SAMUEL NEAMAN INSTITUTE
FOR NATIONAL POLICY RESEARCH

Assessment of Methane Emissions from Natural Gas Supply Chain in Israel

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Executive Summary

Methane gas, the main component of natural gas, is the second most impactful greenhouse gas on global greenhouse gas emissions from anthropogenic sources, after carbon dioxide, and is currently the focus of efforts (along with other short-lived greenhouse gases) to reduce global warming of the atmosphere. Methane, as a contributor to the greenhouse effect, is characterized by a global warming potential coefficient (GWP) of over 25 times compared to carbon dioxide over a 100-year time horizon.

For Israel to be able to correctly assess the benefits of using natural gas, reduce its annual greenhouse gas emissions inventory, and meet its international commitments to reduce greenhouse gas emissions, it is of great importance to professionally assess the scope of emissions from Israel's natural gas supply chain.

The goal of this study is to calculate methane emissions from the natural gas industry in Israel from beginning to end, including production, processing, transmission, distribution, and end users' emissions, while evaluating existing information and data related to the best methodology, and defining additional data that is necessary and how it should be collected.

It is common to attribute emissions from natural gas systems to three categories:

- Fugitive emissions – including leakage from equipment components, evaporation, burning of gas in flares, or blow-down during a controlled process.
- Emissions from fuel burning – methane emissions caused by incomplete combustion during fuel burning (natural gas, but also diesel, or other fuels) that are related to the generation of energy in stationary facilities necessary for site operations.
- Emissions due to operational malfunctions.

The guidelines for quantifying greenhouse gas inventories were adopted by the UN's Intergovernmental Panel on Climate Change (IPCC) in 2006 and updated in 2019. This assessment relies on the most up-to-date emission coefficients that are available for each activity or segment, including changes in emission factors that relate to the implementation of low-emission technologies and practices for natural gas and oil production on land, as well as for the adoption of Leak Detection and Repair (LDAR) programs for characterizing emissions and correcting them in the processing and transmission segments. It is important to note that for offshore production, a single emission coefficient has been published, which does not distinguish between the

emissions resulting from advanced technologies and work practices that contribute to reducing emissions.

The methods for quantifying emissions presented in the UN guidelines are based on different tiers representing different methodological complexity. Tier 1 is based on the use of default coefficients to calculate emissions for each segment based on global averages. Tier 2 is based on coefficients adapted to the country in which the calculation is performed. Tier 3 is based on the use of detailed coefficients for each type of emission source at the facility level or all systems at the specific site, provided that adequate data are available to quantify emissions.

The UN guidelines encourage countries to use specific emission coefficients (Tier 3) if these data are readily available. In the absence of available local data, it is necessary to check whether it is possible to implement emission coefficients of countries with similar technology (Tier 2) since the characteristics of factories and facilities may differ substantially, both from country to country and in different facilities within the country itself. The use of generic emission coefficients (Tier 1) is recommended only If there is no data available for calculating emissions according to Tiers 2 or 3, and emissions from the sector do not have a significant impact on the national emissions inventory.

Formulating specific emission coefficients for the production, transmission, and distribution systems of natural gas in Israel requires strict adherence to the use of verified measurement methods and quality control of the data. The process should be carried out by an independent body and under the supervision of the regulator, include in-depth and professional fieldwork and not rely exclusively on the reports of the organizations responsible for the emissions.

Summary of Findings

The table below presents the emissions reports in Israel, including reports to the Israeli Pollution Release and Transfer Registry (IL-PRTR), and the findings of the WOOD Consultants' report. Local data from the transmission and utilization segments are partial, while there is no publicly available data on emissions for the distribution segment. In the absence of some of the data, the calculation is done according to the quantification methods listed below.

In addition, the table presents a summary of calculations of emissions from the entire natural gas supply chain in Israel, at various tier levels, for 2021, carried out by the research team.

Tier 1 emissions describe the calculation according to the IPCC's average emission factors for fugitive emissions. In the production and processing segment, emissions are

described according to the coefficient for offshore production, as well as a reduced emission coefficient that considers low-emission technologies. In the transmission and distribution segments, emissions are described both according to the amount of gas supplied through the pipelines and according to the length of the pipelines. In the utilization segment, emissions are described according to the amount of gas supplied.

Tier 2 emissions describe a calculation according to regional and national coefficients for fugitive emissions. Regarding malfunction emissions, there is no uniformity in the approaches taken. In the US, for example, total fugitive emissions include malfunction data, while other countries do not collect malfunction emission data. In all cases, the calculation excludes emissions from the combustion of fuels calculated separately from the country's macro data for fuel consumption. In the production and processing segment, emissions are presented in accordance with an American coefficient. In the transmission segment, emissions are presented according to the American coefficient (low value) and European coefficient (high value). In the distribution segment, emissions are presented according to an American coefficient. The total emissions are presented according to the various segments presented, as well as a range of calculated emissions in Israel in 2021, according to the emission coefficients of four countries in their reports to the UN (the Netherlands, Ireland, the United Kingdom, and Norway).

Tier 3 emissions describe a calculation according to the coefficients published or recommended by the Ministry of Environmental Protection and based on data or reports from the operating companies. **In the production and processing segment**, fugitive emissions, emissions from malfunctions and emissions resulting from fuel combustion are presented for the offshore rigs and the processing facility in Ashdod. **In the transmission segment**, partial emissions (fugitive and malfunctioning emissions) associated with maintenance and installation of additional equipment are presented, but it does not include emissions that are associated with the operation of equipment along the pipeline routes (connectors, flanges, faucets, pneumatic regulators, etc.). Emissions from the LNG floating terminal (which operated in 2013-2022), are included in the calculation of emissions resulting from fuel combustion. **In the utilization segment**, emissions from burning natural gas are presented only according to the volume of gas supplied to end users.

Table 1 below summarizes the findings of the calculations and the estimation of emissions in the various tiers.

Table 1: Methane emissions in Israel in 2021 – local reports and calculations according to various tiers

	Production/ Processing	Transmission	Floating Terminal	Distribution	Utilization	Total
Reported Emission	**321** [1 2 3]	**56** (Partial)	-	-	**350** [3]	**727**
Tier 1 calculation based on Average Coefficients	Generic Coefficient **67,750** [1] Low Emission Coefficient **46,186** [1]	According to natural gas quantity **25,115** [1] Acccording to pipeline length **1,726** [1]	**1,660** [1]	According to natural gas quantity **184** [1] According to pieline length **132** [1]	**4,800** [1]	**54,504-99,509**
Tier 2 calculation based on Regional Coefficients	**181,706** [1]	**323-471** [1]		**10** [1 2]		**182,039-182,187**
Tier 2 calculation based on National Coefficients	**11-1,584** [1]	**891-1,236** [1]		**25-821** [1]		**927-3,641** [4]
Tier 3 Calculation	**246** [1 2 3]	**59** (Partial)			**421** [3]	**726**
Emission Estimation according to this assessment (based on the Tier used)	**246** According to Tier 3	**471** According to Tier 2 – European Coefficient	**1,660** According to Tier 1	**10** According to Tier 2 – American Coefficient	**4,800** According to Tier 1	**7,187**

Notes:

[1] Includes fugitive emissions.

[2] Includes malfunction emissions.

[3] Includes emissions from fuel combustion.

[4] The discrepancy between the breakdown in the different segments and the total is due to the fact that in some cases there was no reporting under all segments (for example, emissions in the production segment appeared under a different category) – in this case the lower range shown in the segment is

according to the case where the lowest volume was reported (not zero). In addition, in another case the emissions are reported under the 'Other' category – this case was not associated with emissions under the different sections, but the total reported emissions are displayed in the 'Total' column.

The coefficients used in the current calculations are marked according to their suitability for the Israeli economy – cells with a green background include coefficients with a high level of compatibility, a yellow background indicates a medium level of compatibility, and a red background indicates a low level of compatibility.

The attempt to use local data for estimating emissions in the distribution and utilization segments of natural gas has encountered difficulty due to the lack of complete information regarding the characteristics of the system in these segments, as detailed in chapter 7. It is important to note that for each segment of the supply chain, emissions are calculated according to the assumptions detailed in each of the chapters.

It is evident that there are gaps between emissions reports in Israel and calculations performed according to coefficients from various sources. This point ascertains that **the use of emission coefficients employed by international organizations and other countries cannot provide an unequivocal answer to the assessment of the scope of emissions in Israel, since the characteristics of the natural gas industry differ substantially from country to country** – both due to the age of the facilities, methods and materials used in their construction, and due to the technologies and control measures implemented in their operation.

To verify the discrepancy between the different orders of magnitude of emissions calculated in this assessment, a transparent, comprehensive and independent examination is required of the various equipment components and the scope of activity for all segments of the natural gas supply chain in Israel, together with the extent of the emissions contributed by them. **When the gap between local data and calculations according to Tiers 1 or 2 is large, for example, in the production, processing and transmission segments, one should strive to establish and optimize the calculation according to Tier 3 by collecting detailed data and verifying them through an independent professional body. When local data is lacking and there is a segment with negligible impact on the national emissions inventory, for example, in the distribution segment, Tier 1 methods can be used.**

Various studies (presented in the appendix to this report) indicate that the engineering estimates on which emissions inventories are based may underestimate and lead to low quantification of emissions to the atmosphere. The causes of the underestimations, as revealed by the studies, include the use of emission coefficients that are not suitable for

a given activity, an assessment that does not include all relevant facilities or sources of leakage, or an assessment that does not include high emission release events.

The purpose of the recommendations presented in this document is to improve the toolbox for characterizing data on emissions to the air, to improve data quality through the combined use of methods based on the actual activity scope alongside with methods based on the interpolation of atmospheric measurements and increased data availability and transparency.

Recommendations for improving monitoring and emission inventories reporting

Improving monitoring and reporting of emissions inventories depend on the accessibility of the data and the reliability of the methods for characterizing emissions data according to six quality indicators: simple and fast data processing, data transparency, the possibility of evaluating and verifying the data, access to full operational data (which enables examination of emissions calculations), the inclusion of all sources of emissions, and the possibility of disclosing and publishing the results.

Important criteria for deriving findings for assessing Tier 3 methane emissions:

- Collection of information about the methodology used and the causes of data uncertainty.
- Documentation of the data collection period and the spatial area represented.
- Verification of the reliability of data sources and the collection methods used.
- Fully transparent publication of the combination of the various sources and measurement methods used to obtain the results and generate recommendations.
- Ensure that the results obtained have been audited by independent bodies in cooperation with local experts and stakeholders.

Recommendations

Considering the main findings from this study, the recommendations include:

1. **Increasing accessibility and transparency of information**

1.1. In the production phase

- Increasing the transparency and accessibility of data on all production platforms, like the publication of Leviathan platform data.
- Providing a separate emissions report on Dor Beach pressure reduction station.
- Expanding the reports to include emissions resulting from venting, maintenance and malfunctions in annual reports and IL-PRTR data.

1.2 In the transmission phase

- For Israel Natural Gas Lines (INGL), a government company that embraces commitment to the environment as a supreme value and advocates a sustainable development policy, it is imperative to implement a detailed report of greenhouse gas emissions from the company's activities and not settle for statements similar to the declaration that appears in the 2018-2019 report: "*Information on air pollution and emissions release: The national natural gas transmission system is a closed system that does not emit natural gas into the air. Natural gas is environmentally friendly, and the company is not defined as a polluting facility.*"
- It is recommended that the Natural Gas Authority, as INGL's regulator, require INGL to report on greenhouse gas emissions from its ongoing operations, and enforce the implementation of orderly procedures for monitoring and locating emissions, including the frequency and characteristics of the required tests, and public reporting of the results.
- Require the publication of emissions data from the distribution segment, even if it constitutes a small percentage of all greenhouse gas emissions in the economy. In this case, too, the argument that these are new systems made of plastic piping does not reduce the need to report.
- The Ministry of Environmental Protection published a new procedure as a draft for public comments regarding methane emissions from equipment components and facilities, including reference to component mapping, calculation of emissions, identification, detection and repair of leaks, and reporting, and it should also apply to the transmission and distribution segment. This procedure can address most of the aspects that arose from this work, however, it is important to emphasize several important issues:
    - Require scheduling the screening of equipment leaks (1-4 times a year),
    - Emissions quantification measurements should be carried out every few years (every 2-3 years or following a substantial change in the array of components that may leak),
    - The measurements must be carried out through an independent third party audited by the regulator.
- The U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) published draft guidelines for LDAR for natural gas pipelines last May. It is proposed that the Ministries of Energy and Environmental Protection follow the guidelines, when they are promulgated, and examine their suitability for Israel.

1.3 In the utilization phase

- Inclusion of emissions from fugitive emissions leaks in facilities to obtain a reliable characterization of emissions associated with the utilization of natural gas.
- Updating greenhouse gas emissions thresholds that require reporting to increase data transparency.

2. Calculations and measurements

- The emission coefficients used in the IL-PRTR and in this report (considered Tier 3) rely on emission coefficients published by the Ministry of Environmental Protection that are based on the AP-42 data base maintained by the U.S. Environmental Protection Agency (EPA) and consists of direct emission coefficients for specific emission sources, including the natural gas industry. It is recommended that a thorough process be conducted to evaluate the suitability of these coefficients to the Israeli natural gas market.
- Chapter 8 of this report provides preliminary information on methods for identifying and quantifying methane emissions in the natural gas supply chain, which can serve as a basis for deciding which measurement methods should be adopted in Israel.

Specific recommendations for implementation in Israel

- It should be noted that Israel's national emissions inventory, as developed by the Central Bureau of Statistics, does not include methane emissions from the natural gas sector, though partial emissions from this sector are reported through the IL-PRTR. It is important to verify the compatibility of the emission coefficients used to calculate emissions inventories with the actual measurements, for each segment of the natural gas industry's supply chain, with the goal being that the emissions inventory can be calculated according to local data as described in the Tier 3 methodology recommended in the IPCC guidelines.
- **Increase cooperation** between the Ministry of Environmental Protection and the Ministry of Energy to promote uniformity in reporting emissions from the natural gas industry.
- **Establish a clear mechanism** that will combine and incorporate various types of data and enable their integration to make them accessible to decision makers in a manner that matches their expectations. The mechanism should include activity data at the source of emissions, details of the sources of emissions and atmospheric measurements respectively. The design of the mechanism should be carried out in accordance with international standards.

- **Maintain a unified database**, updated regularly, that includes standards and procedures that will enable decision makers to collect necessary information quickly and in accordance with an immediate focused requirement, transparent, simple, and reliable, including citation of the data source and its quality.
- **Develop an emissions coefficient database**, updated periodically, for the various segments of the natural gas supply chain in Israel, enabling comparison between different parts of the database.
- **Ensure documentation** of appropriate methods and procedures for collecting and providing information for a limited spatial area or short period of time. It is proposed to expand attempts to generate data, with the aim of maximizing the impact of data collection and use.
- **Train industry professionals** in day-to-day operations with an emphasis on preventing or reducing methane emissions. It is also necessary to ensure that the operators of the emissions and atmospheric methane concentration equipment are qualified to operate the required equipment.
- **Develop and ensure** the existence of qualitative (risks and limitations) and/or quantitative control indicators (uncertainty and characterization of errors).
- **Action should be taken** to increase data transparency for training and educational purposes, to expand the number of users of the emissions reporting system, and to increase interdisciplinary information sharing by stakeholders and scientists.