

# Options for reduced greenhouse gas emissions in the petroleum sector

**Climate Cure 2020 has studied measures for the Norwegian petroleum industry which in total could reduce greenhouse gas emissions by 5.5 million tonnes of CO<sub>2</sub> equivalents. While the estimated cost of these measures ranges from NOK 400 to NOK 4000 per tonne of reduced CO<sub>2</sub>, there is significant uncertainty regarding both the cost estimates and technological development. The measures are large, complex industry projects which will take time to realise. Estimates indicate that a reduction of up to 3 million tonnes could be accomplished by 2020.**

Under Climate Cure 2020, the petroleum sector comprises all petroleum facilities on the Norwegian shelf as well as the land facilities at Kollsnes, Sture, Nyhamna, Melkøya, Mongstad and Kårstø. Climate Cure 2020 has studied potential measures in three areas:

- energy efficiency
- electrification
- CCS - Carbon Capture and Storage

## Energy efficiency

In 2008, the petroleum industry was responsible for 27 per cent of Norway's total emissions of greenhouse gases. Most of the emissions are related to energy production.

The introduction of the CO<sub>2</sub> tax in 1991 led the companies to focus more on energy-efficient operations. Many CO<sub>2</sub>-reduction measures were implemented as a consequence of the tax. Reduced flaring and upgrading of turbines are examples of measures that have had a major beneficial effect.

It is still possible to reduce emissions by about one million tonnes of CO<sub>2</sub> equivalents through applying more energy efficiency measures, but this reduction has already been taken into account in the reference path.

## Electrification

In Climate Cure 2020, the Norwegian Petroleum Directorate (NPD) has updated the estimated costs of

### Climate Cure 2020

The mission of Climate Cure 2020 was to evaluate potential measures and policy instruments that could contribute to fulfilling the goal of reducing Norwegian greenhouse gas emissions by 15 to 17 million tonnes (including forestry measures) by 2020.

Climate Cure 2020 has used both sector-specific analyses of measures and instruments as well as macroeconomic analyses to shed light on what can be done to reduce national emissions. Menus have also been prepared to illustrate how some of these measures have been approached, and their consequences. Climate Cure 2020 makes no recommendations. Their work will form the basis for the Government's assessment of Norwegian climate policy, which will be presented to the Storting (Parliament) in 2011.

The Climate and Pollution Agency led the work, which was carried out in cooperation with the Norwegian Water Resources and Energy Directorate, the Norwegian Public Roads Administration, Statistics Norway and the Norwegian Petroleum Directorate.

measures discussed in the report *Power from land to the Norwegian continental shelf*, submitted in January 2008. This report attempted to quantify the costs of measures and resulting emission reductions that could be achieved by replacing equipment for electric power production on the facilities with power from land. The updated costs of measures for area electrification (southern, central and northern North Sea and Norwegian Sea) are estimated at between NOK 1350 and NOK 3100 per tonne of CO<sub>2</sub> reduced. The NPD has studied measures that could yield overall emission reductions of about 4.6 million tonnes. The updated analysis shows that the southern sector of the North Sea is the area with the lowest electrification cost, in part because several of the fields here have long expected lifetimes. As early as in 1996, the Norwegian Parliament resolved that power from land should be studied by developers and followed up by the authorities in connection with each new development on the shelf.

The NPD has also evaluated electrification of the land facility on Melkøya and parts of the Kårstø facility. CCS has also been considered for these facilities. These measures are mutually exclusive.

### **Carbon capture and storage (CCS)**

Climate Cure 2020 has studied the potential for emission reductions through carbon capture and storage on Melkøya, as well as for parts of the land facilities at Kårstø and Mongstad. For first-generation full-scale facilities, the costs of measures aimed at reducing emissions are estimated at NOK 1300 – 2250 per tonne CO<sub>2</sub>. The reduction in emissions by 2020, which is not already included in the reference path, is estimated at 0.6 million tonnes. However, these cost estimates are very uncertain, and there is a need to develop technology in all of the relevant projects.

The costs of measures for capture and storage of CO<sub>2</sub> from offshore emission sources have not been estimated. Earlier analyses indicate that the costs here will be significantly higher than for petroleum facilities on land. However, development of new technology could change the cost scenario for offshore CCS.

Using CO<sub>2</sub> to boost recovery from producing fields could provide a revenue component for CCS in Norway. High oil prices could make it profitable to inject CO<sub>2</sub> to improve recovery. This does, however, require stable access to large volumes of CO<sub>2</sub>, larger than Kårstø and Mongstad can provide. No assessments have been made of the possibility of using CO<sub>2</sub> for improved recovery in Climate Cure 2020.

### **Potential policy instruments**

To realise these emission cuts, it may be necessary to strengthen the use of policy instruments, or even introduce new instruments. One potential policy instrument is an increase in taxes. Another is establishing a climate fund with a pledge of emission reductions that the fund will be responsible for delivering. Greater commitments to research, as well as development of technology and expertise are also key elements towards achieving the emission reduction goals.

Many of the petroleum sector measures analysed under Climate Cure 2020 relate to fields currently in operation. These measures will be most effective if they are implemented as soon as possible. As Norwegian petroleum production will gradually decline, such measures would not be particularly relevant in a longer perspective. Emission reduction measures will have little impact in 2030 and beyond.

### **Questions can be directed to the NPD:**

- Bente Nyland, Director General  
tel.: +47 51 87 60 00, e-mail [bente.nyland@npd.no](mailto:bente.nyland@npd.no)
- Arne Holhjem, Director, Environment and Regulations  
tel.: +47 51 87 60 00, e-mail [arne.holhjem@npd.no](mailto:arne.holhjem@npd.no)