

MONGSTAD, Norway

An example of a full scale CCS plant

Norwegian power corporation Statoils project in Mongstad aimed at CO₂ reduction through CCS from a natural gas-fired power plant and a refinery. This project was as close as you can get to a facility projected at full scale with comprehensive and thorough estimates of investment and operating costs. *It should be noted that the project costs are not readily comparable to CO₂ capture from coal-fired plants.*

The investment and operating costs mentioned below pertain only to the capture stage. A number of other costs including construction of transport infrastructure, transport, injection, storage and monitoring of the captured CO₂ should be added for an accurate picture.

The projected CCS installations were designed to capture approx. two million tons of CO₂ per year of which approx. 1.2 million tons of CO₂ was from the power plant and about 0.8 million tons from the refinery. The project is described in detail in this [Masterplan](#).

We are talking about a mega project: "The capture plants studied in this report demand an area of approx. 150 000 m², corresponding to approx. 20 football pitches. The plants will require 55 MW of electricity, the equivalent of some 17 000 housing units." The plant would be equipped with some of the largest devices and mechanical components ever built. Cost and risk assessments for the investments point to a very high degree of uncertainty: "For projects in this phase the degree of uncertainty usually ranges in a -30% / +40% interval at an 80% confidence interval (the likelihood of occurring within the indicated interval). Risks in this project, however, are probably even higher since the project involves extensive use of new technology, a type of project that neither SH [StatoilHydro] nor the industry have relevant experiences with and because the project entails voluminous construction activities within an existing complex industrial plant already in operation." This may in practice mean that the investment costs might be up to 1.5 times higher than those provided below.

Investments

The investment requirements of CCS installations for the power plant and the refinery together are estimated at 25 billion current Norwegian kroner or €2.96 billion. 50% of these go to capture at the power plant, 20% go to capture at the refinery and 30% are common utility systems for both capture plants.

Operation

The annual operating costs (power, steam, chemicals, salaries, maintenance, service etc.) is estimated at between 1.0 and 1.7 billion Norwegian kroner or between €120 and €200 million in 2020. Energy costs represent 50-70% of the operating costs that will consequently vary in accordance with future energy prices.

Reduction Costs

Based on the estimated investment and operating costs Statoil estimates that total costs per captured ton of CO₂ would be around 1300 to 1800 Norwegian kroner or 154 to 213 euros (2008 price level at 7% discount rate). Costs of transporting captured CO₂, injection, storage and building of transportation infrastructure should be added to these numbers for a full cost estimate. If these are stipulated to be just 20% of the capture costs the CO₂ reduction costs in this case will land somewhere between 1560 and 2160 Norwegian kroner or €185 and 255 per ton. With the above-mentioned uncertainty (-30 / +40%) the range expands to 1100 and 3000 Norwegian kroner per ton of CO₂ or €130-355/tCO₂ or a mean value of some €240 per tonne of CO₂.

The calculations above do not account for the CO₂ emitted in producing and transporting the inevitable extra energy needed to capture CO₂. Mongstad indicates a significantly higher order of magnitude per ton of CO₂ reduced through CCS than the desktop reports suggest. In the long term the price could be even higher. Generally technological advances over time lead to a reduction of costs. In this case, however, the effects will be quite limited compared to the price increases that lie in the cards for key cost components of CCS: coal, gas, oil, steel, nickel, aluminium, cement etc. Furthermore it should be kept in mind that mega-projects (projects with investments of more than USD 1 billion) dependent on public funding have a tradition of budgetary underestimation compared to actual costs, as among others Danish researcher [Bent Flyvbjerg](#) has documented in several papers.

With a cost outlook for CCS like this it is no surprise that the economic stakeholders of the technology are doing what they can to make the public pay for development and dissemination of the technology.

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"Norway dropped plans for a full-scale carbon capture plant at its Mongstad refinery after cost overruns and delays, ending a project that was dubbed as the country's "moon landing" by Prime Minister Jens Stoltenberg." Read further here:

<http://www.bloomberg.com/news/2013-09-20/norway-drops-moon-landing-as-mongstad-carbon-capture-scraped.html>