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PURPOSE OF THE WORK

The climate change and emission inventory for Turkey was prepared and published in 2007 as the First National Communication on Climate Change (Jan. 2007). Analysis showed that the total CO2 emission was 231 Mt according to 2004 data, which is about 0.9 % of world total. The emissions increased to 297.12 million tons of CO2 in 2008.

This paper gives assessment of possible geologic sites for CO2 storage and calculation of CO2 emissions from thermal power plants with capacities > 500 MW, cement factories, steel industry, sugar factories and refineries in Turkey. Coupling of CO2 emission data with site results in a decision to use the emissions from a cement factory which is about 130 km from the selected oil field, Cayalarbası. The cement factory does not have capture facilities yet, but during modelling it was assumed that CO2 is available at the factory sites [Okandan et al, 2009].

INTRODUCTION

When the CO2 emissions inventory is examined, thermal power plants, cement factories, iron and steel industry and refineries are the main sources where CO2 is emitted in large amounts in centralized locations. Emissions in transport and domestic uses are scattered sources and considered to be decreased by efficiency measures.

Figure 1. Emissions inventory for Turkey (TOIE: 2009)

MODELING RESULTS

The geological and numerical model of the field were created using Petrel- Eclipse software. After obtaining an acceptable history match, CO2 injection cycle continued for 20 years. Then the CO2 storage cycle started. Different scenarios were studied. The best scenario resulted in 2 million barrels of oil production during 8 years and 280 million Sm3 of CO2 to be stored during the next 12 years. It was assumed that the CO2 produced during the project will be re-injected using the recycling unit as taken into account during technical feasibility analysis.

The amount of CO2 that can be stored in the selected field can only handle the emissions from a cement factory which is about 130 km from the field. The technical and economic feasibility was based on this conclusion.

TECHNICAL AND ECONOMIC FEASIBILITY

The selected cement factory is about 130 km from the field (Figure 5). It was assumed that the CO2 will be available at the factory site so the feasibility includes the liquefaction process and transport using a pipeline or tankers. In Cayalarbası Field, there was a need for the drilling of new producing and CO2 injection wells were considered as well as compressors and the CO2 recycling unit.

Investment and operating costs for tanker transport was calculated as 34 million USD and 408 000 USD/month operating cost for tanker transport compared to 53.5 million USD investment cost and 414 000 USD/month operating cost for pipeline transport. So transport will be feasible because of the small amount of CO2 to be handled and the duration of the project. The economic analysis at 10 % discount rate showed that if oil is 1000/barrel it will be possible to inject CO2 and produce oil for 6 years. For CO2 storage period it is obvious that new incentives and mechanisms will be necessary to support the operating cost of storage operation.

CONCLUSIONS

- Assessments indicate Turkey is responsible only for the 1% of world CO2 emissions. Establishment of a Carbon Market is underway which will also specify the sectors and activities that will be included in the evaluations.
- The present study indicated that the known oil and gas reservoirs due to their small volumes can only accommodate CO2 emissions from small industrial sites.
- In such a case the transport of CO2 will be feasible by tankers as seen during this project.
- The natural CO2 reservoir, Dodan with the available large volume reservoir, presently 7 billion Sm3 volume is available, where storage may be considered.
- However possibilities of storage in deep saline aquifers must be considered and a possible pilot project will enable the parties to investigate its applicability.
- One critical aspect of CCS application is to set incentives for CO2 storage.
- The present now how on CO2 injection as gained from CO2 - EOR application in Bati Ramin will make the future CO2 storage projects easy to handle.