Liquefied Natural Gas

The Law and Business of LNG,
Fourth Edition

Consulting Editors
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LNG and ESG

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1. Scope and structure of this chapter

This chapter frames LNG in the context of environmental, social and governance (ESG) issues and the energy transition generally. It addresses:

- the avoidance, reduction and removal (ARR) of greenhouse gas (GHG)[1] emissions arising from the production of natural gas and the production, transportation and use of LNG across the LNG value chain; and
- the potential use of carbon credits to offset GHGs not decarbonised by ARR.

While ESG covers a diverse number of related and unrelated matters, this chapter focuses on the 'E' in ESG – and in particular, on the ARR of GHG emissions as an important component of addressing climate change within the energy value chain. In the context of LNG, this chapter examines:

- decarbonisation and avoidance of GHG emissions in the production and transportation of feedstock natural gas and LNG;
- the use of carbon credits (acquired from a voluntary carbon market or trading platform or via bilateral contractual arrangements) for unabated LNG-related emissions;
- the role of natural gas in avoiding the use of higher-emissions fuels; and
- the important future role of carbon capture and storage (CCS) in abating emissions that cannot be abated.

2. Scene-setting

2.1 What is LNG and what is its GHG profile?

(a) LNG and GHG emissions

'LNG' has a narrow meaning, referring to natural gas – consisting predominantly of methane (CH_4) – that is liquefied to -161˚C (its liquid state, which is 1/600 the volume of its gaseous state). Large-scale liquefaction facilities located along

1 'GHGs' are defined as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

marine waterways form the backbone of global LNG production, which is predominantly located in Australia, the Middle East, Papua New Guinea and Southeast Asia, the United States, Russia, Africa and a few offshore locations. Liquefaction facilities are multibillion-dollar assets that have a 30 to 40-year lifespan – an important factor to consider in the design of new liquefaction facilities and in making retrofit investments to reduce GHG emissions for existing liquefaction facilities. Following liquefaction, LNG is transported predominantly by sea, using specialised LNG carriers; and to a much lesser extent on land, using ISO tanks (by rail or road). Following transportation to the port of unloading, LNG is unloaded into specialised storage tanks at land-based or floating regasification facilities, regasified into natural gas and sent out as pipeline gas for ultimate use. Regasification facilities have about twice as much global capacity as the quantity of LNG produced at liquefaction facilities, creating a flexible global trade that adapts to changes in market demand, as evidenced in 2022.

The GHG profile of any company is measured, and expressed by mass, in tonnes of carbon dioxide equivalent (CO_2e) GHG emissions, which translate the global warming potential of CH_4 and other GHG gases into an equivalent amount of CO_2.[2] Emissions are characterised as Scope 1, Scope 2 or Scope 3.

Table 1. Net-zero GHG emissions

Net-zero GHG emissions: achieving a balance between GHG emissions arising and GHG removed from the climate system consistent with the Paris Agreement, including Scope 1, 2 and 3 emissions.	
Scope 1	GHG emissions arising from sources owned or controlled by an organisation.
Scope 2	GHG emissions arising indirectly as a result of the purchase of energy used by an organisation.
Scope 3	GHG emissions arising indirectly across the supply chain of an organisation.

2 The methodology for translating different GHG emissions into CO_2 equivalents can have a significant impact on the impact that is placed on abating those emissions. For instance, if the global warming potential (GWP) measuring period is 100 years (as typically used – www.epa.gov/ghgemissions/ understanding-global-warming-potentials), then methane emissions have a smaller impact than CO_2 emissions, as they dissipate in about a decade on average. However, if the GWP measuring period is 20 years, methane becomes a critical element in reducing the calculation of GHG emissions in the near term. The GWP methodology matters and should always be evaluated when reviewing emissions reporting in CO_2e.

Additionally, the standards for allocating Scope 1, 2 and 3 CO_2e emissions to products such as LNG have slightly different accounting rules than those for organisations, but those differences are not explored in this chapter.

(b) GHG profile of natural gas and LNG

During extraction, production and transportation of natural gas, CH_4 is emitted.[3] By way of example, in the United States, those upstream emissions make up about 99% of all Scope 1 and 2 GHG emissions (in CO_2e) related to LNG production.[4] That allocation of emissions has a significant effect on the ability to abate CO_2 emissions related to LNG projects on a standalone basis. Almost all LNG projects use natural gas as fuel for onsite electrical energy generation, with CO_2 arising upon combustion of natural gas. These are Scope 1 and 2 emissions of the producer of the LNG[5] and will count towards the GHG emissions in the country of production. When electricity is purchased by a liquefaction facility, the power-related emissions are calculated based on the source of that power, with the resulting emissions being treated as Scope 2 emissions for the producer.

Before natural gas is liquefied, it is processed to remove, among other things, water and CO_2, which would take a solid state at the temperature at which CH_4 liquefies. Some natural gas fields are high in CO_2 (some fields are over 60% CO_2), and a number of natural gas fields are deploying CCS to capture and to store permanently the captured CO_2. If not captured, this CO_2 will constitute Scope 1 emissions of the producer and will count towards the GHG emissions for the country of production.

After liquefaction, boil-off occurs[6] (during both storage and transportation). Many LNG carriers capture boil-off and combust it to power and propel the LNG carrier. Upon combustion of gaseous CH_4, CO_2 is emitted. Technologies are being developed to allow the capture of CO_2 arising on combustion of boil-off on LNG carriers (and other fuels to power and propel LNG carriers). Depending on the terms of the sale of LNG, boil-off that is not captured for combustion and CO_2 that is not captured on its combustion on an LNG carrier will be considered:

- Scope 1 emissions of the seller for an ex-ship sale; or
- Scope 2 emissions of the buyer for a free-on-board sale.

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3 CH4 has a little over 80 times the GWP of CO_2, as calculated using a 20-year period GWP methodology. This explains the Global Methane Pledge and the increasing focus of regulators on CH_4 emissions.

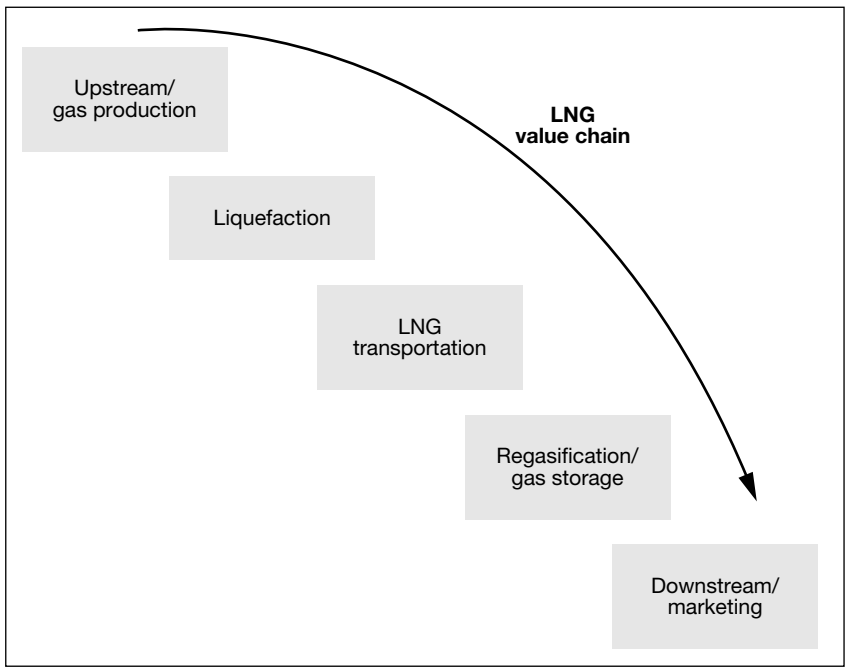
4 Based on the reporting Facilities and Methane Emissions from Petroleum and Natural Gas System Categories Subject to the IRA Methane Charge – Data for 2019, United States Congressional Research Service, Inflation Reduction Act Methane Emissions Charge: In Brief, 4 August 2022, https://crsreports.congress.gov, publication R47206.

5 Under the Greenhouse Gas Protocol product rules, this determination is more nuanced; but for the purposes of this chapter, this allocation will suffice as a fair approximation of the carbon accounting treatment.

6 Boil-off occurs when CH_4, in a liquid state, transfers to a gaseous state.

Upon unloading, storage and regasification of LNG and send-out natural gas (across pipeline systems), CH_4 is emitted. At the point of ultimate use of natural gas as feedstock or fuel for combustion, CO_2 is emitted. The ultimate use of the natural gas is potentially a Scope 3 emission of the producer of the LNG (ie, the seller, irrespective of the terms of carriage) under certain life cycle emissions calculation scenarios[7] and a Scope 1 or Scope 2 emission of the person utilising or combusting the LNG, and will count towards the GHG emissions arising in the country of ultimate use.

Figure 1: LNG value chain



(c) Abating GHG in the LNG value chain

It has been estimated, based on an aggressive 20-year global warming potential (GWP) methodology, that from wellhead to burner-tip, for 70,000 metric tonnes of LNG, up to 250,000 metric tonnes of CO_2e emissions arise,[8] including all Scope 1, 2 and 3 emissions.[9]

Taking as a benchmark 480 million tonnes per year of LNG production

7 Again, this is more nuanced under the Greenhouse Gas Protocol product rules but will suffice for a general understanding of how emissions are likely allocated to LNG under different circumstances.

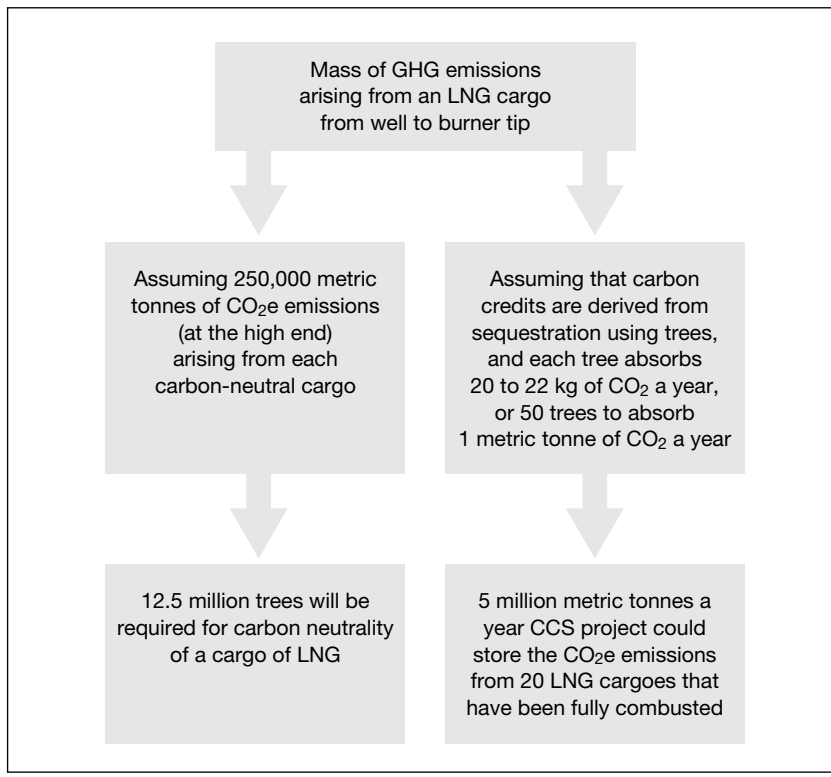
8 Estimate from Jonathan Stern, *Greenhouse Gas Emissions from LNG Trade: From Carbon Neutral to GHG-Verified*, The Oxford Institute for Energy Studies, 2022.

9 These volumes and masses are estimates and do not take account of actual ultimate use of CH_4.

capacity (worldwide capacity at the end of 2022), in theory, unabated use and final combustion of LNG could give rise to over 1.6 gigatonnes of CO_2e emissions a year, with the final combustion being by far the largest source of those emissions (~80% of the GHG emissions in the LNG and regasified LNG value chains).

This makes the use of natural gas as a fuel a critical factor in evaluating the ability to abate or decarbonise all emissions from LNG, as access to LNG in most LNG-consuming countries is possible only because of the global LNG trade. To put it another way, abating all emissions from LNG would require the elimination of a critical fuel source for energy-hungry markets or the large-scale abatement of emissions arising across the LNG value chain, combined with the capture of CO_2 at the source of combustion or other use.

Figure 2: CO_2e in an LNG cargo



Natural gas and LNG are critical as a primary fuel source for heating, power and other feedstock uses in industrialising and fully industrialised economies. The energy crisis in Europe following the Russian invasion of Ukraine in 2022 highlights the critical role that natural gas plays in global energy security.

Natural gas is also needed to enable broader electrification from intermittent renewables, as well as to displace coal-fired capacity in many countries. Thus, the goal of abatement should reflect the growing use of natural gas and LNG and the resulting need to reduce emissions of GHG emissions arising along the chain, including:

- in the production and transportation of natural gas;
- in the production and transport of LNG; and
- at the point of combustion or use of the regasified LNG.

2.2 What is ESG?

(a) ESG in the context of investment in companies and projects

At its broadest, 'ESG' can refer to adherence to:

- laws – in particular, those relating to:
  - the environment[10] and pollution;
  - anti-bribery and corruption;
  - anti-modern slavery;
  - anti-money laundering;
  - competition;
  - employment and labour rights;
  - health, safety and welfare;
  - diversity, equality and inclusivity (including gender, race and sexuality);
  - employee and executive management ratios;
  - human rights;
  - injury rates; and
  - ethical or social matters in the wider – even global – setting; and
- governance matters, including:
  - board diversity;
  - confidential voting and separation of powers; and
  - the frameworks for disclosure and reporting.

Such a broad range of meanings and applications makes any assessment of ESG a difficult one that depends largely on context.

For the purposes of this chapter, we will apply a narrower meaning of 'ESG', referring specifically to ESG matters to which investors and commercial lenders

10 These matters may include:
- carbon intensity;
- energy intensity;
- renewable energy intensity;
- Scope 1, 2 and 3 GHG emissions;
- primary energy source;
- waste management; and
- water management.

have regard in the context of their consideration (with other matters) of whether to invest in or lend to a company. This is an important focus for those working on the development of natural gas and LNG projects.

Applying a slightly broader meaning, 'ESG' refers to matters that may affect the sustainability of a company or a country, with the concept of 'sustainability' including:

- assessing and addressing climate change; and
- in this context, the ARR of GHG emissions at a corporate or country level (including nationally determined contributions (NDCs) under Article 3 of the Paris Agreement).

Given the role of national oil companies (NOCs) and national power companies (NPCs) in many countries, the ARR activities of NOCs and NPCs in those countries are inextricably linked to the achievement of the NDCs.

Applying this narrower definition of 'ESG' in the context of companies and projects:

- investors are likely to want to understand:
  - the GHG emission profile of the company;
  - the plans of the company to avoid, reduce and remove GHG emissions (by reference to Scope 1 and 2 and pre-combustion Scope 3 emissions), and the time frame for doing so; and
  - ultimately, that the company will achieve net-zero GHG emissions by 2050 – often with a demonstration that the ARR plans are consistent with the goals of Article 2.1 of the Paris Agreement (or its future iterations); and
- commercial lenders will want to understand:
  - the GHG emission profile of the company or the project to be project financed; and
  - in respect of any fossil fuel project, whether it is GHG neutral[11] and biodiversity accretive.

Many commercial lenders have ceased to lend to the coal sector and have reduced investment in oil and gas developments; while development banks have ceased to lend in respect of coal-fired power station developments and are considering adopting the same approach to gas-fired power station developments. Some insurance companies have:

- ceased to provide insurance to certain industries, such as coal mining and coal-fired generation; or
- set a timeline for the cessation of provision of insurance in the future.

11 Defining 'GHG neutral' is another tricky area and one beyond the scope of this chapter, but a general understanding of 'carbon neutral' is sufficient for understanding the scope of the commitment.

These changes pose important questions for the future growth of LNG projects.

(b) Criticism of ESG

Since the start of 2021, investors analysing ESG matters – and badging them as such – have faced criticism from both investors and consumers. In some instances, this criticism has prompted financial institutions and insurance companies to adjust their approaches and cease lending and insurance based solely on a carbon-neutral standard for a critical energy source.

For some time, some of the leading investment houses globally have used the term 'ESG' guardedly or not at all. In late June 2023, BlackRock chief executive officer and chair Larry Fink[12] stated that he had stopped using 'ESG' but had not stopped assessing and analysing companies (and other organisations) by reference to their plans for and progress towards decarbonisation (and corporate governance and social matters). BlackRock has continued to invest in companies involved in the production of fossil fuels (including those producing LNG), while at the same time working with those companies to develop decarbonisation plans.

In practice, investors and lenders will assess each company and project by reference to factors (however badged) that are relevant to the sustainability of the business of that company or project, including factors and matters that companies and projects are required to disclose and report. Ultimately, the desires of investors, national and local regulators and consumers, as well as countries seeking reliable non-intermittent energy, will decide the extent to which ESG and carbon neutrality should be primary factors in determining the future of gas and LNG as a fuel.

(c) 'Musts' for ESG evaluation

Integral to the value of any sustainability policies, practices, procedures and systems is the collection of data and information, as well as ongoing assessment and reporting on them. The expectation of markets is to provide increasing amounts of information regarding the performance of companies and their projects in relation to ESG goals. If those ESG goals widen, so will demands on company and project reporting. Companies typically measure their ESG goals for emissions using industry-relevant measurement, monitoring, reporting and verification (MRV) methods. These MRV methods, which are evolving rapidly, are key to assessing GHG emissions arising from the activities of companies and their projects and the effectiveness and efficiency of any ARR initiatives. Reporting of CO_2e emissions based on solid MRV methodologies will be critical to providing evidence of ARR in the LNG value chain.

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12 BlackRock has close to $10 trillion under management.

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Liquefied Natural Gas

The Law and Business of LNG, Fourth Edition

Liquefied Natural Gas: The Law and Business of LNG, Fourth Edition
Since the first edition of this best-selling title in 2008, the international liquefied natural gas (LNG) industry has shown a rare capacity for innovation and change. Despite this, there was no predicting the nature and full extent of the sector's transformation since the book's last edition in 2017, and this fourth edition has been updated to take into account the rapidly shifting arrangements and participations across the international LNG business.

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