

## OIL & GAS

# The Norwegian Oil Industry History and Climate Challenges

Statoil ASA, NORWAY

The Norwegian oil and gas industry has among the lowest CO<sub>2</sub> and Methane emission intensities worldwide. Norway has generally not had specific focus on reduction of Methane emissions for environmental reasons, but due to both strict safety regulations and use of high quality equipment, methane emissions from the oil and gas industry in Norway are estimated and measured to be low. We aim to focus on regulatory interactions between the authorities and the oil and gas industry.

Historically, the cooperation between the Norwegian authorities and the oil and gas industry has been close, and characterized by trust and mutual respect. Open communication about emission challenges in the oil & gas industry has led to implementation of impact-specific rather than concentrations-specific regulations by the authorities. Generally, this openness has led to both cost-effective and realistic regulations that the industry wishes to comply with.

### Norwegian Oil industry history, some highlights

#### 1960 Petroleum not believed to present at the NCS

1962 First application to the Norwegian authorities for exploration at the NCS

1966 The first well drilled in the summer of 1966, however, it was dry

1969 The Ekofisk field discovered.

1971 Production from the Ekofisk field started. This is still in production

#### 1972 Statoil was established.

Ten basic principles, *The 10 Norwegian Oil Commandments*, declared by the Government. These were adopted by the national assembly, including *National supervision and control, Petroleum discoveries must be exploited in a way which makes Norway as independent as possible of others for its supplies of crude oil. New industry will be developed on the basis of petroleum.*

1974 Discovery of the enormous oil field Statfjord

1983 Discovery of the enormous gas field Troll

1985 The Norwegian State's Direct Financial Interest (SDFI) established to represent the State owner interests in a number of oil and gas fields, pipelines and onshore facilities.

1991 The CO<sub>2</sub> tax was introduced to reduce GHG emissions from the Norwegian Continental Shelf (NCS).

2001 Statoil was listed on the stock market.

#### 2008 Assets worth more than NOK 6000 billion have been created by the Norwegian petroleum sector since 1960's

2009 NOK 3000 billion in current terms had been invested since early 60's. About 3 million barrels per day, Total petroleum production is likely to grow in the coming years, due to increasing gas production.

2013 Gas production will probably increase its share to more than 50 percent. Some early accidents gave focus to safety in Norway, which is the main reason for controlling our natural gas – i.e. methane – emissions.

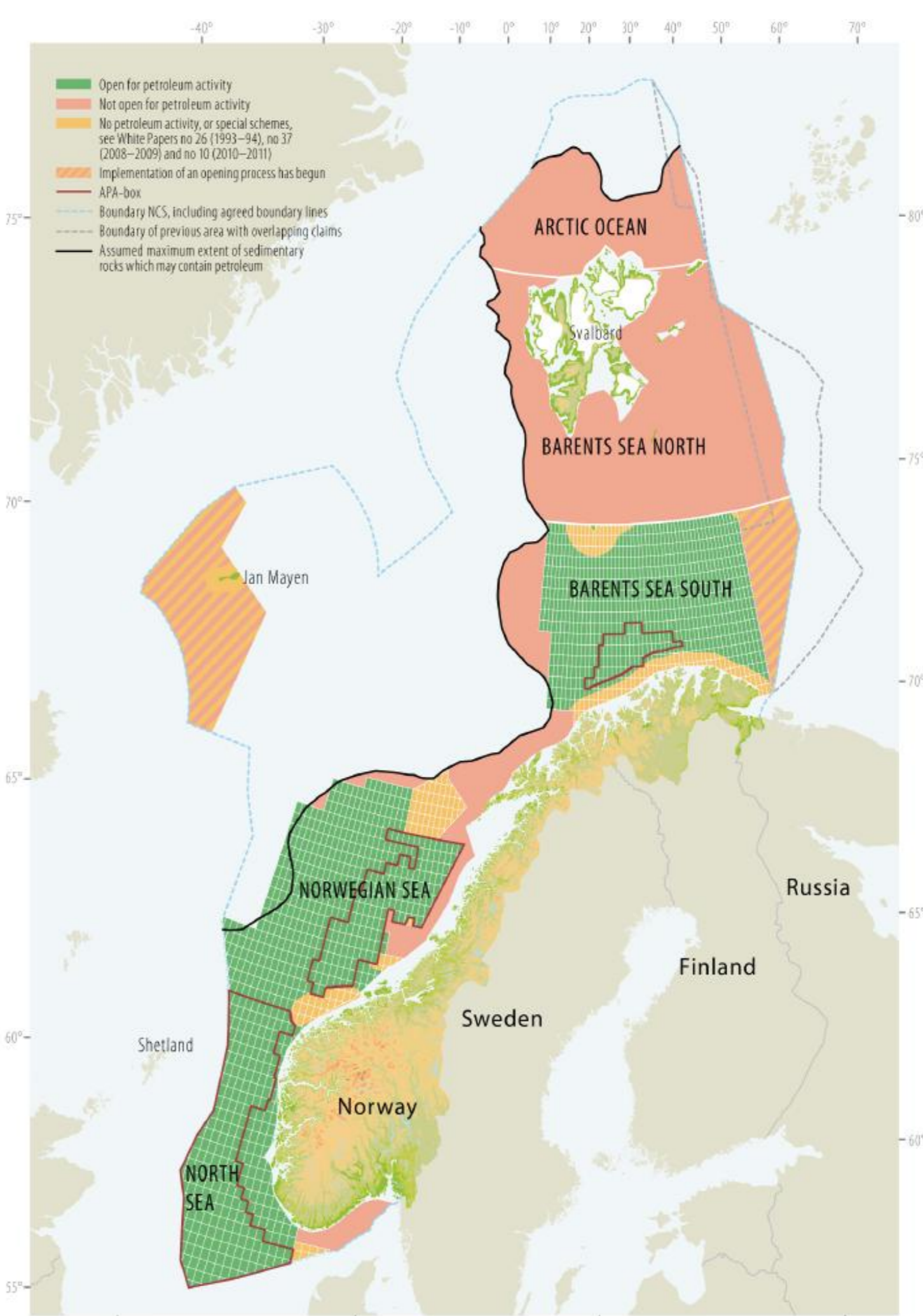
### Major players on the Norwegian Continental Shelf

Ministry of Petroleum and Energy  
The Norwegian Oil and Gas Association  
Norwegian Petroleum Directorate  
Oil & gas operator companies  
Ministry of The Environment  
Suppliers and service companies  
The Climate and Pollution Agency

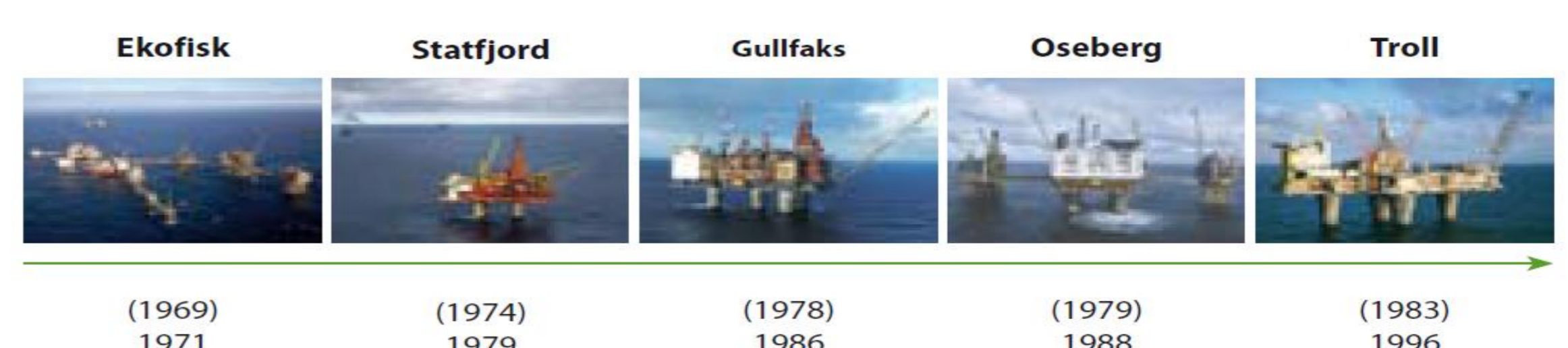
### Norwegian framework conditions

Some regulations that impact methane emissions and stimulate technology development:

- Emission permits
- Flare prohibition
- Safety regulations
- CO<sub>2</sub> tax and the EU Emissions Trading System

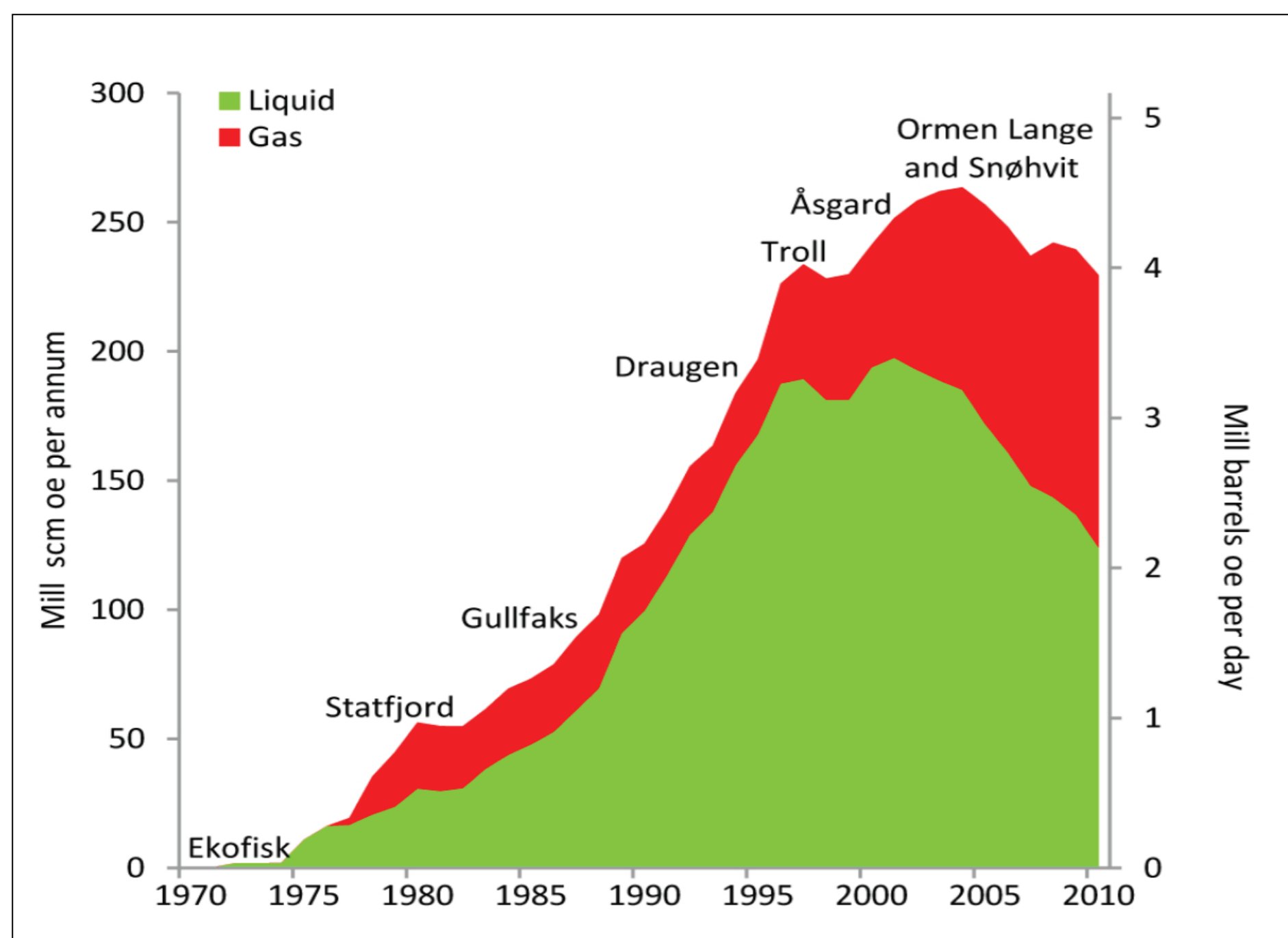


Source: Norwegian Petroleum Directorate



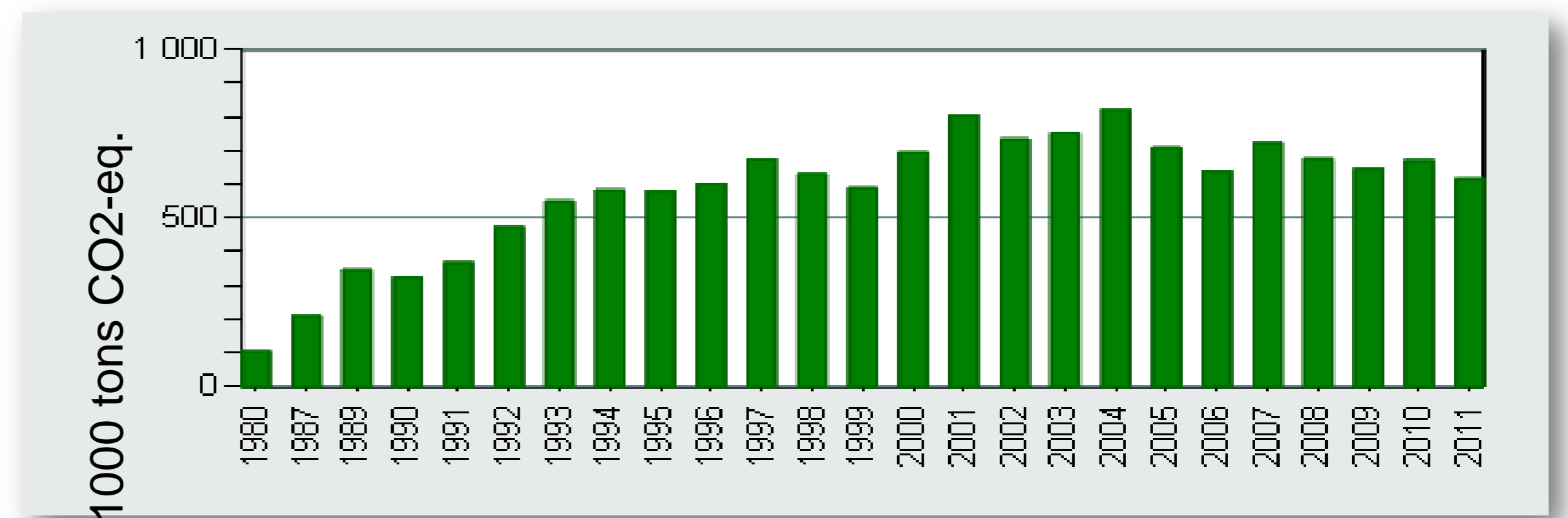


## Norwegian petroleum production 1970-2010



Source: Norwegian Petroleum Directorate, www.npd.no

## Methane emissions from oil & gas 1980-2011



Source: Miljøstatus i Norge (www.miljostatus.no)

### Total National emission of Methane in Norway

National emissions are reported annually by KLIF (State Pollution Control) to be 204.800 tons methane in 2011, out of which the oil and gas sector emits 13.7%.

The sources of emissions per oil and gas field are reported by OLF.

- Cold-venting and Fugitive emissions **65%**
  - Loading and storing **15%**
  - Other unidentified sources **20%**
- 2011 reported Statoil equity methane emissions**  
 20.220 tons, corr. to 425.000 tons CO<sub>2eq</sub>  
 Main sources of methane were identified to originate from
- Energy-production
  - Flaring
  - Diffuse sources, including cold venting (ca. 90 % of total emissions)

### 2011 OGP benchmark data for upstream O&G production

- Statoil 0.09 tons methane per 1000 tons production (o.e)
- Industry average 1.25 tons methane per 1000 tons production (o.e)
- Worst in class 14,26 tons methane per 1000 tons production (o.e)

### VOC-reductions on NCS (including methane)

VRU technology for loading operations. VOC recovery on FPSO's and shuttle tankers. One of the focus areas to reduce methane emissions within Statoil is the a VOC project performed over the last 10 -15 years. Technologies from this work reduce both methane and nmVOC (non-methane VOC).

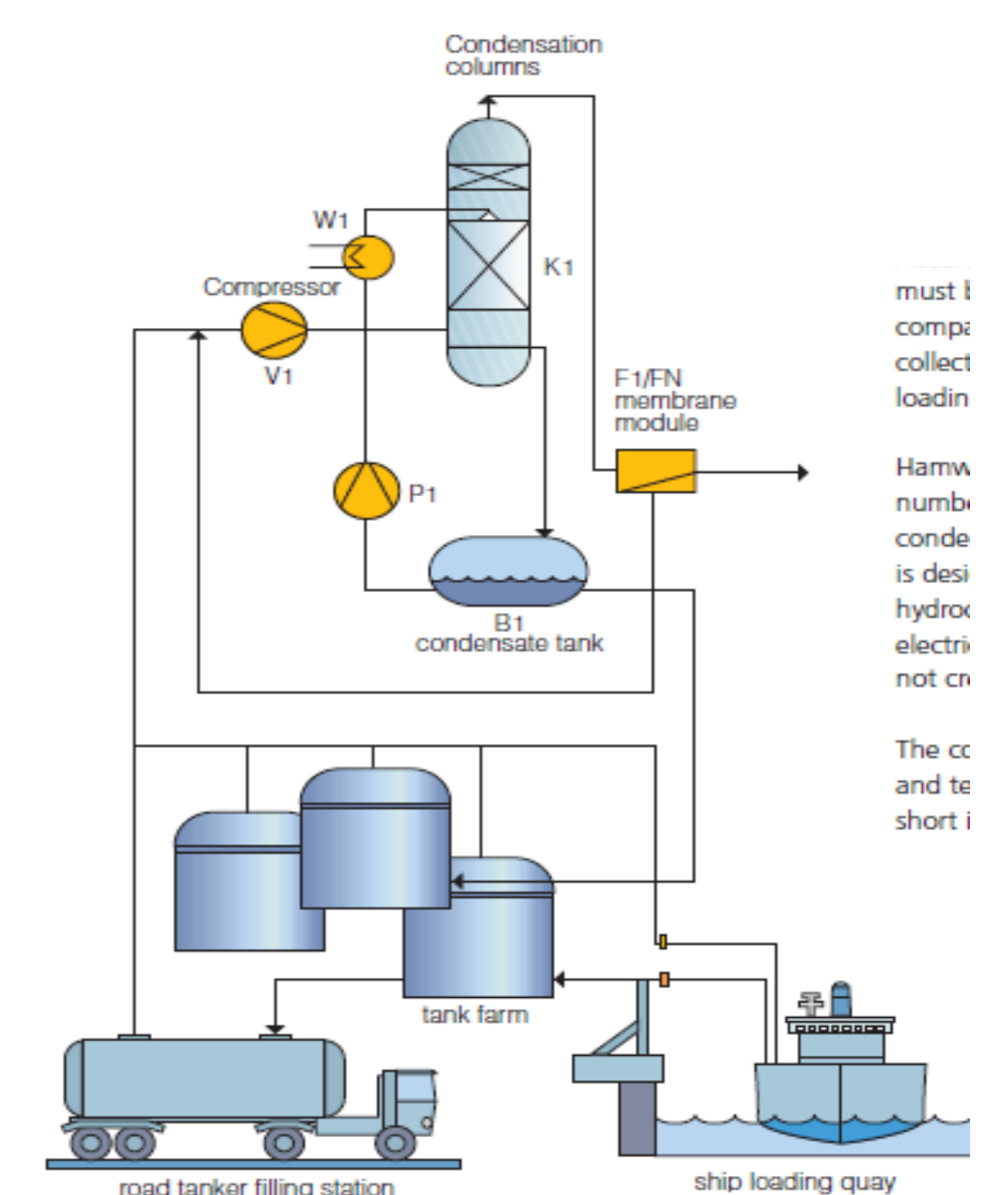
In particular, the applied VOC-reduction condensation-technology for loading near eliminate methane emissions from ship loading.

### Emission reductions from VOC projects

nmVOC 81 000 tons/y  
 Methane 2 300 tons/y

### Statoil's practices for mitigating methane emissions

- VOC recovery on FPSO's and shuttle tankers
- Implementation of gas leakage mitigation measures in our design criteria (collection of possible cold vents into a separate LP flare system, dry compressor seals, valve and flanges selection, e
- Leak and detection programs at our operational control facilities.
- Flaring reduction ignition system



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