CAPTURE–TRANSPORT–STORAGE SCENARIO OF CO_2 EMISSIONS PRODUCED BY OIL-SHALE-BASED ENERGY INDUSTRY OF ESTONIA

Dr. Alla SHOGENOVA

Institute of Geology, Tallinn University of Technology, Senior Researcher, Ehitajate tee 5, 19086, Tallinn, Estonia, alla@gi.ee

Mr Kazbulat Shogenov (a), Ms Raisa Pomeranceva (b), Dr Filip Neele (c), Dr Chris Hendriks (d)

(a) Institute of Geology, TUT

(b) Latvian Environment, Geology & Meteorology Agency

(c) TNO, The Netherlands

(d) Ecofys International Bv

A reduction of 30% in greenhouse gas emissions by 2020, rising to 60–80% by 2050, is a new target in combating global climate change declared by the European Commission. Carbon dioxide capture and geological storage (CCS) is one of the options that will contribute to mitigating climate change. Industrial CO_2 emissions and opportunities for CO_2 geological storage in Estonia were studied together with other European countries within the framework of EU GEOCAPACITY and CO2NET EAST projects supported by the European Commission Framework Programme 6. Estonia produces the largest amounts of CO_2 emissions in the Baltic region, which is explained by oil shale combustion. Per capita CO_2 emissions in Estonia are one of the highest in Europe. Owing to the shallow sedimentary basin containing mainly groundwater suitable for drinking, the geological conditions are unfavourable for CO_2 storage in Estonia. The most favourable conditions for CO_2 geological storage in the Baltic region are in the Middle Cambrian reservoir in Latvia, with the estimated potential of 400 Mt of CO_2 in 16 large structures.

For economic modelling by the Decision Support System (DSS), two planned new blocks of Estonian Power Plants with the expected capacity of 300 MW each and annual CO_2 emissions of 7.7 and 3.3 Mt per year were taken. The anticlinal structures of Luku-Duku and South Kandava in Latvia were selected for the scenario crossing the Estonian–Latvian borders. These structures were determined by seismic investigations and studied by four (Luku-Duku) and five (South Kandava) boreholes. The top of the Cambrian aquifer is located at a depth of 1024–1053 m. The thickness of the reservoirs in the structures is 28–45 m, the area 50 and 69 km^2. The CO_2 storage capacity of the structures is 40.2 and 44 Mt of CO_2. The total estimated storage capacity of the Cambrian aquifer is about 84 Mt of CO_2, which will be enough for about 8 and 11 years at the two sites, respectively. The more optimistic estimated CO_2 storage capacity of these two structures (374 Mt) could be sufficient for about 40 years. CO_2 is assumed to be transported through the pipelines, which could be constructed along the natural gas pipelines routes. The estimated distance of transportation by pipelines is about 650–800 km. The oxy-fuel CO_2 capture technology employed for the modelling is one of the most advanced but the least tested and the most expensive technologies, causing the high price per one tonne of CO_2. The testing of this technology with oil shale is necessary before start of the project, as well as an alternative less expensive post-combustion CO_2 capture technology.