew by 45.5%. This has lead to a drop in primary energy intensity by 18.3%, or 1.4% per year. Over the same period of time, the GHG intensity has decreased by 28%, reflecting the additional effect of fuel switching from coal to gas and increased use of renewable energy and district heating[13].

Changes in economic structure (from manufacturing toward services) have only contributed around 20% of the total decline in energy intensity, indicating that most of the improvement is the result of "real" energy efficiency improvements within the economic sectors.

Key features of Danish experience with improving energy efficiency include:

A significant part of energy savings must be achieved through savings delivered by the network and distribution companies.

A particular emphasis is currently on energy efficiency in buildings (building regulations and norms, an energy-labelling scheme, inspection of boilers and ventilation systems).

Information to the public on energy conservation is the integral part of the Danish strategy.

The public sector must make energy efficient procurement of products and appliances. Public institutions are required to implement energy savings measures that have up to a 5-year payback time.

Energy taxes are an important policy instrument in Denmark, accounting for 4.7% of the total tax revenues in 2005.

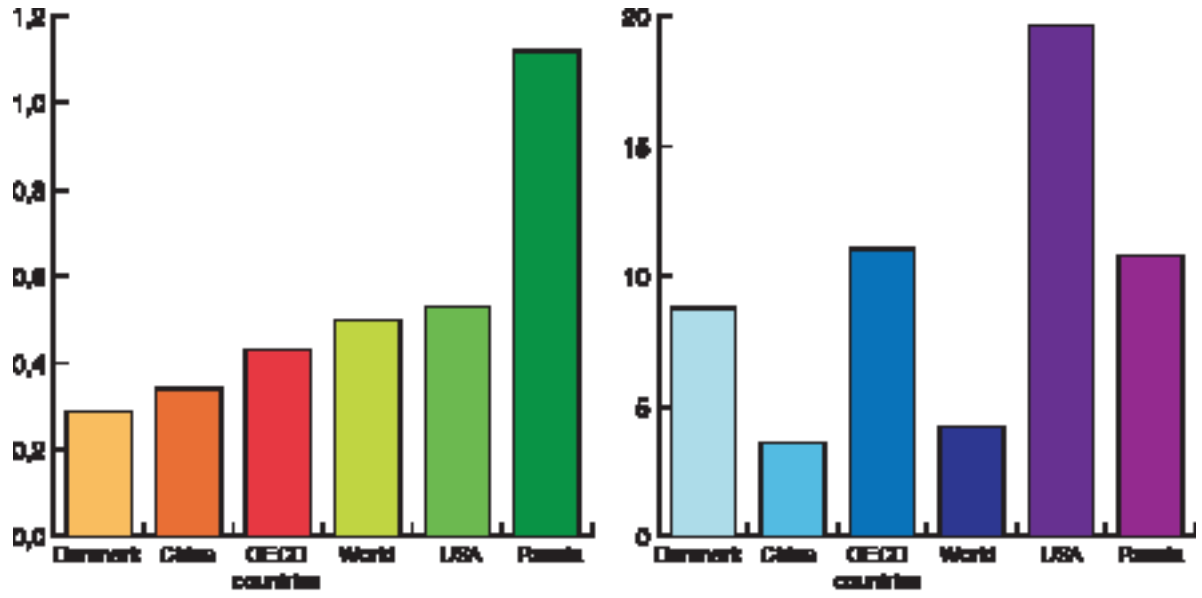
Voluntary agreements with industry on energy efficiency since 1996 served as an important instrument to improve the energy efficiency in industry. The voluntary agreement scheme is closely integrated with energy and CO_2 taxes, offering participating companies a rebate on the green taxes.

[12] Gross inland consumption divided by GDP

[13] Danish Energy Agency (2006): Energy Efficiency Policies and Measures in Denmark, ODYSSEE-MURE

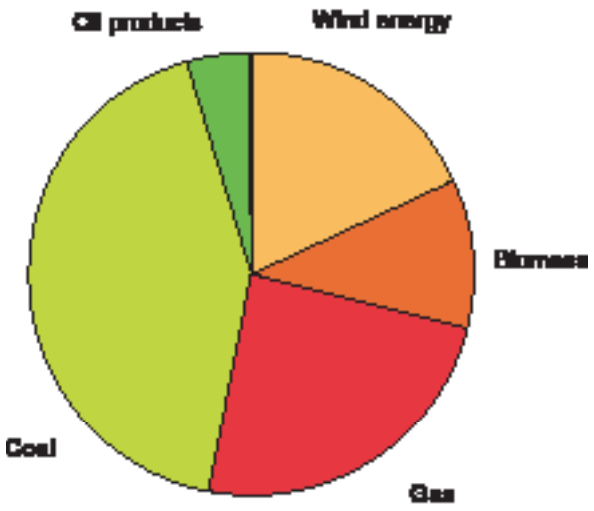
CO_2 emissions per unit GDP unit (purchasing power par), 2005 kg CO_2/$ USA (2000)

CO_2 emissions from fossil fuel per capita t CO_2/pers.



SOURCE: IEA KEY WORLD ENERGY STATISTICS, 2007, WWW.IEA.ORG

Gross electricity production in Denmark by types of fuel in 2005



SOURCE: DENMARK, INFORMATION JOURNAL ON RENEWABLE ENERGY, EC, JANUARY 23, 2008.

Renewable energy in Denmark

Renewable energy provides 17 % of the final energy consumption (2005). As part of the new EU climate and energy package and the 20 % target for EU, the European Commission has proposed that Denmark's target should be to increase this share to 30 % by 2020. The Government's energy strategy aims for a reduction in the use of fossil fuels of at least 15 % in 2025 as part of a longer term vision of becoming independent from the use of fossil fuels.

Denmark has spearheaded development of offshore wind farms with a capacity of 400MW, and more offshore wind farms in the pipeline[14].

The deployment of RES is supported through an array of measures, including i.a.:

A tendering procedure for new large offshore wind installations.

A premium price paid on top of the spot electricity price for wind energy. Fixed feed-in tariffs are available for solid biomass and biogas.

Cogeneration plants based on natural gas and waste receive subsidies.

Renewable heat from biomass and solar energy is supported through tax exemptions.

[14] Denmark, Renewable Energy Fact Sheet, European Commission, 23 January 2008

Low carbon global development scenarios

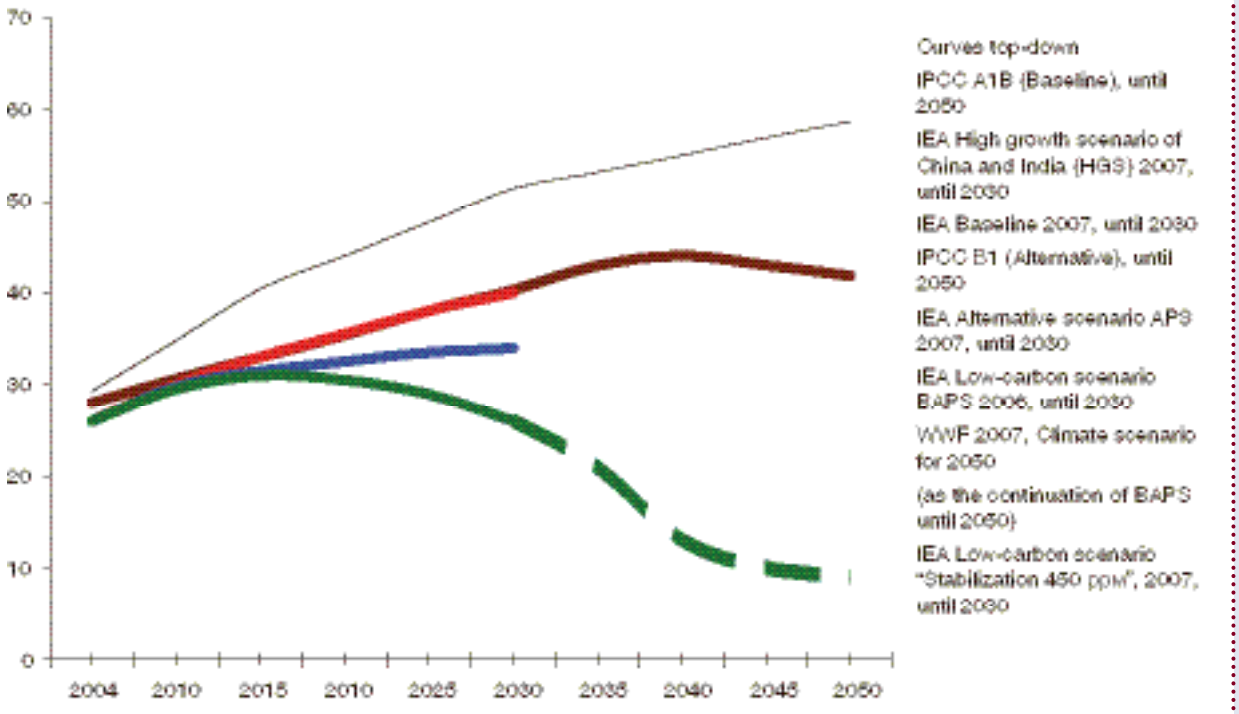
The International Energy Agency (IEA), IPCC and different international and national organisations have developed many scenarios on global energy development. Over the past few years, these scenarios were supplemented by so-called low-carbon scenarios, which aim to solve the problem of anthropogenic climate change in the 21st century and assess the economic costs of doing so. In 2007-2008 the Russian magazine "Economic review" has published a detailed review of global low-carbon scenarios[15], including those for single countries: EU, UK, Denmark, Norway, Brazil, etc.

First of all, these studies have provided a positive answer to the fundamental question of whether mankind has sufficient technologies and resources available to address the climate change problem. Moreover, this can be achieved even without nuclear power development[16].

Secondly, two potential main drivers in reducing emissions, i.e. the oil prices and existing measures to limit emissions and develop new technologies will not be sufficient to reduce emissions to the required level. So additional measures, including policies, plans and projects by the largest countries, and successful implementation of these, are of decisive importance.

The important - but still insufficient - contribution of existing and planned policies and measures is illustrated in an alternative scenario of the IEA (Alternative Policy Scenario, 2007 – blue curve in the below figure), which assumes, that all countries will implement all measures to reduce energy-related CO_2 emissions, which they are currently considering. These measures include energy efficiency and energy savings, reduction of oil and

Review of global scenarios of CO_2 emissions from all types of fossil fuel combustion, bn. t CO_2 per annum



SOURCES: IEA WEO 2006, IEA WEO 2007, WWW.IEA.ORG; UNFCCC REPORT ON INVESTMENTS AND FINANCIAL FLOWS, HTTP://UNFCCC.INT/COOPERATION_AND_SUPPORT/FINANCIAL_MECHANISM/ITEMS/4053.PHP; CLIMATE SOLUTIONS. WWF'S VISION FOR 2050. – WWF INTL., 2007. HTTP://WWW.WWF.RU/RESOURCES/PUBL/BOOK/220/.

[15] Kokorin A.O. «Low-carbon scenario of world energy development». Economic review. №7, 2007. pp 60-67. http://www.fief.ru/content/32/1/FIEF.20Obzor.20dec.2007.pdf. Kokorin A.O. «From Bali to Copenhagen: economic aspect at new international agreement on GHG reduction». Economic review. №8, 2008, is being printed.

[16] IEA WEO 2006, IEA WEO 2007, www.iea.org; Climate Solutions. WWF's Vision for 2050. – WWF Intl., 2007. http://www.wwf.ru/resources/publ/book/220/; Greenpeace «Energy revolution», 2007. http://www.greenpeace.org/russia/ru/ press/reports/1309441.

A set of measures to reduce CO_2 emissions in 2030.

Measures	Step 1: from the baseline to the alternative APS scenario, bn. t CO2	Step 2: from the alternative to the low-carbon scenario BAPS, bn. t CO2	Overall result, bn. t CO2
Reduction of demand: improving fuel efficiency	2,16	0,0	2,16
Reduction of demand: improving power efficiency	1,74	1,0	1,74
Energy efficiency and fuel switch in the energy sector	0,78	1,0	1,78
Renewable energy in the energy sector, biofuel and hybrid engines in the transport sector	0,72	2,0	2,72
Nuclear energy	0,60	1,0	1,6
Carbon capture and storage (CCS) in the energy sector	0,0	2,0	2,0
CCS and energy efficiency in the industrial sector	0,0	1,0	1,0
TOTAL	6,0	8,0	14,0

SOURCE: IEA WEO 2006.

gas consumption by the importing countries, development of renewable and nuclear energy. The biggest 13 programmes (all in EU, U.S. and China) are planning to reduce CO_2 emissions by 2 bn. t/year in 2030 (which is exactly the same as all current CO_2 emissions in Russia).

However, this is not enough sufficient from a climate mitigation perspective. The Alternative scenario can only to stabilize emissions, but not to start their global reduction.

According to low-carbon scenarios (green curves in the figure), the introduction of low CO_2 technologies must be accelerated, primarily in the rapidly developing countries. China and India have the leading role to play in this, but Russia's role is certainly not the least important. To achieve this goal, additional economic incentives need to be included in the new international agreement, the preparation of which was launched at the UNFCCC conference in Bali in December 2007. There are examples of creating completely new incentives.

The main means of achieving emissions reductions is a decrease of demand – energy savings, energy efficiency and savings on fuel for equipment and transport. Here, it is obviously impossible to achieve success without wide support from the public.

It is necessary that every family, every person realizes that efficient use of energy, heat, water and other recourses is not only a matter of the private financial budget. It is a necessity, without which neither the climate problem, nor other societal problems can be solved. Clean air, clean water, woods and cities without waste, efficient use of energy and the climate, in which we live, are all links of one chain – steps in the development of Russian society.

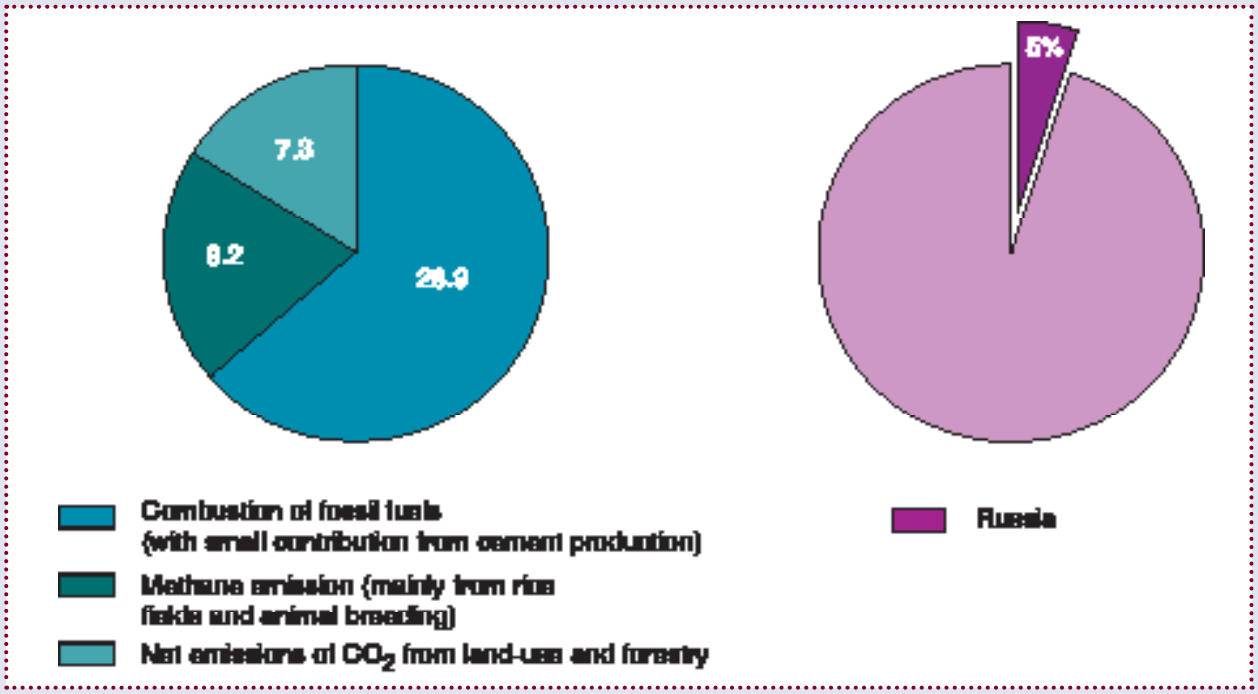
The role of Russia in global GHG emissions and their reduction

Global anthropogenic GHG emissions in 2004 were about 46 bn. t CO_2 equivalents[17]. The contribution of Russia is 2.3 bn. t CO_2- equivalents (2005), or 5%.

The anthropogenic emissions from forests and soils contribute significantly to the overall picture as emissions exceed absorption considerably. This is primarily a result of tropical deforestation, and therefore the Bali road map includes the reduction of these emissions. Due to anthropogenic activities, Russia's forests and soils also emit more than they absorb[18]. Annual carbon loss from soils is practically constant and equals around 300 Mt CO_2, or nearly 15% of Russia's overall GHG emission, while net absorption of CO2 by forests in the recent years has been in the range between 100 and 500 Mt CO_2 per year. In 2005, Russia's forests and soils were CO_2 net-emitters with around 160 Mt CO_2 emissions.

Nevertheless, fossil fuel consumption is the major source of emissions both globally and in Russia. As of 2005, the five largest emitters of CO_2 from fossil fuel combustion (U.S., China, Russia, Japan, and India) produced 55 % of emissions21, and 70 % if the EU is added. Importantly, according to IEA the future contribution of these countries to global emissions hardly depends on the selection of the development scenario, according to IEA. Both in the baseline scenario, and in the Alternative Policy Scenario - as well as in the High Growth Scenario of China and India - the share of the "big six" remains around 70%.

Global GHG emissions, bn. t CO_2eq



[17] Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. http://cdiac.esd.ornl.gov/trends/emis/usr.htm

[18] Report of the review of the initial report of the Russian Federation FCCC/IRR/2007/RUS, 18 February 2008. www.unfccc.int

Contribution of the five largest countries and the EU to global emissions in the IEA's baseline scenario in 2005-2030 (CO_2 from combustion of all types of fossil fuel)

	2005		2015		2030	
	Bn. t/year	Rank	Mt/year	Rank	Mt/year	Rank
USA	5.8	1	6.4	2	6.9	2
China	5.1	2	8.6	1	11.4	1
EU	3.9	3	4.0	3	4.2	3
Russia	1.5	4	1.8	5	2.0	5
Japan	1.2	5	1.3	6	1.2	6
India	1.1	6	1.8	4	3.3	4

SOURCE: IEA WEO 2007, WWW.IEA.ORG.

Primary energy production from various sources in Russia by the IEA's 2007 scenarios for 2015 and 2030

Mtce	2005	2015 Baseline scenario	2015 Alternative scenario APS	2030 Baseline scenario	2030 Alternative scenario APS
Coal	148	180	174	189	170
Oil	192	219	203	239	212
Gas	501	599	567	681	592
Hydro	22	23	23	24	27
Nuclear	56	66	66	98	111
Biomass	10	10	10	9	9
Wind, solar, geothermal, etc.	0	6	6	12	16
TOTAL	929	1103	1050	1254	1136

Source: IEA WEO 2007, www.iea.org

Note:

The Alternative scenario (APS) implies that the leading countries (the EU, USA, China, etc.) will implement all their current plans for energy transformation and greenhouse gas emission reduction.

Concerning figures on tropical deforestation, Brazil and Indonesia should be added to the six countries and regions. According to the latest official data of the UN IPCC, in the mid-1990's, emissions of each of these countries were below 1 bn ton of CO_2-eq. Now, independent assessments indicate that they have caught up with Russia.

Considering the contribution to the global process of limitation and reduction of GHG emissions, Russia is and will be one of the six important countries of the world (considering the EU as one country). Certainly, the above-mentioned low-carbon development scenarios assume a serious input from Russia.

According to the IEA's baseline scenario (2007), in 2015, CO_2 emission from the combustion of coal, gas, and petroleum in Russia will equal 1,800 Mt CO_2/year, and will further grow to 1,970 Mt CO_2/year by 2030 (in 1990, emissions were approximately 2.200 Mt CO_2/year, and in 2005, around 1.550 Mt CO_2/year). Therefore, in the baseline scenario the IEA projects the continuation of the same slow growth of Russia's emission as in 2000-2007: 1-1.5% annually. This should be compared with a 6-7% GDP growth.

In the Alternative scenario APS (2007), the emissions in 2015 will be approximately 1.710 Mt CO2/year, i.e. 5% below the baseline scenario. By 2030, after peaking in the early 2020's, the emission will be back to the 2015

level and 20% below the 1990 level[19]. From the point of view of achieving the global target of two-fold emission reduction in 1990-2050, this seems a good, yet not sufficient result[20].

Following the low-carbon BAPS scenario, Russia should by 2030 return its CO_2 emissions to the 2004-2005 level, which is 30% below the 1990 level. If this path is taken, the emission peak around 2015-2020 may be 10-15% higher.

Both Alternative and even low-carbon BAPS scenarios are in a sense conservative: they depart from conventional perceptions of the global and Russian energy sector development, but suggest considerable adjustments towards faster replacement of technologies and renewable energy deployment. Coal consumption (only through modern technologies) is expected to increase in the coming years and then to stabilize at a practically constant level.

Would a global low-carbon development present a threat to the Russian economy?

The economic consequences of a future climate agreement are a main concern of all countries, including of Russia. The main factors influencing the economic costs and benefits of a global low-carbon development include the following (these are additional to the most important benefit - limiting the damage from climate change):

- The cost of national measures to reduce emissions, e.g. by investing in energy efficiency and renewable energy.
- The income (or costs) from selling (or buying) international emission allowances and credits. The future prices in the carbon market, which depend on the emission commitments of the different countries, play an important role in determining the economic consequences to individual countries.
- Co-benefits of emission reductions, for example in the form of reduced air pollution, savings from increased efficiency of resource use, and opportunities in new markets, e.g. for biomass energy and new energy technologies.
- Effects on the markets of important products that are influenced by climate policies. In the case of Russia, developments in the trading patterns and prices for energy are important factors.

When assessing the impacts of global development pathways on Russia, one question immediately emerges, reflecting that Russia is currently very dependent on the revenues from exports of oil and gas:

Are Russia's gas and oil exports threatened by low-carbon global development scenarios?

Low-carbon scenarios imply approximately a two-fold reduction of the specific "oil intensity" of the global economy (oil consumption per unit of GDP). This looks quite realistic, because this parameter has already declined by 46% over the last 30 years. Therefore, the low-carbon scenario implies a pretty smooth "retreat" from oil.

More than 70 % of proven oil reserves are found in the Middle East. In principle, Canadian oil sands may provide from 300 to 2,500 bn barrels. Nevertheless, in the period under consideration (up to 2030) the Middle East will remain the major oil supplier. From 2000 to 2005, oil production in Russia grew by 30 % to 2 million barrels/day. This huge amount of oil can meet the global demand in the next 10 years if recent demand growth trends persist[24]. The interest in other suppliers is largely provoked by a desire to diversify supply sources. The sustainability of the future oil production will depend on the balance between available investment and production decline rates. Under the circumstances, the low-carbon global development scenario is unlikely to have a serious impact on Russian oil exports.

According to an estimation by the IEA three factors influence development in the gas sector: 1) Large-scale development of a liquefied gas market; 2) Radical diversification of European supply; and 3) Natural gas consumption restrictions in China. In the baseline scenario, these factors limit Russia's gas exports growth to a level of 190 bn. m^3/year (160 to Europe, 20 to China, and 10 to Japan).

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19 IEA WEO 2007, pp. 620-621, www.iea.org.

20 IPCC, 2007, Fourth Assessment Report, Working Group 3. Technical Summary, pages 39 and 90, and Chapter 13, page 776 www.ipcc.ch.

Reduction of the carbon intensity of the economy by three IEA's scenarios in 2005-2030 (shares of 2005 level)

	Baseline scenario	HGS Rapid development of China and India accompanied by moderate success in the implementation of plans of the developed countries	APS Alternative policy (successful implementation of emission reduction plans of the developed countries and China)
Russia and other transition economies	-48%	-49%	-55%
OECD	-31%	-32%	-43%
China	-48%	-55%	-59%
India	-38%	-48%	-55%
Other developing countries	-26%	-25%	-40%

SOURCE: IEA WEO 2007

According to low-carbon scenarios for 2020 onwards, gas import by developed countries will decline along with large-scale introduction of carbon capture and storage technology (CCS) and renewable energy. Russian gas export to Europe would be reduced while exports to developing countries may increase.

According to the rapid growth scenario of China and India, gas consumption grows to some extent while export/import flows may be re-directed towards the Middle East, providing no positive impact on Russia's gas exports.

The impacts of the success and failures of emission control measures are more obvious when it comes to the carbon intensity of economy (CO_2 emission per unit of GDP in comparable prices). The reduction of the carbon intensity in the economies of various countries is illustrated below by three IEA's scenarios: 1) successful emission reduction measures in the largest countries – APS; 2) baseline scenario with no specific measures; and 3) very limited emission reductions in the developed countries along with fast development of China and India (HGS). The High Growth Scenario (HGS) developed by the IEA focuses on the local energy resources of China and India, i.e. a heavy reliance on coal. In this scenario, the share of coal in the global energy balance increases to 46 % (41 % in 2005; in the APS scenario, 40 % is expected), and the share of petroleum drops by 6 %. Increasing reliance on cheap coal at the expense of i.a. Russian gas and oil in the local markets will tend to reduce the competitiveness of Russian energy-intensive industrial outputs vis-a-vis production from Southeast Asian countries. In the HGS scenario, China will also produce oil from oil sands in the same amounts as Canada. Overall, the low-carbon global development scenario, or the HGS, is unlikely to have any serious impact on Russian oil exports.

Restrictions faced by all countries in terms of mandatory greenhouse gas emission reduction measures and the associated costs are easier to overcome for the developed countries and Russia, than for large, rapidly growing developing economies.

If all countries follow a low-carbon development path through a coordinated international approach, it will be easier for Russia to keep its share in foreign markets and provide a proper support to domestic producers in the domestic market. To achieve this target, introduction of new, energy efficiency technologies should obviously receive high priority.

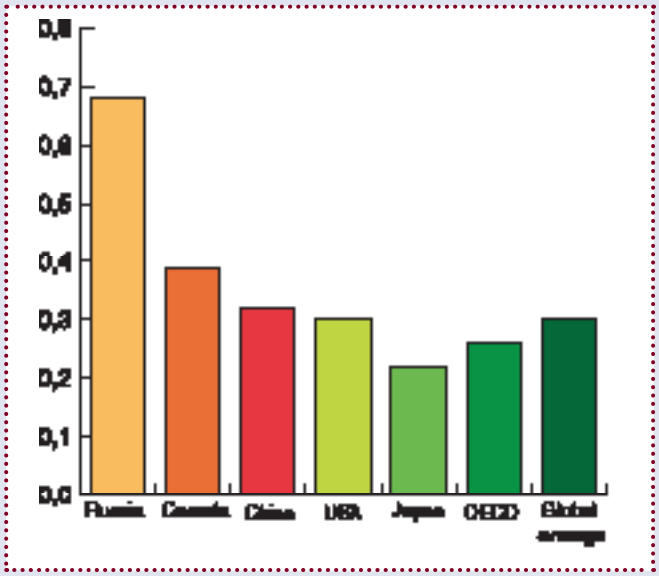
Energy efficiency potential in Russia

Comparisons of energy and economic parameters by country and by region comparisons of energy and economic parameters show that the energy intensity of Russia's GDP is twice that of the global average and three times higher than the EU-15 and Japan. Objective factors relating to Russia's geography can partly explain this. Russia is a northern country with a cold climate and a 5-8 months' long heat supply season. The immense territory and distances between the parts of the country result in large transport networks and transportation energy costs. The high energy intensity of the economy is also determined by its structure where energy intense sectors predominate, including raw materials production and primary processing.

However, these reasons cannot justify the current differences. The basic explanation is major inefficiencies and poor energy efficiency of many technologies. For example, the efficiency of industrial boilers in Russia is 30 % below the best international practice; district heating is extremely inefficient, with high heat carrier transportation losses and poor operation controls.

During the past seven years, the GDP energy intensity has declined rapidly. The reasons are changes to the economic structure (determined by an accelerated growth of the commercial sector); higher loads of production facilities; and high prices of raw materials and fuel. The potential of these factors has been practically exhausted and special measures are needed to ensure further improvements. Otherwise, the high energy demand will be impossible to satisfy due to the scarcity of energy resources and the economic cost to increase materials production and processing.

Energy intensity of GDP in 2005 (toe/1,000 PPP $US 2000)



The estimates[21] show, that in order to maintain the 5-7% GDP growth rate until 2020, assuming a 2.5% annual energy intensity reduction, energy demand would have to increase by 429-800 Mtce, while the potential to increase primary energy supply increase equals 215-286 Mtce at the best.

The technical potential is huge: the direct effect of overnight replacement of the considered technologies and equipment would be a saving of approx. 400 Mtce, or 42% of the 2005 energy consumption. This exceeds 2% of the global energy consumption. This would result in the greenhouse gas emission reduction by a value exceeding the annual emissions of Great Britain.

Reduced electricity consumption means lower fuel demand for electricity generation, lower energy consumption for the production, processing, and transportation of this fuel, as well as for the production of equipment for these purposes, and so on. In fact, reduction of end-use electricity consumption by one unit leads to a multiple reduction of overall primary energy demand. With district heating savings, the reduction will be nearly thrice as high.

Thus, if the efficiency of Russian production technologies and equipment approaches those of the advanced industrialized countries. economic development over the next decades can take place without any increase in primary energy supply.

[21] Igor Bashmakov, Maxim Dzedzichek, Inna Gritsevich, others: Resource of energy efficiency in Russia: scale, costs and benefits. Data from the presentation at the World Bank office in November 2007 were used. A complete text of the report will be published by late-2008.

The structure of Russia's energy efficiency technical potential, Mtce

Sectors of economy	Coal	Crude oil	Petroleum	Natural gas	Other solid fuels	Electricity	Heat	Total	Energy consumption in 2005	Additional investment in the implementation of the potential, $US bn
Total, including gas flaring reduction	85,97	13,44	39,15	265,62	8,51	0,00	0,00	412,68	0,00	324–357
Gas flaring reduction	0,00	0,00	0,00	17,30	0,00	0,00	0,00	17,30	0,00	3–5
Primary energy supply, total	85,97	13,44	39,15	248,32	8,51	0,00	0,00	395,38	934,68	321–352
Electricity production	36,25	0,00	2,20	88,29	0,56	0,00	0,00	127,30	267,05	106
Heat production	34,55	0,61	10,90	105,51	4,98	2,72	0,00	159,24	278,28	8
Fuel production, processing, and transportation	2,26	2,67	0,14	6,94	0,23	11,11	33,82	57,16	121,85	19
End-use energy consumption, total	12,91	0,00	25,75	42,64	2,36	26,64	86,36	196,70	604,00	188–219
Agriculture and forestry	0,03	0,00	2,19	0,11	0,06	1,04	0,72	4,15	8,88	2
Fishery	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,06	
Raw materials production	0,00	0,00	0,20	0,00	0,00	0,53	0,86	1,60	10,28	2
Machine building	12,03	0,00	1,70	14,10	2,00	11,04	18,45	59,33	156,64	35
Construction	0,00	0,00	0,29	0,01	0,01	0,36	0,06	0,72	2,43	
Transport	0,03	0,00	21,08	9,42	0,00	1,13	0,10	31,76	134,99	124–130
Municipal sector	0,00	0,00	0,01	0,00	0,00	0,51	0,49	1,03	5,16	25–50
Commercial	0,01	0,00	0,03	4,46	0,01	6,58	10,64	21,74	51,92	
Residential	0,82	0,00	0,26	14,53	0,27	5,46	55,06	76,39	154,78	
Non-energy needs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	65,39	

SOURCE: ESTIMATIONS BY CENEF/WB, 2007

Implementation of the energy efficiency potential will require an additional investment in the order of $US 290-320 bn. in investment (in 2005 prices). It should be appreciated that the investment needed to save energy is on average 2-3 times smaller, than the investment needed to produce an equivalent amount of energy (or even 4-6 times, with the most cost-effective solutions).

Significant energy saving potential exists in all sectors of Russian economy. The largest electricity savings potential is in buildings (97 bn. kWh) and machine building (90 bn. kWh), and fuel consumption for power generation may be reduced by nearly 160 Mtce. The natural gas savings potential reaches almost 50 % of the overall consumption in 2005 and exceeds natural gas exports.The largest contribution can be made by reduced consumption in electricity and heat generation and in district heating.

Renewable energy potential in Russia, Mtce/year[2]

Resources	Gross potential	Technical potential	
	IEA	IEA	RAO "EES-Rossii"
Solar	2,300	12.5	12-13
Wind	2,000	10	13-15
Small hydro	125	65	65-70
Tidal	N/a	35-80	No data
Geothermal	N/a	115	115-150
Biomass	53	35	N/a
Low-potential heat	105	31.5	30-35
TOTAL	4,593	308.5	340-450

SOURCE: IEA, 2004: RENEWABLE ENERGY POTENCIAL IN RUSSIA: FROM POSSIBILITIES TO REALITY. IEA.

Renewable energy in Russia: potential, targets, reality

Russia has huge resources of virtually all types of renewable energy. In fact, in nearly all regions of the country there are one or two renewable energy sources, the large-scale commercial deployment of which can be cost-effective. According to the estimates of Russia's Energy Strategy until 2020, the technical potential of renewable energy sources amounts to approximately 4.6 bn. tce per annum, which is 4.5 times the current volume of fuel and energy consumption in Russia. The economic potential is identified at 270 Mtce per annum, which is slightly more than 25% of Russia's annual energy consumption. So with adequate financing of initial investment costs (equipment, installation and assembly), a quarter of all necessary energy can be profitably produced from renewable energy resources.

According to IEA estimates - based on data from the mid-1990s - the economic potential exceeds 300 Mtce per annum, while figures from recent estimates by RAO "EES-Rossii" are from 340 to 450 tce/year.

Renewable energy could successfully replace diesel- and other oil fuel-fired installations in many distant settlements in many of Russia's regions that are not connected to the unified energy supply system and continuously experience fuel supply problems. Such locations, normally situated in distant northern parts of the country with a harsh climate, are inhabited by approximately 10 million people.

Small villages, summer cottage communities, as well as one-family cottages and residencies owned and used by the major part of Russia's population are another large and socially important market for small-size independent renewable energy installations.

However, at present, just a very little part of the renewable energy resources is being used in Russia. The share of renewables in the overall primary energy supply is less than 1% (excluding large hydropower plants)[22].

In forest-covered Russia's regions, there are hundreds of locations where current generation capacities have exceeded their lifetime and it makes no sense to repair them. In these locations, it is worthwhile producing heat and electricity by small bio fuel-fired boilers (modern block mini-heat and power plants). The capacity of such installations is normally between 0.5 and 4 MW of heat and up to 1 MW of electricity.

During wood harvesting, only 70 % of biomass leaves the harvest area as round timber, and 30 % (branch wood, forest residue, etc.) are lost and not even included in the statistics. According to the estimates of the RF Forestry Agency, they amount to more than 150 million m3 that may theoretically be used to produce nearly 500 GWh of heat and energy leading to nearly 270 Mt of CO_2 emission reduction per annum27. Apart from addressing energy problems, this amounts to more than 10 % of Russia's overall GHG emissions.

The priority regions having the largest potential are Arkhangelskaya Oblast, Karelia and Komi Republics, Krasnoyarsky Krai, and Novosibirskaya Oblast. Importantly, all the necessary samples of packaging and delivery equipment and of energy modules are available. The problem is to obtain initial financing for the equipment procurement, delivery, and installation. The required amount is considerable but not infeasible to raise. A modern foreign-made module plant costs Euro 600 ,000, whereas the cost of renovating of an existing boiler-house is approximately Euro 400,000. If only heat is to be produced, and renovation of an existing boiler is possible, the cost will decrease to Euro 100,000[23].

Barriers to the implementation of cost-effective investments include the lack of real federal support for the renewable energy; difficulties related to obtaining loans; subsidies for fossil fuel and energy; and the availability of considerable fossil fuel resources, which produces an illusion of overall energy abundance. Renewable energy sources have been discussed at a larger scale lately, The President of Russia has already highlighted the fast development of the global renewable energy market and the fact that Russia is lagging behind in this area[24]. However, so far no real progress in setting up the environment to promote renewable energy sources in Russia can be seen, and the corresponding economic instruments have not yet been brought to the practical implementation stage yet.

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[22] Bezrukikh P.P., Strebkov D.S. Renewable energy sector: strategy, resources, technologies. M.: VIESH, 2005. - 263 p.

[23] Ibid.

[24] D.A. Medvedev, Presentation at the Security Council meeting devoted to Russia's environmental security, Moscow, 29 January, 2008, http://www.medvedev2008.ru/performance_2008_01_30.htm

Dynamic of GHG emission in Russia and its distribution by branches, million t CO_2- equivalents

	1990	2000	2001	2002	2003	2004	2005	2006
Energy sector	2 707 433	1 660 802	1 679 844	1 683 417	1 721 933	1 726 679	1 730 807	1 786 811
Industrial processes	244 508	168 256	170 673	167 347	173 034	183 897	186 846	198 567
Agriculture, waste and other	374 500	209 303	211 753	213 245	210 737	209 315	205 826	205 014
Total (without land-use)	3 326 441	2 038 362	2 062 270	2 064 008	2 105 705	2 119 892	2 123 478	2 190 392
% from 1990 level	100	61	62	62	63	64	64	66
Land-use (sequestration of CO2 in forests and losses of soil carbon)	180 006	347 708	279 440	-192 613	-379 599	-217 840	159 197	288 194
Total (incl. land-use)	3 506 447	2 386 070	2 341 710	1 871 395	1 726 106	1 902 052	2 282 675	2 478 586

Energy sector, 2006, th. t CO2-equv. TOTAL	1,739
Fuel combustion	1,536
Energy sector as branch of economy	785
Industry and construction	386
Transport (cars, pipelines, aviation and other)	185
Other sectors (communal services, agriculture and other)	139
Other fuel combustion not incl. above	42
Fugitive emissions, related to fuel	202
Solid fuel (methane at coal extraction and other)	43
Oil and natural gas (methane and CO2 , incl. gas flaring)	160

GHG emissions in Russia: structure and scenarios

In the 1990's due to a drop in industrial production, GHG emissions inRussia decreased drastically. According to official data approved by UNFCCC, the total volume of emissions during the past six years (2000-2005) was on average 60% of the 1990 level including forestry and land use, and 63% without forestry and land use[25].

During this period, the emissions increase was less than 1 % annually in contrast to a 6-8 % GDP growth. This can be explained by the fact that the GDP growth was mainly determined not by energy intensive sectors, but by, for example, the commercial sector and trade. This is a «slow echo» of Russia's post-crisis development. Output growth was basically tied up with old production capacities, while new capacities were still in the construction phase. Such a situation could not last for long, which is reflected in the 2006 emissions data submitted by Russia to the UNFCCC in May 2008.

The structure of the greenhouse gas emissions corresponds to that of most industrialized countries and

[25] Report of the review of the initial report of the Russian Federation FCCC/IRR/2007/RUS, 18 February 2008. www.unfccc.int

includes (in CO2 equivalents) 75% CO_2, 19.5%, methane, 4% nitrous oxide, and 1.5% F-gases[26]. The UNFCCC's breakdown of greenhouse gas sources by categories is somewhat different from the approach used above. Energy-related sources include the consumption of all fuel types in all sectors of economy, while industrial sources only include emissions from industrial processes. The "agriculture" category includes methane and nitrous oxide emissions from cattle and other "technologies", while fuel consumption in agriculture falls into the energy category. CO_2 absorption/emission by forests and carbon loss/accumulation by soil are estimated under the "land use" category. Fuel consumption by international air and sea transport is not accounted for in the national commitments and not included in the data below.

Comparison of the 2005 and 2006 total emission volumes reveals an 8.5 % growth (or a 5.6 % growth in terms of the 1990 baseline). The growth figures appear worrying, however, a more careful study shows that really nothing that tragic happened in 2006. The 2006 emission increase was by two thirds determined by the CO_2 absorption by forests, which happened to be low that year, and increasing losses of soil carbon, which can hardly be related to the economic development and are likely to "come back".

Growth of the energy sector-related emissions (in the broad sense of the word) amounted to 56 mln t in CO_2 equivalents. This figure represents a 3% growth, or 1.6% of the total Russian GHG emission in 1990. It includes fuel combustion in all sectors of the economy, as well as fugitive emissions (losses and leaks of all kinds).

Emissions from the "large energy sector", as a sector of economy, have also shown significant growth, by approximately 3.5%. This is determined both by increasing energy and heat production and by an escalating share of more carbon intense fuel use. Gas losses, associated gas flaring, etc. also grew in 2006.

In all countries, including Russia, a generally similar relationship is observed: the electrification and industrialization processes, migration to urban areas, and large-scale involvement of population in economic activities are accompanied by a fast emission growth. These trends are currently observed in China and India. However, later on the correlation between emission growth rates and GDP growth rates is flattened. Starting from US$ 20,000 GDP per capita, greenhouse gas emissions are practically not related to the standards of living per se[27].

GHG emissions depend on the population growth, established traditions, lack or availability of own energy resources, etc. During the last 25 years, in all the large countries with GDP over US$ 20,000, the per capita energy consumption has been very slowly following per capita GDP increase. With its specific features of a raw-material-intensive economy, Australia, is the only exception. Arguments on the "universal" linear relationship between growth in GDP and energy consumption reflect a misunderstanding of industrial development stages in various countries.

If Russia succeeds in reaching per capita GDP above US$ 20,000 (in 2005 prices), emissions can only be expected to grow by a maximum of 0.5 – 1% per annum.

How does this compare to the fast growth of electricity production by power plants projected in the "General layout of electricity production facilities until 2020" adopted in February 2008? The fact is that the facilities described in this layout – "the 'big' energy sector" – are only responsible for one third of Russia's greenhouse gas emissions as confirmed by emissions growth in 2006.

Even with the fast demand growth envisaged by the "General layout", the overall figures of the latest official greenhouse gas emission projection for Russia stay accurate: in 2020, the emission will equal 95% of the 1990 level[28], (on average during 2013-2020; if losses of soil carbon will stabilise, and forests will sequestrate CO_2 as they were during past years), but not more than that.

More importantly, the energy demand growth envisaged by the "General layout" is much more poorly explored, than the planning of new electricity production facilities and decommissioning of old facilities. The impression is that the demand projection clearly underestimates the potential for energy efficiency improvements, and thorough additional research will be needed.

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26 UNFCCC database. Common Reporting Format. Russian Federation. Submission 2007 v1.1 www.unfccc.int

27 Stern N., 2006. The Economics of Climate Change. Cambridge University Press, 610 pp. www.sternreview.org.uk

28 The Russian Federation's Fourth National Communication under the United Nations Framework Convention on Climate Change and the Kyoto Protocol, 2006. RosHydroMet, Moscow, 164 p., www.unfccc.int (Innovative-Active Scenario, p. 78).

Russia needs its own Alternative Energy Development Scenario, possibly based on the principles of the IEA's global Alternative Policy Scenario. Development of a Low-Carbon Scenario for Russia is also highly desirable. Such scenarios will allow Russia to understand the potential and mechanisms of emission reductions and will put Russia at the level of other developed countries, which already have such scenarios. Besides, they will allow for a clearer definition of Russia's options, which is highly desirable in the process of developing a new international climate agreement.

One of the key documents which will shape the federal economic policy is the Concept of long-term social and economic development of the Russian Federation[29] (for the period 2008-2020). It includes an innovative, socially-oriented development scenario:

In 2015-2020, Russia should become one of the five leading countries in terms of GDP volume (up from 8th today);

GDP per capita should grow from $US 13,700 thousand in 2006 to $US 30,000 in 2020 and approximately $US 50,000 in 2030;

Russia should take the lead in energy supplies to the world markets;

Russia should play an important role in the high-tech (at least 10%) and intellectual services markets;

Average life expectancy should grow to 75 years;

Of particular relevance is the fact that by 2020, energy efficiency of economy should be increased by 1.6-1.8 times.

Presently, the priority scenario for the development of the Russian economy up to 2020 it the «innovative, socially-oriented development pathway».

If Russia is to catch up with the developed countries in terms of both quantitative GDP and technological quality, given a stable population, this also means stabilization of greenhouse gas emissions. Important questions will thus be:

At what level will the greenhouse gas emissions stabilize?

What is the contribution of various processes to the emission reduction?

How can Russia then start reducing its emission levels?

It is highly desirable to be able to answer these questions in the near future. This will also make it possible to decide on which commitments Russia can make at the COP15 in late 2009 in Copenhagen.

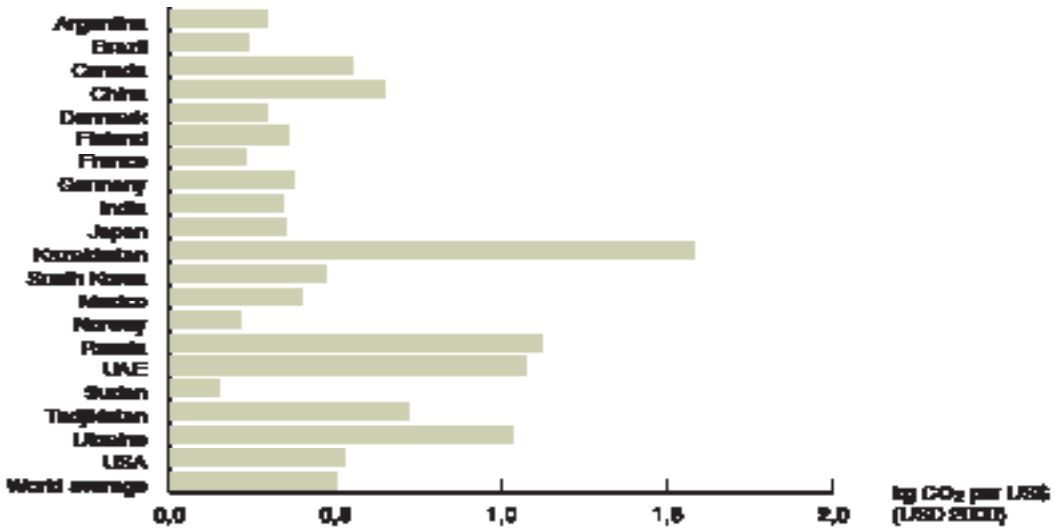
[29] The concept is available from the website of the RF Ministry of economic development and trade http://www.economy.gov.ru/wps/wcm/connect/economylib/mert/resources/5ed83c0048a06e1cb7a1f71eec85a001/oznakomitsya.doc.

Contributions of five largest countries and the EU to cumulative global emissions: historic data and projections by the IEA's baseline scenario for 2005-2030 (CO_2 from the combustion of all types of fossil fuel, rounded values)

Bn. T	1900-1990	1991-2005	2006 -2030	Cumulative, 1900-2005	Cumulative, 1900-2030	Rank in 2030
USA	210	70	160	280	440	1
China	40	50	250	90	340	3
EU	190	60	100	250	350	2
Russia	70	20	45	90	135	4
Japan	<45	>15	20	60	80	5–6
India	<10	>10	60	20	80	5–6

SOURCE: ESTIMATES BASED ON THE ONRL DATABASE, HTTP://CDIAC.ESD.ORNL.GOV/TRENDS/EMIS/USR.HTM, AND IEA WEO 2007, WWW.IEA.ORG

Specific CO_2 emission per GDP unit, 2005 (by parity of purchasing ability)



SOURCE: INTERNATIONAL ENERGY AGENCY, KEY WORLD ENERGY STATISTICS, 2007.

What should be in a new agreement? From Bali to Copenhagen

A framework decision made at the UNFCCC conference in Bali in December 2007 aims at the development of a new global agreement on emission reductions to come into effect in 2013 and sets a deadline for the development of this agreement (December 2009, when the UNFCCC Conference of Parties will take place in Copenhagen). The document incorporates four main areas[30].

All the developed and the strongest developing economies shall reduce or limit their respective emissions depending on the levels of their economic development and available potentials. The developed countries shall assist the developing states in reaching their emission reduction targets.

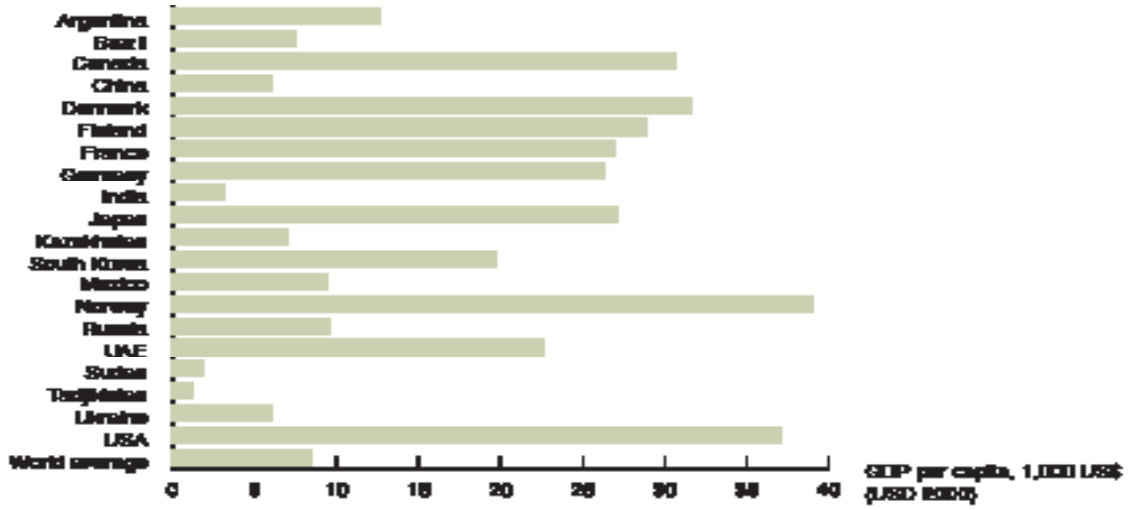
A variety of climate change adaptation measures shall be undertaken, also with support from developed countries.

Transfer of environmentally friendly technologies with low greenhouse gas emissions shall be promoted.

The developing economies, primarily the poorest and the most vulnerable to climate change, shall be received financial support.

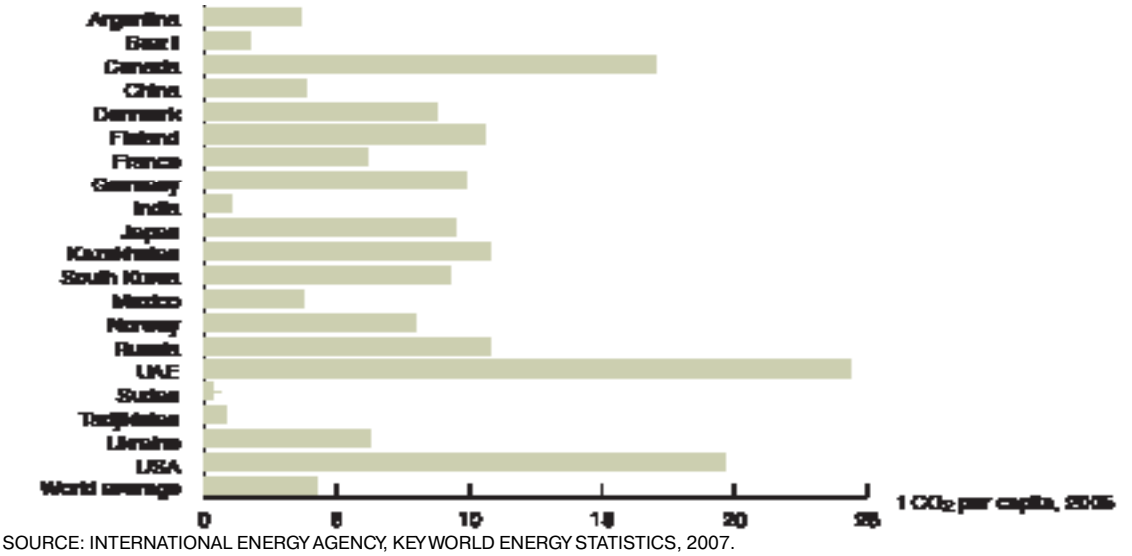
[30] The document UN FCCC/CP/2007.L.7 www.unfccc.int

GDP per capita, 2005 (by parity of purchasing ability)



SOURCE: INTERNATIONAL ENERGY AGENCY, KEY WORLD ENERGY STATISTICS, 2007.

Specific CO_2 emission per capita, 2005



SOURCE: INTERNATIONAL ENERGY AGENCY, KEY WORLD ENERGY STATISTICS, 2007.

Through the decisions at the Bali conference, the international community has demonstrated its willingness to reach an agreement under the UN framework and a capacity to take a long-term perspective. According to Alexander Bedritsky, the Head of RosHydroMet, "It [the Conference] provides a significant push for all countries, including Russia, to enhance joint efforts. Because any group of countries, no matter their development stage, is unable to address global issues alone, especially those related to the reduction of global climate change"[31].

In December 2008, the annual UN conference on climate change will take place in Poznan, thus becoming an intermediary stage of negotiations. Above all, a focus of the discussion, will be on the commitments of the developed countries, including Russia, in absolute emission reduction units (as shares of the 1990 levels). The work is based on the IPCC recommendations that global emissions should be reduced well below 50 % of 1990 levels by 2050, and that emissions by industrialized countries as a group should be reduced by 25-40 % by 2020. Develop-

[31] RIA Novosti, December 13, 2007; see also RosHydroMet's website at www.meteorf.ru

ing economies will be demanding that the developed countries commit themselves to the maximum reductions possible, while the developed countries will be basing their positions on their national climate change targets. It is of the utmost importance during this "bargaining" that" all parties accept the common goal of two-fold reduction of global emissions by the middle of the century and recognize their own pathways in achieving this goal.

Fair distribution of obligations between countries. Approach and parameters

Many different approaches to sharing the emission reduction efforts beyond 2012 have been proposed[32]. The proposals are based on various principles and criteria. While some are closely related to the approach of the existing Kyoto Protocol, others are very different.

One dimension is the type of commitments.

For Annex 1 countries the Kyoto Protocol emphasises fixed quantitative emission targets (in % of 1990 level).

However, these alternative commitment types are mainly being discussed for non-Annex 1 countries that currently do not have commitments under the Kyoto Protocol.

Dynamic targets linked to GDP growth

Targets for specific sectors

Dual targets where emissions must be limited to a certain level and even further reductions are required to be able to sell emission allowances.

For some developing countries, non-target-based approaches have also been proposed - for example, harmonised domestic policies and measures, development-focused approaches, and technology standards.

Differentiation and burden sharing among countries is another key issue. Among the parameters put forward as a basis for allocating emission commitments among countries are:

Per capita emissions as an indicator of fundamental fairness and rights to the atmosphere

Historical responsibility for past emissions or the current GHGs in the atmosphere

GDP per capita as an indicator of ability to pay for emission reductions. Several countries with a per capita GDP higher than Annex 1 countries have the status of a developing country under the Kyoto Protocol and no quantitative emission reduction commitments.

As for the expected per capita CO_2 emissions of Russia, all scenarios project that they will grow. Even stabilisation of the overall emissions by Russia in 2020 against the background of a population reduction would result in growing specific values per capita. As of 2005, CO_2 emission from the combustion of all types of fossil fuels in Russia equalled 10.7 t CO_2/person. In the IEA's baseline scenario, these will grow to 13.3 t CO_2/person by 2015 and 16t by 2030. In the High growth scenario (HGS) for China and India, the same values can be expected. A significant departure from this development can only be seen in the Alternative Policy Scenario (APS). In this scenario, by 2015 Russia's specific emissions will increase to 12.6, and by 2030 only to 14.1 t CO_2/person.

[32] See for example Bodansky D., 2004: International climate efforts beyod 2012: A survey of approaches. www.pewclimate.org/docUploads/2012_20new.pdf

However, there are other parameters that can be used to identify reasonable contributions of various countries to future emission reductions, including Russia. An example is "the historical responsibility" for the accumulated GHG emissions (in other words, the individual responsibilities of countries for the current climate change problem) and per capita emissions. Between 1750 and 1900, fossil fuel combustion in industrialized countries was responsible for a very low emissions (approximately 50 bn. t CO_2). However, between 1900 and 2005, cumulative emissions from fossil fuel combustion already accounted for 1.100 bn. t CO_2.

From 1900 till 2005 the biggest contribution came from the U.S. was – 30%, then 15 the "old" EU countries - 23%, Russia and China - 8%, Japan about 5% and India - 2%, other countries in the world "saved" 25% of the amount.

A future agreement is likely to differentiate commitments between several groups of countries as opposed to the Kyoto Protocol, which only has two groups - one with quantitative commitments and one without them. It seems logical that one or two intermediate country groups will be defined, consisting of the richest developing countries and the fast-growing "emerging" economies. Commitments would be differentiated with the well-known Kyoto-type commitments applying to the industrialized countries and other commitment types such as sectoral commitments or relative targets to the intermediate groups. For the poorest developing countries, participation will be limited to continued use of CDM, possibly backed by national policies and measures.

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