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Russian electric power production sector, related CO_2 emissions, potential for CO_2 sequestration

E. F. Zakharova

Institute of Nuclear Reactors, Russian Research Center "Kurchatov Institute", Moscow, Russia

(elena.zakharova@g23.relcom.ru / Fax: 007-095-1507540 / Phone: 007-095-1507540)

The paper discusses some characteristic features of Russian fuel and energy complex, distribution of energy resources and generating capacities from the point of view of possible implementation of CO_2 capture and sequestration (CCS) technologies for reduction of industrial carbon dioxide emissions. Effective and successful implementation of CO_2 sequestration strategy will be possible only with taking into account economical, geographical, regional, etc. details of the specific region.

Russia is the world's third (after USA and China) highest emitter of GHG, its share in the global GHG emissions is about 11 %. In Russia fossil fuel combustion leads to 98% of CO_2 anthropogenic emission, from which more than 30 % originates in power industry. The paper gives an overview of the current status of Russian electricity generation sector, structure of country's electricity and heat production sector, fuel mix, dynamics of electricity production and related CO_2 emissions over the last decade. Over the period 1990-2003 total GHG emissions and CO_2 emissions significantly decreased due to a drop in a final energy consumption, industry and agricultural production as a result of economic recession in Russia. Industrial CO_2 emissions in 2002 declined by about 37 % compared to 1990.

At the end of the year 2003, the installed generating capacity of the Russian power sector was 215,2 mln kW. From these 148,2 mln kW or 68 % belong to fossil-fuel power plants, 44,3 mln kW or 21 % - hydro power plants, 22,7 mln kW or 11 % - nuclear power plants.

Fossil fuel power plants provides 65% of electricity production in Russia, with natural gas dominating in fossil fuel mix for electricity production, its share is about 65%

compared with 29% of coal. Because of a substantial share of fossil fuel in electricity generation and a projected increasing role of coal in the fuel mix of power plants we need to analyse a potential of CO_2 capture and storage technologies to reduce CO_2 emission from fossil fuel fired power plants taking into account national conditions. We also consider nuclear power's contribution to reduce CO_2 emission from electricity production sector.

The CCS technology assumes that CO_2 captured on fossil-fuelled power stations will then be sequestered in natural geological formations or in the world ocean. Few options for underground CO_2 sink are being considered, from which disused gas and oil fields seem to be most attractive options for CO_2 sequestration.

In Russia, there is an abundant supply of geological formations, which theoretically could be used for CO_2 sequestration. Over 40 % of the world's discovered natural gas resources, near 12 % of the oil resources and about 16 % of proved coal resources are located in the territory of the Russian Federation. Since depleted oil and natural gas fields and unmineable coal beds are considered as possible sites for CO_2 storage, there is potentially a vast storage capacity in geological reservoirs for sequestration of anthropogenic $CO_{2,}$. Estimates of the potential capacity of depleted oil and gas reservoirs for storage of CO_2 have been made based on estimates of cumulative production and proven reserves of oil and natural gas. The overall capacity for Russian West Siberian Basin (depleted oil and gas field capacity combined) is estimated to around 177 Gt CO_2.

The paper considers what could be the potential problems with an implementation of CCS technologies for large reductions in power-related CO_2 emissions. The distances between points of capture and storage are very long. The potential sites for CO_2 sequestration (coal mines, depleted natural gas and oil field) are in the Northern and Eastern part of the country while the bulk of the installed generating capacities are located in the European part of Russia, which means that captured CO_2 would be transported for 2000-4000 km. It should be noted that the majority of national deposits of fuel resources are concentrated in West Siberia, which is characterised by bleak climate and rough terrain. These factors together with huge distance for transportation hinder exploitation of natural resources. These will also pose formidable obstacles for deployment of CCS technologies.