



Norway

Associated Gas Utilization Study

Perrine Toledano, Belinda Archibong, Julia Korosteleva
Thanks to Tom Mitro for his thoughtful review



Columbia Center
on Sustainable Investment

A JOINT CENTER OF COLUMBIA LAW SCHOOL
AND THE EARTH INSTITUTE, COLUMBIA UNIVERSITY

Summary of findings

Fiscal and legal
regulation for APG use

Regulatory Agencies

Proximity to markets for
APG and pipeline
network

No domestic power
need for gas

- The CO2 tax on gas flaring has been a powerful tool for regulating flaring and incentivizing Associated Petroleum Gas (APG) use in Norway .
- The Norwegian Petroleum Directorate (NPD) closely monitors the development of oil and gas fields strictly enforcing flaring prohibitions.
- The enforcement of this regulatory framework is however facilitated by the proximity to huge markets for natural gas combined with an existing gas pipeline transportation infrastructure that can access those markets. This makes the incremental investment to monetize the gas much smaller than in countries not located near large markets like such as in Africa. In the context of Norway, reducing flaring of APG is much easier and less expensive to achieve.
- Thus, as the third largest exporter of gas in the world, most of the APG produced in the country is transported to markets through an extensive pipeline infrastructure and exported mainly to EU nations.
- Domestic power need for gas is low. Norway sources about 95% of its power from hydroelectric sources.

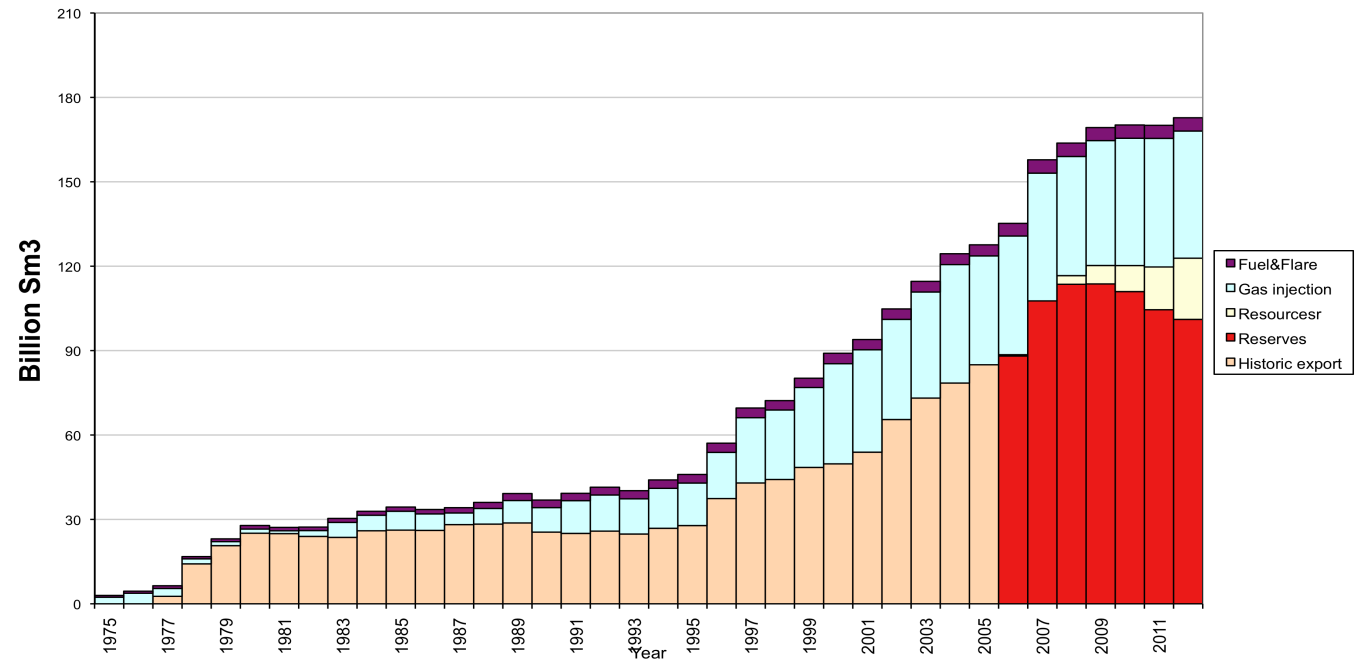


The statistics of APG flaring and use in Norway

Total Gas Produced by Use

Statistics on APG flaring

On the companies involved



Source: Norwegian Petroleum Directorate, 2008

- ◆ Norway is the world's 3rd largest gas exporter, with the majority of its exports to the EU. It is also the largest oil producer in Western Europe.
- ◆ Gas flared as of 2008, was as little as 0.16% of the total annual associated gas from oil production.



The statistics of APG flaring and use in Norway: Who is involved?

Statistics on APG
flaring



On the companies
involved

- Domestic company Statoil dominates oil and gas production in Norway with a number of International Oil Companies (IOC) including ExxonMobil, ConocoPhillips, Total, Shell and Eni having a significant presence in the natural gas and oil sectors in collaboration with Statoil



What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Government institutions involved in regulation of oil production/flaring

Description

Ministry of Petroleum and Energy (MPE)

It has the overall responsibility for the petroleum activity on the Norwegian Continental Shelf. It regulates the activity of oil and gas companies in accordance with the guidelines adapted by the Parliament of Norway.

Norwegian Petroleum Directorate (NPD)

The technical issues related to efficient petroleum resource management is the responsibility of the Norwegian Petroleum Directorate (NPD).

The NPD is administered by the Ministry of Petroleum and Energy, and advises the Ministry in matters concerning the management of the petroleum resources in the Norwegian Continental Shelf. The NPD holds all the important data of petroleum activities. The NPD has the authority to monitor the development of the different oil and gas fields and control flaring and venting during the oil production process.

Legal framework

Fiscal framework



What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

Oil operator	Government
<p>Measuring:</p> <ul style="list-style-type: none"> • Operators who are flaring and venting APG during operational phase are responsible for establishing the internal control system for ensuring compliance, such as obligation to check sensor calibration every six months. • Operators are responsible for keeping an emissions inventory with requirement to submit to NPD before March 1 of each year. 	<p>Measuring:</p> <ul style="list-style-type: none"> • NPD supervises internal control systems for operators to verify that petroleum activities are carried out in accordance with authorities' requirements and accepted by companies' criteria goals. • Also it observes (audits) the application of the equipment that measures quantity of gas used for flaring and venting.
<p>Reporting:</p> <ul style="list-style-type: none"> • Operating company that holds flaring permit has to submit a report to the state authorities , indicating the amount of gas flared daily. • Every six months it has to report on volumes of the flared gas for tax purposes. 	<p>Reporting:</p> <ul style="list-style-type: none"> • Obtaining and evaluating reports submitted by oil operators .



What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

Regulation on Gas Flaring/ APG use	Description
<p>Petroleum Activities Act (1996)</p>	<p>Bans flaring except with permission from the Ministry: <i>“Flaring in excess of the quantities needed for normal operational safety shall not be allowed unless approved by the Ministry” (Section 4.4):</i></p> <ul style="list-style-type: none"> •Associated gas utilization is required to get authority approval of the Plan for Development and Operation •Annual gas flaring permits •Avoid waste of petroleum and reservoir energy •Cold venting is not in accordance with the principle of environmentally prudent petroleum production

Source: NPD, 2008



What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

Fiscal Framework on Gas Flaring/APG use	Description
CO2 Tax	<p>Pursuant to the CO₂ Tax Act, the use of gas, oil and diesel in connection with petroleum activities on the continental shelf is subject to a CO₂ tax as of 1 January 1991.</p> <p>In line with Norwegian climate policy, the CO₂ tax for the petroleum activities has increased over the years and the fee is NOK 0.96 (~\$0.16 USD) per standard cubic meter (Sm³) of gas and liter of oil or condensate, effective 1 January 2013.</p>
Greenhouse Gas Emission Trading Act	<p>Norway is part of the EU's emissions trading system (EU ETS). This entails that the EU's Emission Trading Directive with associated decisions applies to Norwegian petroleum activities and those are therefore subject to mandatory allowances in line with the activities subject to mandatory allowances in the EU.</p> <p>The Greenhouse Gas Emissions Trading Act was enacted in 2005 and was most recently amended in April of 2011. The third emissions trading period started on 1 January 2013, and will run until 2020. As of 1 January 2008, the petroleum activities are subject to both a CO₂ tax and mandatory emissions allowances.</p>

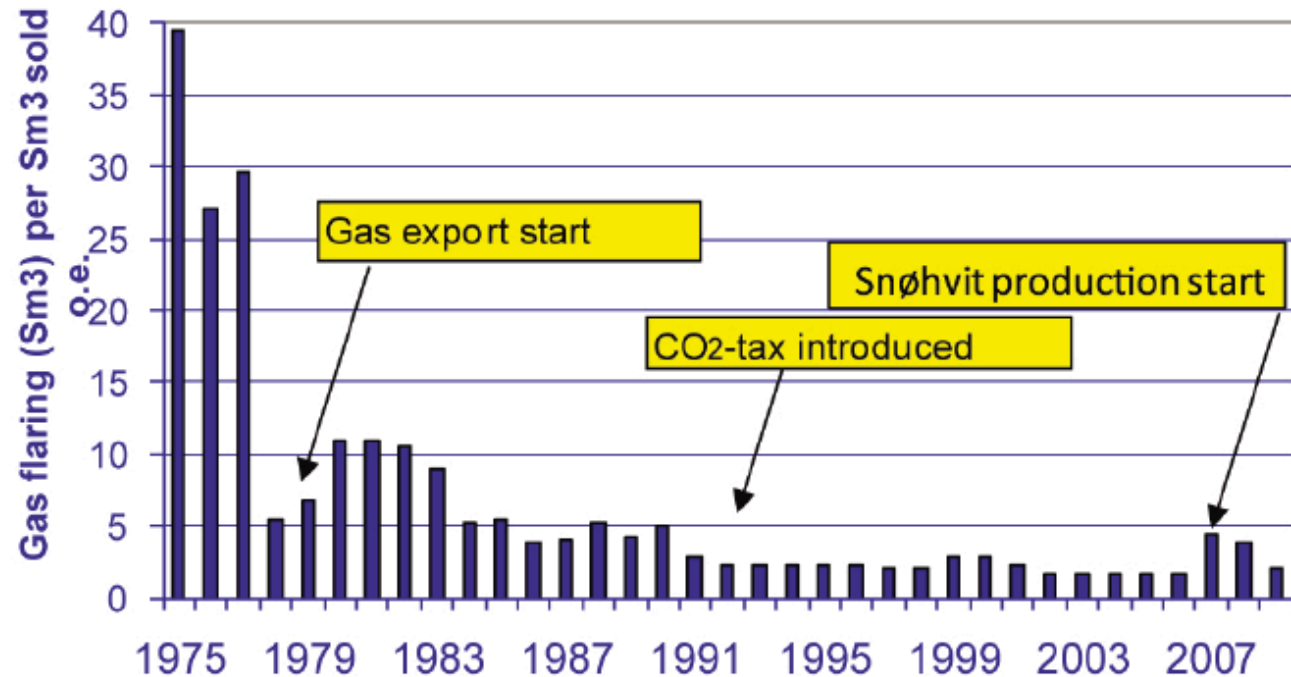


Gas Flaring Reduction from APG use for export and the CO2 tax

Gas reinjection

Technology

Pipeline network



Source: <http://www.npd.no/en/Publications/Norwegian-Continental-Shelf/No2-2010/Tough-line-pays-off/>

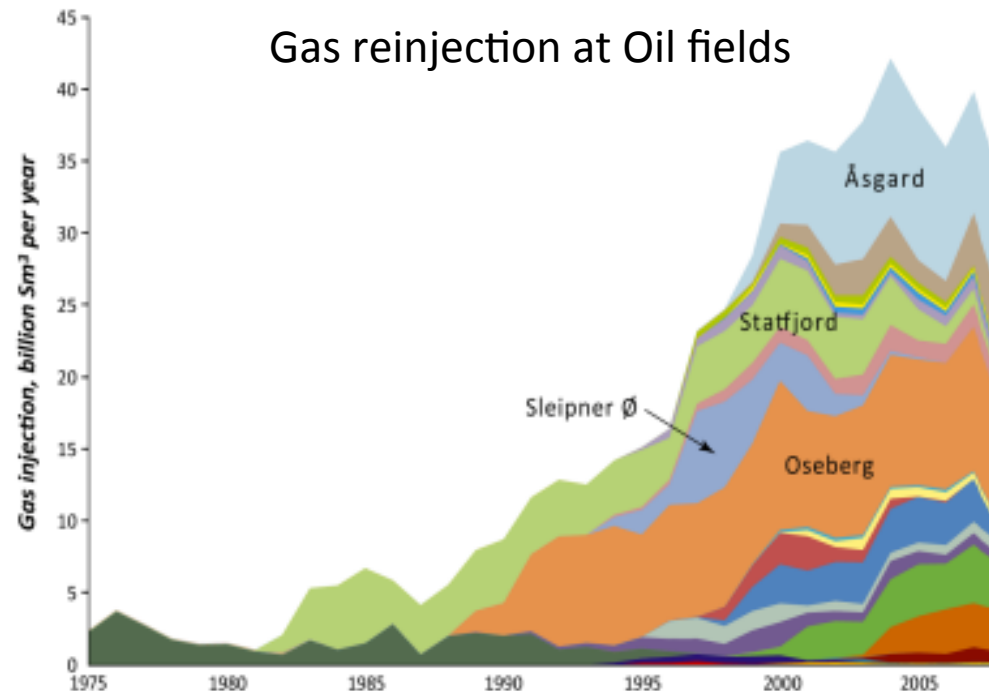
- Most of the APG produced in Norway is exported to the European market and this gas export, enabled by a strong pipeline network and proximity to market along with the CO2 tax over a decade later, has played a significant role in reducing gas flaring in the country (see slides 12-14).

Gas reinjection and EOR

Gas reinjection

Technology

Pipeline network



Source: Leif, H., & Steinar, N. (2010). *Utilization of associated petroleum gas - the norwegian experience*.

- The remaining associated gas that is not exported is, not surprisingly, re-injected. Enhanced Oil Recovery (EOR) effect of gas and APG reinjection is estimated to be 320 million standard cubic meters (Sm³) extra oil and condensate as of 2010.



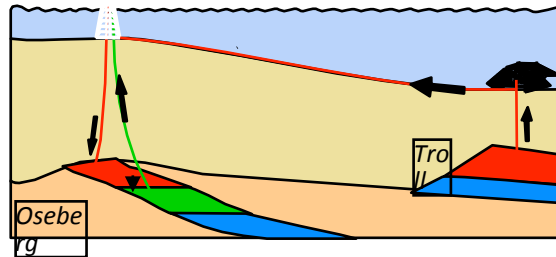
APG use Projects: Gas reinjection cases

Gas reinjection

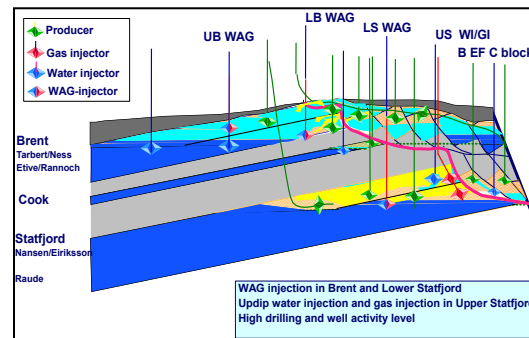
Technology

Pipeline network

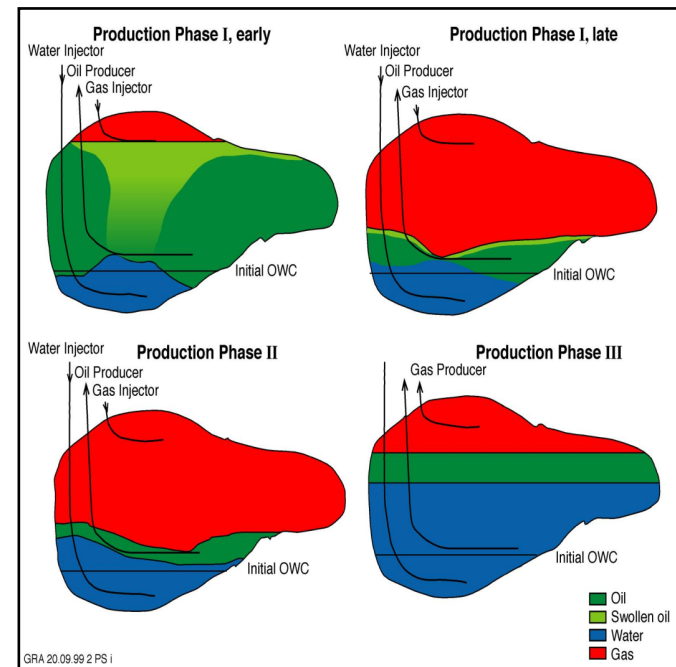
Togi



Statfjord



Grane



Source: Norwegian Petroleum Directorate, 2008

- Some examples of gas reinjection methods used include non-miscible injection (gas does not mix with oil, pressure in well enhances recovery), as in Grane above and miscible injection (gas is mixed with oil to reduce viscosity and increase pressure within reservoir for ease of recovery, more common than non-miscible, also recovers more oil), as in Statfjord field above.

Gulfaks project: Zero continuous flaring technology

Gas reinjection

Technology

Pipeline network

Project Participants:

- Statoil

Project Description and Motivation:

- Following the 1991 CO2 tax, Statoil through its Gullfaks oil field developed a system to end continuous flaring by recycling the flare gas. The flare ignition system was formed to ignite the flare in emergency situations.
- The technique that has been implemented on the North Sea Gullfaks field, involves routing gas which was previously flared back to an existing gas export system through a pipeline network with a valve which can quickly divert the flow to the flare stack if the pressure starts to increase.
- Since 1994, Statoil's Gullfaks A and C platforms have operated the first zero normal flare system.
- Since the technology was adopted on Gullfaks, it has been implemented in nearly 30 Norwegian offshore installations as well as in Azerbaijan, the UK and Angola, among others.

Project Technology:

- Primary elements of the new flare system include a high integrity flare opening valve, a flare gas recovery system, a flare ignition system and a high quality safety system.

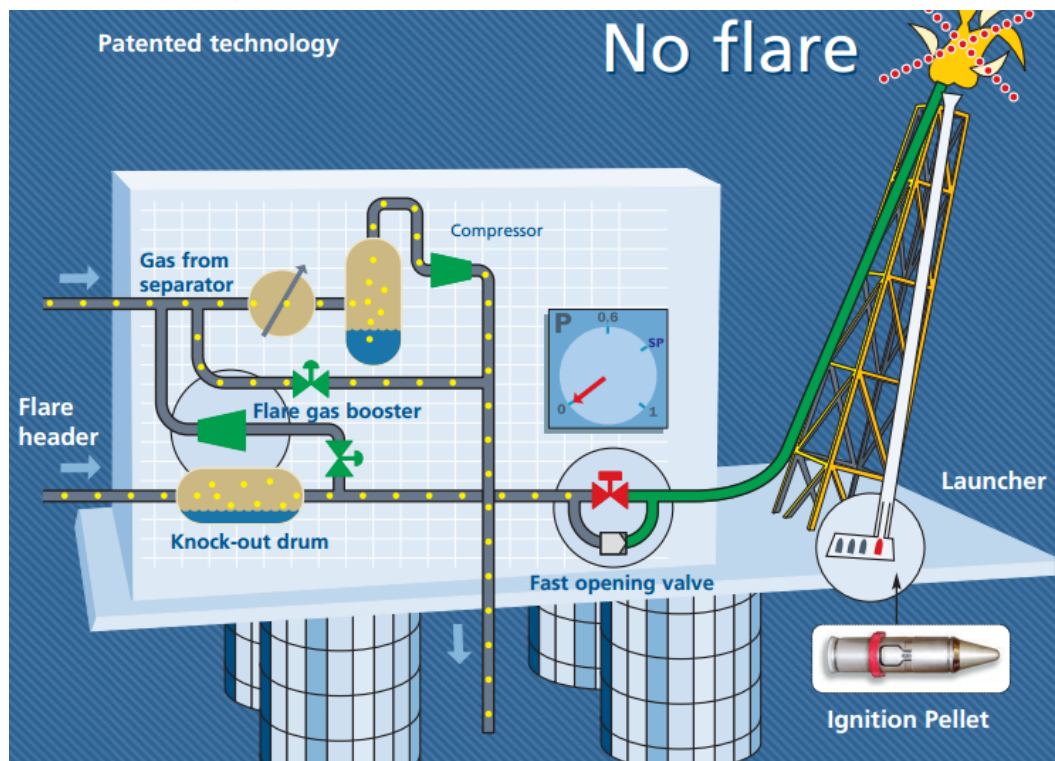


Gulfaks project: Zero continuous flaring technology

Gas reinjection

Technology

Pipeline network



Source: <http://intsok.no/style/downloads/Hamwor-PDF-Hamworthy.pdf>



Far North Liquids and Associated Gas System (FLAGS)

Gas reinjection

Technology

Pipeline network

Project Participants:

- Pipeline is operated by the Shell UK E & P division with Royal Dutch Shell and Exxon Mobil as partners

Project Description and Motivation:

- The FLAGS pipeline is a natural gas pipeline used to transport associated gas and liquids from multiple platforms. It was commissioned in 1982.
- Shell's Brent Bravo platform at the Brent Oil field is the pipeline's source and it ends at St. Fergus near Peterhead in Scotland.
- Associated gas from the Stratfjord oil and gas field is put through the Tampen pipeline (built in 2007) and from the Gjøa/Vega oil and gas field through the Gjøa pipeline (built in 2010). Both pipelines connect to FLAGS.
- The Tampen link enables gas transport from other fields in transit via Statfjord to the UK.

Project Location

- Northern North Sea

Associated Gas Use:

- Associated gas is transported through the FLAGS pipeline system from a number of oil fields for export to the UK.

Project Technology:

- Pipeline is a 36 inch steel pipe and is 280 miles long.



FLAGS and Pipeline line system – North Sea (as of 2009)

Gas reinjection

Technology

Pipeline network



Source: <http://nom.nb.no/eng/Economy-and-society/Gas-pipeline-agreements>



References

- ◆ "Far North Liquids And Associated Gas System (Flags) Pipeline -." *A Barrel Full*. N.p., n.d. Web. 01 June 2014.
- ◆ *Hinderaker, Leif, and Steinar Njå. "Tough Line Pays off." Norwegian Petroleum Directorate. N.p., 15 Dec. 2010. Web. 01 June 2014.*
- ◆ *Hinderaker, Leif, and Steinar Njå. "Utilization of associated petroleum gas - the Norwegian experience". Norwegian Petroleum Directorate, 2010.*
- ◆ *Hope, Thormod. "The Zero Continuous Flaring Technology". Statoil. 2009.*
- ◆ *Lavik, Hakon. "Gas Pipeline Agreements." / Economy and Society / Statfjord – the Giant Which Breaches Boundaries. N.p., n.d. Web. 01 June 2014.*
- ◆ *Nja, Steinar. "Gas Reinjection". Presentation at Workshop on "CDM Methodology Issues related to Gas Flaring". Norwegian Petroleum Directorate, 03 Dec. 2008.*
- ◆ *"Promoting Norwegian Oil and Gas Capabilities in International Markets." INTSOK. N.p., n.d. Web. 01 June 2014.*
- ◆ *Svensen, Thomas K., Sandra Simonsen, and Kristian M. Lind. "Oil and Gas Regulation in Norway: Overview." Practical Law. Thomson Reuters, 1 Apr. 2014. Web. 01 June 2014.*
- ◆ *"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." U.S. Energy Information Administration (EIA). N.p., 30 May 2013. Web. 01 June 2014.*

