Methane emission regulation and management in Norway

What we would like to address today

- Methane emissions in context of GHG performance
- Methane regulations and industry guidelines for offshore Oil & Gas production in Norway
    - MRV and LDAR
    - Fit with OGMP 2.0 framework
- Equinor's views and recommendations

O&G emission | CH_4 emission account for around 4% of total GHG annual emissions

Norwegian Offshore Petroleum Industry (2019)

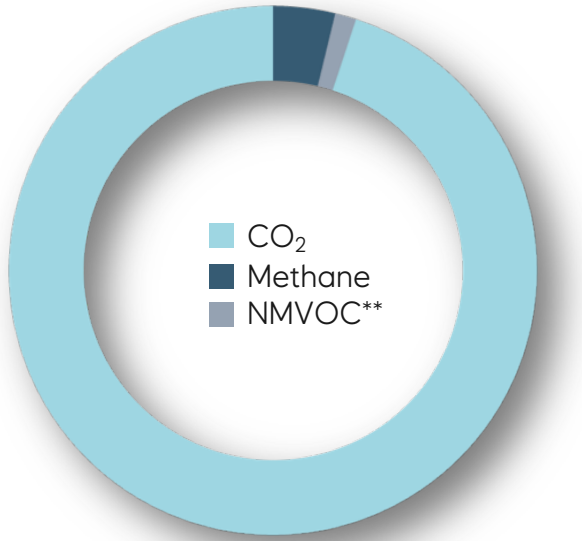
- **CO_2 ~= 10.7 million tonnes/year**

  Power generation and safety flaring

- **CH_4 ~= 0.32 million tonnes/year CO_2e***

  Venting, leaks, loading operations and incomplete combustion

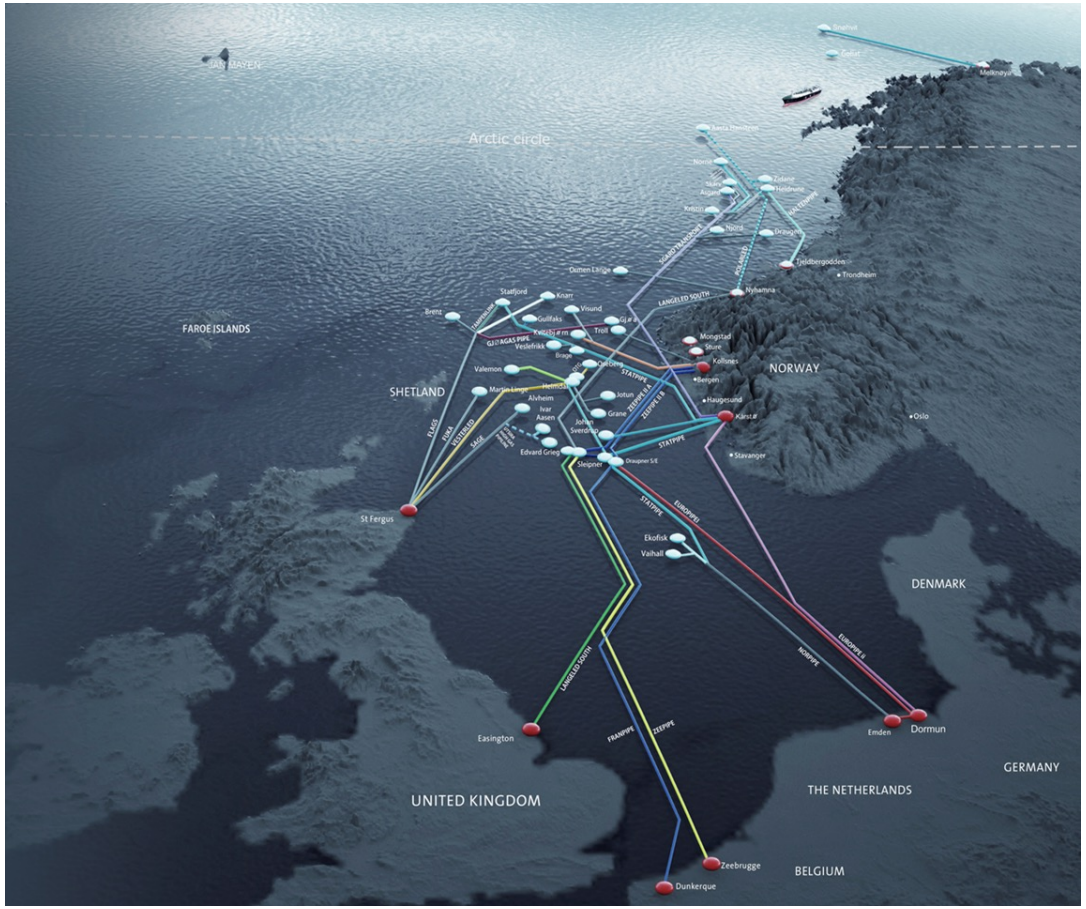
GHG emissions at the NCS are mainly CO_2



*Assumes a GWP of 25

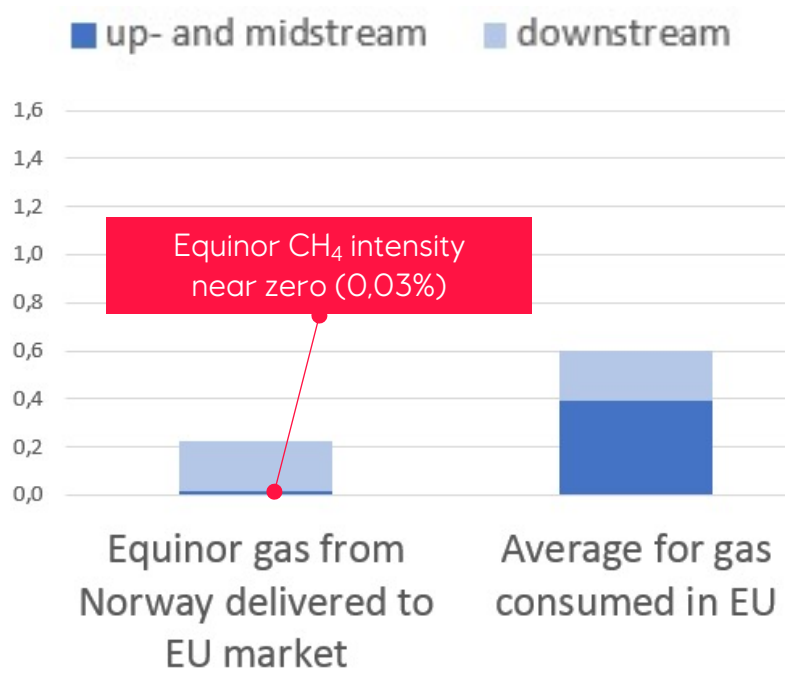
** Non-Methane Volatile Organic Compound

CH_4 Emission intensity | Norwegian production to EU customers below 0.3%



Picture: Gassco

Gas value chain loss (%)



Sources: Statoil 2017, NGVA/thinkstep 2017

Context | CH_4 regulation needs to be seen in context of entire NCS regulation

Design and operational practice

- By design, associated gas is marketed, re-injected or utilized (mandatory for a "Plan for development and operation" to be approved)

Ban on routine flaring since 1970

- Gas flaring and venting, beyond what is necessary to ensure safe operations, is not permitted pursuant to the Petroleum Act, without approval from the Ministry
- Gas combustion at an installation for power and heat, and gas sent to flare, is required to be metered and reported.
- Gas that is vented requires a permit and needs to be quantified using source-specific methodologies.

Carbon price (EU ETS + carbon tax)

- Currently market price for EU ETS credits + CO_2 tax (ca. 800 NOK/t total) - proposed increased to 2000 NOK/t CO_2 in 2030
- Tax on vented natural gas (offshore): 8,76 NOK/Sm^3 - proposed increased towards 2030
- Proposed tax on direct emissions of methane and non-methane volatile organic components (NMVOC) for onshore oil & gas facilities.

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

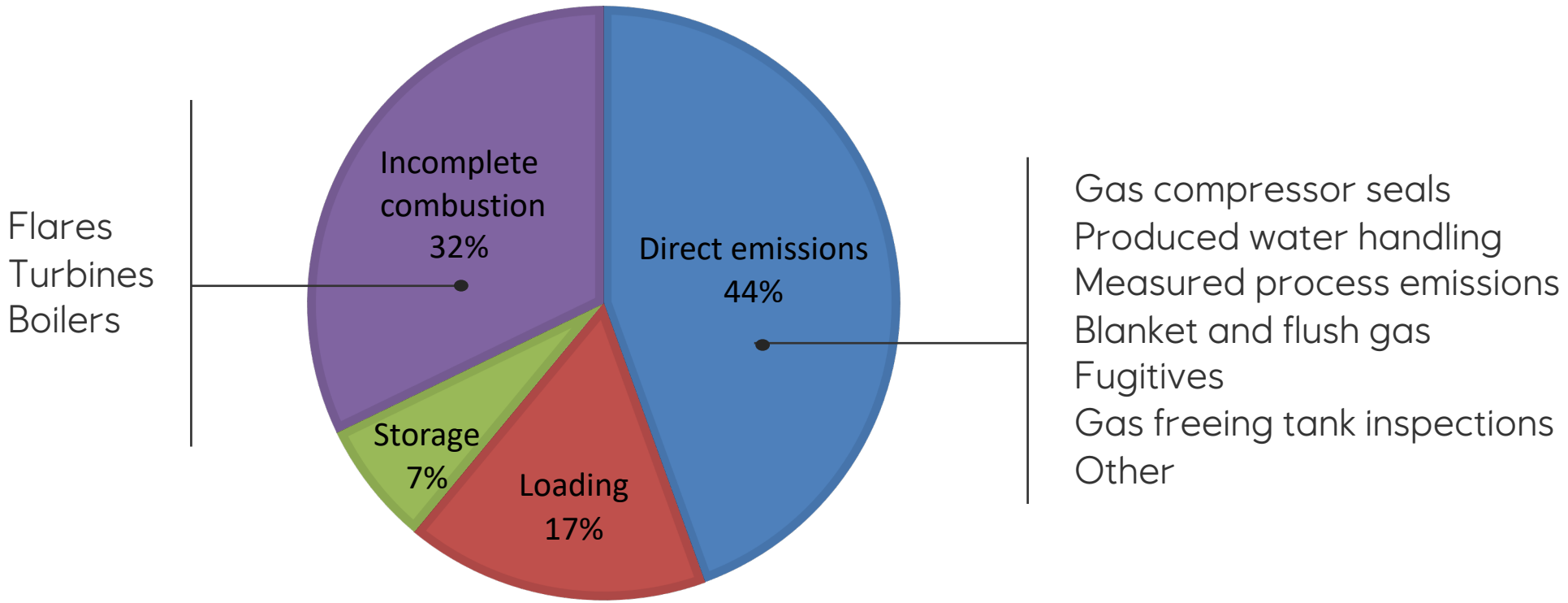
Industry guidelines ensure consistent reporting and quantification:

- **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

- 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

Data quality | Detailed operational insight is key to methane emission reductions



Data transparency | Methane emissions for each installation publicly available

Tabell 7.1: Utslipp til luft fra forbrenningsprosesser på permanent plasserte innretninger							
Kilde	**Mengde flytende brennstoff [tonn]**	**Mengde brenngass [Sm3]**	**CO2 [tonn]**	**NOx [tonn]**	**nmVOC [tonn]**	**CH4 [tonn]**	**SOx [tonn]**
Fakkel		9 772 604	28 426	13,68	0,59	2,35	0,01
Turbiner (DLE)				78,54			
Turbiner (SAC)	2 173	268 879 137	556 959	2 490,32	64,60	244,68	2,43
Turbiner (WLE)							
Motorer	98		311	4,51	0,49		0,10
Fyrte kjeler							
Brønntest							
Brønnopprenskning							
Avblødning over brennerbom							
Andre kilder							
Sum alle kilder	**2 272**	**278 651 741**	**585 697**	**2 587,10**	**65,68**	**247,03**	**2,53**

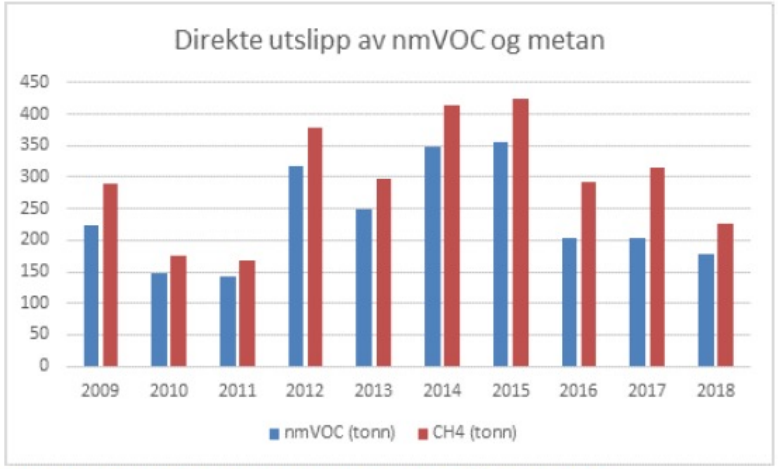
Tabell 7.5: Diffuse utslipp og kaldventilering		
Innretning	**Utslipp CH4 [tonn]**	**Utslipp nmVOC [tonn]**
COSLPromoter	3,03	3,03
SONGA ENDURANCE	2,78	2,78
SONGA EQUINOX	2,53	2,53
TROLL A	4,70	10,80
TROLL B	75,79	24,41
TROLL C	101,33	273,39
SUM	**190,15**	**316,93**

7.7 Diffuse utslipp og kaldventilering

Tabell 7.5 gir en oversikt over direkte utslipp av metan og nmVOC. Beregning av utslipp fra feltet er gjort i henhold Vedlegg B til Norsk Olje og Gass sine Retningslinjer for utslippsrapportering (044) «Håndbok for kvantifisering av direkte metan og nmVOC-utslipp». Det er tatt utgangspunkt i kartlegging av utslippskilder gjennomført i 2015 som en del av prosjektet «Kaldventilering og diffuse utslipp fra petroleumsvirksomheten på norsk sokkel» i regi av Miljødirektoratet. Utslippet fra kilden små gasslekkasjer er beregnet med utgangspunkt i den anbefalte OGI «leak/ no leak»-metoden. For lekkasjer detektert under inspeksjon som ikke faller inn under kategorien pumper, ventil eller konnektor, er det benyttet faktor for pumper.

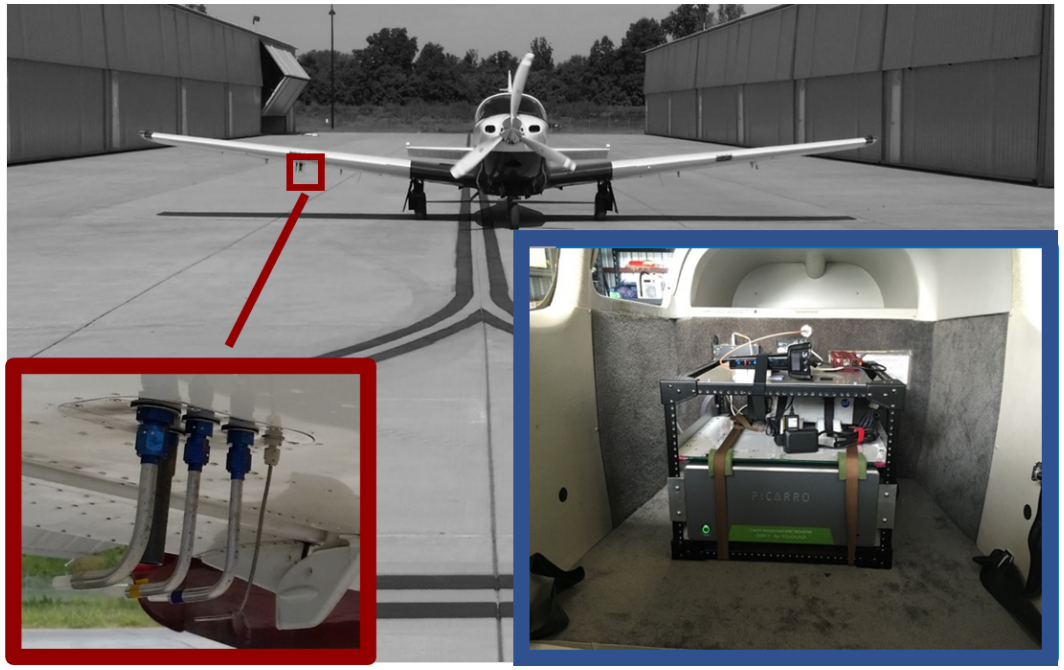
Figur 7.3 viser diffuse utslipp de siste 10 årene. Utslippene i 2018 er noe lavere enn i 2017 bl.a. pga mindre produsertvannvolum.

Tabell 7.5: Diffuse utslipp og kaldventilering		
Innretning	**Utslipp CH4 [tonn]**	**Utslipp nmVOC [tonn]**
KRISTIN	225,70	177,94
SUM	**225,70**	**177,94**

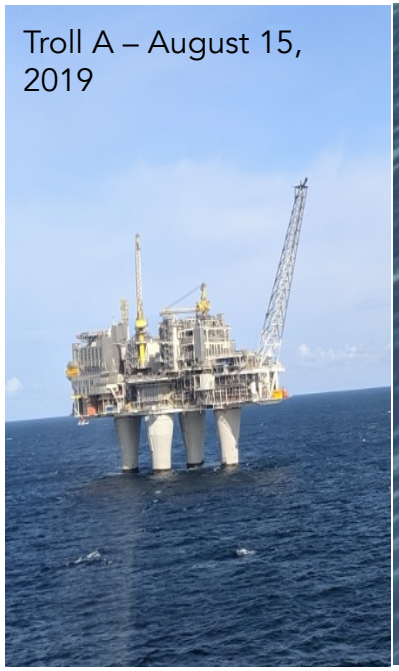


Figur 7.3: Historisk utvikling av diffuse utslipp på Kristinfeltet

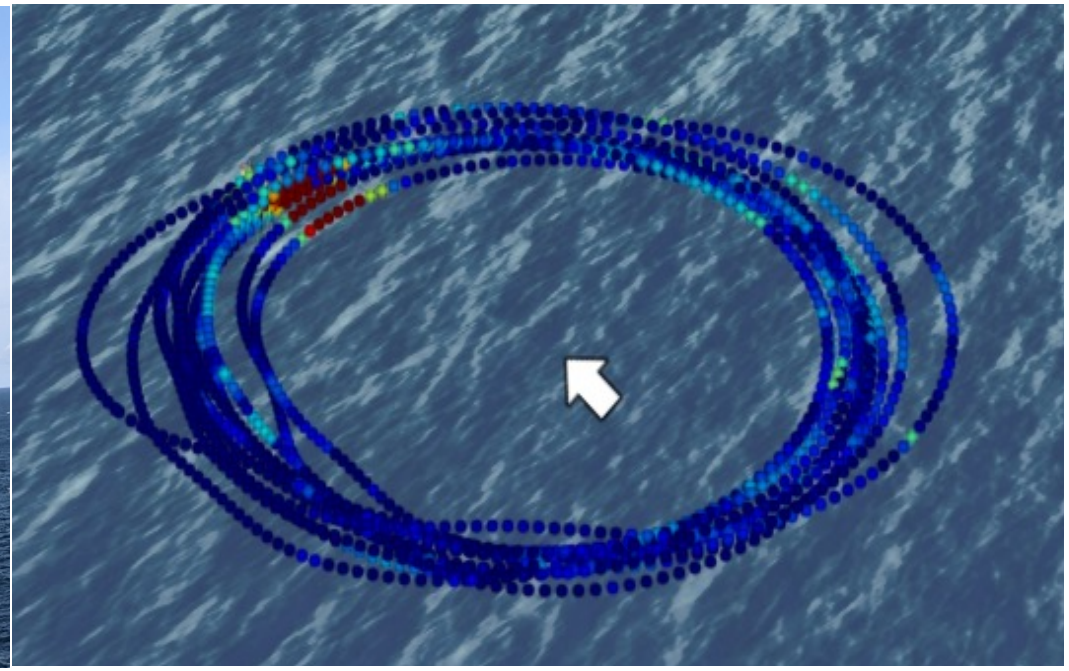
Measurements | 2019 NCS fly-over as part of the CCAC methane science studies



Photos: Scientific Aviation



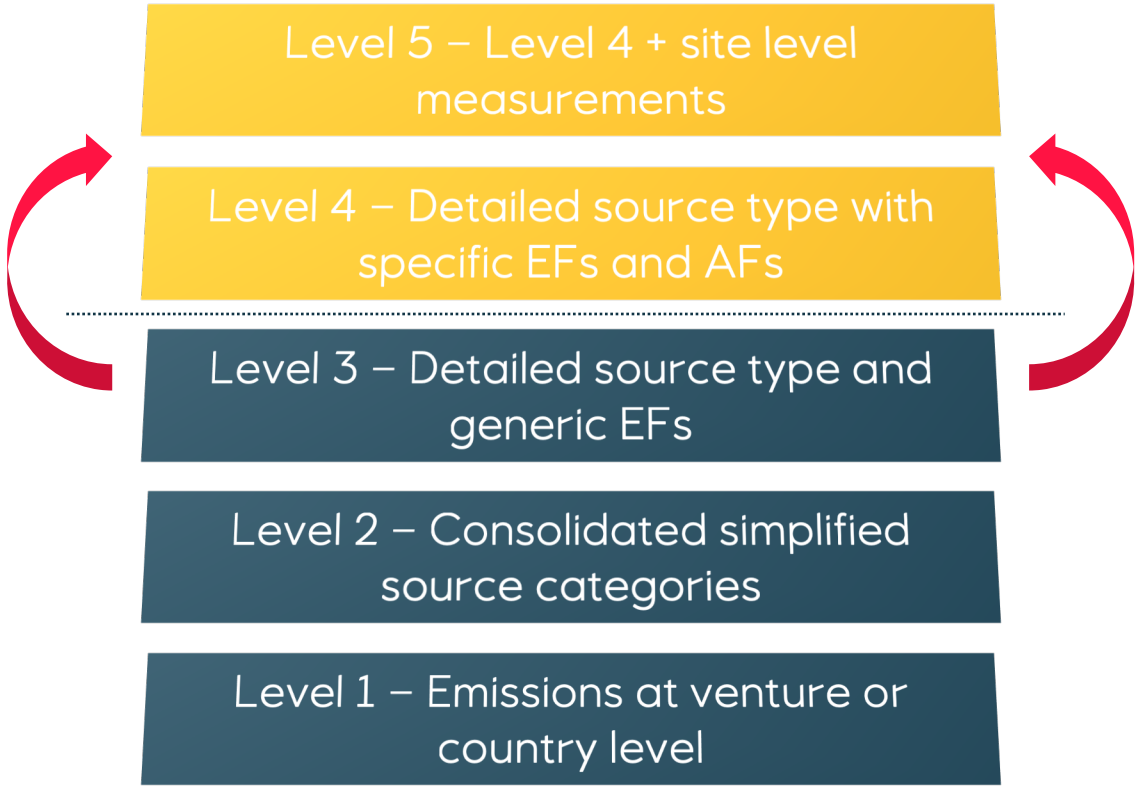
Troll A – August 15, 2019



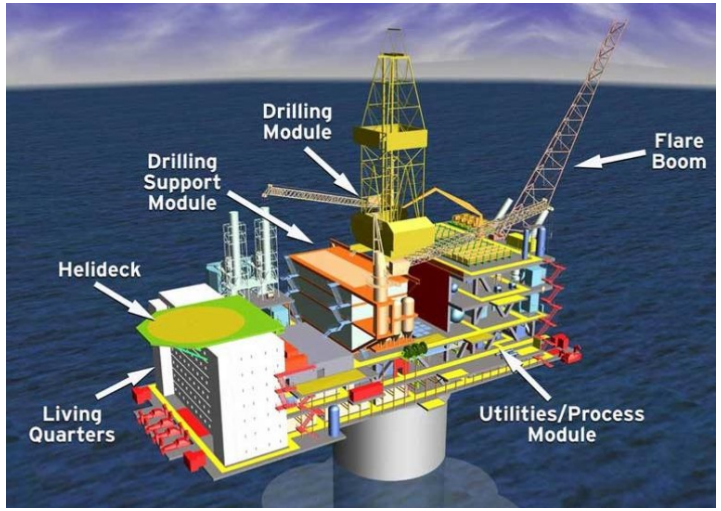
MRV | Norwegian approach lifted emission reporting to OGMP gold standard level

Norwegian approach

1. Survey offshore installations and identify sources of direct methane and NMVOC emissions
2. Suggest new methods for quantifying emissions
3. Prepare new and better emission estimates
4. Assess best available techniques (BAT)
5. Assess methods and techniques for emission reduction



LDAR | requires risk based approach considering operative context



- 200-500 gas detectors (point and line)
- If alarm (20-30% LEL) emergency procedures will ensure short gas leak duration
- At least weekly inspection rounds where leak identification is a focus area.
- Personnel are equipped with gas monitors and in some cases hand-held leak measurement (e.g. %LEL) devices.

- The Optical Gas Imaging (OGI) "leak/no-leak" method is required for the quantification and reporting of methane and NMVOC emissions from **small (fugitive) leakages**

Summary | Equinor recommendations

- Most of the methane emission reduction are achieved by a proper design (export-utilization or re-injection of produced gas, choice of equipment,….)
- Methane emissions need to be addressed, yet climate performance requires focus on all GHG's
- MRV is the first and most necessary step, it provides operational insight, enhances data quality and improves transparency (standards, targets and other incentives may follow),
- OGMP 2.0 well suited as a basis for gaining knowledge in EU and globally
- LDAR technology should be mandated on a risk-based frequency, taking full consideration of the operative context (e.g. off-shore operations)
- Close collaboration between regulator and industry allows for less prescriptive requirements
- An international methane observatory could help climate diplomacy, spreading of good practices and improve global data quality.

Thank you!

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