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CCS FOR GAS-FIRED POWER STATIONS A BUSINESS ECONOMICS CASE[1]

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OVERVIEW

This article reviews a business economics investment analysis for a carbon capture and storage (CCS) project at the Kårstø gas processing plant in south-west Norway. We update an earlier analysis and critically review the methods used, not least for estimating costs. We differ from earlier analyses in that the case is very detailed. Cost estimates developed from a business economics perspective are also important in a socio-economic context, since they are crucial for the size of the subsidies required to ensure implementation of the project. On the basis of the analysis, we discuss the policy implications of CCS for gas-fired power stations in general and for Norwegian climate policy in particular.

Carbon capture from the Kårstø gas-fired power station will occur in a chemical absorption facility (post combustion). See [1]. The facility will be amine-based. With the gas-fired power station in full operation, the facility will typically be able to capture about 1.05 million tonnes of CO_2 per year. The actual capture facility will have a substantial power consumption, and will be almost as large as the power station itself. It has been evaluated and postponed several times by the Norwegian government because of its low cost-efficiency.

METHOD

We utilise standard business economics methods for valuation, including the calculation of abatement unit costs for the project. We differ from socio-economic analyses by also calculating the net present value of the project, with prices for carbon emission allowances applied as income. Substantial weight is given to cost estimates, where we adjust for normal estimation errors and upwards for cost inflation in the industry; see [2].

RESULTS AND CONCLUSIONS

Our conclusion is that CCS at Kårstø is a very unprofitable climate measure with low cost-efficiency. It will require roughly USD 1.7 billion[2] in subsidies, or about USD 136 million per annum. That corresponds to around USD 0.1 per kilowatt-hour for electricity generated by the power station. The abatement cost per tonne of CO_2 is around USD 340, or about 20 times the international price of carbon emission allowances and many times higher than alternative national climate measures.

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[1] We would express our thanks for rewarding conversations with and comments on the article itself from a number of key specialists in oil companies, rig contractors and oil service enterprises. Address for correspondence: Petter Osmundsen, department of industrial economics and risk management, University of Stavanger, NO-4036 Stavanger, Norway. Tel: +47 51 83 15 68. Mobile: +47 99 62 51 43. E-mail: Petter.Osmundsen@uis.no. Home page: http://www5.uis.no/kompetansekatalog/visCV.aspx?ID=08643&sprak=BOKMAL

[2] Monetary amounts have been converted from Norwegian kroner to US dollars at an exchange rate of NOK 1 = USD 0.17.

In the net present value calculation, we have entered the value of international carbon emission allowances secured on the volume of carbon emissions abated by CCS on the income side. We have also assumed 50 per cent uptime for the facility. The business concept of the gas-fired power station is primarily to be a swing generator, which takes advantage of market peaks by generating electricity when this is profitable and otherwise remaining idle (switching option). It will accordingly operate for only a limited period per year, which has also been confirmed by experience so far. It must be strongly emphasised that the estimates are uncertain on both income and cost sides, but the project is clearly very uneconomic in commercial terms.

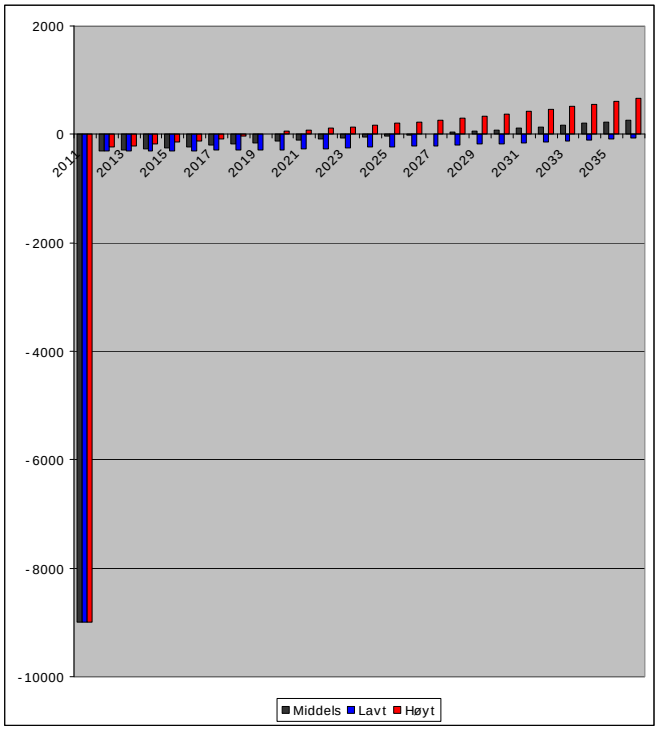

Fig. 1. The cash flow profile for the CCS project, with low, medium and high trajectories for the carbon price.

A key element in socio-economic analyses of CCS, which we have not discussed, is technology development. With such immature technology, large-scale testing is expected to provide useful learning effects. We do not believe individual companies will put great emphasis on this aspect in their profitability calculations. The gain lies too far in the future and is too uncertain, and it is unclear whether the gain will actually accrue to the company concerned. The extent to which this type of benefit will accrue to individual countries is also open to question in socio-economic terms, and it could be argued that technology development might be best achieved through more targeted research measures such as pilot projects. Caution must also be exercised on building learning curves only into favourite projects. Many other climate measures have a potential for learning curves, and a consistent comparison must be undertaken in this area. When looking at the most optimistic learning curves for CCS, it might also be appropriate to bear in mind that carbon transport and storage account for roughly a third of the investment cost. These are mature technologies, where the potential for cost savings is limited.

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