Russia

Mapping national procedures, sources, available data and information

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1. General Information

1.1. Government Structure

The Russian Federation - Russia is a democratic state with a republican form of the government. The State power in the Russian Federation is executed by the President of the Russian Federation, Federal Assembly, the Government of the Russian Federation, the courts of the Russian Federation. The President of Russia is the head of the government, elected for the period of five years by the citizens of the Russian Federation on the basis of universal equal and direct suffrage by secret ballot. The Federal Assembly – the Parliament of the Russian Federation - is a representative and the legislative organization of the Russian Federation and consists of two chambers - the Federation Council and the State Duma. The Federation Council is composed of two representatives from each subject of the Russian Federation: one representative – from the executive and the other – from the representative power.

The State Duma consists of 450 Deputies and is elected for five years. The executive power is exercised by the Government of the Russian Federation and is headed by the Chairman of the Government. The structure of federal executive power includes 18 federal ministries, 36 federal services and 28 federal agencies implementing the state regulation. In the Russian Federation there are 83 administrative territorial units – subjects of the Russian Federation. As of January 1, 2009 there were 21 republics, 9 edges, 46 on-domains, 2 federal cities (Moscow, St. Petersburg), 1 autonomic region, and three autonomous regions. Subjects of the Federation are in order to improve the effectiveness of the social economic development of country and are combined in 8 federal regions. Distribution of the power and the management responsibilities between the federal center and the regional organizationst is carried on the base of the national legislation. In the Russian Federation on 1 January 2008 there were 1096 cities 1361 towns and 23,160 rural communities. The largest cities are: Moscow - the capital of Russia (10,470 thousand people), St. Petersburg (4,568 thousand people), Novosibirsk,(1,389 thousand people), Ekaterinburg (1,323 thousand people), Nizhny Novgorod (1,275 thousand people), Samara (1,135 thousand), Omsk (1,131 thousand), Kazan (1, 120 thousand people), Chelyabinsk (1,093 thousand people), Rostov-na-Donu (1,049 thousand people), Ufa (1,022 thousand people).

1.2. Mapping National Procedures

1.2.1 Key categories according to IPCC

There are three methods provided in the IPCC Guidelines, Chapter 1, Energy: two Tier 1 approaches (the ‘Reference Approach’ and the ‘Sectoral Approach’) and the Tier 2/Tier 3 approach (a detailed technology-based method, also called ‘bottom-up’ approach).

The Reference Approach estimates CO2 emissions from fuel combustion in several steps:

- Estimation of fossil fuel flow into the country (apparent consumption);

- Conversion to carbon units;
- Subtraction of the amount of carbon contained in long-lived materials manufactured from fuel carbon;
- Multiplication by an oxidation factor to discount the small amount of carbon that is not oxidised;
- Conversion to CO2 and summation across all fuels.

For the Tier 1 Sectoral Approach, total CO2 is summed across all fuels (excluding biomass) and all sectors. For Tiers 2 and 3, the Detailed Technology-Based Approach, total CO2 is summed across all fuels and sectors, plus combustion technologies (e.g. stationary and mobile sources). Both approaches provide more disaggregated emission estimates, but also require more data. Russia uses the country-specific method consistent with the IPCC tier 2 method for diary and non-diary cattle and the IPCC tier 1 method for the other animal categories.

1.2.2 Methodology for retrieving key-category data

National energy statistics agencies collect them directly from the enterprises that consume the fuels or from individuals responsible for the combustion equipment. These data are also available from suppliers of fuels who record the quantities delivered and the identity of their customers usually as an economic activity code, or from a combination of these sources. Direct collection of fuel consumption data may occur through periodic surveys of a sample of enterprises, or, in the case of large combustion plants, through enterprise reports made to the national energy statistics agency or under emission control regulations. Fuel deliveries are well identified for gas, where metering is in place, and also for solid and liquid fuels, both of which are distributed to the household and the small commercial consumers market. The data are available from Rosstat national energy surveys and Russian National Accounts and are at a detailed enough level of disaggregation to calculate energy indicators based on physical units on production and provide an initial assessment of the effect of energy efficiency on industry energy consumption. However, several major issues still need to be overcome to develop energy efficiency indicators. For instance, Rosstat uses current Russian roubles in its value-added calculations, but in order to establish an overall indicator for the industry sector, value added in constant currency is required. Questions also exist regarding breaks in Rosstat time series for some data points.

More difficult issues remain in relation to defining the coverage of energy consumption data (the boundaries for the industry).

1.2.3 Responsible authorities and contact persons

N/A

1.2.4 Procedures to address climate-change issues

N/A

1.3. *Population*

1.3.1 Demographic characteristics

The population of Russia on the 1st of January, 2008 amounted to 142,009,000 people, density of the population were 8.3 persons per 1 square km. The population of the Russian Federation is ranked on the seventh place in the world. In 2008 the urban population was about 73% of the total population; the agricultural population was 27%. The number of employed were about 50% of the population, over the five years 2003-2008 there were observed its growth. 7.5% of the total number of the unemployed, determined by the methodology of the International Labour Organization, diminished to 5.3 million (6.9%). The economically active population in 2008 was 75.9 million persons.

Russia is a multiethnic state. On its territory live the representatives of more than 140 nationalities and people. Russians make 4/5 of all population (according to the census of 2002) – 115,889 thousand people. Significant is the share of the Tatars (5,555,000), Ukraine people (2,943,000 people), Bashkir people (1,673,000) Chuvash people (1,637,000) Chechen people (1,360,000), Armenian people (1,130,000) Mordvin people (843,000), Avar-people (814,000) and Belarusians (808,000). Men constitute 46% of the population, women - 54%.

1.3.2 Development indicators

N/A

1.4. *Geographic Profile*

1.4.1. Geomorphologic characteristics

N/A

1.4.2. Ecosystems

N/A

1.4.3. Land use, land-use change and forestry

N/A

1.5. *Climatic Profile*

Russia's territory is located in arctic, subarctic zones, and the biggest part of it - in the temperate zone. Almost everywhere the climate is continental, but in Kamchatka it is the sea climate, in the south part of the Far East - temperate monsoon. Mean (perennial) monthly temperature of air in January vary from 0 - (-6) °C in the European part of Russia (in Northern Caucasus) to (-40) - (-50) °C Eastern Siberia (the Sakha Republic - Yakutia), and in July - from the (22 - 24) °C to (4 - 14) °C, respectively.

The standard deviation of air temperature from the norm in 1961-1990 in January varies from (3 - 3,5) °C in the southern part of Russia to (5 - 5,5) °C in Siberia, and in July - from (1,5 - 2) °C in the south to (3 - 4) °C in the northern European country.

The average annual surface temperature ranges from (12 - 14) °C in the North Caucasus to (-14 - -16) °C in the Republic of Sakha (Yakutia). The total radiation arriving on a horizontal surface increases from 2800 MJ/m2 year in the northern part of the country until 4800 MJ/m2 year in the south, the radiation balance of the whole territory varies from 0 to 2000 MJ/m2 year. The average annual precipitation ranges from 300 - 400 mm in the steppe regions of the country and in northern Siberia to 600-700 mm in the forest zone of European Russia and 800-1 000 mm or more in mountainous areas. The ratio of the amount of precipitation during the cold period to precipitation in warm throughout much of the country is equal to 0.3-0.5 mm. The average number of days with snow cover in winter in the south from 50-100 to 250-300 of the European part of the northern regions of the country. These observations and model calculations show that the climate in Russia is more sensitive to global warming, climate than many other regions of the globe.

Russia has a largely continental climate because of its sheer size and compact configuration. Most of its land is more than 400 kilometers from the sea, and the center is 3,840 kilometers from the sea. In addition, Russia's mountain ranges, predominantly to the south and the east, block moderating temperatures from the Indian and Pacific oceans, but European Russia and northern Siberia lack such topographic protection from the Arctic and North Atlantic oceans.

Because only small parts of Russia are south of 50° north latitude and more than half of the country is north of 60° north latitude, extensive regions experience six months of snow cover over subsoil that is permanently frozen to depths as far as several hundred meters. The average yearly temperature of nearly all of European Russia is below freezing, and the average for most of Siberia is freezing or below. Most of Russia has only two seasons, summer and winter, with very short intervals of moderation between them. Transportation routes, including entire railroad lines, are redirected in winter to traverse rock-solid waterways and lakes. Some areas constitute important exceptions to this description, however: the moderate maritime climate of Kaliningrad Oblast on the Baltic Sea is similar to that of the American Northwest; the Russian Far East, under the influence of the Pacific Ocean, has a monsoonal climate that reverses the direction of wind in summer and winter, sharply differentiating temperatures; and a narrow, subtropical band of territory provides Russia's most popular summer resort area on the Black Sea.

In winter an intense high-pressure system causes winds to blow from the south and the southwest in all but the Pacific region of the Russian landmass; in summer a low-pressure system brings winds from the north and the northwest to most of the landmass. That meteorological combination reduces the wintertime temperature difference between north and south. Thus, average January temperatures are -8 °C in St. Petersburg, -27 °C in the West Siberian Plain, and -43 °C at Yakutsk (in east-central Siberia, at approximately the same latitude as St. Petersburg), while the winter average on the Mongolian border, whose latitude is some 10° farther south, is barely warmer. Summer temperatures are more affected by latitude, however; the Arctic islands average 4°C, and the southernmost regions average 20°C. Russia's potential for temperature extremes is typified by the national record low of -94 °C, recorded at Verkhoyansk in north-central Siberia and the record high of 38 °C, recorded at several southern stations.

The long, cold winter has a profound impact on almost every aspect of life in the Russian Federation. It affects where and how long people live and work, what kinds of crops are grown, and where they are grown (no part of the country has a year-round growing season). The length and severity of the winter, together with the sharp fluctuations in the mean summer and winter temperatures, impose special requirements on many branches of the economy. In regions of permafrost, buildings must be constructed on pilings, machinery must be made of specially tempered steel, and transportation systems must be engineered to perform reliably in extremely low and extremely high temperatures. In addition, during extended periods of darkness and cold, there are increased demands for energy, health care, and textiles.

Because Russia has little exposure to ocean influences, most of the country receives low to moderate amounts of precipitation. Highest precipitation falls in the northwest, with amounts decreasing from northwest to southeast across European Russia. The wettest areas are the small, lush subtropical region adjacent to the Caucasus and along the Pacific coast. Along the Baltic coast, average annual precipitation is 600 mm, and in Moscow it is 525 mm. An average of only 20 mm falls along the Russian-Kazak border, and as little as 15 mm may fall along Siberia's Arctic coastline. Average annual days of snow cover, a critical factor for agriculture, depends on both latitude and altitude. Cover varies from forty to 200 days in European Russia, and from 120 to 250 days in Siberia.

1.5.1. Precipitation

Russia has little exposure to ocean influences. That is the reason why the most of the country receives low to moderate amounts of precipitation. Highest precipitation falls in the northwest, with amounts decreasing from northwest to southeast across European Russia. The wettest areas are the small, lush subtropical region adjacent to the Caucasus and along the Pacific coast. Along the Baltic coast, average annual precipitation is 600 millimeters (23.6 in), and in Moscow it is 525 millimeters (20.7 in). An average of only 20 millimeters (0.79 in) falls along the Russian-Kazakh border, and as little as 15 millimeters (0.59 in) may fall along Siberia's Arctic coastline. Average annual days of snow cover, a critical factor for agriculture, depends on both latitude and altitude. Cover varies from forty to 200 days in European Russia, and from 120 to 250 days in Siberia.

1.5.2. Temperature

The air movements even out the north-south contrasts in winter temperatures, which might be expected to occur as a result of latitude. Thus, on the Russian Plain isotherms have a north-south trend, and temperatures at each latitude decline from the west toward a cold pole in northeastern Siberia. From west to east within a narrow latitudinal range, the January mean is 18 °F (−8 °C) at St. Petersburg, −17 °F (−27 °C) at Turukhansk in the West Siberian Plain, −46 °F (−43 °C) at Yakutsk, and −58 °F (−50 °C) at Verkhoyansk.

1.5.3. Other climatic characteristics

Over the last 100 years (1907-2007) according to the network of Roshydromet, the warming in Russia as a whole amounted to 1.29 ° C in the condition of the average global warming, according to the Fourth Assessment Report IPCC, 0.74 °C. During the period 1976-2006 average warming of Russia reached 1.33 °C. In most of the Russia in this period, annual minimums and maximum daily temperature in-terrestrial air increased, the difference between them decreases (minimum increasing more rapidly than the maxima), number of days with frost decreased. The greater increase in the minimum and maximum daily temperature was observed during the cold season.

1.6. Economic Profile

1.6.1 General

Following a rough year in 2009, where the Russian economy dropped by 7.9%, GDP in Russia grew by 4% in 2010, and is expected to continue growing through 2011.Russia's economy is the tenth largest in the world, with a GDP of $1.477 trillion in 2010. As noted, that is higher than in 2008, when GDP was a $1.232 trillion, but still lower than 2008, before the crash, when Russian GDP was at a peak of $1.667 trillion.

To provide a better idea of what these massive numbers mean, Russia's GDP per capita in 2010 was $15 900. That compares with a GDP per capita of $47,123 for the United States, and a GDP of $88,232 for Qatar.

The Russian economy remains overshadowed by its Soviet legacy. The economy collapsed after the fall of the USSR, following President Yeltsin's decision to adopt radical economic reforms in order to transform Russia into a free market economy overnight.

The so called shock therapy approach that Yeltsin followed (after prompting by the USA, much of Europe and the International Monetary Fund) led to hyperinflation, the removal of Soviet price controls, and a dramatic collapse of the Russian economy. It is arguable that much of this collapse would have happened anyway (and indeed was necessary if Russia was ever to transition into a market economy), but it is likely that the process was hastened by the adoption of shock therapy.

Russia's economy reached its low point in the 1998 Russian financial crisis, where dramatic swings in the global price of raw materials (particularly oil and gas) destabilised the Russian economy. GDP dropped by more than half, from $404.927 billion in 1997 to $195.906 billion in 1999, and it wasn't until 2003 that the Russian economy crept above $400 billion again.

Since then, the Russian economy has grown rapidly, fuelled largely by exports of raw materials and energy resources such as oil and gas. The dramatic increase in the price of raw materials has helped to boost Russian income as well. As well as measuring raw numbers – GDP grew from $196 billion in 1999 to $1.6 trillion in 2008 – Russia's position in the world shifted as it moved from the 22nd largest global economy to become the 11th largest economy in the world. The growth in income has led to a renewed confidence in Russia, and a much more assertive foreign policy under its last two Presidents, Vladimir Putin and Dmitry Medvedev.

Growth seems likely through 2011, but critics continue to worry that Russia's economy is overly dependent on the export of oil, gas and other raw materials, and that other sectors of its economy are not strong enough to pick up the slack from any downturn should the global oil and gas prices fall significantly.

In terms of income per capita, Russia ranks quite low on the scale – the 51st place in the World. However, the GDP Purchasing Power Parity (PPP), which takes into account the relative cost of living in each country, Russia's GDP ranks 6th in the world, behind the United States, China, Japan, India and Germany.

1.6.2 Primary sector

Russia has nearly 200 million hectares of agricultural land, of which about 120 million is utilized to grow crops, mainly grains, annual or perennial forages, sunflowers, potatoes and vegetables or temporarily lies fallow. The remainder is devoted to permanent meadow or pasture or simply out of production at the moment. Agricultural enterprises (i.e. former state and collective farms) dominate production of most agricultural commodities in Russia, including 78.2% of total grains in 2009. Agricultural enterprises tend to be big with an average size of nearly 5,000 hectares and are larger in the spring wheat region (mainly Siberia) than in European Russia. Private farms tend to be much smaller, with an average size of about 50 hectares but they account for a growing percentage of Russia's commodity production. In 2009 private farms accounted for 20.9% of Russia's total grain production. Private household plots, with a maximum size of 2 hectares produced an astonishing 81.1% of the country's potatoes and 71.3% of the vegetables in 2009, either for personal consumption or for sale at local markets. Whereas private farms produced 5.8% and 10.3% respectively and agricultural enterprises produced 13.1% and 18.4% respectively (source: Rosstat). Foreign investors are welcome in Russia when investing in primary agricultural production. It is not possible to own farmland directly by foreigners though, but facilities can be owned entirely. Russia is different from western markets when establishing but with the right consultancy, it can be a profitable investment.

At the beginning of 2011 two memorandums has been signed between the Russian and the Danish agricultural ministers, emphasizing the great relationship and corporation in the sector on both governmental and private company level. Special attention has been pointed to the sectors of grain handling and logistics, efficient milk production and meat technologies. Within these sectors lie great potential and market opportunities for Danish companies. Food security is a major concern for any country and when you are the head of a state covering 170 million square kilometers with around 140 million people it is important that you take the issue seriously. President Dimitry Medvedev is doing just that by signing an executive order concerning the Russian Federation's Food Security Doctrine on February 1, 2010.

The doctrine is part of the National Security Strategy of the Russian Federation through to 2020. Its objective: to guarantee food supplies, develop agriculture and create mechanisms for swift response to internal and external threats to the food market. This is a truly noble initiative for a state where 10% of the population is engaged in agricultural production. Overall, this is a document which sets the share of domestically produced meat, fish and other foodstuffs in the overall volume of supplies of the respective products on the domestic market. These figures are then used as the criteria for evaluating the food security situation in the country. According to these threshold values, the agricultural sector in Russia should produce: not less than 95% of grain; not less than 80% of sugar; not less than 80% of vegetable oil; not less than 85% of meat; not less than 90% of milk; not less than 80% of fish; not less than 95% of potatoes; not less than 85% of table salt. In this way, the country will become almost completely self-sufficient when it comes to food.

President Medvedev also expressed his belief that with the right developments, this program will help not only Russia but its neighbours as well. Which states he meant was not specified, but an educated guess points at the Central Asian republics, which often face problems in the area of food security. This is explained by the constant over-production of food in the EU and the self-sufficiency of China, leaving only the countries on the southern border of Russia.

1.6.3 Secondary sector

Rich in natural resources, Russia has the largest natural gas reserves in the world, the second largest coal reserves and the eighth largest oil reserves. All these resources constitute a major portion of Russia's exports. In fact, 80% of Russia's exports constitute oil, natural gas, metals and timber. Russia uses these reserves to secure both its economic and political interests.

Russia is a major minerals producer, being a global leader in several products, including diamonds, nickel, copper, coal, gold, PGE's, tin and bauxite. However, since the dissolution of the Soviet Union, Russia has struggled to maintain its ailing mineral industry. Many of its primary minerals are now located outside of the country in other independent CIS states. The reciprocal also applies, as Russia was the main producer of oil and gas supplies to the CIS. This has placed a strain on trade and import/export agreements and as a result, production for most commodities has dropped by as much as 50%.

Domestic demand for Russia's mineral production has declined due to the major downturn in the Russian economy, devaluation of the rouble as well as a waning defence industry (responsible for the consumption of several metals). This has resulted in Russia turning to export markets. Apart from a few companies in the PGE and nickel sector (Norilsk Nickel) and perhaps in aluminium, Russia's minerals production is of a lower grade and quality, resulting in few companies that can "make the grade" and compete globally. The old Soviet planning system was responsible for developing several low-grade ore deposits in the Soviet Union. In these scenarios, factors such as costs were not employed, as they are in a market based economy. As a result, several Russian companies produce a lower quality product (relative to Western production), which does not make Russian mineral products globally desirable.

Although Russia has massive quantities of explored reserves, it is estimated that between 30 and 70% of Russia's reserves are not exploitable under current economic conditions using mining methods from the Soviet period. In order to turn this around; new technology needs to introduced to exploit these reserves. The old Soviet system did not include market economy costs when calculating ore reserves, therefore necessitating a review of reserve estimations throughout all the former Soviet Union countries.

The most significant mineral producing regions in Russia are located in the Kola Peninsula, the North Caucasus, East Siberia, the Urals and the Russian Far East. These regions host Russia’s massive raw materials base, with reserves estimated at approximately 20 years for iron ore and 10 – 30 years for other non ferrous metals.

The mineral industry of Russia is one of the world's leading mineral industries and accounts for a large percentage of the CIS's production of a range of mineral products.

The Russian construction industry recovered some semblance of stability in 2010 and gradually began to pick up again after the downturn. This upturn in fortune was achieved despite the tight budgetary situation, which eventually resulted in certain cuts, e.g. in the area of transport infrastructure development.

Over the past year, an increase in activity has been recorded in the residential sector, however, it has mainly been in the form of increased demand for housing and greater competition for land plots being sold. Very few new residential developments were commenced; instead, developers focused on the completion of ongoing projects.

In the 1990s, Russia urgently needed a revival of the manufacturing sector to provide employment and steer the restructuring of industrial priorities away from the impractical Soviet emphasis on subsidized heavy industry and the military-industrial complex (MIC). Although a substantial share of Russia's MIC enterprises underwent full or partial conversion to civilian production and most manufacturers were partially or fully privatized, manufacturing output continued a general decline in the mid-1990s. This trend had slowed by 1995, when the decrease in total industrial production was 4 percent compared with 1994; the 1994 total had been 23 percent below that of 1993.

The Soviet Union's ferrous metallurgy industry was a showpiece of centralized planning of heavy industry. The fast-growing industry, vital in supplying other heavy industries with semi-finished inputs, led the world in output in the 1970s and the 1980s. Beginning in the mid-1980s, however, ferrous metallurgy did not keep pace with the demands of domestic industry and foreign markets for more sophisticated and stronger metal materials. Many older plants with outmoded technology remained in full production; Soviet plans called for refitting the industry in the 1990s, but Russia's resources have not been sufficient for such a massive project.

In 1994 the ferrous and nonferrous metallurgical industries accounted for about 16 percent of industrial output. In 1996 more than 80 percent of Russia's steel output came from eight plants, although about 100 plants were in operation. Among the industry's most important products are pipe, pig iron, smelted steel, finished rolled metal, and shaped section steel. The four largest steel enterprises are the Novolipetsk and Cherepovets metallurgical plants, located southeast and north of Moscow, respectively, and the Magnitogorsk and Nizhniy Tagil metallurgical combines, located in the Ural industrial region. In 1995 the Cherepovets plant was re-formed as the

Severstal' (Northern Steel) Joint-Stock Company. In the mid-1990s, more than half of Russia's steel production came from the outmoded open-hearth furnace process; the more modern continuous casting method accounted for only 24 percent of output.

In the first half of the 1990s, the steel industry was hit especially hard by Russia's overall economic decline, which caused domestic consumption to drop sharply; by 1996 only 50 to 60 percent of capacity was in use. Between 1991 and 1994, output of rolled steel dropped from 55.1 million tons to 35.8 millions tons. Foreign sales were especially important as the only source of hard currency for some enterprises, accounting for as much as 60 percent of output in some cases. In 1995 Russian exports increased by 30 percent, making Russia the second largest exporter of ferrous metals in the world. The profitability of such sales dropped substantially between 1994 and 1996, however. Much of the steel industry's domestic business was payment in kind to input suppliers and railroads. Production costs are raised by the prices of such domestic inputs as coal and iron ore and transportation, which averaged at or above world levels in 1996. Another major cost to the ferrous metallurgy sector is social support programs for workers. Those costs in turn raise domestic metal prices above international levels.

The Noril'sk Nickel Joint-Stock Company dominates Russia's nonferrous metallurgy industries. It controls nearly all of the country's aluminium and nickel production and 60 percent of copper production. The largest operations in the industry are Noril'sk Nickel in north-western Siberia and Bratsk Aluminium, Krasnoyarsk Aluminium, and Sayan Aluminium in south-central Siberia. More than 90 percent of Russia's aluminium comes from six smelters. Some smelters have been privatized and export their semi-finished products. Inputs, especially alumina (of which Russia has little), became much more expensive in the mid-1990s, as did transportation and electricity costs. At the same time, export revenues fell.

In the Soviet period, the machine-building industry was at the center of the industrial modernization programs that required a steady supply of capital equipment to respond to new demands. However, the inefficient organization of industrial planning caused bottlenecks in crucial programs and generally unreliable performance. The industry is concentrated in the European part of Russia, with major facilities in Moscow, St. Petersburg, Nizhniy Novgorod, and the Ural industrial region. (Russian machine building includes the automotive, construction equipment, and aviation industries as well as the tractor, electrical equipment, instrument making, consumer appliance, and machine industries.)

Between 1985 and 1995, production of most categories of machines decreased significantly, mainly because of declining domestic orders. For example, by 1992 production of metal-cutting machines had dropped by 20 percent, washing machines by 47 percent, turbines by 36 percent, and tractors by 45 percent. In 1993 production of about one-third of sixty-two major categories of products declined by at least 50 percent. In 1995 production for the entire machine-building complex was about 4 percent below the 1994 level.

The most important branch of light industry is cotton textiles, which has production centers in Ivanovo, Kostroma, Yaroslavl', and about two dozen smaller cities between the Volga and Oka rivers east of Moscow. The economic slump of the

1990s had a dramatic effect on textile production and other light industries. In 1995 Russia's light industry suffered the sharpest drop in production of all economic sectors, slumping by an estimated 25 to 30 percent compared with the previous year. Prices for light-industry goods increased by an average of 2.9 times in 1995 after having increased by 5.6 times in 1994.

Unemployment in Russia's textile production centers has been among the highest in the country. In early 1996, an estimated 70 percent of workers in the industry were on furlough or working part-time. The chief cause is the Russian consumers' decline in personal income, hence in demand. In the mid-1990s, consumers purchased most of their textile products at flea markets, which offered both a wider variety of merchandise and cheaper prices than most stores. By the end of 1995, orders for all types of light-industrial production were 48 percent of the average for the previous years. Production declined by 20 percent in fabrics, 21 percent in leather shoes, and 44 percent in knitted goods, but stocks of finished products grew because demand decreased at a faster rate.

The high price of cotton also has hampered the textile industry, which had been accustomed to paying low prices for its raw material when the major suppliers in Central Asia were part of the Soviet economic system. Although their cotton is not of high quality, Central Asian sellers now charge world market prices. (Cotton from the "far abroad," outside the former Soviet Union, is even more expensive, however.) In 1996 industry experts expect some improvement because of expanding export markets in Europe and new investment in light industry by Russia's banks. They also expect an increase in domestic shoe manufacturing in the 1990s because the high import duties on foreign shoes make them twice as expensive as Russian shoes--although in 1996 some 65 percent of shoes sold in Russia were imported. The former member countries of the Council for Mutual Economic Assistance (Comecon--see Glossary) were the chief source of such goods.

The centers of the chemical industry traditionally have been areas where critical raw materials and allied industries were available. Before 1960 plants were near mineral deposits, potato farms, coking coal, and nonferrous metallurgy plants. When oil and natural gas became prime raw materials for chemical production, plants were built near the Volga-Ural and North Caucasus gas and oil fields or along pipelines. In the 1980s, major plants were built at Omsk, Tobol'sk, Urengoy, and Surgut in the western Siberia oil region and at Ufa and Nizhnekamsk in the Volga-Ural region. In the same period, the government gave strong investment and research support to chemical production because of its importance to the rest of heavy industry.

The major divisions of the chemical industry are paints and varnishes, rubber and asbestos products, synthetic tar and plastic products, mined chemical products, household chemicals and washing compounds, mineral fertilizers, chemical fibers and filaments, and paper and pulp. In the 1990s, output has decreased in all of those areas. Among representative products, between 1985 and the early 1990s production of mineral fertilizers dropped by 29 percent, agricultural pesticides by 74 percent, industrial carbon by 28 percent, sulfuric acid by 19 percent, synthetic tars and plastics by 16 percent, paints and varnishes by 43 percent, household soaps by 25 percent, and caustic soda by 15 percent.

Based on Russia's huge supply of timber, a substantial lumber-processing and pulp industry developed in the Soviet period as a subsidiary of the chemical industry. In 1996 Russia's largest pulp and paper enterprises were at Kondopoga near the Finnish border, Bratsk west of Lake Baikal, Syktyvkar in the Republic of Komi, and Kotlas southeast of Arkhangel'sk. Most pulp and paper companies do not own timber resources, but timber suppliers, who lease timberland from the state, generally sell raw materials at below world prices, giving Russian manufacturers a competitive advantage. Some mergers have occurred between suppliers and manufacturing operations.

In the early 1990s, production of raw timber dropped by about 25 percent, mainly because of equipment depletion, lack of credit, higher railroad transport fees, and a drop in construction of lumber roads. In 1993 production of raw timber was 450,000 cubic meters, 75 percent of the 1992 total; production of commercial cellulose was 79 percent of the previous year's total; and of cardboard, 73 percent.

Energy plays a central role in the Russian economy because it drives all the other elements of the system--the industrial, agricultural, commercial, and government sectors. In addition, energy, particularly petroleum and natural gas, is the most important export and source of foreign exchange for the Russian economy. Experts forecast that the energy sector will continue to occupy this central position until Russian manufacturing reaches a level competitive with the West.

Exploitation and Consumption

Russia's self-sufficiency in fuels and power generation puts the country in a good position for future economic growth and development. But Russia is also one of the most energy-dependent countries. The International Energy Agency of the Organisation for Economic Co-operation and Development (OECD--see Glossary) estimated that in 1993 it took 4.46 tons of oil equivalent (TOE) to produce US$1,000 of Russia's GDP, compared with an average of 0.23 TOE to produce US$1,000 of GDP for the OECD member countries.

Russia's excessive consumption of energy results from the Soviet system, which artificially priced energy far below the level of world market prices and thus subsidized it. Soviet energy-pricing policies disregarded resource utilization in the quest for higher output volumes and discouraged the adoption of conservation measures. Soviet planners also skewed resources toward the defense-related and heavy industries, which consume energy more intensively than other sectors of the economy. Until the 1980s, the national economy managed to survive under such policies because of the Soviet Union's rich endowment of natural resources.

The problems that plagued the Russian energy sector in the last decades of the Soviet Union were exacerbated during the transition period. Since 1991 the output of all types of fuel and energy has declined, partly because of plummeting demand for energy during a time of general economic contraction. But the energy sectors also have suffered from the intrinsic structural defects of the central planning system: poor management of resources, underinvestment, and outdated technology and equipment.

The structure of energy and fuel production began to change dramatically in the 1980s with the exploitation of large natural gas deposits. In the mid-1990s, natural gas accounted for more than half of Russia's energy consumption, a share that is expected to increase in the next decades. Oil accounts for another 20 percent, a proportion that is expected to remain approximately constant. Coal and other solid fuels, water power, and nuclear energy account for smaller shares that experts predict likely will decline after 2000. Despite the waste of fuel in the Russian economy, Russia manages to produce a surplus of energy for export. Exports, particularly of natural gas and oil, have accounted for 30 percent of Russian energy production, and this share is expected to hold steady. Russia's drive to become a market economy should help to alleviate some of the problems of the energy sector. Russian energy pricing policies have changed. Since January 1992, energy has been gradually deregulated, closing the gap between world market prices and domestic prices and forcing consumers to conserve. Russia is also adopting Western technology and more efficient management techniques that will improve productivity in the sector.

Oil

Russia ranks third in the world in oil production, after Saudi Arabia and the United States. Estimates place proven and potential oil reserves at 8 to 11 billion tons. Russia's oil production peaked in 1987, then there began a decline that continued through 1995. In the latter year, the yield was 741 million barrels, 13 million barrels less than the previous year. Output for the first quarter of 1996 was 182 million barrels.

Wasteful Soviet oil exploration and extraction techniques depleted wells, which often fell far below their potential capacity. Soviet technology was not capable of exploring and extracting as deeply and efficiently as Western technology. These handicaps have been instrumental in Russia's plummeting oil production during the last two decades. In 1994 the number of oil wells drilled was only one-quarter the number drilled in 1983. About two-thirds of Russia's oil comes from Siberia, mostly from huge fields in the northwest part of the region. The main European oil and gas fields are located in the Volga-Ural region, the North Caucasus, and the far north of the Republic of Komi.

Russian oil companies are vertically integrated units that control the entire production process from exploration to transmission. The largest company is Lukoil, which, according to some measurements, is the largest oil company in the world. The dominance of a few large companies has made all stages of petroleum exploitation and sale extremely inefficient. National and local government policies have discouraged individual retailers from establishing independent gasoline storage facilities and stations; therefore, retail gasoline likely will continue to be in very short supply (only 8,900 stations were operating in Russia in 1995). Until January 1995, government policy applied quotas to oil exports, and until July 1996 tariffs were applied to oil exports. Both policies, resulting from the gap between controlled domestic prices and world market prices, aimed at ensuring a sufficient supply of oil to meet domestic demand; both were lifted as the gap narrowed.

The search for new oil deposits has been a primary force in Russia's foreign policy toward states to the south. Russia has staked its claim to the Caspian oil reserves that Western companies are exploring in conjunction with Azerbaijani, Turkmenistani, and Kazakstani state companies. The presence of Western interests and the strong role being played by Iran and Turkey, Russia's traditional regional rivals, have complicated this policy, which aims to achieve maximum benefit from Russia's position on the shore of the north Caspian. Also a source of international controversy is Russia's insistence that Caspian oil flow northward through Russian pipelines rather than westward via new lines built through Georgia and Turkey (see Foreign Investment in Oil and Gas, this ch.).

Natural Gas

Russia is also one of the world's largest natural gas producers. Its proven reserves have been estimated at 49 billion cubic meters, or roughly 35 percent of the world's total. Natural gas has also been one of the most successful parts of the Russian economy. In the early 1980s, it replaced oil as the Soviet "growth fuel," offering cheaper extraction and transportation. Although output has dropped in the 1990s, the decline has not been as severe as that for other energy sources or the rest of the economy. Natural gas production peaked in 1991 at 727 million cubic meters, then dropped throughout the early 1990s. But 1995 production, 596 million cubic meters, was an increase from the previous year. After European gas fields in the Volga-Ural region dominated the industry through the 1970s, production shifted to giant fields in Siberia. The Urengoy and Yamburg fields in the West Siberia region are among the most productive; the former is the largest field in the world. Soviet plans called for rapid development of new reserves in the Yamal Peninsula in the Arctic Ocean north of Urengoy, but environmental problems and infrastructure costs slowed development. Hasty construction and poor maintenance have caused chronic breakdowns and accidents in the long pipelines of Russia's natural gas delivery system (see Transportation, this ch.).

The State Natural Gas Company (Gazprom) has a virtual monopoly over Russia's gas production and transmission. A vertically organized enterprise, the company has been reorganized into a joint-stock company, in which 40 percent of the shares remain under state control. Company employees hold another 15 percent, managers of the company hold 10 percent, and the remaining 35 percent were sold at public auction. Gazprom controls a network of regional production associations. Its management, which once was headed by Prime Minister Viktor Chernomyrdin, has been accused of corruption and tax evasion.

Coal

For more than 150 years, coal was the dominant fuel supporting Russia's industries, and many industrial centers were located near coal deposits. In the 1960s, oil and natural gas overtook coal when plentiful reserves of those fuels became available and the coal shafts of the European Soviet Union (located primarily in what is today Ukraine) were being exhausted. Russian coal reserves are estimated at 200 billion tons, an amount that experts say is more than ample for current usage trends. Siberia and the Far East produce about three-quarters of Russia's coal, with the European contributions coming largely from the Vorkuta field (Pechora Basin) in Komi, the Urals, the eastern Donets Basin in the southwest, and the Moscow Basin. Largely untapped coal fields lie in the Siberian Tunguska and Lena basins. Productive fields in Siberia are located along the Trans-Siberian Railroad, making their exploitation more economical. The largest operational sources in that region are the Kuznetsk, Kansk-

Achinsk, and Cheremkhovo fields. Coal is one of the less important sources of energy because its labor-intensive extraction makes production much more costly than other fuels. Rossugol', the Russian coal company, controls coal production through regional associations that are organized as joint-stock companies. Russian coal production has declined markedly over the last decade, and the coal industry has suffered a long series of strikes. Coal miners, among the best paid industrial workers of the Soviet period, have organized strikes that have gained national attention to protest the industry's long delays in paying wages. Experts predict that coal output will continue to dwindle as its relative usefulness in industry and domestic applications is reduced. In 1994 Russia produced 249 million tons of coal, and in 1995 the total rose to 255 million tons. Production for the first quarter of 1996 was 71 million tons.

Nuclear Energy

In 1996 some twenty-nine nuclear reactors were operating at nine sites: Balakovo on the northwest border of Kazakstan, Beloyarsk in the southern Urals, Bilibino in northeastern Siberia (the only station east of the Urals), Kola in the far northwest, Kursk near the Ukrainian border, Novovoronezh on the Don River, St. Petersburg, Smolensk west of Moscow, and Tver' northwest of Moscow. Altogether these facilities accounted for 10 percent of Russia's energy generating capacity in 1994. The plants are operated by regional joint-stock companies in which the Ministry of Atomic Energy (Minatom) controls 51 percent of the shares. The nuclear energy sector has undergone financial problems because of government funding reductions. The industry has turned to selling goods related to nuclear energy--equipment and instruments, nuclear fuel, medical isotopes, and fertilizers.

The industry's financial problems, along with the disaster that occurred at the Chernobyl' plant in Ukraine in 1986, have raised questions about nuclear safety. Western countries have provided financial assistance in some cases because of their concern about Russia's lax standards of handling nuclear materials and the continued use of outmoded equipment. Russia's piecemeal environmental laws have led to indiscriminate dumping and burial of radioactive wastes, which are creating severe environmental problems. The theft of nuclear materials has become another source of danger emanating from Russia's nuclear energy program.

Nevertheless, experts predict that nuclear energy probably will play an important role in the Russian economy if enough investment is available to expand existing capacity. In 1992 Minatom announced plans to double nuclear energy capacity by 2010, but ensuing financial problems have caused a reduction of that goal, and no new capacity has been added since the breakup of the Soviet Union. The International Atomic Energy Agency (IAEA) projects that construction of new capacity will not begin until after 2005, even if the investment climate is favorable.

Conventional Power Generation

Much of the conventional fuel produced in Russia is burned to produce electric power. The Unified Electric Power System operates Russia's electric power plants through seventy-two regional power distribution companies. The power system consists of 600 thermal generating systems, more than 100 hydroelectric plants, and Russia's nine nuclear plants. Of the total rated generating capacity of 205 GW, only about 188 GW were available as of 1996. In 1995 Russia's power plants generated a total of 846 million kWh, compared with 859 million kWh in 1994. Generation for the first quarter of 1996 (normally the peak demand period of the year) was 268 million kWh.

In 1993 natural gas provided 42 percent of electricity production; hydroelectric plants, 19 percent; coal, 18 percent; nuclear power, 13 percent; and other sources such as solar and geothermal plants, 8 percent. Natural gas and coal are burned at thermoelectric plants, which produce only electricity, and at cogeneration plants, which produce electricity and heat for urban centers. The largest hydroelectric plants are located on the Volga, Kama, Ob', Yenisey, and Angara rivers, where large reservoirs were built in massive Soviet energy projects. Thermoelectric and hydroelectric plants--located in Siberia because of available fuels and water power--send power to European Russia through a system of high-voltage transmission lines.

Consumption of electric power divides into the following categories: industrial, 61 percent; residential, 11 percent; the services sector, 11 percent; transportation, 9 percent; and agriculture, 8 percent. Regional energy commissions control the price of electricity.

Foreign Investment in Oil and Gas

In the mid-1990s, many analysts consider the oil and gas industries to be the best targets for foreign investment in Russia. The record of foreign investment in that period illustrates both the potentials and the pitfalls of such ventures. Experts have concluded that the Russian oil and gas sector will require large amounts of foreign capital to improve output. According to some estimates, the oil sector will require US$30 to US$50 billion in new investment just to maintain the mid-1990s level of production. To return production to its peak levels will require an estimated US$70 to US$130 billion in new investments, which clearly would have to come from foreign sources. The Russian oil and gas sector also would benefit from infusions of Western technology and expertise. However, according to a 1995 report by Cambridge Energy Research Associates, key figures in the oil industry, most of whom were schooled in the isolated Soviet-era approach to commerce, have been indifferent or hostile to Western management methods.

By the end of 1994, the oil and gas sector accounted for about 38 percent of total foreign direct investment in Russia, but the total input was only about US$1.4 billion. Although Western companies are poised to commit large amounts of capital for exploration, as of 1996 most foreign investment had gone to repairing and maintaining current facilities. Some analysts have estimated that foreign investment in the oil and gas sector could reach US$70 billion by the year 2000.

Among several United States oil companies active in Russia, Texaco heads a consortium in the largest project, the development of oil fields in the Timan-Pechora section of the Komi region north of the Arctic Circle. The project, under negotiation since 1989, has an estimated potential of US$45 billion in investment over the next fifty years. Conoco, a subsidiary of the DuPont de Nemours chemical firm, leads a consortium of United States and European firms and a Russian firm in the Polar Lights project to explore Siberian oil fields. Two United States companies, Marathon

Oil and McDermott, along with the Japanese companies Mitsui and Mitsubishi and Britain's Royal Dutch Shell, are engaged in one of several projects to explore for oil off Sakhalin Island on the Pacific coast. The last two projects each could bring in as much as US$10 billion.

Nevertheless, Russia's generally poor investment climate and other obstacles such as special taxes have discouraged additional investment in gas and oil. As of mid-1996, a tax of about US$5 per barrel was imposed on oil exports, and a tax of about US$2.60 was levied per 1,000 cubic meters of natural gas exported. Foreign and domestic firms were also subject to royalty payments to the Government for the privilege of drilling for oil. Foreign investors have argued that reduced profit margins are a substantial obstacle to the support of some projects. Some major oil investors have received tax exemptions, but delays in rebate payments have created additional deterrents.

1.6.4 Tertiary sector

Russia's trade surplus grew 24.7% in 2010 to $167.5 billion. The trade surplus amounted to $167.5 billion, or $33.2 billion more than in 2009. Preliminary national 2010 data on foreign visitors to Russia show modest recovery in arrivals of 4.4% after a slight fall earlier in the year (and a sharp annual fall in 2009). As the largest country in the world, Russia has one of the world's longest webs of railways

According to data of the Russian Federal State Statistics Service, Russia's air transport conveyed 91 million passengers in 1990 and 51 million passengers in 2008.

The telephone system underwent significant changes in the 1990s. There are more than 1,000 companies licensed to offer communication services. Access to digital lines has improved, particularly in urban centers; Internet and e-mail services are improving. Russia has made progress toward building the telecommunications infrastructure necessary for a market economy. However, a large demand for main line service remains unsatisfied domestic: cross-country digital trunk lines run from Saint Petersburg to Khabarovsk, and from Moscow to Novorossiysk. The telephone systems in 60 regional capitals have modern digital infrastructures. Cellular services, both analog and digital, are available in many areas; in rural areas, the telephone services are still outdated, inadequate, and low density international: country code – 7. Russia is connected internationally by three undersea fiber-optic cables; digital switches in several cities provide more than 50,000 lines for international calls. Satellite earth stations provide access to Intelsat, Intersputnik, Eutelsat, Inmarsat, and Orbita systems

1.6.5 Future prospects for the country’s economy and development

Russia’s economy grew by close to 4 percent in 2010. Compared with developed economies, this was a robust achievement, given the uncertainties faced by the global economy and the continuing debt crises in some small European economies. These economies could still endanger the stability of the European economy more widely, and thus cast a shadow on the prospects of Russia’s major trading partner.

Still, Russia’s growth was about 1 percentage point lower than was generally expected a year ago. Inflation was slightly higher. These differences can be explained largely by the extreme summer weather and numerous forest fires that plagued the country. As a result, Russia's grain harvest was about 25 percent below the recent average. While Russia has emerged as a major exporter of grain—especially of feed wheat—in past years, it banned grain exports last August; the ban remains in effect until this summer.

On the positive side, the price of oil has surpassed the levels foreseen by markets and expected by Russian policy makers. Instead of U.S. $80-85 per barrel, the market price has exceeded the U.S. $100 level. Consequently, Russia's annual budget deficit remained below 4 percent of GDP, when a deficit topping 5 percent of GDP had been expected. If oil prices continue to rise, Russia could balance its budget sooner than its announced target of 2016. However, much will depend on the government's spending decisions before the elections for the Duma later this year and for president in early 2012.

Contrary to the last two years, when the government boosted pensions very strongly—first by a quarter and then by almost half on average—an increase of just 10 percent was announced for 2011. That would increase the average pension after inflation by just a few percent. It is difficult to believe that such restraint would hold, given the very low general pension levels in Russia and the one-third share—and growing—of the electorate that is of pension age.

1.7. Transportation

The transportation system during the Soviet period was organized in the form of vertically integrated monopolies controlled by the central government. Thus, for example, the same administrative agency owned and operated the airports, airlines, and enterprises that manufactured aircraft. The infrastructure eroded seriously in the late Soviet period and requires much modernization and reform, for which Russia relies heavily on foreign investment and aid.

1.7.1 Road transport

Roads were one of the least-used forms of transportation in the Soviet Union, a characteristic that has continued in the Russian Federation. Soviet industry placed little emphasis on the production of automobiles and other modes of personal transport, and the privately owned vehicle was a relatively rare phenomenon; therefore, the demand for road construction was small. The dominance of the railroads for cargo transport also constrained the demand for the construction of roads. In 1995 Russia had 934,000 kilometers of roads, compared with 6.3 million kilometers in the United States (see fig. 10). Of Russia's total, 209,000 kilometers were unpaved, and 445,000 kilometers were not available for public use because they served specific industries or farms.

The World Bank has estimated that in twenty years the demands of Russia's new economy will increase the road system's share of transportation to 41 percent from its 1992 level of 13 percent. However, in 1992 some 38 percent of Russia's highway system required rehabilitation or reconstruction, and another 25 percent required repaving. Many major bridges also required large-scale repair in the mid-1990s.

1.7.2 Shipping

Maritime transportation plays an important role in Russian transit, but the country's geography and climate limit the capacity of shipping. Many Russian rivers run from south to north rather than from east to west, constraining their use during the Russian winters.

Russia's major ports providing access to the Baltic Sea are St. Petersburg and Kaliningrad, and Novorossiysk and Sochi are the main Black Sea ports (see fig. 12). Vladivostok, Nakhodka, Magadan, and Petropavlovsk-Kamchatskiy account for the bulk of maritime transportation on the Pacific coast. The largest Arctic port, Murmansk, maintains an ice-free harbor despite its location on the northern shore of the Kola Peninsula. In 1995 Russia's merchant marine had about 800 ships with a gross tonnage of more than 1,000, of which half are standard cargo vessels, about 100 oil tankers, and eighty container ships. Russia also owns 235 ships that are over 1,000 tons and sail under foreign registry. In 1991 the merchant marine carried 464 million tons of cargo.

Navigable inland waterways extend 101,000 kilometers, of which 16,900 kilometers are man-made and 60,400 are navigable at night. Boats of the Russian River Fleet do most of the inland shipping, which accounted for 514 million tons of cargo in 1991. The Russian government has made efforts to decentralize control over water transportation and to separate control of liners from ports.

1.7.3 Railways

Railroads are the dominant mode of transportation. In 1995 Russia had some 154,000 kilometers of railroads, 26 percent of which were electrified, but 67,000 kilometers of that total served specific industries and were not available for general use. The entire system is 1.52-meter gauge. In 1993 railroads accounted for 1,608 billion ton-kilometers of cargo traffic, compared with the 26 billion ton-kilometers provided by trucks. The prominence of railroads is the result of several factors: the vast distances that need to be covered; the penchant of Soviet economic planners for locating manufacturing facilities in politically expedient areas rather than where raw materials and other inputs were available; and the conditions for granting state fuel subsidies, which provided no incentives to break up cargo transportation into shorter-haul operations that could be covered by road. Cargo traffic is the predominant use of railroads, in contrast to the emphasis on passenger traffic in West European railroad systems. This pattern is a product of the Soviet emphasis on heavy industry and production rather than on consumers. In 1992 Russia's railroads accounted for 253,000 passenger-kilometers, and by 1994 the total had dropped to 227,000 passenger-kilometers.

Railroad traffic has plummeted since the beginning of Russian economic reform, reflecting a general decline in economic activity. Between 1992 and 1994, freight haulage dropped from 1.9 million ton-kilometers to 1.2 million ton-kilometers, and Russia's rolling stock and roadbeds deteriorated, mainly because of insufficient maintenance funding. In 1993 an estimated 8.5 percent of Russian rail lines were defective. As a market economy takes shape, experts forecast a smaller relative role for the railroads. The combination of fuel and material costs, substantially higher in the absence of government subsidies, and new alternative routing will likely prompt Russian manufacturers to find more efficient means of transporting goods. For shorter hauls, trucks will replace rail service, and intermodal transportation will receive greater emphasis as an outgrowth of marketization.

1.7.4 Air transport

Of the modest amount of passenger traffic in Russia, air service accounts for a relatively large portion, although the volume of traffic declined in the first half of the 1990s. In 1990 the monopoly service of Aeroflot, the Soviet Union's state-owned airline, accounted for 22 percent of the total distance passengers travelled, a proportion comparable with the proportion of travel on the airlines of the United States and Canada. However, the contribution of air service to total travel had dropped to 12.5 percent by 1993, and the number of passengers flying was less than half the 1990 total. Subsidized air fares and long-distance flights between cities accounted for much of the air activity in the early 1990s. In 1994 Russia had a total of 2,517 airports, of which fifty-four had runways longer than 3,000 meters, 202 had runways between 2,400 and 3,000 meters, and another 108 had runways between 1,500 and 2,400 meters.

As with the rest of the economy, air travel has declined substantially as prices have increased and travelers' incomes have declined. The airline industry also has undergone major adjustments in the 1990s. Aeroflot, since 1995 a joint-stock company with majority state ownership, remains the main Russian airline. However, more than 200 regional carriers have emerged in the former Soviet Union, and most of them are in Russia. With flights from so many carriers, direct service is now available between regions, including direct flights from the Russian Far East to Japan and Alaska, without the previously obligatory stop in Moscow or St. Petersburg. At the same time that airlines decentralized, so did reservation systems and navigation control networks, making those aspects of airline travel less efficient. Experts predict that as market forces continue to work in the sector, higher fuel costs and declining passenger demand will force mergers and bankruptcies that eventually will lead to a more efficient system. The airline industry also must deal with an aging capital stock. As of 1993, some 48 percent of the national system's aircraft were more than fifteen years old. To upgrade, Russian airline services have purchased aircraft from Western firms and demanded more modern aircraft from domestic manufacturers.

1.8. Energy Generation

1.8.1 Energy supply

In Russia there are 34% of proven world natural gas reserves, about 12% - oil, about 20% and 32% of black and brown coal, respectively. Provision of energy production is based on the proved reserves of oil and gas. Mineral resources base of uranium is sufficient to ensure the needs of nuclear energy. Primary energy production increased by 5.6% as a whole in the period 2004-2007. Production of primary energy resources in 2007 compared to 2004 increased due to increase oil production - by 6.8%, coal (11.5%) and gas (3.0%). 5.4% increase was in nuclear power generation and hydroelectricity. Amount of electricity produced by all plants in the period 2004-2007 increased by 8.9%. The highest rates develop nuclear energy. Electricity produced by thermal power plants is 66.6% of its total production (Excluding renewable energy). The contribution of hydropower and nuclear plants amounts to 17.6% and 15.8%, respectively.

1.8.2 Energy consumption

Today the energy consumption for production and transportation of drinking water make up 0.7 – 0.8 kWh per cubic meter. Different technical solutions (e.g. frequency regulation) make it possible to save app. 20-30% on the energy. To reach these goals in all of Russia there is a need for $30 million. All in all there is a 50% water wastage, which occurs on the way from the water-supply source and to the consumers. The primary reason is the extensive damage 12 on the nets and the high failure rate (app. 5-6 damages annually pr. /km. net). And also because of the inadequate measuring devices which only meter app. 30-40% of the consumed water. The acquisition and installation of the measuring devices in all of Russia require lump-sum investments in the sum of $200 millions. The water wastage could be reduced by 20-25%, if there were more investments in replacement of the nets.

1.9. Waste disposal

1.9.1 Solid waste disposal

In 2007 the waste by economic activities amounted to: from mining - 2 785.2 million tons, from the manufacturing sector - 234.9 million tons, the production and distribution of electricity, gas and water - 70.8 million tons of the used and disposed of for these activities were 65.7%, 35.0% and 11.8% respectively. The growth in waste production and consumption was mainly driven by increasing the proportion of waste hazard class V (Practically non-hazardous) that ranged from 90 to 96%. Waste disposal of I-III hazard class (most dangerous) in 2004-2007 was quite stable and their number was not more than 0.4% of the total mass of waste. Key environmental and technical solutions applied in the use and neutralization of waste products and consumption - is building waste-treatment plants and storage of waste in landfills. The introduction of modern equipment and of technologies order to extract useful or harmful components reduces the area of municipal solid waste.

Emissions of air pollutants from stationary sources in period 2004-2007 were almost unchanged, amounting 20,4-20,6 million tons in emission patterns 27.7% accounted for mineral extraction, 34.0% in manufacturing, 22.2% for the production and distribution of electricity, gas and water 16.1% on other sources (data 2008). Emissions from motor vehicles increased by 6.5% in the period under review. In 2007, it was caught and disposed of 61.3 million tons of pollutants or 74.8% of the total amount of pollutant substances from stationary sources. Relation between the quantities of emissions and carbon capture and disposal of pollutants varies significantly by type of economic activity. As a part of emissions from stationary sources is dominated by gaseous and liquid substances - their share is 87%, and the rest - represented 13% solids.

As required under Russian Federation regulations, wastes must be assessed and classified according to different hazard classes. The rules concerning the classification include dividing wastes into five hazard classes, whereby Hazard Class I wastes are the most hazardous and Hazard Class 5 wastes are considered to be non-hazardous. Table 1 presents some examples of waste streams for different Hazard Classes in accordance with the Federal Waste Classification Catalogue, approved by RF MNR Order No. 786 of 12/2/2002, and the Attachment to RF MNR Order No. 663 of 7/30/2003, Amendment to the Federal Waste Classification Catalogue. (FWCC).

Hazard class	Hazard description	Waste stream project examples	International definotion
1	Extremely hazardous	Mercury containing fluorescent lights, activated carbon contaminated with mercury sulphide.	Hazardous
2	High hazard	Concentrated acids, alkalines, halogenated solvents, lead acid batteries, dry batteries, etc.	Hazardous
3	Moderate hazard	Used lubrication oil, oily sludge, oily rags, used oil filters, non-halogenated solvents, paint wastes, etc.	Hazardous
4	Low hazard	Domestic trash, non ferrous metal scrap, some chemicals, some construction waste treated sewage sludge, treated medical wastes, water based drilling mud, etc.	Hazardous / non-hazardous
5	Practically non-hazardous	Inert wastes: plastic, ferrous metal scrap, inert construction wastes, food waste, brush wood, nontreated wood waste.	Hazardous / non-hazardous

Table 1. Russian Waste Classification System

This classification system is somewhat different to those applied in other countries, such as member states of the European Union, where it is often the case that wastes are simply classified into two groups: hazardous or nonhazardous. SEIC generally considers all Hazard Class 5 wastes under the Russian system to be non-hazardous. It is also recognized that most Hazard Class 4, and some Hazard Class 3 wastes, would be considered to be nonhazardous in the EU and OECD Member States. Russian Federation regulations permit the disposal of some Hazard Class 3 and all Hazard Class 4 (with a few exceptions) wastes into municipal solid waste landfills. This is subject to an application and permission procedure whereby the waste generator must substantiate the approach taken for disposal. For the purposes of differentiating between waste management options and diversion to recycling, reuse or resource recovery, SEIC is using the Russian Hazard Class 1 to 5 classification system. Hazardous wastes, as described in international regulations, are defined in the SEIC Waste Management and Minimisation Standard as:

1) Hazard Class I, II and III wastes under prevailing Russian Federation regulations, excluding any Hazard Class III waste for which disposal in municipal landfill facilities is permitted (under special conditions and limits defined in Russian Federation regulations);

2) It should be noted that under current RF waste management regulations (Amendment to the FWCC) some oily waste, having less then 15% hydrocarbons of the total mass are considered to be Hazard Class 4 wastes. In accordance with international practice, SEIC will consider oily wastes as hazardous and will not dispose untreated oily waste at municipal landfills.

1.9.2 Wastewater treatment

One fourth of the world's fresh surface- and groundwater is located in Russia. The water utilities sector is one of the largest industries in Russia serving the entire Russian population. Supposedly 50% of all the water resources are not suitable for drinking water; 75% of Russia's surface water is polluted and 30% of the available groundwater is seriously polluted. This is why the extremely low water quality is a sweeping problem in Russia.

The Russian wastewater sector has been neglected for a long period of time due to lack of state support and investments. The wastewater treatment plants are fitted with outworn equipment that needs repair renewal, or modernization. A consequence is an enormous amount of inadequate treated wastewater emitted in the natural water resources. Despite the fact that almost all of the Russian cities have a sewer system, there are fundamental problems with the sewer connection and we see a lot of smaller cities without sewage at all. The Russian wastewater sector is overburdened, and the worn out water treatment plants and sewer systems do not have the capacity to treat the big amount of wastewater.

The cleansing capacity

- The cleansing capacity is 56, 1 mill. m³ daily, which is 102.7% of the capacity in 1995.
- The total sewage system is 118,000 km.
- 28% of the wastewater is treated in accordance with the existing regulations, while the rest is emitted without proper treatment
- 60% of the water treatment plants are overburdened, and 38% has been operating in 25-30 years and there is a tremendous need for repairs and renewals

In 1995, the Russian government significantly improved the key document governing the water sector, Water Code of the Russian Federation. On April 22, 2005, the Duma amended the Water Code to include norms regulating use, recovery and protection of water sources. According to the decree of St. Petersburg Administration Tariff Committee N 143-r from October 31, 2007 the following prices are in force from 01.01.2008 till 31.12.2008: 2,23RUR or 0,062EUR for the technical water, 15,77RUR or 0,438EUR for sewerage.

The Russian water and wastewater market are to a great extend sustained by loans and investments from international investment institutions, including The World Bank and The European Bank for Reconstruction and Development. A range of financial programs including local, national, and international companies are supporting the Russian market in cleansing of water and waste water. The international companies are foremost focused on advancement of privatization of the sector.

Some of the most important revenue sources

- An annually state support from federal and regional budgets, which are not adequate to fulfil the needs for renewal of the out worn infrastructure
- In 2002 the so-called oligarch groups entered the water and waste water cleansing market. These financial groups are involved in public businesses such as RAO UESR (Russia's Joint Energy systems), who owns Rosiskiyi Komunalniyi Sistemi (Russian Communal Systems); and Alfa Group, who owns RosVodokanal
- Organisations like International Finance Corporation, OECD, The World Bank, The European Bank for Reconstruction and Development and EU

As mentioned above the Russian government improved the key document governing the water sector, Water Code of the Russian Federation. The Code widens ownership over water sources allowing private ownership of isolated water areas. It also determines the principals on which use of water source agreements and water consumption fees should be based. The Code also calls for a maximum term of 20 years for water use agreements. These amendments are a step forward in the decentralization of management in the water sector and a transfer into a more market oriented system. Another positive development is the reform of the communal services tariff system. Currently, Tariffs only account for 50-60 percent of the market rate and thus do not cover costs, making self-financing in the sector impossible. As a result, "vodokanals" cannot afford modernization of their facilities and equipment. On the other hand, due to the low tariffs the sector is not attractive to private investors. On December 10th, 2004, the government passed a new law on Regulation of Tariffs in the Municipal Utility Sector, which is designed to reform the tariff system and make it economically viable. The law stipulates establishment of an independent body which will review and modify tariffs, as needed, on a regular basis.

Another recent positive development is the adoption by the government of the Federal Program of Modernization of the Municipal Utility Sector in Russia. According to this program, the government plans to allocate USD 50 million from the 2005 federal budget to support renovation in the water sector that will cover 126 water works. If the Russian water resources are going to be effectively exploited and expanded it is necessary to further develop the existing legislative framework in the"Russian Federations Water Codex" for use and maintenance of water deposits. April 22, 2005 the following was added to the Codex:

- Regulating norms for use, improvement and protection of water resources
- The ownership of water resources is expanded to allow private ownership of isolated water areas
- Setting up rules for water consumption charges
- Collective agreement with regard to consumption of water resources
- Introduction of a 20 year period for water consumption agreements

The main asset owners (water utility owners) are local governments. Although there are a few cases where the federal government owns water supply and sanitation systems (including the cities of Moscow and St. Petersburg as well as in the water scarce regions of Primorye, Stavropol, and Krasnodar), in the majority of locations (95 percent) municipalities own both the water supply and sanitation properties and manage them as municipal unitary enterprises, or “vodokanals.” Vodokanals are responsible for supplying drinking water and cleaning wastewater. Water quality is the responsibility of the Centers of Gossanepidemnadzor (State Sanitary and Epidemiological Surveillance Centers). These Centers have specialized laboratories where regular tests of drinking water are conducted.

2. The National GHG Inventory

2.1. Development of a national system for the GHG inventory

2.1.1 Government Ministries/ Agencies responsible for collecting and inventorying data

The Russian Federation ratified the UN Framework Convention on Climate Change (UNFCCC) on November 4, 1994. In 2004, the Russian Federation ratified the Kyoto Protocol within the UNFCCC. On February 16, 2005 the Kyoto Protocol entered into force for the Russian Federation, as well as for each state involved in this international agreement.

In 2006, in accordance with the requirements of the Kyoto Protocol Russian system for evaluation of anthropogenic emission and absorption of greenhouse gases (hereinafter - the evaluation system) was created. In addition, Russian Registry of Carbon Units was founded.

The evaluation system is designed for:

- Estimation of anthropogenic emissions and absorption of greenhouse gases;
- Reporting annually, in accordance with the UNFCCC and the Kyoto Protocol, the relevant data in the form of an inventory of anthropogenic GHG emissions and absorption;
- Generation of reports submitted by the Russian Federation in accordance with the UNFCCC and the Kyoto Protocol;
- Informing the public authorities and local governments, organizations and people on the volumes of anthropogenic GHG emissions and absorption;
- Developing procedures for reduction of anthropogenic GHG emissions
- The authorized national body responsible for the evaluation system is Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet).

Roshydromet together with other federal executive authorities is responsible for developing procedures for formation and functioning of the evaluation system. Roshydromet states a list of governmental statistical reporting and other data concerning processes and activities related to anthropogenic emissions, as well as methods of data collection and processing.

Roshydromet collaborates with the Ministry of Economic Development of Russia, MNR of Russia, Russian Ministry of Industry, Ministry of Transport of Russia, Ministry of Agriculture of Russia, Ministry of Regional Development of Russia, Federal State Statistics Service and Rostekhnadzor and some other relevant organizations and institutions. Federal authorities stated above should ensure the annual submission of relevant data and information to Roshydromet.

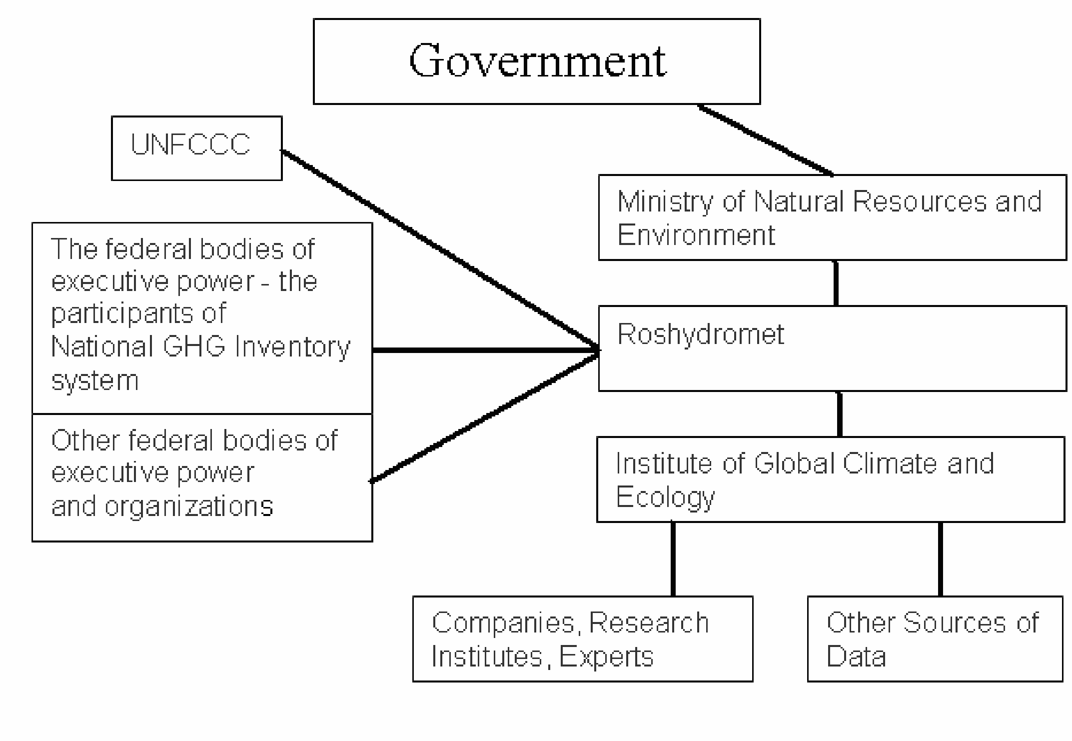

Figure 1. The generalized scheme of the evaluation system in the RF

2.1.2 Supporting institutions

In accordance with the Order of Roshydromet (March 20, 2006 # 63) State Enterprise "Institute of Global Climate and Ecology of Roshydromet and RAS" (IGCE) acts as a methodological center for evaluation of anthropogenic GHG emissions and absorption. Primary activity data on the sources of GHG emissions in the energy, industrial, agricultural, forestry and other sectors of the economy, as well as all the necessary methodological information are collected by IGCE. This organization is also responsible for drafting national reports, communications and other deliverables to the bodies of the UNFCCC and the Kyoto Protocol and to the relevant government authorities.

IGCE utilizes official statistical reports, informational materials and analytic reviews from ministries and agencies, Russian companies, international organizations, as well as publications in scientific, technical and industrial literature. IGCE has introduced a number of hardware and software solutions for data storage and processing.

The administrator of Russian Registry of Carbon Units is Federal State Unitary Enterprise "Federal Center of Geo-ecological Systems."

2.1.3 Measurement methodology and data sources

In accordance with the decision of the 3rd Conference of the Parties to the UNFCCC and Article 5.2 of the Kyoto Protocol, an inventory of anthropogenic emissions and absorption of greenhouse gases should be based on the recommendations and methodologies developed by the IPCC. According to the IPCC methodology, the primary activity data for emissions and absorption include national, governmental and ministries' statistical reports, as well as conversion factors to convert the activity data into the value of GHG emission and absorption. If the activity data and/or conversion factors are absent, it is possible to utilize the values recommended by the IPCC or provided by international organizations (IPCC, 1997; IPCC, 2000; IPCC, 2003). The general scheme of preparation of National GHG inventory system in the Russian Federation is determined by the structure of national evaluation system (see Fig. 2).

Preparation of the inventory starts with a block of collection and initial data processing by responsible ministries and agencies, transformation the incoming data into the formats required for calculations; analysis of the completeness of the information available; preparation of intermediate data for further processing; calculations of GHG emissions and absorption; presentation results to consumers and to the bodies of the UNFCCC and the Kyoto Protocol through the UNFCCC Secretariat. A considerable amount of data is collected through the requests sent to the companies - business entities, research and other organizations. IGCE generates these queries, their delivery is executed either directly by IGCE or via relevant ministries and agencies. If necessary, Roshydromet sends the queries to the ministries and departments not involved in the National GHG system on a regular basis. In addition, IGCE permanently monitors scientific, technical and economic publications in order to obtain methodological information (coefficients of GHG emissions, parameters of technological processes), as well as additional quantitative data on the activities related to GHG emissions or absorption. In some cases, expert estimates are also used.

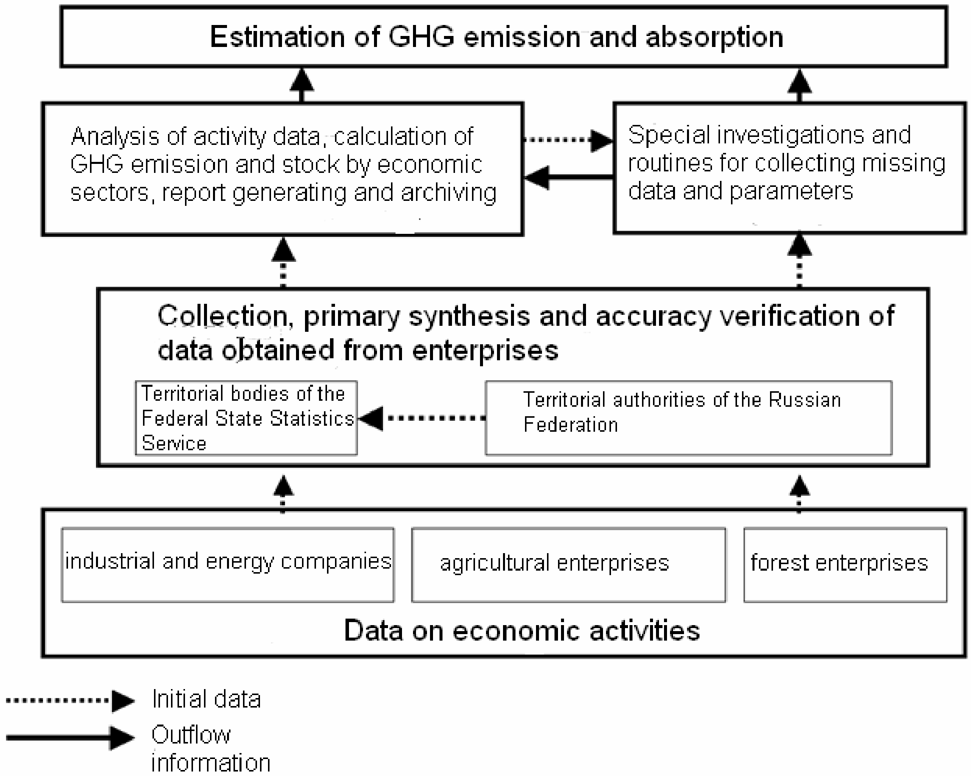

Figure 2. Structure of national evaluation system

2.1.4 Activity data

Primary activity data on the sources of GHG emissions in the energy, industrial, agricultural, forestry and other sectors of the economy, as well as the necessary methodological information are collected by IGCE. IGCE utilizes official statistical reports, informational and analytical materials from ministries and agencies, Russian companies, international organizations, as well as publications in scientific, technical and industrial literature. IGCE maintains a hardware and software base for data storage, processing and archiving.

The National Inventory Report (NIR) is the main document that contains materials characterizing the activity data for a certain period of time (the latest version of NIR covers 1990-2008 years). In addition, quantitative data of the inventory are contained in the tables of common reporting format (CRF). These tables are submitted to the UNFCCC in electronic form. Estimates of GHG emissions and absorption are made for all sectors of economy and for most categories of sources according to the classification of the Intergovernmental Panel on Climate Change (IPCC). Methodological framework of the national GHG emissions includes the guidelines of the IPCC, the national guidelines and results of individual research. To recalculate the emissions of greenhouse gases in carbon dioxide equivalent (CO2-equiv.) the IPCC global warming potential of 1995 is used. It is based on the climatic effects of greenhouse gases over a 100-year period.

2.1.5 Conformity with data-exchange standards

To assess the ability of conducting transactions within and outside Russia, to verify data exchange process and to coordinate administrative processes Russian registry of carbon units was successfully tested within the framework of program Go-Live Rehearsal 2 organized by the UNFCCC Secretariat over the period from 10.07.2008 to 23.07.2008. This test demonstrated the successful transactions and data exchange with Japan and New Zealand. During the period from 06.08.2008 till 08.08.2008, as a part of test for registers' coordination organized by the UNFCCC Secretariat, Russian registry successfully conducted operations with registries of Belgium, Switzerland, France, Finland, Hungary, Japan, Lithuania, Poland, Romania and some other countries.

It should be also mentioned that the production platform of the Russian registry of carbon units has been officially connected to the production platform of the international transaction log (ITL).

2.2. Systematic Observations

2.2.1 Measurements of meteorological parameters and instrumentation deployed

To understand the causes of climate change and create means for its prediction it is necessary conduct continuous and coordinated observations in all regions of the world. Global Climate Observing System (GCOS) was established by the World Meteorological Organization (WMO), United Nations Environment Programme, International Oceanographic Commission UNESCO and the International Council for

Science. It utilizes observational instruments placed on surface, marine vessels, floating buoys, probes, airplanes and satellites. In the Russian Federation climate and climate change monitoring is conducted by Federal Agency for Hydrometeorology and Environment Monitoring (RosHydromet). The monitoring activities are conducted within the framework of the WMO Convention program, World Weather Global Atmosphere Watch, Global Ocean Observations and the Global Terrestrial Observing System.

The Russian segment of the World Weather Watch consists of 1633 stations, including 454 stations of the benchmark climate network. Benchmark stations are representative stations with a full program of observations covering the territory of a uniform meteorological regime.

Figure 3. The main terrestrial meteorological network of RosHydromet includes 1633 observation stations. Red circles denote 454 benchmark stations. Source: Evaluation report of climate change, RosHydromet, 2008

Benchmark stations hold a long series of observations and are not subject to closure and transfer. Russian segment of terrestrial GCOS network amounts to 135 stations.

Regional Basic Climate Network of the Russian Federation includes 238 stations, aerological network – 105 stations, including 12 stations of the GCOS system, ozonometric network amounts to 27 stations. Actinometrical observations are conducted by 191 weather stations. Hydrological monitoring on rivers, lakes and water reservoirs is fulfilled at 3085 points. High-altitude surveillance of atmospheric border layer takes place at one station (300-foot mast in Obninsk, Kaluga region). Monitoring of snow cover is maintained on three basic stations and at 8 points in the North Caucasus (Dagestan).

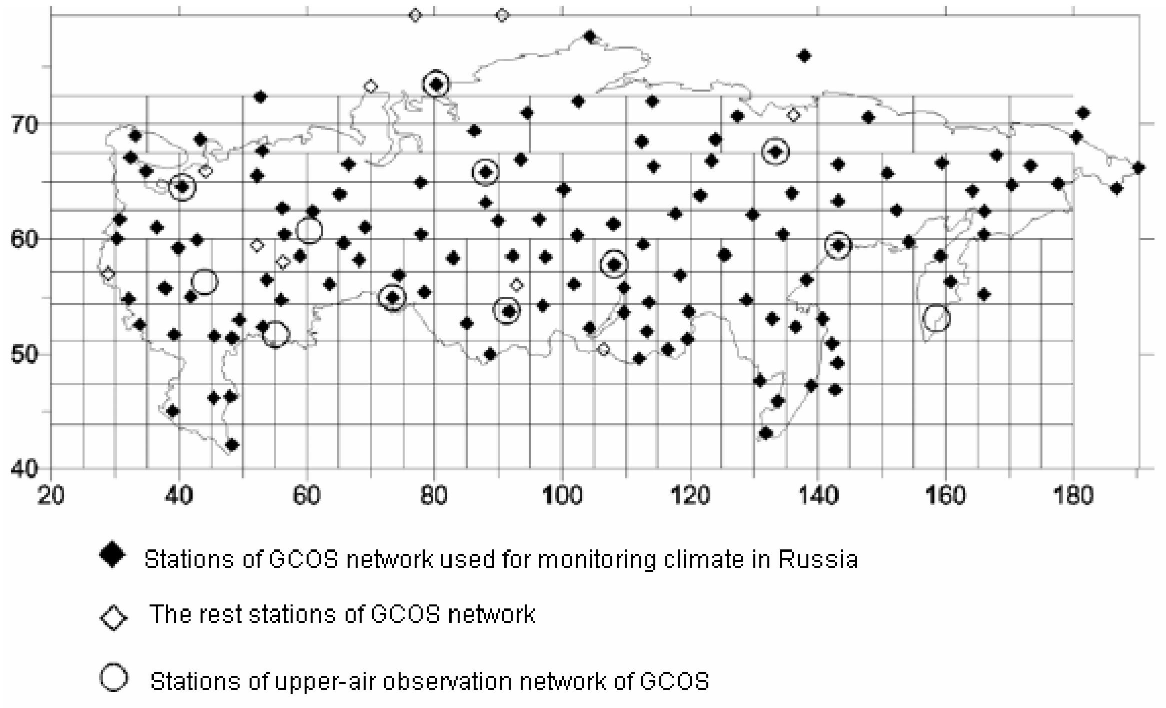

Figure 4. The network of GSOC in Russia (both terrestrial part and upper-air observation network). Source: The Fifth National Report of the Russian Federation on the fulfillment of commitments resulting from the Convention on Nuclear, Rosatom, 2010.

Concentration of greenhouse gases (carbon dioxide and methane) is monitored at one station located in Teriberka (Murmansk region). There are also 28 stations for monitoring of total ozone concentration. Starting from 1970 Institute of Atmospheric Physics (Russian Academy of Science) performs a continuous monitor of the total concentration of carbon monoxide, methane and water vapor in the atmosphere. These series are the longest in the world. Since 1980, observations of ozone and nitrogen oxides concentrations have been also performed. These data are available in the international network.

GCOS segment of meteorological stations also includes four Russian stations in Antarctica (Bellingshausen, Mirniy, Novolazarevskaya and Vostok stations). In 2003 the research program on the drifting stations "North Pole" was re-launched. These stations perform a set of standard meteorological observations in the high Arctic latitudes including observations for greenhouse gases concentration (drifting station SP-35 and SP-36). Drifting stations SP-32, SP-33, SP-34, SP-35, SP-36 and SP-37 operated in 2003-2010. Drifting station SP-38 is currently in use (from October 2010 to present time).

Some climate observations are also performed by other agencies (Ministry of Defense, Russian Academy of Sciences). However, Roshydromet performs the main bulk of climate observations.

The density of the meteorological network in some regions of Russia is insufficient to study regional climate. Therefore a significant attention is paid to the analysis of the climate data from satellite observations.

Roshydromet releases an annual report which provides information on the status of climate in the Russian Federation.

2.2.2 Oceanic observations

Russia performs a wide range of oceanographic observations and participates in various relevant programs within the framework of WMO, IOC (Intergovernmental Oceanographic Commission) of UNESCO, GCOS, GOOS (Global Ocean Observing System), GLOSS (Global Sea Level Observing System) and under other programs. Systematic observations are made for the following indicators of the marine environment:

- sea surface temperatures - at 163 coastal and island meteorological stations and posts, and on 280 ships under the programs VOS (Voluntary Observing Ship Scheme) and SOOP (The Ship Of Opportunity Programme) WMO;
- salinity at the sea surface – at 122 coastal and island meteorological stations and posts;
- sea level - at 101 post, including 14 stations of the GLOSS network.

The standard range of marine coastal observations includes sea level, temperature and salinity of sea water measurements, measurements of sea waves' height, ice cover height and ice phenomena. Most of the stations were opened in 1930 that enabled to accumulate long series of observations of the natural environment reflecting changes in climate at high latitudes.

Observations of sea surface water temperatures are maintained at 163 coastal and island marine hydrometeorological stations and posts. The temperature of the surface layer of water is measured four times a day by means of mercury or electronic thermometer with a scale 0.1 °C. At the same time, the measurements of sea surface temperature are also carried out on the ship-based stations (under VOS, SOOP Programmes). Every year the observational data are obtained from approximately 280 voluntary observing ships.

Sea-level measurements are carried out at marine coastal and island meteorological stations and posts (101 post, 14 of them belong to the GLOSS network) four times a day with level rulers. At stations with automatic sea level recorders a continuous record of the water level is maintained within the day that results in the series of hourly values of sea level. At present time the sea-level data from 5 stations (Barentsburg, Murmansk, Nagaevo, Tuapse and Petropavlovsk-Kamchatsky) are transmitted to the international centers.

Salinity at the sea surface is measured at 122 coastal and island meteorological stations and posts. Network of coastal and estuarine meteorological stations in the Arctic includes 13 stations located in the Barents Sea, 15 stations on the coast of the Kara Sea, Ob and Taz Bays, 6 stations in the Laptev Sea, 5 stations in the East Siberian Sea and 3 stations in the Chukchi Sea.

Observations are also performed in the Caspian (6 stations), Black (5 stations) and in the Baltic Sea (8 stations) as well as in the Japan (17 stations) and the Okhotsk (39 stations) Seas.

2.2.3 Terrestrial observations

Permafrost observations

Studies on permafrost are held mainly by institutes of Roshydromet and Russian Academy of Science. At present time the permafrost situation is monitored at permafrost stations in Anadyr area, Yakutia, Nadym area, Yamal area, Vorkuta area and Pechora Bay area. Most of these stations are involved in the international project Circumpolar Active Layer Monitoring (CALM) and enter the GTN-P (Global Terrestrial Network - Permafrost) GCOS. Russia is also responsible for monitoring at 25 stations of the CALM network.

Observations of hydrological systems

Observations of hydrological systems are maintained on a regular basis by Roshydromet, institutions of Russian Academy of Sciences and Ministry of Natural Resources of Russia. The hydrological network of Roshydromet contains at present 3085 posts. In addition to these posts there are 3 swamp stations, 4 water-balance stations and 140 monitoring posts that measure evaporation from water surface.

CO_2 cycles

Studies of the carbon cycle are carried out by Federal Forestry Agency (FFA) of Russia. These studies include calculations of carbon balance in forests in Russia. In addition, various mathematical models describing the carbon budget of forests are being developed.

Detailed investigations of various stages of the carbon cycle as well as evaluation of carbon stocks in forest ecosystems are performed in the International Forest Institute of Russian Academy of Natural Sciences.

Russian Academy of Agricultural Sciences (RAAS) develops the program "Increasing of soil fertility in the Russian Federation". Increasing soil fertility results in an increase of soil carbon stocks due to a boosted absorption of CO2 from the atmosphere.

Monitoring of land surface and land-use

The observations include systematic integration of agricultural lands, collecting data on the area of swamps and peat accumulation rates, methane supply into atmosphere. These activities are conducted in the divisions of Roshydromet, Rosreestr and Russian Academy of Sciences. Systematic studies of the influence of climatic factors on terrestrial ecosystems are maintained in the Institute of Global Climate and Ecology of Rosgidromet and RAS and in the Institute of Forest Science RAS. Studies related to the effect of warming on tundra and flows of methane into the atmosphere are carried out by the Institute of Atmospheric Physics RAS.

Forestry, the spread of fires

Federal Agency of Forestry conducts systematic observations of the emergence and spread of forest fires, as well as the effectiveness of control procedures. The latter include a set of ground-based and remote methods of monitoring, detection and evaluation. Fire data are collected and compiled using the "Remote Information System

Fire Monitoring "- a joint project of the Central Base of Aviation Protection of forests in Russia (Avialesohrana), Space Research Institute, Centre for Ecology and Productivity of Forests, and Institute of Solar-Terrestrial Physics RAS (Siberian Branch). The system implements technology for receiving and processing satellite data on forest-fires.

Temperature measurements in boreholes drilled at the Russian station Vostok are held on an irregular basis since 1957. Precision thermograms of deep wells present the basis for the reconstruction of temperature changes caused by global climate change over the last 500 thousand years. In January 1970, 1.5 km to the North of Vostok Station a snow ground to monitor the rate of increase of the snow cover height was installed. In December 1998, to the west of this snow ground a new polygon, completely identical to the old, was opened. Observations at both test sites are conducted simultaneously. These observations are not a part of any official monitoring program.

2.2.4 Air-quality monitoring

Network of air-quality monitoring is implemented and developed by institutions of Roshydromet. This network includes 260 Russian cities and towns. Regular monitoring of air quality is carried out on 710 stations plus additional 50 stations of other federal agencies.

Network monitoring of air pollution in major cities of Russia covers 35 cities with 234 operating stations (Table 2 with data for the largest cities in Russia). Observational stations are located in residential areas near highways and industrial areas of cities. In accordance with their location the stations are divided into urban background (in residential areas), industrial (in the zone of influence of industrial enterprises), automobile (near major highways) and the regional. The number of stations in each city varies, sometimes drastically. For example, in Krasnodar there are only 3 stations versus 13 stations in Nizhny Novgorod with the two times less area.

In each city or town, observations are carried out 3-4 times a day, in the morning, afternoon and evening hours.

Monitoring of the atmosphere components affecting the climate change is conducted in Russia as well. The main directions in this field include:

1) monitoring of carbon dioxide and methane concentration in the surface layer of the atmosphere,
2) monitoring of total concentration and vertical distribution of ozone in the atmosphere,
3) monitoring of transboundary transmission of air pollutants,

4) complex background monitoring,
5) monitoring of chemical composition and acidity of precipitation.

The results of these observations are transmitted to data centers of international programs GAW (Global Atmosphere Watch), EMEP (European Monitoring and Evaluation Programme), and WMO World Data Centre for Greenhouse Gases.

Observations of carbon dioxide and methane concentrations

Regular measurements of carbon dioxide concentration in the surface layer of the atmosphere have been carried out in Russia since 1987 under the Global System for monitoring carbon dioxide and the WMO Global Atmosphere Watch (GAW). Before 1993 observations were conducted at three GAW monitoring stations: Bering Island (the Commander Islands), Kotelniy Island (the New Siberian Islands) and Teriberka (the northern coast of the Kola Peninsula). Monitoring of carbon dioxide concentration in the surface layer of the atmosphere has been carried out at Teriberka from 1988 to present whereas the measurements at the other two monitoring stations were stopped in 1994.

Observations of methane concentration take place now in Russia at:

1) Teriberka station
2) New Port station (the southern coast of the Yamal Peninsula, since 2004).
3) Voejkovo station (St. Petersburg suburb, since 1996),
4) the Central Geophysical Observatory (since 2000).

Regular monitoring of hydrogen concentration has been conducted at Voejkovo station since 2008. Under the research Programme International Polar Year in 2007-2008 concentrations of carbon dioxide and methane were measured in the Arctic Ocean (the research vessel "Akademik Fedorov", the icebreaker "Yamal", and at the drifting polar station NP-35). Similar measurements were carried out in Antarctica (Novolazarevskaya station).

3. Reporting

3.1. The GHG inventory, emissions per sector

Figures 4 and 5 illustrate greenhouse gas emissions by sector in the Russian Federation without regard to the sector "Land use, land-use change and forestry."

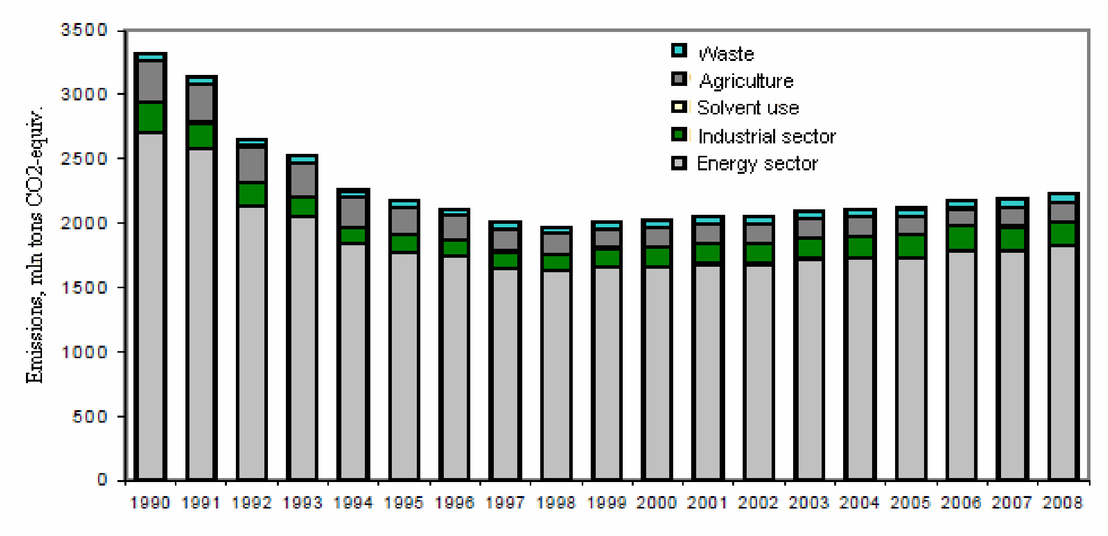

Figure 4. Anthropogenic emissions of greenhouse gases in the Russian Federation without land use, land-use change and forestry. Source: National Inventory Report, 2010.

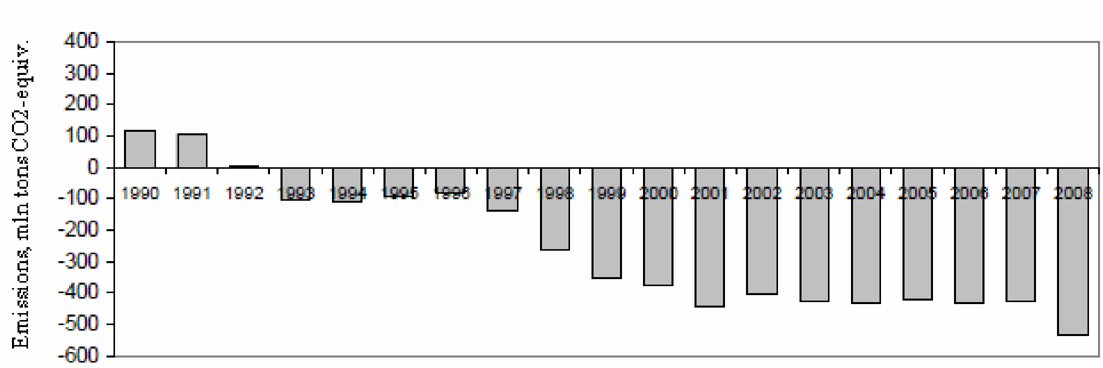

Figure 5. Dynamics of anthropogenic emissions and absorption of greenhouse gases in the sector "Land use, land-use change and forestry". National Inventory Report, 2010.

From 1990 to1998 there was a decrease of emissions in all sectors of Russian economy. This reduction was caused by general economic situation in the country at that time. In subsequent years, during the period of economic growth, a steady increase of emissions has been observed. In 2008, emissions increased by 13.0% compared to 1998 - a year with the lowest total emissions of greenhouse gases. However, the growth of emissions in the industrial sector has changed in 2008 with a certain decline - by 6.0% compared to the previous year.

The distribution of emissions by sector has been changed only slightly during 1990-2008 years. The energy sector dominates in the overall volume of emissions (in 1990 and 2008 it accounted for 81.5% and 82.2%, respectively). The share of agricultural sector decreased: during 1998-2008 years emissions' growth has not been observed (9.6% and 6.5% respectively in 1990 and 2008). The emissions associated with waste exceeded the level of the base year yielding 121.5% in 2008 compared to 1990 year level.

Total GHG emissions amounted to 2,228.89 mln tons CO2-eq. in 2008. This volume includes emissions from energy, industrial and agricultural sectors, as well as due to the use of solvents and other products and waste management. Total emissions in 2008 were significantly (32.9%) less than 1990-year level. In general, the growth rates of emissions observedin recent years were relatively low due to general increase in energy efficiency and due to the structural economic changes of that period, in particular, the increasing proportion of non-manufacturing sector in the Russian economy.

Dynamics of emissions in land-use, land use change and forestry is characterized by a clear trend of absorption increase and emission reductions during 1990-2008 years. This was caused by:

- reduction of emissions from arable lands in use (due to the reduction of the area of arable land, increase in average yields of most crops in recent years and, in general, lower levels of microbial respiration in agricultural soils as a result of low doses of organic fertilizers);
- accumulation of soil organic carbon on land converted from arable to forage due to the growth of their areas over the period.

3.2. GHG inventory emissions per type

Greenhouse gas emissions per type for the period 1990-2008 are presented in Fig.6. Amount of the provision of the first period of the Kyoto Protocol (annually determined minimum balance of units in the national registry) is 11 144 444 164 tons of CO2 equivalent.

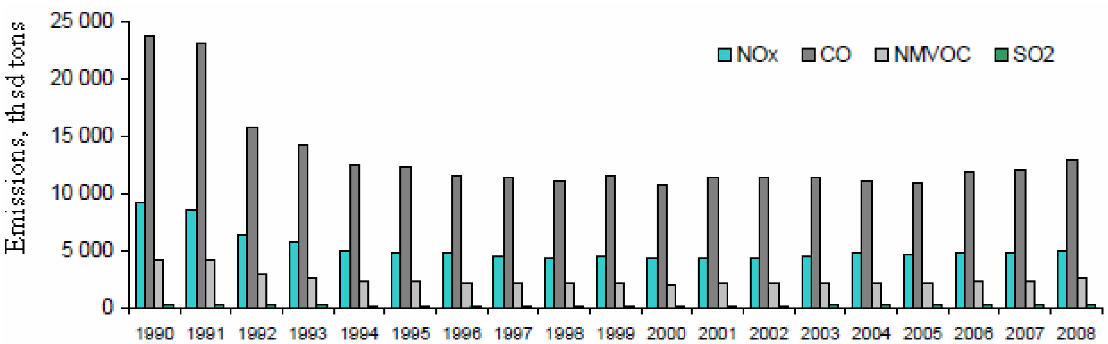

Figure 6. Total emissions of greenhouse gases with indirect effect in the energy sector. Source: National Inventory Report, 2010.

Emissions of gases of indirect effect have been declining in recent years. This can be explained by the fact that total consumption of fuels has not reached the 1990 level yet, due to increasing energy efficiency of the economy and improvement of gas cleaning systems and increased efforts to control environmental quality.

3.3. Information publicly available

Most information related to GHG emissions is obtained by calculation. Therefore. the main sources of information are the data from various statistical reports (Russian Industry 2005. 2010 http://www.gks.ru/bgd/regl/b10_48/Main.htm; Russian Statistical Yearbook 1998. 2005. 2006. 2007. 2008. 2009. 2010 http://www.gks.ru/bgd/regl/b10_13/Main.htm; Customs Statistics of Foreign Trade of the Russian Federation. 2009. Fuel and Energy Balance of Russia http://www.energystrategy.ru/editions/source/TEK-Rus_2000-2009_sod.pdf).
Relevant statistical information is also contained in the Fifth National Communication of the Russian Federation (http://unfccc.int/resource/docs/natc/rus_nc5_resubmit.pdf) and National Report on greenhouse gas inventory (http://www.climatechange.ru/files/NIR_RUS-2011_vol2_0.pdf).

4. Verification

4.1. Statistical methods for QA/QC analyses

Introduction in the Quality Assurance (QA) and Quality Control (QC)

Quality assurance and quality control of the national GHG inventory of the Russian Federation are conducted on a regular basis. Institute of Global Climate and Ecology coordinates the activities on quality assurance and control of the national GHG inventory. As shown in Figure 7. Federal ministries and agencies supply Institute of Global Climate and Ecology (IGCE) with data in the aggregated form. Accordingly, the primary procedures to verify the quality of these data are performed by the correspondent agencies by means of special internal techniques. In turn, IGCE performs a secondary monitoring and verifies the activity data. as well as parameters and calculations made on the basis of these aggregated data. The organizational chart and list of activities to ensure quality control and national GHG inventory of the Russian Federation are shown in Figure 8.

IGCE quality control procedures include:

- Formal control of the activity data parameters and calculations;
- Cross-checking of data parameters and calculations
- Verification of procedures for the collection and storage of activity data settings, payment and other materials, including information on inspections.

Formal control and cross-checking of activity data parameters and calculations are carried out by IGCE experts responsible for preparation of national GHG inventory. Mistakes made during data entry or due to using the wrong parameters and incorrect methods are identified and corrected. The list of correcting routines with correspondent requirements. frequency and responsible persons are defined by special Procedure "Assurance and Quality Control of the National Inventory of Anthropogenic Emissions and Absorption of Greenhouse Gases in the Russian Federation prepared in IGCE RosHydromet and Russian Academy of Sciences". For key controlled parameters the quality control is applied according to the Intergovernmental Panel on Climate Change (IPCC) Tier 2.

Quality assurance procedures are aimed at independent evaluation of the national GHG inventory to ensure its compliance with IPCC methodologies and the requirements of UNFCCC, as well as for the perfection purposes. Quality assurance is performed by attracting organizations and experts that do not participate in preparing the national inventory but possess a vast experience in the assessment of emission and absorption of greenhouse gases and are familiar with the IPCC methodology. Quality assurance process also involves organizations, ministries and departments that provide data for National GHG inventory. Public discussions of published materials by inventory specialists also contribute to the quality assurance process.

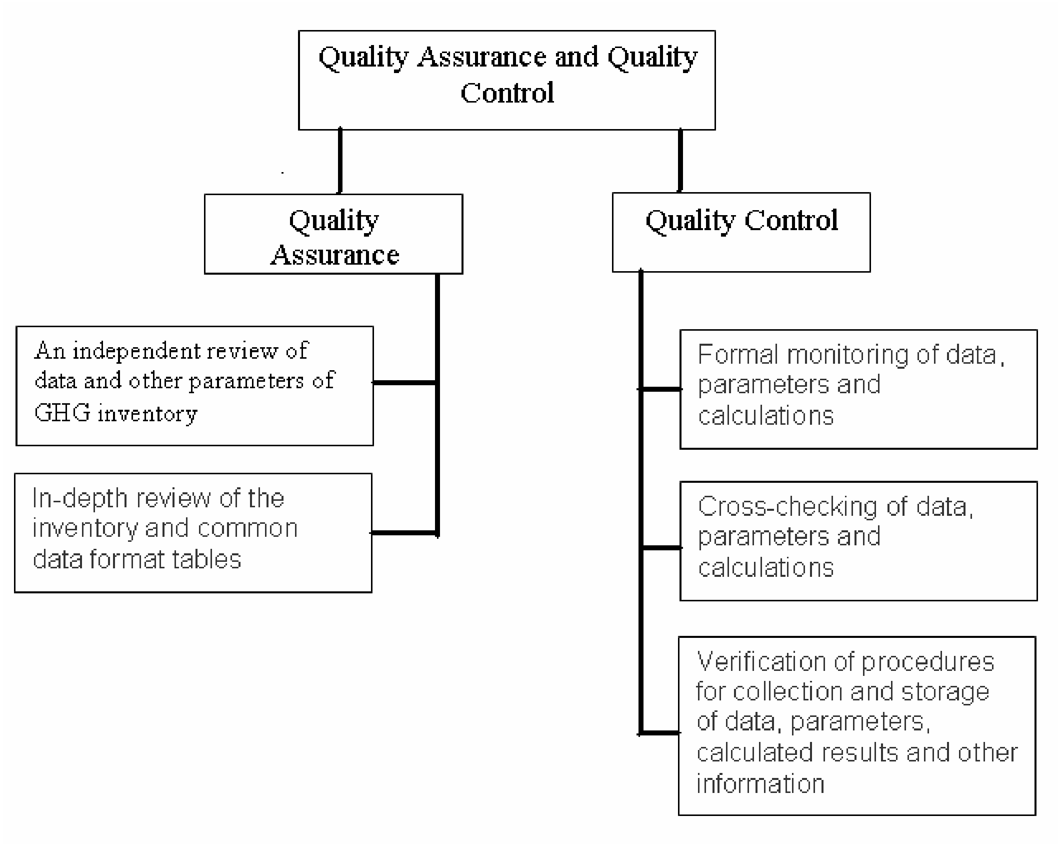

Figure 7. Quality assurance routines.
Source: National Inventory Report, 2010.

As shown in Figure 7 the quality assurance routines include:

- Reviewing the data parameters and other actual information contained in the National report on greenhouse gases inventory of the Russian Federation (the audit);

- An in-depth review of the national report and the tables of the common inventory report.

Reviewing the data settings and other actual information of the National inventory report on GHG inventory is an independent verification of the correct use of activity data and other information provided by organizations and agencies. The key aim of this verification is to identify errors and mistakes in the use of baseline data and to ensure the usage of the most recent and accurate data and parameters for calculations. Comments and suggestions from ministries, agencies and organizations are included in the text of National report on GHG inventory by IGCE. If necessary, the recalculation of the emission and absorption values takes place eventually.

An in-depth review of national reports and tables of the common inventory report presents a technical review and analysis of the methods, procedures, calculations and assumptions involved. as well as of the order of data presentation in individual sections within National inventory report on GHG inventory. An in-depth review is done by checking the documentation and by verifying the plausibility of assumptions used. transparency and completeness of the inventory, as well as its compliance with reporting regulations of the IPCC and the UNFCCC. In-depth review is carried out by independent organizations and experts that are not directly involved in the preparation of national inventory but have an experience in the assessment of emission and absorption of greenhouse gases and are familiar with the IPCC methodology.

Procedure "Assurance and Quality Control of the National Inventory of Anthropogenic Emissions and Absorption of Greenhouse Gases in the Russian Federation prepared in IGCE RosHydromet and Russian Academy of Sciences" also dictates the timetable of quality assurance and control process. This timetable is very detailed with respect to the type and timing of QA/QC routines and covers the period between the previous and subsequent National GHG inventory. QA/QC timetable corresponds to the plan of quality assurance and control which is required by relevant documents of the IPCC and the UNFCCC (IPCC. 2000 IPCC. 2003. and documents FCCC/SBSTA/2004/8, FCCC/SBSTA/2006/9). Due to the high costs certain types of quality control procedures for the IPCC Tier 2 are applied once in 2-3 years.

4.2. Calculation of data-verification indices

N/A

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15. Federal State Statistics Service, 2009. “Statistical yearbook of Russia 2009”, available at: http://www.gks.ru/free_doc.

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List of abbreviations

CD RF – Climate Doctrine of the Russian Federation

CDM – Clean Development Mechanism

CER – Certified emission reduction

CRF - Common Reporting Formats

EMEP - European Monitoring and Evaluation Programme

ETS – Emissions trading scheme

FEB – fuel and energy balance

FEC – fuel and energy complex

FFA - Federal Forestry Agency

FWCC - Federal Waste Classification Catalogue

GAW - Global Atmosphere Watch

GCOS - Global Climate Observing System

GDP – Gross National Product

GHG – Green House Gases

GLOSS - Global Sea Level Observing System

GOOS - Global Ocean Observing System

IGCE - Institute of Global Climate and Ecology

IOC - Intergovernmental Oceanographic Commission

IPCC - Intergovernmental Panel on Climate Change

JI – joint implementation

LULUCF - Land Use, Land-Use Change and Forestry

MW – megawatt

NIR - National Inventory Report

PPP – public-private partnership

QA - Quality Assurance

QC - Quality Control

RAAS – Russian Academy of Agricultural Sciences

RAS - Russian Academy of Science

RES – Renewable energy sources

RF – Russian Federation

RF – the Russian Federation

RosHydromet - Federal Agency for Hydrometeorology and Environment Monitoring

SOOP – The Ship Of Opportunity Programme

SRO – self-regulatory organization

UES – Unified Energy Systems

UNFCCC – United Nations Framework Convention on Climate Change

VOS – Voluntary Observing Ship Scheme

WMO - World Meteorological Organisation

National sources of available information

Type of data	National source	Notes	www
Popula-tion data	Demographic Yearbooks of Russia by Federal State Statistics Service	All needed data is available	www.gks.ru
Climate statistics	Database of RIHMI-WDC (All-Russian Research Institute of Hydrometeorological Information-World Data Center) V.M. Veselov- veselov@meteo.ru, I.R.Pribylskaya - i.r.pribylskaya@mail.ru	Precipitation, temperature, extreme events: long-term monthly data from 558 meteostations; additional procedures for averaging should be performed to control for spatial irregularity of meteostations Water resources – OK.	http://aisori.meteo.ru/ClimateR
Economy Industry	Federal State Statistics Service yearbooks	All needed data is available	www.gks.ru
Adapta-tion	Water Use: National Agency for Water Use is responsible for collection of data. Federal State Statistics Service use information from Agency when preparing yearly reports.	Water Use: there is no separate data for energy generation. Only 1993-2008 yearly timeseries, Agricultural/Industry/Households breakdown.	http://www.gks.ru/free_doc/new_site/oxrana/tabl/oxr_vod1.htm

Type of data	National source	Notes	www
General	Federal State Statistics Service	OK	
Transportation	Federal State Statistics Service, Office of Trade and Services Statistics, Akimova I.V. (495)607-45-12 Akimova@gks.ru	OK, 1970-2009, types of transport breakdown	http://www.fedstat.ru/indicator/data.do?id=31313
Policies and measures	Surface of Irrigated Land - Federal Service for State Registration, Cadastre and Cartography, Shubich Sergey Mikhailovitch - 526-76-91 rnd10818@rosreestr.ru Surface of forests – Federal Forestry Agency, Head of the Section of State Forest Register Kotsuba V.S - 8(499)230-87-72	Data on various “green tariffs”, quotas, and incentives is very diverse. There is no nation-wide green tariff policy, only local ones (like special biogas tariff in Belgorod) Irrigated Land – only 2009-2010 Surface of Forests – only 2009-2010 Failed to find data on arable land.	Irrigated land: http://www.fedstat.ru/indicator/data.do?id=38122 Forests: http://www.fedstat.ru/indicator/data.do?id=38196

Type of data	National source	Notes	www
Demand	Ministry of Energy, Federal State Statistics Service, Agency for forecasting energy balances in electricity	In Soviet Union during planned economy fuel balances were collected from 1968. With dissolution of USSR fuel balances were discontinued. In 2011 legislation was adopted, regulating preparing yearly nation-wide energy balances. Currently data needed to evaluate energy balances 1990-2011 is available in very diverse format in statistical yearbooks of regional branches of Federal State Statistics Service (there are about 83 branches). To synchronize series obtained from raw data with diverse structure we need to develop aggregating methodology (like those developed in Tacis projects EuropeAid/120746/C/SV/RU, EuropeAid/126554/C/SER/RU, only for aggregating data from 83 sources, not from 1 or 3). We have only one body which makes energy balances, but only for electricity sector - Agency for forecasting energy balances in electricity. They make yearly aggregated balance of supply and demand in electricity, with supply breakdown Hydro/Heat/Nuclear/Small Regional, without further dividing electricity from Small Regional stations to RES/Non-RES, etc. Demand is shown with one line, aggregated to total. Two other lines are export and losses. As we've already mentioned, there is no more detailed balances even in Ministry of Energy.	http://www.e-apbe.ru/