



Regulations for associated gas in Norway



Associated gas



- Norway <. 5 large onshore gas processing gas for processing natural gas from the offshore gas fields, but what about the associated gas from oil fields?
- Flaring of gas is prohibited since 1971
- No development of an oil field without a solution for disposal of gas other than flaring (Petroleum Act § 4-4)
- A driving force for the development of gas infrastructure offshore

Options:

- Export by pipeline to connect to larger gas pipelines (if not directly to gas processing plants onshore)
- On site energy source (combustion in gas turbines)
- Gas reinjection into reservoir (permanent or temporary)



Regulatory (flaring) history - Norway

- Flaring of gas (normal operation) is prohibited since 1971
- Oil field not developed if plan does not include a solution for disposal of gas other than flaring (Petroleum Act § 4-4)
- Flaring still necessary in emergencies and for some maintenance operations. The Petroleum authorities (Norway) issue yearly permits for certain amounts of gas to be flared for this purpose
- The CO₂-tax (from 1991) – and later the quota-system both provide incentives to further reduce flaring
- Although flaring is limited to shut-downs/start-ups/pressure relief for maintenance/process disturbances, there is still potential for further reductions

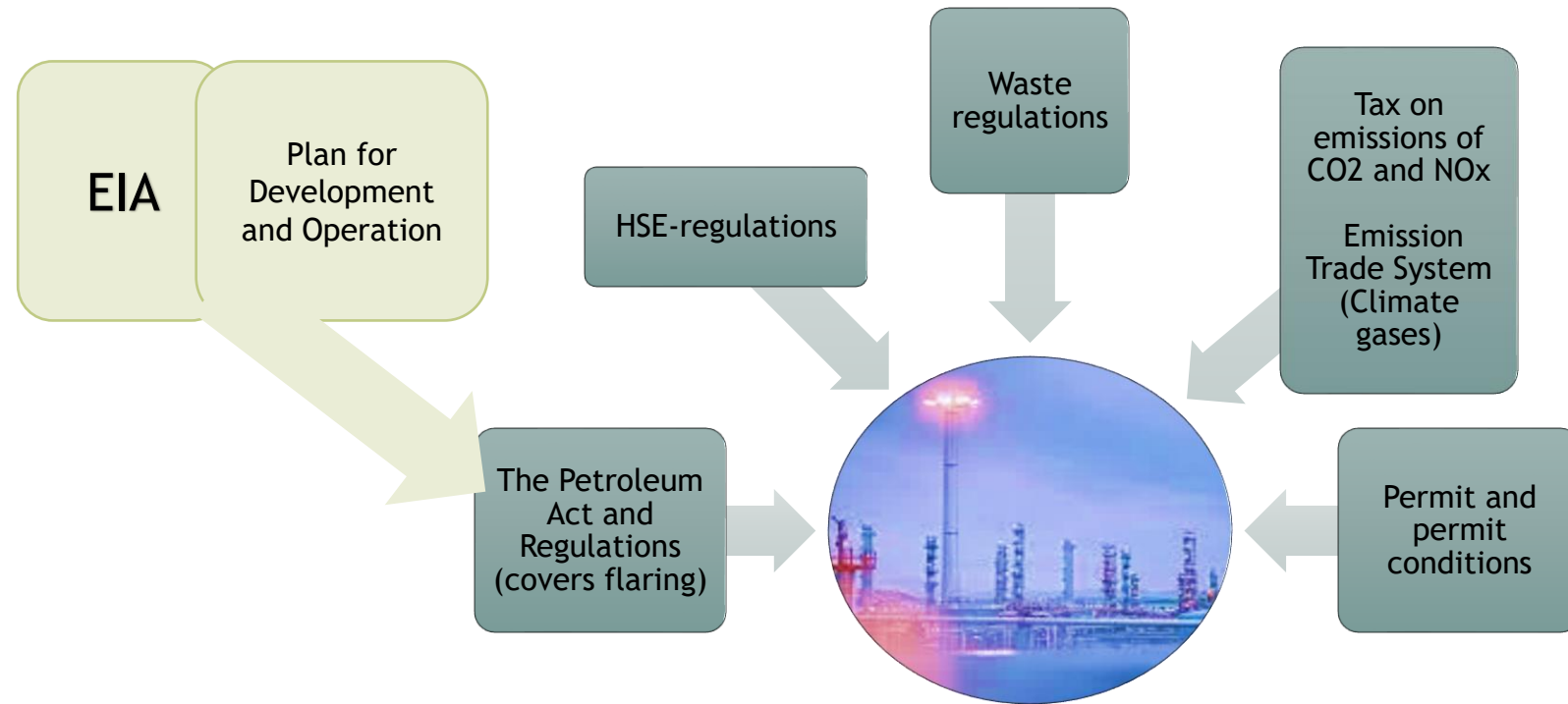


Emission sources

- Besides flaring, venting and fugitive emissions are widely recognized as significant sources of GHG emissions and air pollution
- Other emission sources subject to regulations in gas processing: fuel combustion (turbines/engines), SRU, loading operations
- Methane highly in focus, but CO₂, VOC, SO₂, NO_x, H₂S, Hg, BTEX (benzene, toluene, ethylbenzene, and xylenes), and n-hexane must also be controlled



Environmental regulatory framework for (il and gas activities





BAT is the key word for the regulators



- We put most efforts into ensuring BAT is selected when a new project is being planned (the EIA scoping process)
- Modification of existing plants to BAT-level for new plants can have high abatement costs
- All processes generating waste streams shall be considered

BAT for TEG regeneration (methane and BTEX reduction):

- ✓ **New facilities:** Recovery of waste gases both from the degassing tank and boiler
- ✓ **Existing facilities:** Recovery is technically possible, but can have high abatement cost

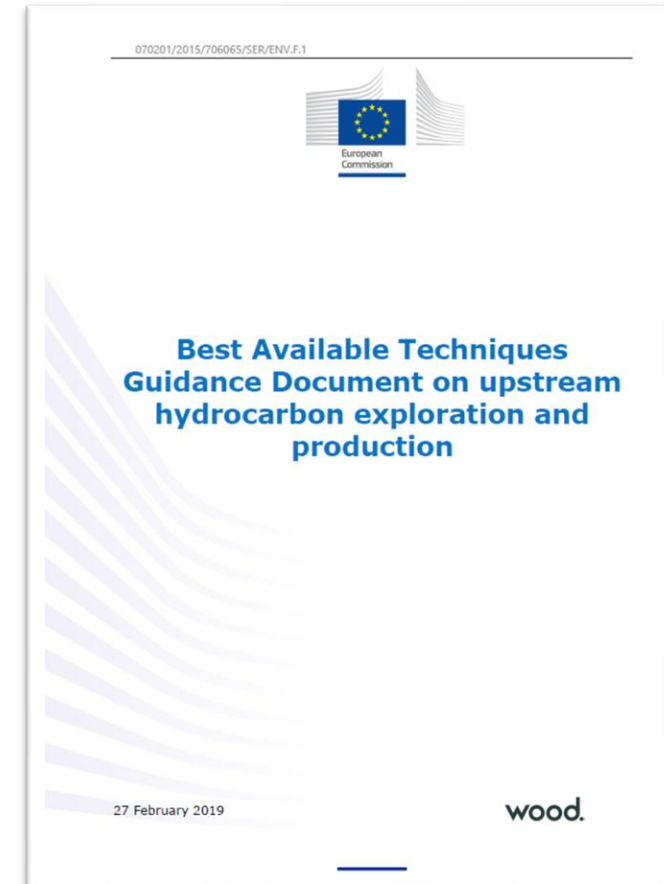


How to assess BAT ?



Norway: EU-regulations apply

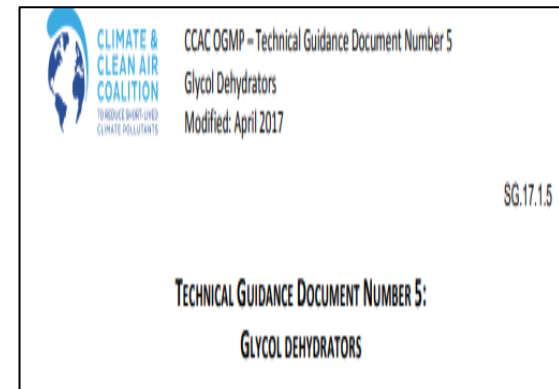
- The European Commission (EU) develops BAT-Reference Documents (BREFs) and BAT-conclusions
- BREF describes and evaluate Best Available Techniques (BAT) and associated emission levels:
<https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/best-available-techniques-bat-reference-document-refining-mineral-oil-and-gas-industrial>





Other BAT-documents/technical guidances

- Guidance Document from The Climate & Clean Air Coalition and Oil and Gas Methane Partnership:
<https://www.ccacoalition.org/en/resources/technical-guidance-document-number-5-glycol-dehydrators>
- The main principle is to recover (or flare) waste gas from the unit



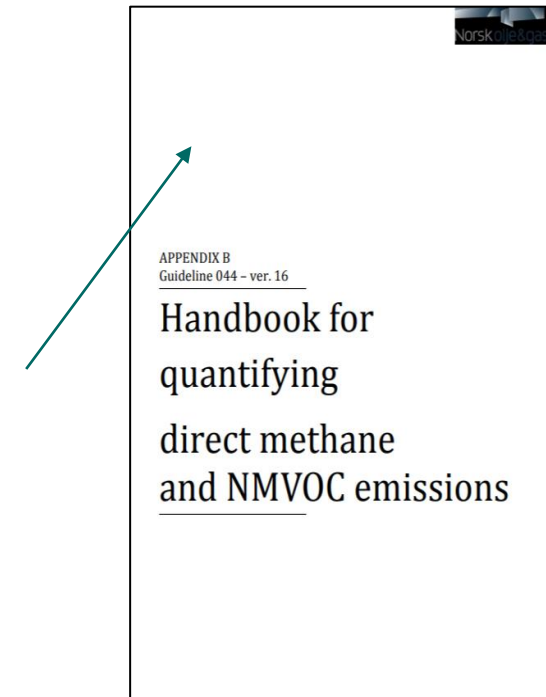


Reporting guidelines on venting and fugitive emissions (direct emissions)

Norwegian requirements (regulations) :

Reporting on methane and NMVOC from the oil and gas sector shall be undertaken in accordance with:

- Quantification methodologies for upstream oil and gas described in the Norwegian Oil and Gas Association "Handbook for quantifying direct methane and NMVOC emissions", Guideline 044, Appendix:
<https://www.norskoljeoggass.no/contentassets/cd872e74e25a4aadac1a6e820e7f5f95/044---appendix-b-voc-emmissions-guidelineline.pdf>
- Quantification methodologies in BAT conclusions for refineries (2014/738/EU) for onshore facilities (i.e. BAT 6, see section 1.20.6)





Compliance Monitoring

Good relationship and dialogue between operators and regulators. The regulator's role is to be clear and professional.

Compliance monitoring is based on:

- ✓ Operator submit yearly (detailed) report to the Environment Agency) comprising emission inventories, results of monitoring/measurements, chemicals and energy, any non-conformity incidents and more
- ✓ Audits and inspections (not necessarily at fixed frequency, but priorities based on risk)
- ✓ Campaigns (letter campaigns where operators shall answer specific questions)



Newly proposed regulations (EU and US)

- Purpose: to control emissions of methane from crude oil and natural gas extracting and pipeline transport of natural gas and distribution
- Regulatory approach: strict regime for leak detection and repair, calculations and reporting, verification by measurements (OGI)
- The regulations will obviously level playing field for the gas producers, but it will also be demanding for the authorities to follow up, as it prescribes how often we shall carry out inspections and receive and respond to reports





Regulations on NO_x and SO_x emissions to air

Combustion (gas turbines and boilers) :

Regulated by standards (concentration limits) as found in the EU BREF for Large Combustion Plants (LCP) and refinery BREF

BAT=Low-NO_x burners for boilers and dry-low emissions (DLE) gas turbines (new installations)

Bubble principle for refineries (all combustion sources excluding flaring): A limit for total emissions per year (tonnes/year) within the bubble can be considered for NO_x and SO_x, but should be based on each unit operating optimally.



Heights of stacks for emission of SO₂, NO_x etc. shall be decided on the basis of ensuring sufficient dispersion and compliance with environmental/health quality standards for ambient air



Discharge of water

- All waste streams shall be treated before disposal
- The EU BREF documents stipulate standards (concentration limits) for a long range of chemical parameters:
 - e.g. TOC, oil, benzene, NH₄ + ...
- The standards reflect the optimal effect of wastewater treatment plants (and considering the receiving environment)





Carbon capture and storage – one technique used for climate gas mitigation

- Two gas facilities in Norway are capturing CO₂ from the produced natural gas by using amine technology, and the captured CO₂ is disposed in geological formations (1000-3000 m below the seabed) for final disposal.
- By using this technique; 1,5 mill tonnes CO₂/year are geologically stored instead of being emitted to the atmosphere.

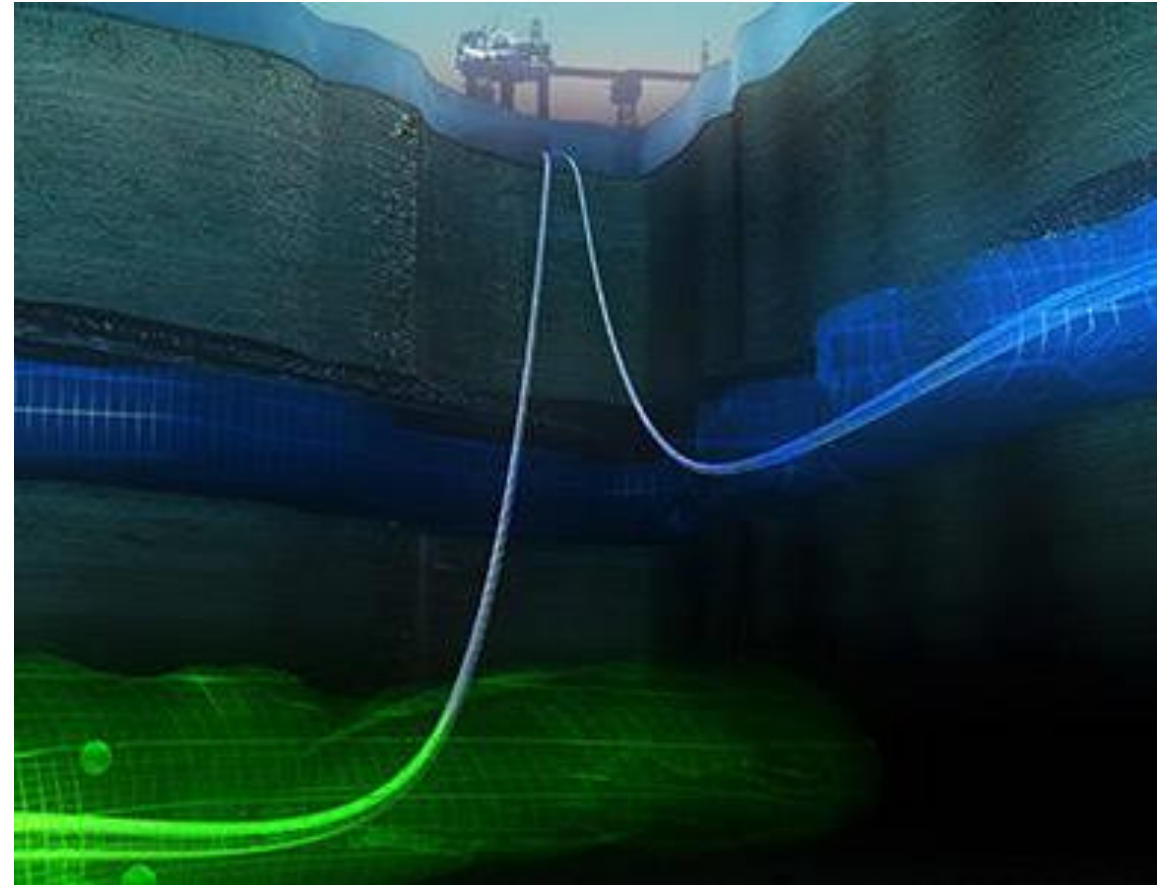


Illustration: Steipner