The cost issue in capturing and storing co2

Science

One of the biggest challenges to projects focused on the capture and storage of CO_2 is the cost. In situ mineral carbonation is quite a new concept but it’s very promising. Nevertheless, transport and storage costs of ISMC are still much higher when compared with storage in sedimentary basins ($17/tCO2 against $8/tCO2). Considering a CO_2 capture cost between $55 and $112/tCO2, the total cost of ISMC will vary between $72 and $129/tCO2.

Compared to the price of CO_2 emissions at the European Union Emission Trading Scheme which is $7/tCO2, ISMC remains an expensive process. Emitting CO_2 and paying taxes is still cheaper than capturing and storing CO_2. Until market forces or taxes increase the price of CO_2 emission, there is no financial stimulus for ISMC. The costs of ex situ mineral carbonation are even higher and range between $50 and $300/tCO2. Since there are very few commercial applications of ISMC, the cost estimates are roughly based on pilot projects like CarbFix or laboratory experiments. Important issue with the costs based on the CarbFix project is the lack of compression costs in this project. In general, transport and storage costs of ISMC are higher compared to the CarbFix project due to this inclusion.

The total cost of ISMC depends on the amount of CO_2 injected and can be subdivided in capital costs and variable costs. The capital costs consist of equipment, installation, cost and design for both injection and monitoring wells, site screening, licensing and permit costs. The variable costs include electricity, water, operations and maintenance (2, 5% of the initial capital costs) and monitoring costs. (Elisabet Ragnheidardottir)All costs, expect for monitoring wells, site screening and monitoring, are CO_2 flow rate dependent. For the pilot program of CarbFix, all costs and operations are known, and the program is scaled to higher CO_2 flow rates to make realistic cost predictions for larger scale projects. At low CO_2 flow rates, capital costs dominate the project's total costs, at higher flow rates, the variable costs exceed the capital costs. It can be assumed that projects elsewhere in the world, would only be interesting if they receive CO_2 at high flow rates which makes the project strongly dependent on the variable costs. Electricity costs is the most dominant variable cost when the annual sequestered CO_2 is within the range of 50. 000 to 400. 000 tons of CO_2. When the 400. 000 tCO_2/year is surpassed, water costs will become dominant. The injection of CO_2 dissolved in water increases the energy necessary for injection considerably but is a more secure way of injection since water dissolved CO_2 is not buoyant.

Another advantage of ISMC in comparison with CO_2 storage in sedimentary basins is once the carbon is precipitated in a stable carbonate mineral, the CO_2 cannot re-migrate to the surface. This limits the risks of CO_2 storage drastically and eliminates all monitoring costs once mineral carbonation is confirmed. Especially at low CO_2 flow rates, monitoring and monitoring wells make up a big part of the costs.

These days much research focusses on designing capture ready powerplants and its economics. Those powerplants are more efficient and produce less CO_2 per unit of energy output. The biggest advantage is the decrease in capture costs, which make up 70% of the total costs of ISMC. Due to the need for a proper CCS technique, lowering the costs of ISMC may be the best solution. The slow pace of the mineral carbonization process and the need for enhancing the energy consuming chemical reactions are currently the most limiting factors for ISMC. Determining locations where natural features, for example geothermal gradients, contribute to the process, may be a good way to reduce costs. Other ways to reduce costs are implementing the production of sellable products in the process, the extraction of certain pollutants from the used gas or integration of different processes.