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Resource Efficiency Gains and Green Growth Perspectives in Russia

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- Russia's current situation is characterized by several environmental problems (pollution of air, soil, ground- and surface water) and high levels of greenhouse gas emissions and energy intensity. Energy intensity is more than twice the world average. Energy is mainly derived from Russia's rich fossil resources (natural gas and oil). In the field of renewable energy generation, it lags behind many countries, including other BRICS.

- There is a fairly well developed system of environmental institutions and legislation alongside European and international frameworks. Nevertheless, there is no integrated and balanced approach to environmental policy. Moreover, actual implementation of policy is slow and often inconsistent. However, the concept of green growth is included in national strategies and one of the main objectives of recently approved documents. Public awareness is very low.

- Russia has a huge potential for developing a green economy. Opportunities for green growth exist mainly in energy savings, renewable energy (wind energy, biomass, hydropower, and geo-thermal energy), manufacturing, green construction, water and waste treatment, forestry, agriculture and tourism. Estimations of the number of green jobs are very difficult. However, there are many economic, political, cultural and social obstacles to the creation of such an economy; the main ones being corruption, gaps in legislation and insufficient development of civil society.

Content

1. Current Situation and Policy

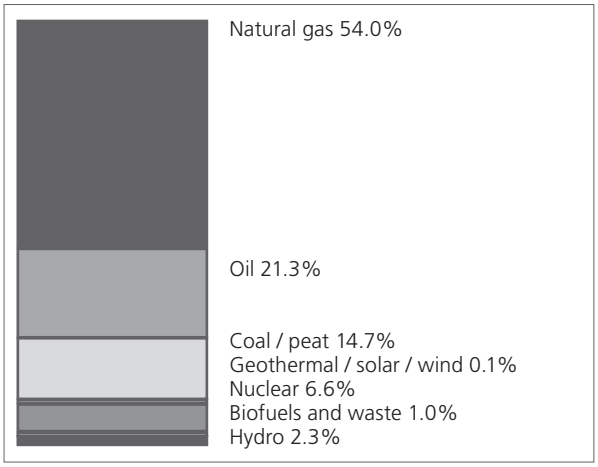
1.1 Current Situation

Russia plays an important role in the preservation of the global environment due to its large ecological potential, which – to a considerable extent – compensates for the negative impact of global industrial development. The same could be said of its export of natural gas, which is considered to be a relatively clean fossil fuel, given its lower emissions of CO_2 compared to other fuels.

Russia's environmental situation is characterised by medium pressure on the environment. More than 60 per cent of its territory is not affected by economic activities and in 2010 49.4 per cent of its land area was forested, compared to a world average of 31.1 per cent.[1] Russia's extensive forests – accounting for more than one-quarter of world forests – and swamplands act as a global carbon sink. Russian forests absorb 10 per cent of the country's emissions, although the rate is falling.

According to IEA statistics, the share of natural gas in Russia's total primary energy supply in 2009 was 54 per cent, one of the highest in the world, and it has expanded, mainly at the expense of oil.[2]

Figure 1. Share of natural gas in Russia's total primary energy supply, 2009



Source: OECD/IEA, 2011.

1. World Bank Environment data. Available at: http://data.worldbank.org/topic/environment.

2. IEA Energy Statistics, OECD/IEA, 2011.

At the same time, the current ecological situation is characterised by the serious pollution of air, soil, surface water and groundwater, which is concentrated mainly in the European part of the country and in big cities and industrial sites. About 40 per cent of the urban population lives in cities with polluted air.[3]

Poor air quality is linked mainly to pollution from heavy industry, emissions of coal-fired electric plants, growing transportation in major cities and deforestation. In 2009, Russia ranked fourth in the world for carbon emissions from fuel combustion and second among the industrialised countries behind the United States.[4]

One of the main reasons for significant pollution and greenhouse gas emissions is the low efficiency of resource consumption. Russia is one of the most energy-intensive economies in the world, although this indicator has been steadily decreasing. The energy intensity (energy use per unit of GDP) of the Russian economy is more than twice as high as the world average, 2.6 times greater than OECD countries and the highest among the BRICS countries.[5] The country ranks among the top 25 energy-intensive countries in seven major areas of economic activity: agriculture; hunting and forestry; construction; manufacturing; transport, storage and communications; wholesale and retail trade; restaurants and hotels.[6] High energy consumption drives up prices of most manufactured goods and leads to their poor competitiveness. The urgent need to increase energy efficiency is further dictated by the observable decline in the health of the Russian population.

In the past two decades Russia has substantially reduced its energy intensity, which improved by 2.5 per cent a year during the 1990s and by over 5 per cent in the years 2000–2007.[7] This has led to a concomitant decrease in Russia's level of greenhouse gas emissions.

3. Putin, V., At a government meeting, 16 February 2012. Available at: http://premier.gov.ru/eng/points/106/.

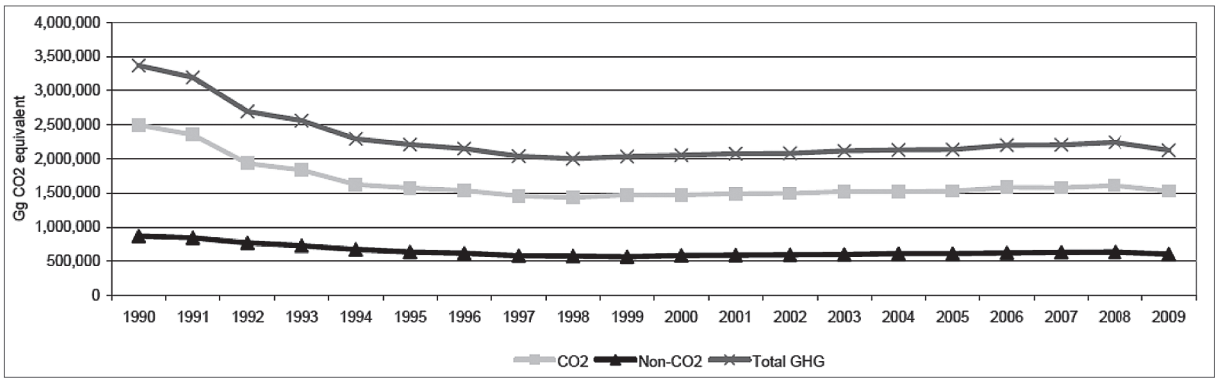
4. CO_2 Emissions from Fuel Combustion. ***Highlights*** (2011 Edition). International Energy Agency.

5. Key World Energy Statistics 2011, IEA.

6. World Bank, »Energy Efficiency in Russia: Untapped Reserves«, International Finance Corporation, Washington D.C., World Bank, 2008.

7. Development of Energy Efficiency Indicators in Russia, OECD/IEA, 2011.

Figure 2. Total GHG emissions in Russia (without land use and forestry).



Source: Summary of GHG Emissions for Russian Federation, United Nations Climate Change Secretariat.

As may be seen from Figure 2, CO_2 emissions decreased substantially from 1990 to 2009. Russia led the BRICS countries in reducing CO_2 emissions; they fell by 34 per cent between 1990 and 1998 (mostly as a result of the economic downturn after the break-up of the former Soviet Union and the reduction of heavy industry in the economy) and by 30 per cent between 1990 and 2009.[8]

However, the energy intensity of the national economy is still very high, which is partly due to plentiful natural resources, a cold climate (with permafrost over much of Siberia), vast territory and long distances between industrial sites, leading to long mileage transport networks and substantial energy costs. But these factors alone do not explain the lag in energy intensity between Russia and other countries. Even taking into account Russia's climate conditions, the energy intensity indicator should be a maximum of 25–30 per cent higher than that of European countries.[9] The current situation may be explained by the structure of the national economy, the use of outdated technological equipment (such as electric power lines and lighting devices), which result in immense energy waste, and environmental policy.

1.2 Environmental Policy and Recent Changes

Until recently not enough attention was paid to the environmental aspect of economic policy. Environmental policy lacked an integrated and balanced approach, despite a fairly well developed system of environmental institutions and legislation. Recently, however, it has undergone significant changes.

Environmental issues are under the joint competence of the Russian Federation and federal subjects. The main agency responsible for environmental policy as well as for policy and regulation of the exploitation of natural resources is the Ministry of Natural Resources and Environment of the Russian Federation. It coordinates and supervises the activities of the Federal Service for Hydrometeorology and Environmental Monitoring, the Federal Service for the Supervision of Natural Resource Management, the Federal Agency for Water Resources and the Federal Agency for Subsoil Management. The Committee on Natural Resources, Environmental Management and Ecology of the State Duma develops environmental laws.

Several other agencies are responsible for different aspects of environmental policy, such as the Federal Service for Hydrometeorology and Environmental Monitoring, which takes the lead in international negotiations on climate change; and the Federal Service for Ecological, Technological and Nuclear Oversight, which deals with nuclear and radioactive waste matters. The Ministry of Economic Development and Trade is responsible for the coordination of Russia's implementation of the Kyoto Protocol. Other agencies, including the sanitary control and tax authorities, also play an important role in the protection of human health, wildlife and the environment.

8. CO_2 Emissions from Fuel Combustion, ***Highlights*** (2011 edition), International Energy Agency.

9. Danilov-Danilyan V.I. Environmental value of energy saving, Bulletin of Russia's Center of environmental policy, »On the way towards Russia's sustainable development«, No. 32, 2005, pp. 50–55.

The framework of environmental (and climate) policy is established in the Russian Constitution, several environmentally oriented strategic documents, domestic legislation and international environmental agreements (Russia being party to almost all major international environmental agreements, with a few exceptions).

The Russian Constitution guarantees citizens the right to a clean environment. There are more than 70 federal environmental laws and 4,000 by-laws. The basic environmental law, the 2002 Federal Law on Environmental Protection, defines principles of environmental activities. Other important framework legislation includes the Federal Law on Air Protection, the Federal Law on Waste Management, the Federal Law on Sanitary Protection, the Federal Law on State Environmental Review, the Federal Law on Ecological Examination (a basis for environmental impact assessment) and some others. There are also codes with environmental content: the Water Code, the Forestry Code and the Land Code.

The 2002 Environmental Doctrine defines the long-term goals, directions, objectives and principles of Russian environmental policy. The Social and Economic Development Framework until 2020 and Government Action Plan until 2012 envisages environmental policy targets, including a decrease in energy intensity.

Recently, attitudes towards environmental issues have been changing. Climate change and energy efficiency have been identified among the main trends of Russian policy. Quite frequently national political authorities have stressed the priority of environmental policy, which is gradually being recognised as a good opportunity to implement the stated goal of modernisation. Energy efficiency and conservation are included in the five strategic priorities for the country's technological development.

echnical re-equipment of the energy sector is seen as essential to the Russian economy, both to increase its competitiveness on the global market and to avoid accidents such as the one at the Sajano-Sushenskaja power plant in 2009. Actual implementation of policy is not always consistent and has advanced more slowly than official declarations. But the process has begun.

In the past two years Russia's Ministry of the Environment has developed more than one hundred regulatory acts, forming a new structure of environmental legislation. Documents in some sectors of the economy also envisage environmental goals.

In February 2012, a draft of Russia's first ever strategic planning document in the sphere of the environment – the presidential decree »On the fundamentals of state policy in the field of Russia's environmental development up to 2030« – was approved by the government. According to the document, energy efficiency improvement, »green« growth, climate mitigation and adaptation are mentioned among the five main objectives of state environmental policy. For the first time, Russian environmental strategy is balanced with economic considerations. Each goal has concrete quantitative objectives.[10] The government is expected to develop a package of special measures to realise the decree by December 2012.

The Presidential Decree »On some steps towards enhancing the energy and environmental efficiency of the Russian economy« of 2008 sets a target for reducing energy intensity by 40 per cent by 2020 compared to 2007 levels. By 2020 Russia should reduce its level of carbon emissions by up to 30 per cent.[11] To achieve this goal, the government has formulated a comprehensive action plan for improvements in energy efficiency in different sectors of the economy. Currently, a legal framework is under preparation to ensure implementation of this aim and to combat climate change.

The strategic priorities of Russia's Energy Strategy in the Period until 2030, adopted in 2009, include energy security, ecological safety and the energy and economic efficiency of the energy sector. The strategy envisages the development of non-fuel energy and the creation of conditions for the widespread application of energy-saving technologies.[12] However, the broader development of alternative energy is foreseen only in the period from 2022 to 2030.

10. Official site of the Ministry of Natural Resources and Environment of the Russian Federation. Available at: http://www.mnr.gov.ru/news/detail.php?ID=128251.

11. »On some measures for improving the energy and environmental efficiency of the Russian economy«, Presidential Decree No. 889, 4 June 2008.

12. Energy Strategy of Russia for the period up to 2030 (ES-2030) approved by decree N° 1715-r of the Government of the Russian Federation, dated 13 November 2009.

The »Climate Doctrine of the Russian Federation for the Period until 2020« from 2009 is a key document for implementing climate policy. It officially acknowledges the threat of global warming to the country's security and sets fundamental tasks for Russia in forming its climate policy, including energy efficiency measures. Although of a general character, the doctrine envisages the introduction of stimulus mechanisms for rational natural resource use and the adoption of resource- and energy-saving technology, as well as the creation of conditions for the effective functioning of the natural resource complex and the reclamation of renewable natural resources and sustainable forest management.

As part of the implementation of this doctrine, the »Comprehensive Plan for Implementing the Russian Federation's Climate Doctrine for the Period until 2020« was adopted by a government decree in 2011. The Plan suggests that the Ministry of Economic Development introduce changes into Russia's long-term macroeconomic forecasts »taking into account climate risks, mitigation of anthropogenic impacts on the climate, and adaptation to climate change«,[13] as well as specifying actions in different sectors of the economy, time periods and agencies responsible for their realisation. It suggests, among other things, measures for increasing energy efficiency, the production of hybrid cars and usage of alternative and hydrogen-based fuels, the building of »passive houses« (with zero energy consumption), and the introduction of a domestic greenhouse gas emissions trading system. The plan has yet to provide the necessary funding and other resources.

Other national programmes that include climate change measures are the Concept of Long-Term Socio-Economic Development of the Russian Federation for the period up to 2020, the National Security Strategy of the Russian Federation until 2020, strategies up to 2020 in the fields of transport, forest sector, water development, and Principles of State Policy of the Russian Federation in the Arctic for the period up to 2020 and beyond.

An important step towards enhancing energy efficiency was made by the adoption of the Federal Law »On Saving Energy and Increasing Energy Efficiency, and on Amendments to Certain Legislative Acts of the Russian Federation«, adopted in 2009. The Law establishes principles for the regulation of energy consumption, and provides for amendments to existing legislation (on technical regulation, housing, taxation and so on). The clauses of the previous Law were largely of a declarative nature and not supported by effective implementation mechanisms.

The Law provides for new standards for the use of energy-consuming products, such as the phasing-out of incandescent light bulbs, as well as energy efficiency requirements for newly constructed buildings. The requirements apply in particular to certain elements and construction of buildings, technologies, and materials used during construction, capital repair and reconstruction projects. Organisations with state or municipal equity participation are mandated to approve energy-saving and energy efficiency programmes. State or municipal procurement orders should be placed with due regard for energy efficiency regulations. For this purpose, tax incentives, subsidies, energy audits, labelling and other economic mechanisms are envisaged to encourage the use of energy-saving technologies, including the use of secondary energy resources and renewable energy sources. For example, a requirement to label products according to energy efficiency classification for producers and importers of principal household energy-consuming appliances has been effective since 2011, for computer and office equipment since 2012 and for other goods since 2013. Currently, the government is elaborating financial incentives to encourage energy conservation, taking into account international and regional experience. The law provides for measures of informational support for activities related to energy savings and increases in energy efficiency.

Russia is taking measures to reduce gas flaring, which is a substantial source of greenhouse gas emissions. In 2009, the Government Decree »On Measures to Stimulate the Reduction of Atmospheric Pollution by Products of Associated Gas Flaring« set a mandatory level of associated gas utilisation at 95 per cent starting in 2012. Producers will be liable to pay higher fees for excessive flaring, increased by a factor of 4.5 times. If a producer fails to install at his production facilities the tools to measure the actual volumes of associated gas production, utilisation and flaring, a factor of six will be used to calculate the fee.

13. Comprehensive plan for implementing the Russian Federation's climate doctrine for the period until 2020. Available at: government.ru/media/2011/4/29/40950/file/730R_pril.doc (accessed 3 August 2011).

In the sphere of transport, Russia is making efforts to close the gap with OECD countries as well, adopting, among other things, European emission standards, which apply to both imported and domestically produced cars. The current car fleet will remain in circulation until the end of its life-cycle. Euro 3 standards were introduced in 2008. The implementation of Euro 4 standards was scheduled for 2010, and Euro 5 for 2014, but the government postponed the implementation of Euro 4 emissions standards at the initiative of Russian companies until 2013. In addition, Russia is encouraging the production of hybrid cars with electric transmissions, with the goal of producing up to 100,000 hybrid cars a year.[14]

The Russian government is implementing a gradual liberalisation programme in the power sector to increase energy efficiency, reduce carbon emissions and promote modernisation of the energy sector, including privatisation of the former state electricity monopoly RAO UES and deregulation of energy prices for industrial consumers, as well as a gradual increase in household electricity tariffs, sanctioned by the government in 2011. A gradual increase in gas prices is planned as well.

Measures have been taken to increase investments in energy-saving projects. In 2009, the Russian government announced plans to finance such projects up to USD 59 billion by 2020, which could save USD 329 billion in 2010–2020. Moreover, Russia's Energy Strategy through 2030 envisages investments of USD 2.4–2.8 trillion in the energy sector by 2030.[15]

In the field of renewable energy generation (excluding large hydropower energy) Russia lags behind many countries, including China and Brazil. At present, the share of alternative energy sources (excluding large hydropower and nuclear energy) is about 1 per cent of energy generation.[16] In 2009, the Russian government approved »The Main Directions of State Policy in Improving the Energy Efficiency of Electric Power Industry Based on Renewable Energy Sources for the Period Up to 2020«, aimed at increasing the share of renewable energy to 2.5 per cent by 2015, and to 4.5 per cent by 2020, primarily by means of biomass and wind energy, as well as small-scale hydro stations.

Currently, Russia is in the process of working out the long-awaited legal framework and financial support for the development of renewable energy sources. On 22 December 2011 the Ministry of the Economy issued a set of regulations on the energy sector, that is, the new drafts of the Energy Law, Gas Law and Act on Renewable Energy Sources, aimed at creating a legal framework in the field of energy, taking European standards into consideration as well as including regulations on gas-related issues and renewable sources of energy from the existing Energy Law Act. The Draft Act on Renewables aims to improve support for renewable energy, which should lead to an increase in investments in new generation capacity. Moreover, the Draft Act implements some of the regulations of Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on promoting the use of energy from renewable sources.[17] According to the plan, in 2012 the main legislative acts regulating the use of renewable energy sources should be adopted.

Other steps to stimulate the reduction of emissions and increase energy efficiency are being implemented. In November 2011 the President of Russia approved the government's law on the establishment of a unified state automated system for environmental monitoring, including monitoring of the condition and pollution of the environment, the air and radiation levels. The law envisages the integration of environmental monitoring with the international monitoring system.

Environmental accounting is gradually being introduced into environmental reporting. According to the Presidential Decree of 2010 »On evaluating the effectiveness of the executive authorities of RF subjects and local authorities of urban districts and municipal areas on energy economy and energy efficiency«, energy efficiency indexes are obligatory in reporting.

Currently, drafts of several new laws and regulations, covering forest conservation, environmental auditing and the use of other economic instruments, are under consideration. A significant increase in environmental fines is planned in two stages – in 2012 and 2014. The

14. G20 clean energy, and energy efficiency deployment and policy progress, OECD/IEA (2011).

15. Energy Strategy of Russia for the period up to 2030 (ES-2030) approved by decree N° 1715-r of the Government of the Russian Federation dated 13 November 2009.

16. »Renewable Energy Policy in Russia: Waking the Green Giant«, IFC Green Paper (2011).

17. See: http://www.cliffordchance.com/publicationviews/publications/2012/01/proposed_legislativechangesregardingth.html.

State Duma is currently considering a law on applying the world's best environmental practices not only to the construction sector, but also to other industrial sectors. Work on this law was done in cooperation with international experts.

Russia takes an active part in international cooperation in the area of climate, being party to both the UNFCCC and the Kyoto Protocol. Although delayed, a legal framework for the realisation of Kyoto joint implementation projects was created in 2009 and 2010. Now there are more than 100 JM projects, most of them in the oil and gas, industry and renewable energy areas. However, due to the ambiguity of Russia's participation in the post-2012 climate regime, the future of the emission trading mechanisms is uncertain.

Russia participates in the activities of other international organisations, including the International Energy Agency, the International Council on Large Electric Systems (CIGRE), the International Partnership for the Hydrogen Economy (IPHE), and some others.

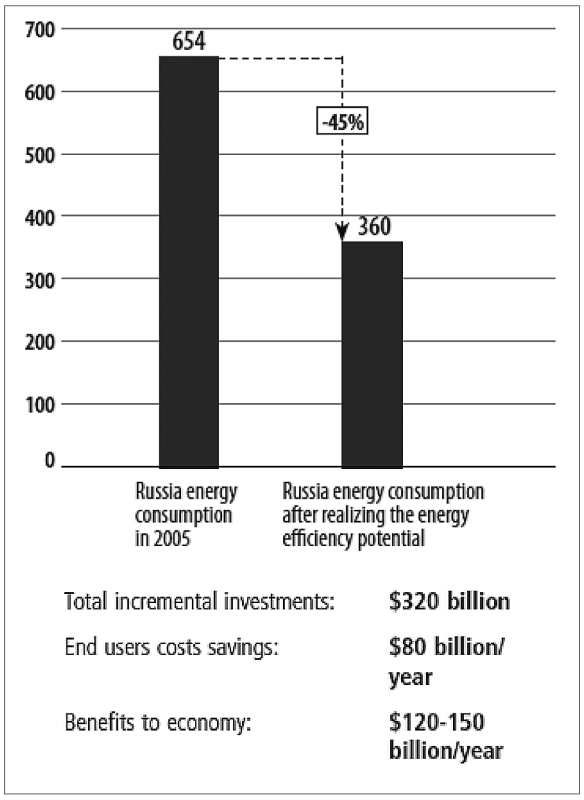
Environmental law enforcement and other measures have had some effect in the past few years. Total air emissions of harmful substances have been somewhat reduced. Environmental investments are gradually increasing, primarily in the private sector.

Nevertheless, the above-mentioned measures are not enough; much more has to be done to reverse the environmental situation and follow an environmentally oriented trajectory.

1.3 Energy Saving Potential

The largest savings and most economically beneficial way to reduce CO2 emissions is to improve energy efficiency. Russia has enormous energy efficiency potential, which exceeds the expected increase in primary energy production by 2020 by a factor of 2–4. It is estimated that energy consumption per unit of output can be reduced by an additional 40–50 per cent from 2000 levels,18 which would amount to savings of as much as USD 80 billion annually. To achieve energy efficiency potential, Russia will have to invest an estimated USD 320 billion.19 Through energy efficiency measures alone, Russia could reduce GHG emissions by 20 per cent compared to 1990 levels. Moreover, these measures would further energy security (saving up to 240 billion cubic meters of natural gas, 340 billion kWh of electricity, 89 million tonnes of coal and 43 million tonnes of crude oil and equivalents in the form of refined petroleum products per annum),20 stimulate modernisation and sustainable economic development, reduce environmental costs and improve the health and welfare of the population. Energy efficiency potential is presented in Figure 3.

Figure 3: Russia's energy efficiency potential, investment and benefits[21]



Source: CENEF for the World Bank.

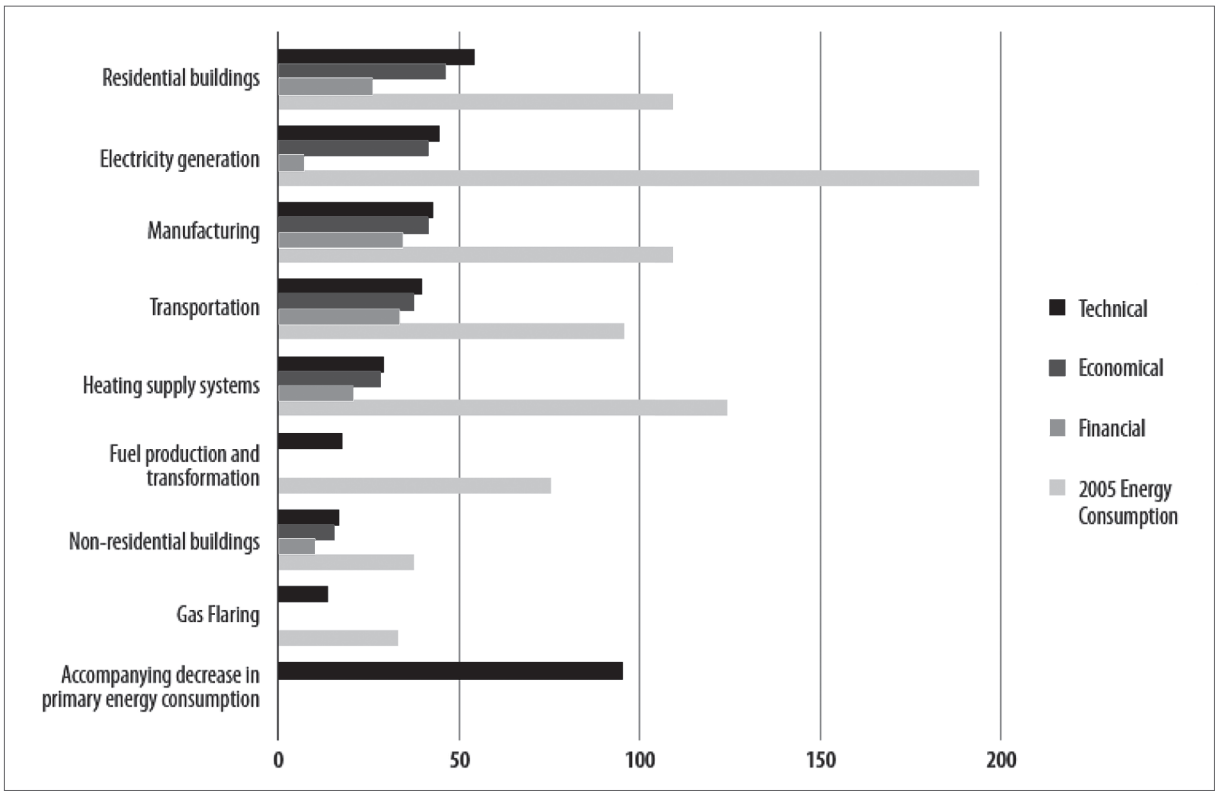
18. Progress with Implementing Energy Efficiency Policies in the G8, OECD/IEA (2009).

19. World Bank (2008), »Energy Efficiency in Russia: Untapped Reserves«, World Bank, International Finance Corporation, Washington D.C.: World Bank.

20. Ibid.

21. Ibid.

Figure 4: Energy efficiency potential by sector



Source: CENEF for the World Bank.

According to a study prepared by the World Bank Group in cooperation with the Centre for Energy Efficiency in Moscow (CENEF), the largest technical energy efficiency potential exists in the building, electricity generation and manufacturing sectors. The energy efficiency potential by sector, indicating the economically attractive and financially viable level of the potential, is presented in Figure 4.

The energy efficiency potential in end-use sectors, as may be seen from Figure 4, is higher than in the energy supply. The building sector, including residential, commercial and public buildings, where heating plays a large role (as does power) has the greatest potential to improve final energy consumption, accounting for one-third of its use. The residential sector consumes nearly three-quarters of the sector's energy; commercial and public buildings consume the rest. Three-quarters of Russia's buildings get their heat and hot water from district heating, so energy-efficiency programmes in the heat and buildings spheres must be closely coordinated. The Russian government has developed an energy code for new buildings that contains requirements for existing and new buildings in both commercial and residential sectors. The use of energy-efficient materials in housing and the public utilities sector may help to cut energy waste.[22]

More than half of primary energy is consumed in the Russian power and heating sector. There is great potential for improvement in every sector of electric power generation because of its relatively low efficiency. Russia's fossil energy plants have an average efficiency of 36 per cent, compared to the OECD countries, where coal- and oil-fired condensing plants operate at an average energy efficiency of 38 per cent, gas-fired condensing plants at 41 per cent, some combined-cycle gas plants achieve efficiencies of 57 per cent and some coal plants 47 per cent. The performance of nuclear power plants is low, primarily because of their downtime. The efficiency and safety of hydropower plants is low as well,

22. Development of Energy Efficiency Indicators in Russia, OECD/IEA (2011).

and could be improved with modern turbines and control systems.[23]

Russia could increase the efficiency of fuel power plants by utilising more distributed generation and optimising energy delivery system designs.

There is great scope for improving energy efficiency and reducing emissions in the manufacturing sector, which is the largest end user, representing roughly 25 per cent of total final energy consumption and 15 per cent of total final energy supply.[24] Most of the savings could be achieved by improving the efficiency of electricity and heat use at Russia's manufacturing facilities. The greatest potential lies in the most energy-intensive industries: ferrous metals and non-ferrous products, pulp and paper, cement, chemicals and petrochemicals, machinery and transport equipment.[25] The ferrous metals, pulp and paper, and cement industry alone represent 53 per cent of the sector's energy-saving potential, with 39 per cent concentrated in ferrous metals.[26] Energy efficiency potential lies in non-energy-intensive industries as well: bakeries, meat processing and others represent 42 per cent of the potential and should not be discounted by policy interventions.[27]

There is also potential to reduce energy intensity in services and transport, although the shortage of data on energy use in transportation hinders policy decisions. The best existing data are for privately owned vehicles, which have dramatically increased in number, especially in Moscow. Other sectors of transport and services have also expanded – as has their energy consumption – due to rapid economic development. Over the period from 1998 to 2008, energy consumption in Russia's transport sector increased by 25 per cent.[28]

The centralised district heating systems, providing citizens with heat and hot water simultaneously, offer large opportunities for energy savings. Energy losses occur at the primary energy sources, in the distribution of hot water and steam through the rarely insulated pipes and in housing. Renewing and improving insulation with modern materials could reduce current losses of about 25 per cent in the district heating network to about 12 per cent.[29]

There are opportunities for increasing energy efficiency in extracting and refining industries as well; oil extraction and refining, natural gas production and processing, and coal production and transformation. There is potential to increase energy efficiency in gas flaring (which has one of the highest levels of inefficiency in the production of oil and gas in Russia, reaching 4–5 per cent of Russia's total gas production).[30]

1.4 Current Economic Strategy

From the 1950s the economic strategy of the Soviet Union was oriented towards developing technologically advanced manufacturing. A wide range of manufactured items, such as chemicals, aerospace equipment, shipbuilding, electric power generating and transmitting equipment, medical instruments, road and rail transportation equipment, communications equipment, and agricultural machinery were developed, but in the absence of competition their efficiency was and remains low. Consequently, although there was a diversified economy, it was based largely on the exploitation of natural resources and low-value-added industries.

In the past two decades there has been a shift to the trade and services sector, which accounts for more than half of the country's economy, although its share is still less than in most developed countries. The fuel and energy complex and low-value-added industries still dominate the economy, being the driving force of many other sectors and the most important source of foreign currency for the Russian economy.

In the international division of labour, Russia has thus far mainly been a supplier of raw materials, which account

23. Millhone, John P., »Russia's neglected energy reserves«, 2010 Carnegie Endowment for International Peace.

24. »Pathways to an energy and carbon efficient Russia«, McKinsey and IFC (2009).

25. »Development of Energy Efficiency Indicators in Russia«, OECD/IEA (2011).

26. World Bank (2008), »Energy Efficiency in Russia: Untapped Reserves«, World Bank. International Finance Corporation, Washington D.C.: World Bank.

27. »Pathways to an energy and carbon efficient Russia«, McKinsey and IFC (2009).

28. »Development of Energy Efficiency Indicators in Russia«, OECD/IEA (2011).

29. »Pathways to an energy and carbon efficient Russia«, McKinsey and IFC (2009).

30. World Bank (2008), »Energy Efficiency in Russia: Untapped Reserves«, World Bank, International Finance Corporation, Washington D.C.: World Bank.

for nearly 80 per cent of its exports. This structure makes Russia highly dependent on commodity prices, has a negative impact on development rates and hampers the progress of knowledge-intensive industries.

In recent years, the government has begun realising its »modernisation« strategy, intended to reduce dependency on primary resources and build up high-technology sectors. The Russian government has been investing in hard and soft innovation infrastructure, establishing so-called institutes of development of the Russian innovative economy, hundreds of techno parks and business incubators, and four special economic zones. The Skolkovo project, for example, receives substantial government investment, attracting technology from such foreign companies as Siemens, IBM and Cisco Systems. Russian companies have begun investing in the modernisation of infrastructure, specifically Russian Railways. Consequently, in 2010–2011 processing industries, primarily in machinery and chemistry, contributed to economic growth to a considerable extent,[31] an indication that the country's economy is slowly changing.

At the end of 2011, a newly revised strategy for the innovative development of the Russian economy by 2020 was adopted by the government, aimed at catching up with the increasing pace of technological development of the global economy and its involvement in economic processes. The programme declares a so-called »mixed innovation strategy« to be optimal. In several areas, such as aerospace, nanotech and composites, nuclear power and ICT, Russia may adopt a global leadership strategy, providing world-class innovative solutions and technologies. In other areas the country will follow a »catch up strategy«, importing and adopting the most advanced technologies available on the market. Long-term goals are established in the strategy, along with quantitative and financial indicators.[32]

According to expert forecasts, in the short term the energy sector will continue to occupy the leading position in Russia's participation in the international division of labour. In the medium to long term, much depends on the country's ability to follow its declared innovation path.

31. See: http://premier.gov.ru/events/news/14975/; council.gov.ru/kom_home/kom_budg/files/download/mer.doc.

32. Russian Innovation Strategy 2020. Available at: http://www.finnode.fi/files/173/Russian_Innovation_Strategy_2020_in_brief.pdf.

2. Prospects for Green Growth in the Russian Economy

2.1 Potential for Green Growth

Russia has huge potential for developing a green economy, due to its intellectual potential, large market size and ecological capital. Opportunities for green growth exist in practically all sectors of the economy, especially in energy savings, renewable energy, manufacturing green construction, water and waste treatment, forestry, agriculture and tourism.

Substantial potential for green growth exists in energy efficiency, given that this stands at the forefront of Russia's strategy. New laws and programmes, addressing energy inefficiency and climate change, create demand for energy-efficient and other green products and services. Upcoming major sports and political events, such as the 2012 Vladivostok APEC summit, the 2014 Sochi Olympics and the 2018 FIFA World Cup provide opportunities for green development, taking Russia's commitment to sustainability into account. The realisation of large-scale oil and gas projects, such as »Sakhalin 1« and »Sakhalin 2«, envisaging the introduction of environmental technologies, may stimulate the growth of the environmental market as well. For example, the 2014 Sochi Olympic Games programmes include projects for waste and water treatment and the development of infrastructure projects according to environmentally efficient construction standards. Investment plans include the realisation of energy efficiency projects. In November 2009, the government outlined plans which include spending USD 59 billion on energy-saving projects over the next ten years.

One of the main sectors with substantial potential for green growth is energy power generation and supply: 70–90 per cent of Russia's power lines need to be replaced. In 2010 an ambitious modernisation programme began. The Russian Federal Grid Company (FGC UES) approved a programme to begin smart grid development with a planned investment estimated at 3 billion RUR in 2011 and 5 billion RUR in 2015.[33]

Green construction is one of the most promising trends

33. UK Trade and Investment Sector briefing: Environment and Water Opportunities in Russia (2010).

in development and could create millions of jobs. Green building construction is becoming more popular in the planning, design and construction of infrastructure, road-building and other construction projects. Opportunities exist for products in heating and water-saving technologies, including wall insulation, efficient faucets and windows, heat-reflecting films for windows, weather-stripping for doors, insulation for pipes, radiator heat mirrors and lighting systems in public buildings.

Due to the rapid increase in the number of motor vehicles in Russia and attendant environmental concerns, there is a market for road surfaces that lower CO_2 emissions, mass transit traffic management systems and sustainable asphalt paving,[34] as well as cleaner transport and fuel.

There is substantial potential for developing other energy-saving technologies, including smart grid technology, through cooperation with more developed countries.

Russia has considerable potential in renewable energy provided by its natural environment, including hydro energy, biofuels, wind energy, geothermal and even solar energy. Currently, micro and small enterprises dominate in this area. The underdevelopment of renewables is most of all due to the availability of vast reserves of cheap natural gas. However, as many countries are now trying to reduce their dependence on Russian natural gas, Russia could use this opportunity to develop renewable resources as a new large-scale energy export.

Russia is the fifth largest renewable energy producer in the world (including large hydropower energy), mostly due to its extensive river network and well-developed hydroelectricity production. About 9 per cent of the world's hydro resources are concentrated in Russia.[35] Hydropower is one of Russia's greatest energy resources, accounting for about 21 per cent of total electric power production. Russia is currently the world's fifth largest producer of hydropower,[36] and only about 10 per cent of its hydropower potential has so far been developed.

Large hydroelectric power stations dominate in this area, which could be made more efficient by installing modern technological equipment, such as more effective turbines.

There is also considerable potential in Russia for small to medium hydropower projects, most of which would be located in Siberia and the Far East. In the USSR, there were 5,000 small hydro stations in Central Russia alone, which are not currently operational but could be made viable through the introduction of attractive tariffs, even without the need for additional support.

Substantial opportunities exist in the development of wind energy. Although utility-scale wind turbines first appeared in Russia, there was no state policy in this area, and the total installed wind capacity is only about 15–20 MW.[37] In recent years, the wind energy industry has begun to develop even in the absence of specialised policy. In 2008, the first wind turbine was connected to the grid in Murmansk, and there are plans to build a large-scale wind farm in the same region. The development of wind energy is promising because of Russia's vast territory and long coastlines, especially in Siberia and the Far East.

Another important potential source of renewable energy is biomass. About half of the Russian population lives in areas without a direct connection to gas or oil transmission pipelines, but the regions have huge resources of wood, peat and other biomass-based material. The potential for biomass electricity – including sewage sludge, cattle manure and lumber waste – is nearly 15,000 MW.[38] The forestry sector has great potential for supplying wood waste products that are now only minimally used. With the reconstruction of pulp and paper plants, the use of wood waste is becoming more prevalent. Another potential source of biomass is the agricultural sector, whose resources are only marginally used. About 40 thermal power stations use biomass, mostly waste from the wood processing industry. Biomass is also used as solid fuel in certain districts' heating boilers. Some of the recently built heating plants were at sawmills, where they produce heat energy and do not feed electricity into the grid. Russia has some 100 plants that convert biomass and agricultural wastes into biogas, but there are no large-scale biogas power plants and no projects planned in this area.

34. US Commercial Service, see: http://export.gov/trademissions/russia-energy/eg_main_044503.asp.

35. »Russian efforts towards a low-carbon economy«, see: http://www.energy-enviro.fi/index.php?PAGE=2&NODE_ID=4&ID=3032.

36. »Renewable Energy Essentials: Hydropower«, OECD/IEA (2010).

37. ***Russia, Country Profile***, European Bank for Reconstruction and Development, June 2009, London: EBRD.

38. »Russian efforts towards a low-carbon economy«, available at: http://www.energy-enviro.fi/index.php?PAGE=2&NODE_ID=4&ID=3032.

Russia has considerable solar resources despite its climate; its potential for solar energy is estimated at 2.3 trillion tonnes of coal equivalent. The greatest solar potential, which is largely unused, is in the southern parts of Central Russia and Siberia, as well as the Far East. The problem is that the production of solar collectors is not well developed due to insufficient internal demand for solar energy. In recent years, Russia has become increasingly interested in competing in the international market for solar products in order to boost its own high-tech industry. The country has some experience in the industry from developing solar power for its space programme several years ago. The state corporation Rosnano is currently investing 1.29 billion RUR in the construction of the first new generation of solar power systems in the south of Central Russia, a project that will see the development of a full cycle of solar energy components.[39]

One of the most developed renewable energy resources in the country is geothermal energy, which is used for heating and electricity production in the Far East and Northern Caucasus. There are vast untapped geothermal resources. Resources are estimated in theory at 3,000 MW[40] and over 3,000 wells have been drilled. The use of geothermal sources to produce electrical power in Russia is also significant, and has been growing continuously. There are currently some 92–129 MW of geothermal power plants operating, and about 55 MW of planned additional capacity. The geothermal resources in Kamchatka are large enough to satisfy the local demand for electric power and heat for more than 100 years.[41]

Russia is also engaging in projects to use tidal energy. The only existing plant, which was built in 1968 in the Barents Sea, remains one of only a few in the world and has been operating successfully despite the extreme environmental conditions in Arctic Ocean. In 2007, a small tidal power plant was built as a pilot project in the same bay. If successful, there are plans to replace it with larger generating capacity and, potentially, to build several more plants in other bays.

Niche geographical factors in Russia allow some renewable sources of energy to function even without state intervention. For example, in the south of Russia, cake (sunflower and so on) boilers sell well. The process is not employed in large-scale energy projects, however, as nobody sees any reason for them.

Clean energy production potential includes hydrogen generation and storage, fuel cells and hydrogen engines. There are several programmes going on in Russia, in which major companies such as Gazprom, a Russian gas giant, are already participating. For example, the Russian Kurchatov Institute has developed an innovative natural gas reforming technology for hydrogen production. The natural gas pipeline network can be modified to deliver pure hydrogen or hydrogen/natural gas mixture to local customers in different parts of the country. This production concept – although much research and testing work on it is still needed – may also well contribute to the future development of the European hydrogen society,[42] owing to the Nord Stream gas pipeline, which links Russia and the European Union.

One of the most promising sectors of Russia's economy is water treatment. The Russian government plans a large-scale modernisation of the water infrastructure, including improving water quality and wastewater treatment processes. At present 41 per cent of water supply networks and 29 per cent of wastewater discharge networks are in urgent need of upgrading.[43] Demand for various water filters and purifying systems is growing. Russia needs to spend an estimated USD 459 billion to upgrade or build infrastructure for water and sanitation.[44] In 2009, the Russian government launched a large investment programme »Clean Water« and is already planning to spend at least USD 20 billion on water projects by 2020.[45]

Large potential exists in the waste treatment market. Russia has accumulated more than 90 billion tonnes of solid waste, including industrial and residential. According to the Ministry of Natural Resources of the Russian Federa-

39. »Rosnano investing in Russian Solar Energy«, RT News, 14 December 2009. Available at: http://rt.com/business/news/solar-panels-russia-rosnano/.

40. »Russian efforts towards a low-carbon economy«, available at: http://www.energy-enviro.fi/index.php?PAGE=2&NODE_ID=4&ID=3032.

41. EBRD (2009), ***Russia, Country Profile***, European Bank for Reconstruction and Development, June, London.

42. »Russian efforts towards a low-carbon economy«, available at: http://www.energy-enviro.fi/index.php?PAGE=2&NODE_ID=4&ID=3032.

43. Russian Water Association, Frost and Sullivan (2010).

44. »Market Insight: Water Sector Outlook for Russia«, Tomasz Zagdan, Frost and Sullivan, 8 August 2009.

45. »Russia Sees $20 Billion Investment in Water by 2020«, Reuters, 20 August 2009.

tion, only 30 per cent of total waste is recycled or processed. For industrial waste, the percentage of processed waste is 35 per cent of the total volume. As for solid waste, only 4 per cent of the total amount is processed (except for Moscow where the percentage is significantly higher), compared to 76 per cent in Germany. The remaining 96 per cent goes directly to landfills, but there are no landfills in Russia that are equipped with landfill gas capture systems, which means that 100 per cent of landfill gas leaks into the atmosphere.[46] The Russian government recently announced plans to recycle 20 per cent of solid waste by 2016. Moscow, St Petersburg and a number of other regions in Russia have announced projects to build waste sorting and waste processing plants. Opportunities exist in many areas of waste management, including waste-to-energy technologies and landfill management. For instance, annual growth of the waste separation equipment market has reached 20 per cent.[47]

Other up-and-coming sectors include sustainable forest management, organic agriculture, ecotourism and environmental services.

2.2 National Green Market

Today, Russia's environmental market is greatly underdeveloped, but it has recently trended upwards, and has huge potential.

Environmental industries in Russia began to take off at the end of the 1980s. Until the 1990s the rates of development were rather low due to the decrease in pollution control expenditures. In the 2000s – apart from the last crisis – growth rates accelerated primarily in big cities due to infrastructure modernisation and the development of national and international projects in some key industries, such as fuel and energy, ferrous and non-ferrous metallurgy, chemistry and petro-chemistry. Major infrastructure projects in larger cities included water supply, sewage treatment, solid waste, methane emission reduction and radiation remediation projects. The stabilisation of the Russian economy prior to the current economic crisis stimulated all segments of the environmental industry. The growth of domestic sales of environmental equipment and services was increasing at approximately twice the rate of overall firm sales.

There is no comprehensive research on Russian environmental industries, but estimates, which vary substantially, are in the range of USD 2–4 billion. A recent estimate put the Russian environmental technology market at USD 4 billion annually (from an unpublished analysis based on the 1997 National Survey of Russian Business by the Tirone Corporation, a US market analysis firm in Russia).[48] According to the American Industrial College of the Armed Forces, the market is estimated at approximately USD 2 billion.[49] The actual environmental technology market potential in Russia could be valued in the hundreds of billions.[50]

The environmental equipment market is estimated at USD 640 million. During the last few years it has increased by 65 per cent. According to Rosstat, in 2000–2009 total capacities of recycled water systems increased by 14.3 times, installations for sewage disposal by 6.6 times and installations for the capture and neutralisation of hazardous gas products by 1.2 times.[51]

Local producers account for only 40 per cent of the market, while market leader positions are held by foreign companies. Russia produces environmental equipment in such industries as water seepage and reclamation, waste and scrap recycling. Russian producers cover 45 per cent of water treatment demand, 29 per cent of solid waste treatment demand and only 15 per cent of air cleaning demand. Specifically, about 80 per cent of solid waste equipment is supplied by foreign producers (mostly China and South Korea). Foreign technologies are widely used in the area of energy efficiency as well.

The volume of imported products is increasing more than twice as fast as the volume of Russian equipment. The main supplier for environmental equipment is Germany, accounting for about one-fifth of Russian imports in this sector. Other suppliers are Italy, Sweden, the United

46. »Pathways to an energy and carbon efficient Russia«, McKinsey and IFC (2009), pp. 90–91.

47. UK Trade and Investment Sector briefing: Environment and Water Opportunities in Russia (2010).

48. See: http://www.ccc.ca/eng/images/content/markt_research/market-russia-environmental.pdf.

49. Environment Industry, Final Report, The Industrial College of the Armed Forces, National Defense University, Washington, Spring 2009, p.11.

50. See: http://www.ccc.ca/eng/images/content/markt_research/market-russia-environmental.pdf.

51. Russia in figures, 2011. www.gks.ru.

States and the United Kingdom.[52] The same holds true for many other segments of the environmental market.

The largest and fastest growing sector is water treatment technologies (equipment and filters for water treatment), amounting to more than 40 per cent of investments. The number of companies involved, such as those producing filters for consumers, is increasing. According to Frost and Sullivan, the total size of the Russian water and wastewater treatment market reached approximately USD 917.9 million in 2010. It is expected to almost double at an annual compound growth rate of 9.2 per cent from 2010 to 2017, boosted, as already mentioned, by the need for legislative compliance as well as refurbishment and upgrade demands.[53]

Air treatment sales make up more than 30 per cent of the market and demonstrate substantial growth rates, registering 20 per cent volume growth in 2011.[54]

The waste treatment segment now makes up less than 5 per cent of the market. Although the sector is relatively small, recently it has developed rapidly. For example, annual growth of equipment for solid waste treatment is about 20 per cent.[55]

Environmental concerns have begun to penetrate into practically all industries. New energy efficiency legislation has stimulated the development of various »green« sectors, including green construction, energy- and resource-conservation technologies, and renewable energy projects. In 2010, there was a significant increase in green building activity in Russia: from green architecture to energy-conserving materials and fixtures such as toilets, light bulbs and appliances.[56]

Another nascent and rapidly growing sector of the Russian economy is organic agricultural products. According to the International Federation of Organic Agriculture Movements, the size of the market for organic agricultural products market is USD 60–80 million, but most organic food products in Russia are imported.[57]

The number of companies in environmental industries is rapidly rising, particularly companies operating abroad and »dirty« industries. Oil companies – despite technical, organisational and financial problems and inconsistent state policy – have begun realising their own environmental programmes: Gazprom, Rosneft, Lukoil, TNK-BP, Tatneft, Norilsk Nickel and so on.

Development of the environmental sector stimulates innovation and investment activities. A number of ambitious projects are currently under way. Rosnano, a state-owned corporation working on nano-technology projects, is considering the option of creating a vertically integrated company in the field of solar energy, which would include the development of new technologies, production of solar cells and electricity production.[58] Siemens has forged a deal with the partly state-owned hydroelectricity company RusHydro, envisaging the construction of wind farms through three joint ventures.

Russia's new innovation hub, Skolkovo, has received USD 5 billion in funding for applied science projects in the fields of energy efficiency, space and telecommunications, information technology, biomedical sciences and nuclear power. Over 180 business and science stakeholders are engaged. For example, two major UK–Russia projects have been launched: a £9.3 million energy efficiency project involving BP and Imperial and a joint-satellite project to predict earthquakes with University College London.[59] The American San Diego Gas & Electric Company, in cooperation with Russian Belgorodenergo (the Belgorod region energy company) and the Belgorod Regional Administration, has agreed to cooperate on the deployment of smart grid technologies.[60]

Russian carmakers are planning to begin production of hybrid cars with electric transmission, which is backed

52. Corporate Security and Safety Market in Russia, Finpro ry, May 2010.

53. Russian water and wastewater treatment market in full recovery, 1 September 2011, available at: http://www.globe-net.com/articles/2011/september/1/russian-water-and-wastewater-treatment-market-in-full-recovery/

54. Euromonitor International, 31 January 2012, available at: http://www.marketresearch.com/map/prod/6799224.html

55. See: http://www.research-techart.ru/report/wastes-recycling-equipments.htm

56. See: http://www.seda-og.org/export/Documents/Russia%20Trade%20Mission%20Statement.pdf.

57. See: http://www.ya-fermer.ru/news/po-proizvodstvu-ekologicheskih-produktov-rossiya-otstaet-ot-vsego-mira-na-20-let.

58. Chepurina, M., What's behind Russia's climate policy? Small steps towards an intrinsic interest, Working Papers N°03/12. IDDRI. Paris, France.

59. Russia: Opportunities for UK Business & Research with Skolkovo Innovation Hub – February 2012, British Embassy, Moscow.

60. See: http://www.seda-og.org/export/Documents/Russia%20Trade%20Mission%20Statement.pdf.

by the government. Production of Russia's first domestically produced electric car, the E-mobile, will begin at a plant in the St Petersburg region at the end of 2012. The target is to produce up to 100,000 hybrid cars per year.[61] The mass production of the Ellada electric car by the Lada car maker is expected to begin in two years.

Pilot projects of smart grid development in the Siberian Federal District, Far Eastern Federal District and Northwestern Federal District are being elaborated. The Interregional Grid Distribution Company (MRSK), a major Russian electricity distributor, is developing a smart grid as a pilot project, which builds on MRSK's project of the past few years for improving city street lighting controls, automating distribution networks and installing neuron automated electricity metering systems.

Various projects to develop national green industries, including those with international cooperation, are already being realised. Financial assistance for energy efficiency projects is being provided by some countries, primarily the Scandinavian countries, Germany and the Netherlands, as well as international organisations, particularly the International Finance Corporation and EBRD, in cooperation with local banks.

The state corporation Rosnano is producing multilayer semiconductors for new energy-saving lamps in collaboration with the Finnish company Optogan. In 2010, Russia began the national commercial development of energy efficient LEDs. A new business for the production of solar battery modules was created in 2009 by Renova for the European market.

2.3 Green Jobs

The data that would be necessary to enable us to estimate the number of green jobs in Russia are simply not available. However, the recently announced reorientation of the Russian strategy towards technological development and green growth, implemented in investment policy and the use of new technologies; the ongoing transformation of environmental legislation; and the growing demand for environmental goods and services, as well as the growing concern for a satisfactory and healthy environment, could well stimulate green employment.

The restructuring of the national economy and the move away from heavy industry reduces employment in old polluting industries in and of itself. Nevertheless, the current significant dependence on the fuel and energy complex makes a radical impact on green employment unlikely in the short run.

Nevertheless, the ongoing realisation of energy efficiency measures in all sectors of the economy is already increasing the quantity of green jobs. As many sectors of the economy improve their energy and resource efficiency, the boundaries between »clean« and »dirty« industries become blurred and so-called green jobs increase even in »dirty« industries. Since the Russian government has made energy efficiency a central part of its economic development strategy, job growth in the short and medium term is forecast in this field. In this sense, the greatest potential for increasing green employment is in energy power generation and supply, smart grid technologies, green construction (which alone could create millions of jobs) and energy-efficient private and public transportation (such as high-speed rail), as well as many traditional sectors of the economy. For example, basic programmes such as improving building insulation can generate up to 50,000 seasonal or permanent jobs. The nuclear programme involves hundreds of thousands of jobs.[62]

Alternative energy is one sector with potential for green jobs growth in line with the government strategy to increase its share in the energy supply, although probably in the long term. Most such employment potential is in the hydro energy segment, related to a large increase in hydropower and in small energy stations.

There is an upward trend in employment in developing green industries, such as recycling, water management, food and agriculture. In the medium and long term, job growth potential exists in forestry, ecosystems protection and restoration, ecotourism, eco-innovations and new green technologies markets. Green development may also offer a solution to one of Russia's most serious problems: the extinction of many small rural villag-

61. »G20 clean energy, and energy efficiency deployment and policy progress«, OECD/IEA (2011).

62. »Pathways to an energy and carbon efficient Russia«, McKinsey and Company (2009).

es. The current and potential development of organic agriculture, especially by family firms, may boost village employment for at least 20,000 people, not to mention suppliers, and stimulate additional positions in the ecotourism sector.[63]

Measures to increase economic efficiency by employing new technologies and management systems are creating new skills requirements. The Russian labour force, amounting to nearly 76 million workers in 2010, is undergoing tremendous changes. Although well-educated and skilled, it is largely mismatched to the rapidly changing needs of the Russian economy.[64] Hence, the focus of government employment policy should be on financing the creation of green jobs and professional retraining, rather than a purely social agenda. All the more so, given that the rate of unemployment in Russia is lower than in France, the United States, Italy, Canada and the United Kingdom (although higher than in Germany and Japan),[65] and there are shortages of skilled workers, with green industries potentially serving as sources of economic growth and stable employment.

2.4 Current Technological Development

Russia's current technological level remains somewhat low and unevenly distributed in different spheres, as a result of many factors, including historical development, the deep economic crisis in the 1990s and economic policy.

In the USSR serious emphasis was placed on technological development, although chiefly military or dual-purpose technologies were competitive internationally. In the years of perestroika the technological structure deteriorated, with only a few fields showing technological improvement.[66] The gap between Russian industry and the industry of most OECD countries increased in the majority of processing and high technology fields.[67]

The material and technical base in Russia is to a considerable extent obsolete. According to the main Russian statistical agency Rosstat, the depreciation of fixed capital stock in Russia at the end of 2010 was more than 47 per cent,[68] with 20 per cent in need of replacement. The average age of industrial equipment is 19 years. The most serious situation is in the energy sphere, where more than half the equipment has been in service for 30–40 years.[69] The replacement of equipment occurs primarily through the purchase of foreign equipment and technologies.

According to the 2010 ICT Development Index (a composite index made up of indicators covering ICT access, use and skills), Russia is in 47th place out of 152 countries (and first place among the top five in the CIS region) in technology development. In comparison with the 2002 report, Russia moved up five positions in the 2010 ICT development index ratings.[70]

Russia is still among the world's leaders in human potential, top in overall literacy and basic education. Russia's higher education, especially technical and natural science education, is highly valued as well. Over 23 per cent of the population has a university degree. However, the quality of higher education has been decreasing, mostly due to underfinancing. The education does not respond to the needs of the economy. There is a surplus of labour with higher education and a deficit of the qualified technical staff[71] necessary for the innovation economy. This problem is considered by business to be one of the main obstacles to investment activity and economic growth.[72] The situation is steadily improving, but Russia still lags in education expenditure (4 per cent of GDP), compared

63. »The extinction of villages and the countryside may be stopped by the development of organic agriculture«, internet magazine ***Agriculture in Russia***, 16 December 2011, available at: http://selhozrf.ru/node/997.

64. Russia in figures – 2011. Available at: http://www.gks.ru/bgd/regl/b11_12/IssWWW.exe/stg/d01/06-03.htm.

65. Trends in the labor market, Statistical Bulletin 2011, Available at: http://www.gks.ru/bgd/regl/B11_04/IssWWW.exe/Stg/d03/2-rin-trud.htm.

66. The Russian Economy: Overcoming the Technology Lag, Russian Expert Review, available at: http://www.rusrev.org/eng/content/review/print.asp?ids=129&ida=1291.

67. The Russian Economy: Overcoming the Technology Lag, Russian Expert Review, available at: http://www.rusrev.org/eng/content/review/print.asp?ids=129&ida=1291.

68. See: http://www.gks.ru/wps/wcm/connect/rosstat/rosstatsite/main/enterprise/fund/index.html#.

69. World in the process of change: challenges and opportunities for Russia, World Economy and International Relations, No. 9 (2011), p. 9.

70. See: http://www.itu.int/ITU-D/ict/publications/idi/material/2011/MIS2011-ExceSum-E.pdf.

71. Obolensky V., »Modernization of the Russian Economy: Concept, Instruments, Forecast«, World Economy and International Relations, No. 1 (2011), p. 103.

72. »Perspectives on innovation activity in Russia«, Report at the 10th international scientific conference »Russia: key problems and decisions« (INION RAN, 18 December 2009), Centre of Strategic Research.

not only to developed (over 5 per cent of GDP), but to many developing countries as well.[73]

The relative number of researchers is much higher than in developed countries and has been increasing in recent years. Russia is behind only China, the United States and Japan in the absolute quantity of scientific personnel (400,000). But the proportion of scientists in overall employment is in the third decile of the world rankings. Russia also ranks lower in terms of the availability of specialised research and training services, availability of scientists and engineers and containment of the brain drain. Weak intellectual property rights legislation also hinders innovation.

Russia has increased its R&D expenditure in recent years and now is in the top 10 countries for overall R&D expenditure (4 billion euros in 2010), but lags behind Western economies in relative R&D&I expenditure (1.3 per cent of GDP) and particularly in business openness towards innovation. However, its R&D infrastructure is not suited to serving the global market economy. The majority of expenditure is by the state. Industry financing of R&D is much lower in Russia, at just 29.4 per cent of all R&D compared to averages of 55 per cent and 63.8 per cent in the EU27 and OECD, respectively.[74] The corporate research and development sector is active only in a limited number of markets and, on average, businesses spend less than 1 per cent of production value on research and development (and 3 per cent of their revenues on the introduction of new equipment), which is low compared not only to the 3–5 per cent in the world's leading economies, but also to the 1.5–2.5 per cent in many developing countries.[75] Passive innovation (the adoption of existing technologies) is still the most widespread approach among Russian companies.

Russia does not lag behind most of the most advanced countries in patent activity. According to data from the World Intellectual Property Organisation, Russia was one of the leading countries in patents activity, at tenth place in 2010. Since the crisis in this sphere in the middle of the 1990s, the number of patent applications has been increasing.[76] The most serious problem lies in the assimilation of technologies.

The share of Russian innovative products in global markets is very low, less than 0.5 per cent. The country's strongest positions are in non-electric machinery (2 per cent); chemicals (0.8 per cent) and aerospace technology (0.4 per cent).[77]

In recent years, the situation has been gradually changing. The Russian government has been making efforts to create favourable conditions for the innovative economy necessary to implement specific scientific ideas, projects and technologies. The development of an innovative economy has become one of Russia's top priorities. The new innovation strategy up to 2020 sets ambitious productivity and innovation goals, with the aim of establishing Russia as a leader in technological innovation. Regulations are envisaged to introduce lower rates for high-tech and engineering companies. Recent changes in legislation may serve as a stimulus to investments in green technologies.

State and business expenditures on innovation have been growing, as has the number of innovation businesses. The Russian government has been investing intensively in diversified innovation infrastructure. Funding has been increased for training engineers to work in priority economic sectors.[78] New measures provide allocations of USD 16 billion of government investments[79] in so-called »institutes of development« for the innovative economy being established: this includes about 200 technoparks and business incubators, 100 centres of technology transfer, four special economic zones with special tax and customs regimes and the realisation of the Skolkovo project.[80] The Federal Targeted Programme for Research and Development in Priority Fields (of the S&T Complex of Russia in 2007–2012) alone has seen its financing increase almost fourfold over the past year, from 1 billion RUR in 2010 to 4 billion RUR in 2011. Large state companies invested 50 per cent more money in

73. Russian Innovation Strategy 2020.

74. »Main Science and Technology Indicators 2009-1«, OECD (2009).

75. »Perspectives on innovation activity in Russia«, Report at the 10th international scientific conference »Russia: key problems and decisions« (INION RAN, 18 December 2009), Centre of Strategic Research.

76. WIPO Statistics Database (October 2011).

77. Russian Innovation Strategy 2020.

78. Meeting of the Commission for Modernization and Technological Development of Russia's Economy, 26 September 2011.

79. Meeting of the Commission for Modernization and Technological Development of Russia's Economy, 26 October 2011.

80. Russian Innovation Strategy 2020, available at: http://www.finnode.fi/files/173/Russian_Innovation_Strategy_2020_in_brief.pdf.

their innovation programmes in 2011 than in 2010.[81] The attitude of society and business toward the development of science and technologies is slowly changing. In some knowledge-intensive sectors, such as the software industry, endogenous innovation has led to success on global markets.

Russia maintains development potential in a number of macrotechnologies, primarily in aerospace technologies, nuclear power, electric power machine building, special metallurgy, space technology, communications, nanotechnologies, hydrogen power, fuel elements, some areas of biotechnology, medicines, and some areas of chemistry and materials, optoelectronic and laser technologies.[82]

The main ways to stimulate the innovation development path include: weakening the state regulation of entrepreneurial activities, using economic instruments to give incentives to innovative companies, increasing financing and support of innovative SMEs, further developing infrastructure, introducing innovations into all spheres, including management and the cooperation of state and business in research, and creating an »innovative climate«.

2.5 Barriers to the Green Economy

There are many economic, political, cultural and social obstacles to the creation of a low-carbon and green economy; these are closely interlinked. The main economic barriers include the dominance of resource-intensive and polluting industries in manufacturing, the high degree of depreciation of fixed assets, the inadequate technological level of the economy, the underdevelopment of the environmental market, the low awareness among Russian companies of the role of the environment in their business, as well as an inadequate economic and environmental policy, which is characterised by the shortage of environmental priorities in the economic strategy.

Recently, state environmental policy has become more active, but the government still has a lot to do. The main problems include:

- monopoly of energy producers;
- lack of an integrated state monitoring system;
- lack of an integrated approach to legislation;
- inconsistencies and gaps in the law;
- deficiencies in law enforcement and control;
- weak usage of economic instruments;
- shortage of investments in the economy and environmental programmes;
- shortage of incentives to conduct research and to introduce eco-innovations;
- corruption;
- low awareness among businesses of the role and benefits of environmental measures.

3. The Role of Politics and Society

3.1 The Role of the State

Until a few years ago the state did not play an active role in green strategy, placing, as already mentioned, a low priority on environmental issues in government policy. Recently, however, the government has named the environment as one of the priorities in Russian state policy, taking particular measures to change the legal base in this field. It is important that these words are also translated into action.

To this end, a set of policy regulations is urgently needed.[83] It is necessary to further integrate environmental considerations into economic policy, developing and using a set of environmental indicators. There is a need to fill in the gaps in legislation and eliminate inconsistencies.

81. Meeting of the Commission for Modernization and Technological Development of Russia's Economy, 21 March 2012.

82. »The Russian Economy: Overcoming Technology Lag«, Russian Expert Review, available at: http://www.rusrev.org/eng/content/review/print.asp?ids=129&ida=1291.

83. Some of them are identified in the IFC document »Energy Efficiency in Russia. Untapped Reserves«.

It is important to decrease the monopoly of energy producers, proceed gradually with electricity and gas sector reforms, and remove energy subsidies (while taking into consideration social problems). A special policy to create a free market of energy services is required.

A complex monitoring system is needed, in particular for energy, as a means of inexpensive and effective control of energy consumption.

Furthermore, it is vital to increase investments in modernising the national economy, raising their share in GDP from the current 20–21 per cent to 35–40 percent,[84] reorienting investments to energy efficiency programmes and key green industries. This will attract private national and Western investors and improve the competitiveness of the Russian economy.

In addition, it is especially important to stimulate R&D in the field of energy efficiency and renewable sources of energy through tax incentives and subsidies. Innovations should aim at a wide usage of alternative energy sources, as well as at increasing efficiency in other areas, such as oil refining (the gasoline yield from crude oil in Russia is a maximum of 50–60 percent, lagging significantly behind the United States, where the figure is 90 per cent).

In energy-intensive areas the introduction of new – and gradual enforcement of existing – energy efficiency standards is required, such as for the use of energy-efficient building materials. It is necessary to update other state standards which do not correspond to European ones, already impeding exports to Western countries. Russian air companies already face restrictions due to the expansion of the EU emissions trading scheme to include aviation. It is essential to impose sanctions on companies that do not comply with standards, such as automobile companies. All these regulations should be realistic. There is a need to eliminate legal loopholes in environmental legislation, such as the narrow usage of environmental impact assessments, which should also include medium and small projects.

It is essential to use the full range of economic instruments, including taxes and tax exemptions to reduce energy consumption and increase the energy efficiency of final products, with a view to stimulating business activity and introducing new technologies. Possible measures include cap-and-trade schemes, green procurement, eco-labelling for industrial equipment, transportation and household appliances, and subsidies, such as those for energy-efficient machinery, electricity metering equipment and the development of renewables. In the building sector in particular, incentives, information and certification schemes may be introduced.[85]

The development of green procurement mechanisms is necessary in order to improve the energy and resource efficiency of the economy and to stimulate the environmental market. Financing may be provided from environmental funds. A system of environmental funds existed at the end of 1990s and would be most desirable today.

State support for the development of energy-saving technologies, rather than new investments in energy production, is essential. Regulations should promote innovative technologies, including those based on bio fuel and the development of solar and hydrogen energy.

It is important to restore the system of forestry management to fight forest fires, as well as the management of swamplands, as both forests and swamps are significant natural carbon sinks. In agriculture, implementing measures to restore organic soils would help to reduce emissions, as organic soils contain high densities of carbon.

Waste management measures could reduce landfill gas leaks into the atmosphere. Moreover, recycling and direct use of landfill gas would be economically attractive for companies.

It is also essential to fight corruption, which hinders the effective implementation of the law.

An information system to increase public awareness of the benefits of energy efficiency measures would be a relatively low-cost immediate action.

84. »World in the process of change: challenges and opportunities for Russia«, World Economy and International Relations, No. 9 (2011), p. 9.

85. Progress with Implementing Energy Efficiency Policies in the G8 – OECD/IEA. 2009.

3.2 The Role of European Standards

International and European standards contribute to the development of Russian environmental policy, all the more so as the EU has developed an integrated system of progressive environmental legislation.

In the 1990s Russia took steps towards bringing national environmental legislation more closely in line with EU norms. However, in the intervening years these norms have rarely been revised. Hence, Russia lags behind many developed countries, especially in transportation emissions standards and noise impact. The integration of Russia into the world economy requires the harmonisation of national environmental regulations with key principles and standards of the EU, which means their adoption, to a feasible extent.

In recent years, Russia has been working to harmonise its legislation with EU legal acts. For example, Russia has been working to pass its own Reach act and aims to harmonise it with European Reach, as well as with the system of classification and labelling of chemical substances. The harmonisation of national environmental standards with international documents in order to develop a Russia–EU dialogue is defined among the main aims of the Technical Committee on Standardisation »Protection of the Natural Environment«, established in 2011.

Over the past 15 years, the EU has provided support for numerous projects aimed at improving environmental standards in Russia, including the development of various recommendations for Russian legislative authorities. The main areas of convergence with European legislation include air protection, biodiversity, »horizontal« European legislation, integrated control of the environment and wastewater management.

Cooperation in this area is especially important in view of protectionist barriers facing Russian companies. Specifically, the European Union's new emissions trading law obliges international airlines to pay for carbon emissions when using European airports.

3.3 Social, Cultural and Political Obstacles

The main social problems include negative demographic trends, health problems in cities as a result of a deteriorating environment, insufficient development of civil society and deficiencies in expertise on energy-efficient project development. The environmental training of specialists is thus necessary to fulfil national obligations to reduce energy consumption.

One of the most significant barriers to the creation of a green economy is the worsening demographic situation. According to forecasts, in the coming years the population will continue to decrease.

Significant income inequality also hinders the creation of a green economy. According to World Bank data, inequality remains high, although income distribution improved in 2007–2009.[86] In particular, the increase in the price of electricity affects the lowest-income levels of the population.

Russian citizens, especially those living in polluted cities, are concerned about the quality of the environment. For decades, Russia was a state-ruled economy without functioning market mechanisms, which impeded market competition and failed to stimulate the efficient use of natural (and labour) resources, leading to their waste. Even now the majority of the population does not see the point in conserving plentiful resources and has difficulty adjusting to new rules on energy conservation. Moreover, the national culture tolerates a certain amount of mild infringement of the law, making it more difficult to enforce environmental laws in Russia. For these reasons, current polls rank Russia the lowest of all nations, with less than 1 per cent of respondents thinking they are best placed to take advantage of green growth.[87]

Another important obstacle to climate policy is so-called climate scepticism, traditionally strong in Russia. Quite a number of leading researchers insist that global warming is not caused by anthropogenic factors, although recent hot summers – especially the summer of 2010, which had serious consequences for people and the economy – stimulated a partial change in attitudes to climate issues. Nevertheless, many citizens believe that the real problem of global warming is both artificial and beyond human solution, showing that Russia lacks public awareness of

86. GINI index, World Bank, Development Research Group, http://data.worldbank.org/indicator/SI.POV.GINI.

87. Development of Energy Efficiency Indicators in Russia, OECD/IEA (2011).

the necessity and social benefit of climate change measures. Russian consumers have not been provided with the know-how and resources to take simple measures in this regard, such as adding insulation to windows and doors, which can substantially reduce heat loss. Many consumers and business leaders still do not see energy efficiency as a priority. It is therefore necessary to continue increasing information dissemination and expanding public environmental awareness in order to lead to a shift in the values of both the general population and the private sector. Measures should be taken to stimulate public awareness of and demand for green products.

Another problem is the relatively weak involvement of NGOs which – with a few exceptions, such as WWF Russia and Greenpeace – do not play a significant role in the creation of the green economy. Current practices and traditions prevent them from active participation in environmental decision-making. Some environmentally dangerous construction objects were undertaken without public consultation.

Hence, it is important to increase the involvement of NGOs in the process of raising public awareness of climate change and the green economy, and also to strengthen the dialogue with business about implementing energy-efficient policies for industry. To this end, voluntary agreements may work as one measure to reduce energy consumption and as a first step towards realising further measures on the way to green development.

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