Geophysical Research Abstracts
Vol. 14, EGU2012-5109, 2012
EGU General Assembly 2012

Simulation of submarine gas hydrate deposits as a sustainable energy source and CO_2 storage

G. Janicki, T. Hennig, S. Schlüter, and G. Deerberg
Fraunhofer UMSICHT, Process Technology, Oberhausen, Germany (georg.janicki@umsicht.fhg.de, +49 208 8598 1295)

Being aware that conventionally exploitable natural gas resources are limited, research concentrates on the development of new technologies for the extraction of methane from gas hydrate deposits in subsea sediments. The quantity of methane stored in hydrate form is considered to be a promising means to overcome future shortages in energy resources. In combination with storing carbon dioxide (CO_2) as hydrates in the deposits chances for sustainable energy supply systems are given.
The combustion of hydrate-based natural gas can contribute to the energy supply, but the coupled CO_2 emissions cause climate change effects. At present, the possible options to capture and subsequently store CO_2 (CCS-Technology) become of particular interest. To develop a sustainable hydrate-based energy supply system, the production of natural gas from hydrate deposits has to be coupled with the storage of CO_2. Hence, the simultaneous storage of CO_2 in hydrate deposits has to be developed.
Decomposition of methane hydrate in combination with CO_2 sequestration appears to be promising because CO_2 hydrate is stable within a wider range of pressure and temperature than methane hydrate. As methane hydrate provides structural integrity and stability in its natural formation, incorporating CO_2 hydrate as substitute for methane hydrate will help to preserve the natural sediments' stability.
Regarding the technological implementation, many problems have to be overcome. Especially heat and mass transfer in the deposits are limiting factors causing very long process times.
Within the scope of the German research project »SUGAR«, different technological approaches are evaluated and compared by means of dynamic system simulations and analysis. Detailed mathematical models for the most relevant chemical and physical effects are developed. The basic mechanisms of gas hydrate formation/dissociation and heat and mass transport in porous media are considered and implemented into simulation programs like CMG STARS and UMSICHT HyReS.
By means of abstract scenarios, the effects occurring during gas production and CO_2 storage within a hydrate deposit are identified and described. The behaviour of relevant process parameters such as pressure, temperature and phase saturations is discussed and compared for different production strategies: depressurization, CO_2 injection after depressurization and simultaneous methane production and CO_2 injection.