Methane Emissions: Experience from the NCS

European Energy Forum
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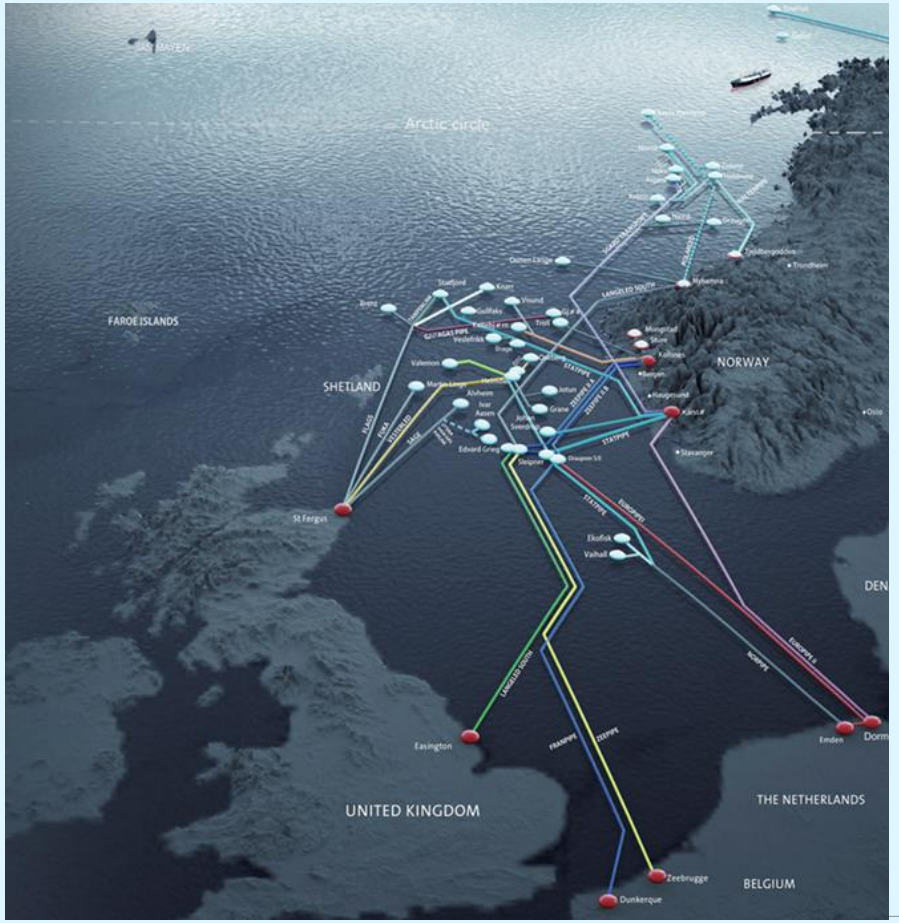
Near-zero methane intensity

Technology

Specific local factors

Regulation



Calculated by Equinor

Based on external sources

Upstream
Exploration, development and production

1.3 GHG intensity ($g\ CO_2e/MJ$) | 0.01 Methane intensity (%)

Midstream
Processing and transport

0.3 GHG intensity ($g\ CO_2e/MJ$) | < 0.01 Methane intensity (%)

Downstream
Transmission, storage and distribution

1.9 GHG intensity ($g\ CO_2e/MJ$) | 0.31 Methane intensity (%)

Greenhouse gas and methane intensities along Equinor's Norwegian gas value chain

Facility level measurements confirm low methane emissions

CCAC methane science study collected data from 21 offshore O&G installations

From the Abstract:

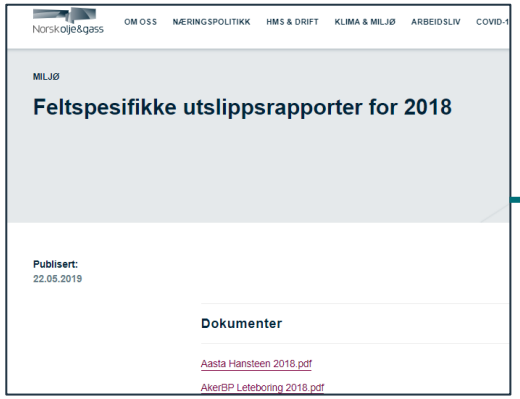
1. *The operator-reported facility-level emissions largely agreed with total measured fluxes (within 1σ error) for all facilities measured, with mean measured fluxes* ***16% lower*** *than those reported*

2*. In contrast, comparisons of facility-level measured emission rates with estimates from Scarpelli et al. show large discrepancies, with total measured emissions being* ***40% higher*** *than total inventory emissions estimates for all facilities surveyed (in aggregate).*

Measured emissions ***40% higher*** *than total inventory emissions estimates*

Theoretically modelled emissions
- *Emissions per field modelled from total emissions for O&G production reported by Norway to the UNFCCC*

Mean measured fluxes **16% lower** than operator reports



Annual data from operators to the authorities
- *Field-specific emission data*

Norway's national inventory report to the UNFCCC
- *Total O&G emissions (based on the field specific data reported from operators)*

MRV | Norwegian Regulatory framework a collaborative effort with industry

Legislative act M-107

- obligation to report emissions to air, including methane emissions
- all operators must submit an annual report to the Norwegian Environment Agency

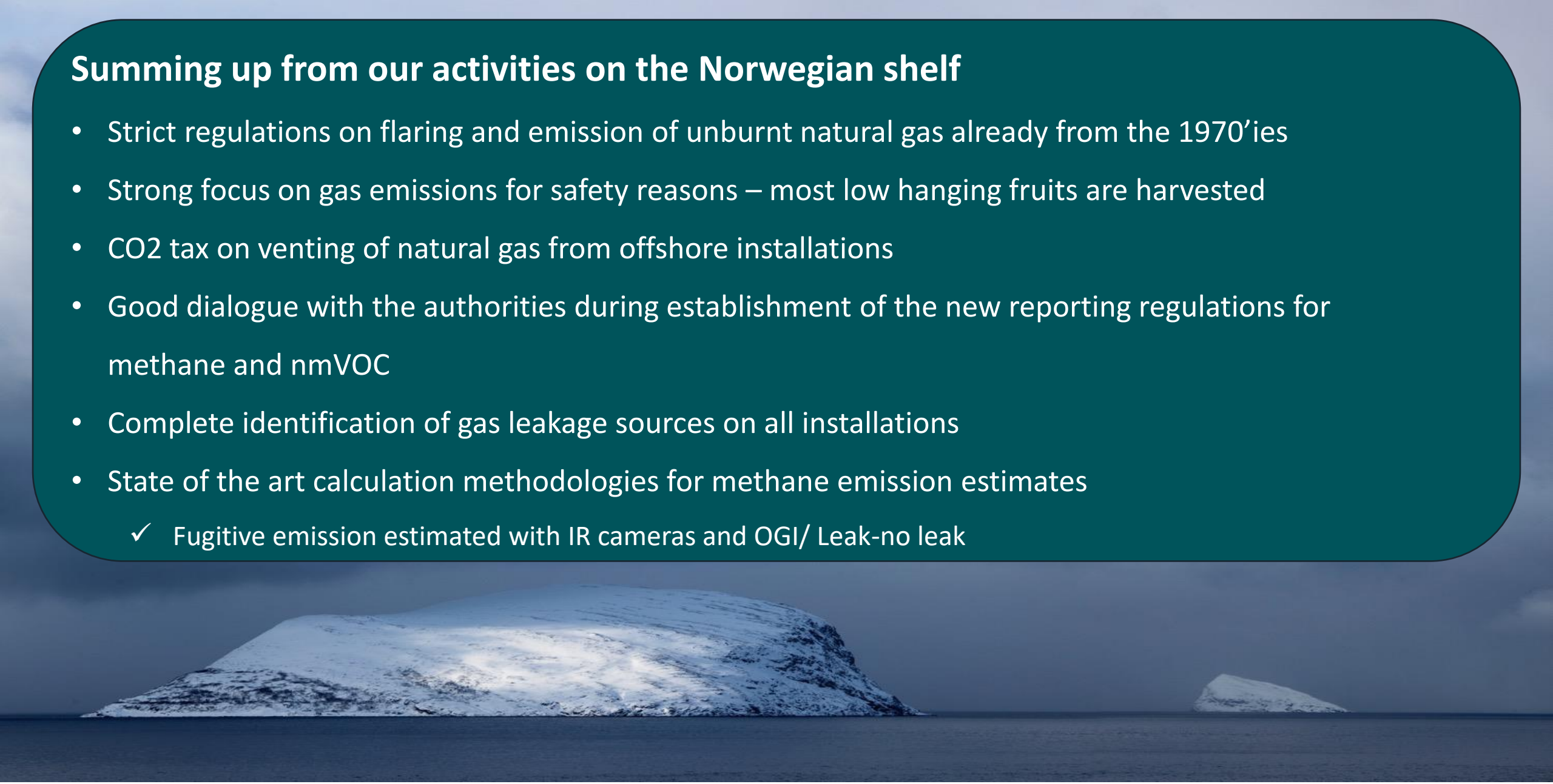
Industry guidelines ensure consistent reporting and quantification:

- **Guideline 044 Recommended guidelines for emission and discharge reporting**
  - developed by the Norwegian Oil and Gas Association (NOROG) in cooperation with the authorities
  - ensures consistent emission and discharge reporting from all licenses
- **Appendix to Guideline 044 Handbook for quantifying direct methane and NMVOC* emissions**
  - models for calculating direct methane and NMVOC emissions
- **Optical Gas Imaging (OGI) "Leak/no-leak" method for quantification of small leaks and fugitive emissions**
  - industry template
  - describes how LDAR can be used to quantify emissions, not only reduce

* non-methane volatile organic components (NMVOC)

Summing up from our activities on the Norwegian shelf

- Strict regulations on flaring and emission of unburnt natural gas already from the 1970'ies
- Strong focus on gas emissions for safety reasons – most low hanging fruits are harvested
- CO2 tax on venting of natural gas from offshore installations
- Good dialogue with the authorities during establishment of the new reporting regulations for methane and nmVOC
- Complete identification of gas leakage sources on all installations
- State of the art calculation methodologies for methane emission estimates
  - ✓ Fugitive emission estimated with IR cameras and OGI/ Leak-no leak



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