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Improving the environmental footprint of energy systems:**Methane management in extractive activities****Methane Management in extractive industries - best practices
in the gas sector****Model Framework for Reducing Methane Emissions along the Gas
Value Chain****Note by the secretariat****I. Introduction**

1. Methane, the primary component of natural gas, is a powerful greenhouse gas with a 100-year global warming potential 25 times that of carbon dioxide (CO₂) (Intergovernmental Panel on Climate Change (IPCC)¹). The main sources of anthropogenic methane emissions are agriculture (including fermentation, manure management, and rice cultivation), landfills, wastewater treatment, coal mines, and the oil and gas industries.

2. Based on the best currently available calculations and studies, out of approximately 550 million tonnes of total global methane emissions, those from the oil and gas sector are estimated to amount to 55 million tonnes of gas emitted annually (International Institute for Advanced Studies (IIAS) Working Paper December 2016). IPCC reference studies indicate that the share of methane emissions that originates from oil and gas sectors is between 9 per cent and 12 per cent of total global methane emissions, which translates into about 2 per cent of annual global natural gas production or 75 bcm per year (1 tonne methane = 1,360 Scm).

3. The oil and gas industry continues to improve operations to reduce emissions along the gas value chain in order to ensure that methane emissions from the sector will continue

¹ Fourth Assessment Report (AR4), Climate Change 2007: The Physical Science Basis, p. 212 available at http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4_wg1_full_report.pdf,

to decrease, notwithstanding the current and the predicted future increase in oil and gas production.

4. Technologies for detecting and quantifying methane emissions, as well as standard national/regional methods for reporting them are available.² However, their implementation is not always harmonised and in some cases it may be complicated to make comparisons of the data.

5. The Committee on Sustainable Energy at its twenty-third session, 19-21 November 2014, considered the potential role for the United Nations Economic Commission for Europe (ECE) in developing norms and standards on methane management. The Committee requested that the relevant ECE groups of experts prepare a coordinated, solutions-oriented report on methane management in extractive industries with a focus on establishing a baseline, benchmark and scale of current methane emissions in those industries, with the aim of giving clear guidance to policy makers and the extractive industry.

6. Following the Committee's request, the Group of Experts on Gas accepted to participate in the preparation of a report on methane management in extractive industries. The Group's contribution to the document will to a large extent draw from the work of its Task Force on Best Practice Guidance to Reduce Gas Leaks in the Gas Value Chain, which was established to help ECE member States to improve efficiency along the gas supply chain.

7. In order to facilitate this important work, the secretariat submits the following Model Framework for Reducing Methane Emissions along the Gas Value Chain for the Group of Experts' review and comments. Notwithstanding a prescriptive tone of the Model Framework, its primary role is to provide a point of departure for discussions among the experts.

II. Guiding Principles

8. Governments could cooperate with operators and owners of gas infrastructure for the purpose of developing best practices for methane management, including a regular exchange of information and an open dialogue among all stakeholders.

9. Governments could carefully assess what information and data needs to be collected and disclosed by operators and owners of gas infrastructure, in order to reduce unnecessary administrative burdens on the gas industry.

² See, for example:

(a) United Nations Framework Convention on Climate Change, available at:

http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conven_g.pdf, see in particular Article 4, Article 10, and Article 12 of the Convention.

(b) US Environmental Protection Agency, Greenhouse Gas Reporting Program available at:

<https://www.epa.gov/ghgreporting>. See also 40 CFR Part 98 available at: <https://www.ecfr.gov/cgi-bin/text->

[idx?SID=3c71c656d3f1a8cdf64a78060d713bf9&tpl=/ecfrbrowse/Title40/40cfr98_main_02.tpl](http://www.ecfr.gov/cgi-bin/text-idx?SID=3c71c656d3f1a8cdf64a78060d713bf9&tpl=/ecfrbrowse/Title40/40cfr98_main_02.tpl)

(c) Norwegian Environmental Agency 2016: "Cold venting and fugitive emissions from Norwegian offshore oil and gas activities – summary report". The report presents a survey and mapping of direct methane and NMVOC emissions from Norwegian offshore infrastructure, an updated estimate of emission inventories, proposals for improved future quantification of the emissions, and an assessment of emission abatement opportunities. It identifies a total of 48 potential emission sources. (<http://www.miljodirektoratet.no/no/Publikasjoner/2016/Juni-2016/Cold-venting-and-fugitive-emissions-from-Norwegian-offshore-oil-and-gas-activities--summary-report/>)

10. Operators and owners of gas infrastructure could observe existing standards on methane emissions along the gas value chain. Best practices and new common methodologies could be discussed, exchanged and implemented in a timely manner.
11. Governments could engage and cooperate with gas industry and key stakeholders in the process of continuous improvement of inventories submitted to the United Nations Framework Convention on Climate Change (UNFCCC), such as through the development of country-specific emission factors and/or methods.
12. Where feasible, methane emissions deriving from gas infrastructure and activities along the entire value chain could be reduced and utilized.
13. Given the global warming potential of methane, in case of unavoidable methane emissions, flaring could be preferred to uncontrolled venting.
14. Along the whole gas value chain and throughout the entire life cycle of gas infrastructure, operators and/or owners have the primary responsibility for taking measures to prevent methane emissions to the environment.
15. Where feasible, gas infrastructure could be designed, constructed, maintained and operated in a manner that minimises the likelihood of methane emissions to the environment.³
16. Proper quality, good condition, integrity and safe functioning of gas infrastructure could be ensured by their operators and/or owners through adequate design, accurate construction, systematic and thorough maintenance, routine inspection, detection, comprehensive monitoring and tracking of methane emissions, as well as through sound management.
17. Operators of gas infrastructure could develop, test and regularly update internal measures for measurement, reporting, and verification (MRV) of methane emissions.
18. Operators and owners of gas infrastructure could submit to the competent authority periodic reports on:
 - (a) Adopted internal measures for MRV of methane emissions;
 - (b) Methane emissions released from their gas infrastructure.
19. Although many safety regulations are in place in the vast majority of the cases, should methane emissions occur in quantities that pose a hazardous risk, operators and/or owners of gas infrastructure, in coordination with competent authorities, could immediately undertake measures to address the underlying problem and minimize its consequences.

III. Options

A. Acknowledgments and definitions

20. These Guiding Principles provide a minimum set of requirements for reducing methane emissions from gas infrastructure at every stage along the gas value chain. Taking into account their existing regulatory frameworks, as well as scientific and technical developments, different countries may apply different policies, measures and methodologies to achieve this goal.

³ Some of the standards on construction and operation of gas infrastructures are defined by the International Organization for Standardization (ISO) and its Technical Committee 67 'Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries' and the Technical Committee 193 'Natural gas'.

21. Following are options to ECE member States, competent authorities, operators and/or owners of gas infrastructure and the international entities involved in the gas business.
22. For the purposes of this document:
- (a) “Gas infrastructure” means any part of gas infrastructure at any stage of the gas value chain from extraction to distribution, with the exception of pipes distributing gas in buildings and devices destined for non-commercial use, including those installed in buildings and vehicles.
 - (b) “ECE member State” means each state that is a member of ECE, as enlisted in Annex I;
 - (c) “Competent authority” means public institution performing administrative and/or regulatory functions in the fields of MRV of methane emissions and reducing methane emissions;
 - (d) “Gas industry” means natural and/or legal persons, as well as associations, organizations, unions, or groups that represent interests of such persons, whose principal field of activity lays in extraction, production, processing, storage, transport, and/or distribution of natural gas.
23. The annexes to this document shall constitute an integral part thereof.

B. Options for ECE member States and for competent authorities

24. ECE member States and competent authorities, in cooperation with gas industry and key stakeholders, could maintain and update, when necessary, national emission inventories.
25. ECE member States and competent authorities could adopt and regularly revise policies for efficient operation of gas infrastructure.
26. ECE member States and competent authorities, in cooperation with operators and owners of gas infrastructure, could develop sector-wide best practices on (1) MRV of methane emissions and (2) reducing methane emissions. They could be consistent with the Guiding Principles. In addition, ECE member States could develop the necessary reference documents for implementing the identified best practices.
27. Identified best practices, together with their respective reference documents, could facilitate collaboration amongst ECE member States on methane management along the gas value chain. Such collaboration could occur in accordance with the principles outlined in Annex II.
28. ECE member States and competent authorities, on the basis of the reliable data collected in accordance with identified best practices, could set methane emissions reduction goals within their specific self-imposed timeframes.
29. ECE member States could assure that the process of developing best practices, best available techniques and policies related to detecting, monitoring, tracking, reporting and preventing methane emissions along the gas value chain has a participatory character.
30. ECE member States could designate competent authorities to be responsible for handling the tasks addressed in this document. The governments could ensure that these authorities are provided with mandate, information and resources sufficient for effective execution of tasks entrusted upon them.
31. ECE member States and competent authorities could ensure that operators and owners of gas infrastructure are taking measures that are technically and economically feasible, as well as practically justified, for minimising methane emissions from the gas infrastructure.

32. Competent authorities could carry out a permitting process for new gas infrastructure, including, inter alia, environmental impact assessment, according to relevant domestic regulations and standards. With regard to the existing gas infrastructure, operators and owners of gas infrastructure could undertake the environmental impact assessment on a periodic basis and provide the required information to the competent authority in a timely manner.

C. Options for operators and/or owners of gas infrastructure

33. While designing, constructing, maintaining and operating gas infrastructure, operators and/or owners of gas infrastructure could take all measures that are technically and economically feasible, as well as practically justified, in order to assure that methane emissions are minimised.

34. Design, construction, maintenance and operation of gas infrastructure could be undertaken in accordance with recognized national and international norms, standards, guidelines and specifications applicable to a given type of a gas infrastructure.

35. Operators of gas infrastructure could establish internal measures for MRV of methane emissions. These measures could be reviewed regularly, taking into account the progressively acquired experience.

36. Operators of gas infrastructure could provide competent authorities with periodic reports on implementation of internal measures for MRV of methane emissions, as well as on methane emissions discharged by their gas infrastructure. These reports could be prepared in accordance with the relevant instructions prescribed by competent authorities.

37. Operators of gas infrastructure could cooperate with competent authorities in order to facilitate the management and update of national emission inventories.

D. Options for international organizations and associations

38. International entities established for the purpose of developing a regulatory framework for gas activities, as well as those serving as representatives of the interest of enterprises and/or individuals operating in the gas sector, could foster cooperation among their members and collaborate with one another.

39. The above-mentioned international entities could collaborate with governments to assist with identifying best practices for (1) MRV of methane emissions and (2) reducing methane emissions from the gas sector.

Annex I

List of ECE member States

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|--------------------------|--|
| • Albania | • Liechtenstein |
| • Andorra | • Lithuania |
| • Armenia | • Luxembourg |
| • Austria | • Malta |
| • Azerbaijan | • Monaco |
| • Belarus | • Montenegro |
| • Belgium | • Netherlands |
| • Bosnia and Herzegovina | • Norway |
| • Bulgaria | • Poland |
| • Canada | • Portugal |
| • Croatia | • Republic of Moldova |
| • Cyprus | • Romania |
| • Czech Republic | • Russian Federation |
| • Denmark | • San Marino |
| • Estonia | • Serbia |
| • Finland | • Slovak Republic |
| • France | • Slovenia |
| • Georgia | • Spain |
| • Germany | • Sweden |
| • Greece | • Switzerland |
| • Hungary | • Tajikistan |
| • Iceland | • The former Yugoslav Republic of Macedonia |
| • Ireland | • Turkey |
| • Israel | • Turkmenistan |
| • Italy | • Ukraine |
| • Kazakhstan | • United Kingdom of Great Britain and Northern Ireland |
| • Kyrgyzstan | • United States of America |
| • Latvia | • Uzbekistan |
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Annex II

Cooperation among ECE member States

1. ECE member States could, taking into account efforts already made at national and international levels, take appropriate measures and cooperate within the framework of this document, to reduce methane emissions along the gas value chain and minimise negative impacts on human health and/or the environment.
2. ECE member States could, by means of exchange of information, consultation and other cooperative measures, work on developing and implementing policies and strategies for MRV of methane emissions and reducing methane emissions along the gas value chain, taking into account, in order to avoid unnecessary duplication, efforts already made at national and international levels.
3. ECE member States could, consistent with their laws, regulations and practices, facilitate the exchange of technology for MRV of methane emissions and reducing methane emissions along the gas value chain, particularly through the promotion of:
 - (a) Exchange of available technology on various financial bases;
 - (b) Direct industrial contacts and cooperation;
 - (c) Exchange of information and experience;
 - (d) Provision of technical assistance.
4. In promoting the activities specified in paragraph 3 of this Annex, ECE member States could create favourable conditions by facilitating contacts and cooperation among appropriate organizations and individuals in both the private and the public sectors that are capable of providing technology, design and engineering services, equipment and/or finance.
5. ECE member States could, at the multilateral and/or bilateral level, exchange information, inter alia, on:
 - (a) Legislative and administrative measures, policies, objectives and priorities for MRV of methane emissions and reducing methane emissions along the gas value chain;
 - (b) Acquired experience in MRV of methane emissions and reducing methane emissions along the gas value chain;
 - (c) The development and application of the best practices for MRV of methane emissions and reducing methane emissions along the gas value chain;
 - (d) The development and application of the best available technologies for MRV of methane emissions and reducing methane emissions along the gas value chain.
6. ECE member States could, at the multilateral and/or bilateral level, assist one another in:
 - (a) Sharing experiences in MRV of methane emissions and reducing methane emissions along the gas value chain;
 - (b) Promoting education and training in MRV of methane emissions and reducing methane emissions along the gas value chain;
 - (c) Organizing international meetings, workshops, and symposia devoted to best practices and technologies in MRV of methane emissions and reducing methane emissions along the gas value chain;

(d) Promoting cooperation in research and development of best practices and technologies in MRV of methane emissions and reducing methane emissions along the gas value chain.

(e) Responding to emergencies resulting from excessive methane emissions from gas infrastructure. In the event of an emergency, assistance could be rendered at the request of an ECE member country where the excessive methane emissions occurred.
