Arctic LNG 2 Project

GREENHOUSE GASES AND ENERGY EFFICIENCY PHILOSOPHY

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ACRONYMS AND ABBREVIATIONS

BAT	Best Available Technique
BAT-AEEL	Best Available Techniques – associated energy efficiency levels
BOE	Barrels of Oil Equivalent
CCGT	Combined Cycle Gas Turbine
CGTP	Complex Gas Treatment Plant
ECA	Export Credit Agency
EDPS	Emergency Diesel Power Station
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EP4	Equator Principles 4
ESAP	Environmental and Social Action Plan
ESHIA	Environmental, Socio-Economic and Human Health Impact Assessment
EU	European Union
GBS	Gravity-based structure
GHG	Greenhouse gases
GTPP	Gas-Turbine Power Plant
IFC	International Finance Corporation
IFI	International Finance Institution
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ITS	Information and Technical Reference Book
LLC	Limited Liability Company
LNG	Liquefied natural gas
OECD	Organisation for Economic Cooperation and Development
OGCF	Oil, gas, and condensate field
PAES	Mobile automated gas turbine power plant
PGTP	Preliminary Gas Treatment Plant
PJSC	Public Joint Stock Company
PS	Performance Standards
RF	Russian Federation
CCS	Carbon Capture and Storage
SGC	Stabilised gas condensate
TOE	Tonne of Oil Equivalent
TSC	Technical Screening Criteria
UN	United Nations
UNEP	The United Nations Environment Programme
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
WWTP	Wastewater Treatment Plant
YNAO	Yamal-Nenets Autonomous Okrug

1 INTRODUCTION

1.1 The Arctic LNG 2 commitment

Arctic LNG 2 is aware of potential of greenhouse gases (GHG) impacting the environment on a global scale through their contribution to the climate change and is committed to actively promoting the reduction of GHGs across its operations in a safe, technically and commercially viable manner.

Arctic LNG 2 recognizes that the use of liquefied natural gas (LNG) as an energy source is less carbon intensive than other types of fossil fuel considering GHG emissions over the full LNG life cycle (production, processing, transportation, and end-use combustion) comparing to life-cycle emissions from either coal or fuel oil as a means of delivering the same amount of energy. Nevertheless, the GHG emissions of LNG production stage are relatively high in comparison with other types of industries.

Arctic LNG 2 confirms its full commitment to manage GHG emissions of the Arctic LNG 2 Project responsibly, including identification, accounting and reporting, monitoring and control, prevention and minimization of the Project carbon footprint and increase of the Project energy efficiency. For this purpose, two guiding documents are developed and to be implemented in the framework of the Project implementation, and namely the current GHG and Energy Efficiency Philosophy and GHG and Energy Efficiency Management Plan.

1.2 Purpose of the document

The Greenhouse Gases and Energy Efficiency Philosophy (hereinafter – the Philosophy) is an overarching document setting out an overall strategy in respect to greenhouse gases (GHG) and energy efficiency (EE) management in the framework of the Arctic LNG 2 Project, its key principles and objectives as well as the approach to achieve them, and describing high-level prevention, minimization, mitigation, monitoring and control decisions and measures. The Philosophy provides an understanding of the applicable requirements and benchmarks for assessment of the respective Project performance.

1.3 Area of application

The Greenhouse Gases and Energy Efficiency Philosophy provides the strategy for managing GHG and EE issues in all components of the Arctic LNG 2 Project in a consistent way. This philosophy considers the full Project lifetime including planning, design, construction, commissioning and transition phase, operation, as well as decommissioning in the future. The Philosophy is a tool ready for adoption by operators of the associated facilities and activities providing a suitable framework for sustainable development in compliance with the current standards and best practices.

The Philosophy is a live document which is to be developed over time along with the Project implementation and following any updates in rapidly developing international and national regulatory requirements and the world economy settings.

1.4 Document structure

The Philosophy is structured as follows:

- Section 1 provides introductory information;
- Section 2 identifies the regulatory requirements applicable to the Project;
- Section 3 defines the inter-company policy and document settings in respect to GHG and EE management;
- Section 4 includes a brief description of the Project;
- Section 5 presents information on the international and national approach to GHG emissions accounting and reporting as well as the approach currently adopted by the Project;
- Section 6 provides the overview of the Project GHG emissions sources at the construction, transition and operation phases;
- Section 7 is devoted to the benchmark assessment of the Project against sectoral, international and national best practice performance in respect to the LNG production;

- Section 8 includes the Arctic LNG 2 commitments on mitigation measures in respect to the GHG emissions and energy efficiency in the Project framework;
- Section 9 presents the summary of this document including outcomes of the benchmark assessment.

2 APPLICABLE REGULATIONS AND STANDARDS

2.1 International requirements

2.1.1 Overview

The global community faces the challenge of reducing GHG emissions in a rapid way, and transition to low carbon economy based on the current understanding of the climate change nature and the respective projections under various scenarios by the end of 21st century. The available global budget of GHG emissions, i.e. the aggregate of all future emissions of GHG is defined by the set limit of warming and its non-exceedance probability. Climate models in the Fifth Assessment Report of the IPCC indicate that the remaining budget of GHG emissions for 50% probability of non-exceedance of global temperature by +1.5 C was only 580 $GtCO_2$[1].,

To facilitate the GHG emissions reduction efforts, the Paris Climate Agreement was prepared at the end of 2015 which regulates the measures applied since year 2020 to decrease carbon dioxide concentration in atmospheric air. Most countries including Russia signed the Agreement in 2016. The Paris Agreement was ratified in Russia by the Government Resolution of 21.09.2019 No.1228.

At the global level, most countries have commenced transition to low carbon economy, therefore, it is expected to be implemented as a gradual though rapid process. A late transition to low carbon scenario in global economy may be sharp and ineffective, in terms of mitigation of climate change, which would entail high physical risks and transition risks, and may trigger economic crisis in certain countries and regions. Failure to take effective measures to reduce the emissions may result in high and critical geopolitical and physical risks, and a global economic crisis in the middle and long terms.

In general, it is expected that the use of fossil fuel for energy generation will be phased out in the long term, therefore, businesses most likely to be exposed to immediate effects of the transition period are those engaged with production and processing of coal, oil and natural gas (listed in the descending order of sensitivity to the change), and those using the above resources in their production processes. Furthermore, the physical and transition risks will affect most sectors of economy and industry in one way or another, e.g. energy-intensive industries will be affected by changing energy prices. Decline in growth rates and return on investments was identified as the main impact.

Even though reduction of GHG is a complex issue in the context of economic development objectives, many countries and individual major cities have adopted low carbon strategies, implement measures and apply technologies that will help to reduce GHG emissions to a significant degree. So far, the efforts have resulted in a notable and rapid decline in prices for renewable energy, development of carbon-free technologies for cold and heat supply, and changes in habits and consumption levels in a number of local communities throughout the globe. This trend is a driving force for introduction of new standards and requirements for products and their manufacturing processes, including carbon taxes.

It is almost defined that future development strategies of countries and regions will use a system of government regulation mechanisms for GHG emissions control in terms of quantity and costs/taxation, in order to minimize carbon-intensive energy sources (e.g. carbon tax, carbon trade, legal restrictions).

The international financial institutions (IFI) also fully recognize the importance of minimizing GHG emissions. Therefore, their covenants for project loan funding include requirements to apply best available techniques, as well comprehensive GHG assessment and public reporting requirements (Equator Principles 4, 2020; IFC Policy on Environmental and Social Sustainability, 2012).

[1] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press.

2.1.2 EU Directives and CBAM perspective

In December 2019, the European Commission presented the European Green Deal[2], an overarching framework and program of actions to transform the European economy into a low and zero-carbon mode. A key component of the Green Deal is the proposed 'Climate Law'[3] embedding a legal commitment for the EU to achieve climate neutrality by 2050, in line with the objectives of the Paris Agreement. The EU is focused to reduce carbon emissions by at least 55% (compared to 1990 level)[4] by 2030 and to completely ban emissions by 2050.

Currently, the European Commission, in the context of the new Green Deal agenda (EU Green Deal), is developing the approach of introducing a Carbon Border Adjustment Mechanism in the EU applicable to imported goods, in order to offer advantages for producers with low greenhouse gas emissions. This cross-border carbon levy implies that producers with high consumption of fossil fuels will pay for the GHG emissions related to the product manufacturing.

At present, several alternative approaches are being considered for the cross-border carbon tax, and some possible schemes have been identified. Specific proposals about the EU border carbon tax are expected in second quarter of 2021, and regulations concerning the external parties will follow soon after that.

Practical implementation of the cross-border carbon tax is scheduled in 2023. Meanwhile, determination of the collection mechanism, timing, payers, taxation base, rates and privileges by that time may be doubtful, due to the serious differences between stakeholders. Most likely, a pilot period will be established for selected sectors of economy, where metallurgy, cement production and energy generation are considered as a priority, as well as certain chemical industries.

Producers in countries where approach to carbon emissions regulation is compatible with that of the EU can be exempt from the tax. The Boston Consulting Group originally estimated the tax rate at 30 USD per ton of emissions of CO_2, but in early January 2021 the quota on GHG emissions in the EU emissions trading system (ETS) reached 34 EUR per ton[5], and is increasing.

2.1.3 EU Taxonomy Regulations

The EU taxonomy is a classification system establishing a list of environmentally sustainable economic activities. The EU taxonomy is an important enabler to scale up sustainable investment and to implement the European Green Deal. Notably, by providing appropriate definitions to companies, investors and policymakers on which economic activities can be considered environmentally sustainable, it is expected to create security for investors, protect private investors from greenwashing, help companies to plan the transition, mitigate market fragmentation and eventually help shift investments where they are most needed[6].

The "Taxonomy Regulation"[7] (EU Regulation 2020/852 of 18 June 2020) creates a legal basis for the EU Taxonomy. It sets out the framework and environmental objectives for the sustainable investment, as well as new legal obligations for financial market participants, large companies, the EU and Member States.

It establishes six environmental objectives:

1. Climate change mitigation;
2. Climate change adaptation;

[2] The detailed information is available at https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[3] Proposal for a Regulation of the European parliament and the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law), available at https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588581905912&uri=CELEX:52020PC0080

[4] https://ec.europa.eu/clima/policies/eu-climate-action/law_en

[5] https://www.reuters.com/article/us-eu-carbontrading/eu-price-on-pollution-hits-record-high-in-early-2021-idINKBN29A1WQ

[6] https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[7] EU Regulation 2020/852 of 18 June 2020 "On the establishment of a framework to facilitate sustainable to facilitate sustainable investment, and amending Regulation (EU) 2019/2088"

3. The sustainable use and protection of water and marine resources;
4. The transition to a circular economy;
5. Pollution prevention and control;
6. The protection and restoration of biodiversity and ecosystems.

The Taxonomy Regulation establishes the framework for the EU taxonomy by setting out conditions that an economic activity has to meet in order to qualify as environmentally sustainable. To align with the EU Taxonomy, economic activities must (art. 3, EU Regulation 2020/852):

- contribute substantially to one or more of the six environmental objectives;
- do no significant harm to the other objectives;
- meet minimum social safeguard standards (OECD Guidelines for Multinational Enterprises[8], UN Guiding Principles on Business and Human Rights[9], including the principles and rights set out in the eight fundamental conventions identified in the Declaration of the International Labour Organisation on Fundamental Principles and Rights at Work and the International Bill of Human Rights[10]); and
- complies with technical screening criteria.

The Taxonomy Regulation will be supplemented by delegated acts which contain detailed Technical Screening Criteria (TSC) determining whether an economic activity can be considered sustainable, and hence can be considered Taxonomy-aligned. For each environmental objective it is specified what economic activities should be screened for substantial contribution to that objective. Furthermore, it also specifies the remaining environmental objectives that should be checked to ensure that the economic activity does no significant harm.

The final EU Taxonomy Climate Delegated Act was published on 21 April 2021[11], and it will be formally adopted once it has been translated in all EU languages at the end of May 2021. A second delegated act for the remaining objectives will be published in 2022[12].

Article 8(1) of the Taxonomy Regulation, provides that certain large undertakings that are required to publish non-financial information under the Non-Financial Reporting Disclosure (NFRD)[13] regulation should disclose information to the public on how and to what extent their activities are associated with environmentally sustainable economic activities as defined under the EU Taxonomy legislation.

On 21 April 2021, the Commission adopted a proposal for a Corporate Sustainability Reporting Directive (CSRD)[14], which would amend the existing reporting requirements of the NFRD. The scope of the non-financial reporting requirements is now extended to all large companies and all listed companies, resulting in almost five times as many companies falling under the scope of the CSRD as compared to the NFRD.

As specified in art. 8 of EU Regulation 2020/852 the Commission will adopt another delegated act specifying the information companies subject to NFRD will have to disclose on how, and to what extent,

[8] http://mneguidelines.oecd.org/guidelines/

[9] https://www.ohchr.org/documents/publications/guidingprinciplesbusinesshr_en.pdf

[10] https://www.ilo.org/global/standards/introduction-to-international-labour-standards/conventions-and-recommendations/lang--en/index.htm

[11] https://ec.europa.eu/info/publications/210421-sustainable-finance-communication_en#taxonomy. The text of the EU Taxonomy Climate Delegated Act (Provisional version) is available at https://ec.europa.eu/info/publications/210421-sustainable-finance-communication_en#taxonomy

[12] https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[13] Non-Financial Reporting Directive (Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups), available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095

[14] Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as regards corporate sustainability reporting, available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A52021PC0189&utm_campaign=RGR-RMC-EXTERNAL-EU-TAXONOMY&utm_medium=email&_hsmi=125176731&_hsenc=p2ANqtz-_QnZVH2tubESjo4barSwX0_evX-kygjkFmoQHm_wGZAKJToigjfyTfj80Q_kYrDzDhKH1yURn7gTLhxnqLrzzYWt1qGQ&utm_content=125110258&utm_source=hs_email

their activities align with those considered environmentally sustainable in the EU taxonomy. A draft version of this delegated act was made available online on 7 May 2021 for a 3-week feedback period[15].

The first two environmental objectives on climate change will have to be disclosed on as of January 1st, 2022. Alignment with the remaining four environmental objectives needs to be included in disclosures as of the 1st of January, 2023.

The separate EU Taxonomy Report is prepared to assess the Project characteristics against the Taxonomy requirements in respect to *climate change mitigation* and *climate change adaptation* objectives.

2.1.4 Equator Principles

The Equator Principles (EP) are ten environmental and social standards to be adhered to in case of project financing by the Equator Principles Financial Institutions (EPFI). The EPs are updated periodically. The latest iteration, EP4, came into effect for all EPFIs on 1 October 2020[16] and is supported by a suite of Guidance, including The Equator Principles Implementation Note[17] and Guidance note on Climate Change Risk Assessment[18].

In line with Principle 2: *Environmental and Social Assessment* a climate change risk assessment (CCRA) is required to be undertaken for Category A projects and, as appropriate, Category B projects. For the projects with direct and indirect GHG emissions over 100,000 t CO_2-equivalent per year, CCRA must also include a completed alternatives analysis which evaluates lower GHG intensive alternatives.

The Principle 10: *Reporting and Transparency* requires public annual reporting on GHG emission level (combined Scope 1[19] and Scope 2[20] emissions, and specific emission rate per unit of product, if applicable) during the operational phase for Projects emitting over 100,000 t CO_2-equivalent per year.

The implementation requirements are detailed in Annex A: Climate Change: Alternative Analysis, Quantification and Reporting of Greenhouse Gas Emissions.

GHG emissions should be calculated in line with the GHG Protocol (see Section 5.1 for details) to allow for aggregation and comparability across Projects, organisations and jurisdictions. Clients may use national reporting methodologies if they are consistent with the GHG Protocol.

Public reporting requirements can be satisfied via host country regulatory requirements for reporting or environmental impact assessments, or voluntary reporting mechanisms such as the Carbon Disclosure Project[21], where such reporting includes emissions at the Project level.

2.1.5 IFC Environmental and Social Framework and Performance Standards

IFC is part of the World Bank Group and a recognised international leader in the sphere of development and implementation of environmental and social sustainability policies.

In accordance with its Environmental and Social Sustainability Policy, the planned investments shall be assessed using Environmental and Social Performance Standards (PS). The current Environmental and Social Sustainability Policy and Performance Standards of the IFC were published in April 2012.[22].

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[15] Draft Commission Delegated Regulation supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by specifying the content and presentation of information to be disclosed by undertakings subject to Articles 19a or 29a of Directive 2013/34/EU concerning
environmentally sustainable economic activities, and specifying the methodology to comply with that disclosure obligation, available at https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-article-8-draft_en.pdf

[16] https://equator-principles.com/wp-content/uploads/2020/05/The-Equator-Principles-July-2020-v2.pdf

[17] https://equator-principles.com/wp-content/uploads/2020/09/Implementation_Note_Ext_Sept_2020.pdf

[18] https://equator-principles.com/wp-content/uploads/2020/09/CCRA_Guidance_Note_Ext_Sept_2020.pdf

[19] Scope 1 Emissions are direct GHG emissions from the facilities owned or controlled within the physical Project boundary

[20] Scope 2 Emissions are indirect GHG emissions associated with the off-site production of energy used by the Project

[21] https://www.cdp.net/en

[22] https://www.ifc.org/wps/wcm/connect/24e6bfc3-5de3-444d-be9b-226188c95454/PS_English_2012_Full-Document.pdf?MOD=AJPERES&CVID=jkV-X6h

According to PS 3 *Resource Efficiency and Pollution Prevention*, for projects that are expected to produce more than 25,000 tonnes of CO_2-equivalent annually, the client will quantify direct emissions from the facilities owned or controlled within the physical Project boundary, as well as indirect emissions associated with the off-site production of energy used by the Project. Quantification of GHG emissions shall be conducted annually in accordance with internationally recognised methodologies and good practice[23].

2.1.6 OECD Corporate GHG Reporting

Export Credit Agencies (ECAs) of OECD-member countries apply the Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the Common Approaches) revised in 2016[24].

The Common Approaches requires to report:

- the estimated annual greenhouse gas emissions from all fossil-fuel power plant projects;
- the estimated annual greenhouse gas emissions from other projects, where such emissions are projected to be in excess of 25,000 tonnes CO_2-equivalent annually.

In this context, where relevant and feasible, Adherents shall try to obtain and to report the estimated annual direct and indirect (Scope 1 and Scope 2) greenhouse gas emissions in CO_2-equivalent and/or the estimated annual direct greenhouse gas emissions (Scope 1) by carbon intensity (e.g. in g/kWh) for the six greenhouse gases to be generated during the operations phase of the project.

OECD Working Papers on International Investments on corporate greenhouse gas emission reporting[25] provides an overview of current government schemes promoting corporate reporting on greenhouse gas (GHG) emissions and analyses their main components. It refers that the use of scope 1, 2, 3 to classify emissions as defined by the GHG Protocol has become common language and practice today. Standard measurement methodologies (such as the GHG Protocol and ISO 14064) have also emerged and act as referenced methodologies today.

2.1.7 World Bank/IFC EHS Guidelines

The World Bank / IFC Environmental, Health, and Safety (EHS) Guidelines[26] are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC Performance Standard 3 on Resource Efficiency and Pollution Prevention. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the IFC and are generally considered to be achievable in new facilities at reasonable costs using existing technology.

The following IFC guidelines are relevant to the Project activities:

- General EHS guidelines (April 2007);
- EHS Guidelines for Liquefied Natural Gas (LNG) Facilities (April 2017);
- EHS Guidelines for Onshore Oil and Gas Development (April 2007);
- EHS Guidelines for Offshore Oil and Gas Development (June 2015);
- EHS Guidelines for Thermal Power Plants (December 2008);
- EHS Guidelines for Ports, Harbors, and Terminals (February 2017);
- EHS Guidelines for Crude Oil and Petroleum Product Terminals (April 2007);
- EHS Guidelines for Waste Management Facilities (December 2007);
- EHS Guidelines for Water and Sanitation (December 2007);
- EHS Guidelines for Shipping (April 2007).

[23] Estimation methodologies are provided by the Intergovernmental Panel on Climate Change, various international organizations, and relevant host country agencies.

[24] http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=tad/ecg(2016)3

[25] Kauffmann, C., C. Tébar Less and D. Teichmann (2012), "Corporate Greenhouse Gas Emission Reporting: A Stocktaking of Government Schemes", OECD Working Papers on International Investment, 2012/01, OECD Publishing. https://www.oecd.org/daf/inv/investment-policy/WP-2012_1.pdf

[26] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

The General EHS Guidelines contain recommendations for reduction and control of greenhouse gases and enhancement of energy efficiency potentially applicable to all industry sectors. The relevant industry sector specific guidelines provide a general recommendation that technically feasible and cost-effective attempts should be made to optimize energy efficiency and design facilities to reduce energy use with an overall objective of reducing air emissions.

EHS Guidelines for Liquefied Natural Gas (LNG) Facilities [27] provides the sector-specific energy consumption value (Table 2-1).

Table 2-1 Energy Consumption

Parameter	Unit	Industry Benchmark
Energy consumption – LNG liquefaction process	kWh/ton LNG	275-400

EHS Guidelines for Thermal Power Plants[28] provides information on typical CO_2 emissions performance of different fuels (including gas)/ technologies (Table 2-2).

Table 2-2 Typical CO_2 emissions performance of new thermal power plants (fuel – gas)

Efficiency	CO_2 (gCO_2/ kWh – Gross)
Efficiency (% Net, lower heating value)	
36-40 (simple Cycle GT) 40-42 (Boiler)	505-561 (Net) 481-505 (Net)

2.1.8 Best practice

Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) establishes fixed emission limit values and lays out recommended schemes for equipment design and use to ensure a high level of protection of the environment as a whole through the use of the best available techniques (BAT).

The European Union BAT Reference Documents (BREF)[29] do not establishes energy efficiency levels for preparation and liquefaction of natural gas and stabilisation of gas condensate. BAT Reference Document for Large Combustion Plants[30] (2017) sets BAT-associated efficiency levels (BAT-AEELs) for large power generation and combustion plants. These levels for combustion of natural gas (for new units) are provided in table 2-3 below.

Table 2-3 BAT-associated energy efficiency levels (BAT-AEELs) for natural gas combustion (new units) [31]

Type of combustion unit	BAT-AEELs[32]		
	Net electrical efficiency (%)	Net total fuel utilization (%)	Net mechanical energy efficiency (%)
Gas-fired boiler	39 – 42.5	78 – 95	No BAT-AEEL
Open cycle gas turbine, ≥ 50 MW_{th}	36 – 41.5	No BAT-AEEL	36.5 – 41

[27] https://www.ifc.org/wps/wcm/connect/ab72db72-736a-43e7-8c81-f2d749ec3ad1/20170406-FINAL+LNG+EHS+Guideline_April+2017.pdf?MOD=AJPERES&CVID=lJuCgVs

[28] https://www.ifc.org/wps/wcm/connect/f82a5f06-f3f7-4033-8ea6-b767523cda8e/FINAL_Thermal%2BPower.pdf?MOD=AJPERES&CVID=jqeD9Eg&id=1323162579734

[29] http://eippcb.jrc.ec.europa.eu/reference/

[30] https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC_107769_LCPBref_2017.pdf

[31] https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC_107769_LCPBref_2017.pdf

[32] In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or heat generation).

The Project benchmarking overview is provided in Section 7 below.

2.2 National requirements

2.2.1 National climate change policy and GHG reduction target

The Russian Federation (the RF) pursues a state policy in the field of reduction of greenhouse gas (GHG) emissions and increasing energy efficiency in various sectors of economy. The RF regularly provides national reports on GHG emissions inventories, based on assessment of man-induced emissions and GHG removal by sinks. Such assessment is conducted by Roshydromet in line with the commitments accepted by Russia under the UN Framework Convention on Climate Change and in accordance with the RF Government Instruction of 01.03.2006 No. 278-R[33].

In 2016, the RF signed the Paris Climate Agreement and further ratified it by the Government Resolution of 21.09.2019 No. 1228. For implementation of the Paris Agreement, RF President Decree of 04.11.2020 No.666 "On reduction of GHG emissions" sets the following targets:

- to reduce GHG emissions by 70% by year 2030 relative to the level of 1990, considering the maximum possible absorptive capacity of forests and other ecosystems;
- to develop and approve a Low-carbon Socio-economic Development Strategy of the Russian Federation until 2050;
- to foster implementation of measures for reduction and prevention of GHG emissions, and enhancing GHG sinks.

The RF President Decree "On measures to implement the state scientific and technical policy in the field of environmental development of the Russian Federation and climate changes" of 08.02.2021 No. 76 pushes (within the 6-month period) the development of a program of science-intensive technological solutions for studying climate, adaptation mechanisms and its effects and ensuring sustainable and balanced low-carbon development.

In late December 2019 the Russian government approved a national plan (RF Government Order No. 3183-r[34]) of 29 broad measures that encompass institutional, organisational and methodological measures aimed at shaping government approaches to adaptation to climate change. Government ministries and agencies are to devise sector-specific adaptation plans by Q3 2021.

2.2.2 GHG reporting at the national level

At present the state regulation of GHG emissions is based on the principle of voluntary emissions inventory to be prepared by the constituent entities of the Russian Federation.

The Climate Doctrine of the RF approved by the RF President Decree of 17.12.2009 No.861-rp and amended by the RF Government Instruction of April 30, 2018 No. 842-r, requires development and adoption of regulatory, methodology and other documents for annual reporting by major industries and energy companies with annual direct GHG emissions of more than 150,000 t CO_{2e}, starting from 2019. Since 2019, the large industries are requested by environmental authority to provide the information on their GHG emissions. However, no specific requirements for the inventory, timeframe and reporting format have been developed by present.

In February 2021, the draft Federal Law "On GHG emissions limitation" was disclosed for comments and recommendations (the second round of consultations). The law concept covers two main issues: obligatory GHG reporting for large GHG emitters (over 150,000 t CO_{2e}, for the 1st stage until 2024) and legal base for carbon credits management, as a tool to reduce carbon footprint and attract investment.

[33] RF Government Instruction of 01.03.2006 #278-r (as amended on 05.04.2019) "On the institution of the Russian system for assessment of man-induced emissions from sources and removal by sinks of greenhouse gases not regulated by the Montreal Protocol on Substances that Deplete the Ozone Layer adopted in Montreal on September 16, 1987"

[34] RF Government Order "On approval of the national plan of the first stage of climate change adaptation for the period until 2022" of 25.12.2019 No. 3183-r

2.2.3 Energy efficiency

The main legal act regulating the energy efficiency of enterprises is Federal Law "On Energy Saving and Energy Efficiency Increase and Amending Certain Legislative Acts of the Russian Federation" of 23.11.2009 No. 261-FZ. It created a legislative, economic and organisational stimulus for energy saving and increase of energy efficiency of industries.

The Russian Ministry of Construction, Housing and Utilities set the special obligatory requirements[35] on the EE of all buildings, structures and installations (with a few exceptions) in accordance with the RF Government Order of 17.11.2017 No. 1550/pr [36]. The EE requirements cover:

- the maximum energy consumption limits for buildings and structures;
- requirements regarding the architectural, functional, technological, construction, engineering and technical solutions impacting the EE of buildings and structures; and
- requirements regarding the specific construction elements of buildings and structures, applicable equipment, technologies and materials.

2.2.4 Best practice

The Russian Federation adopted the BAT principle in environmental regulation process starting from 2019. Category I facilities (having significant adverse environmental impact) have to comply with the best available technologies (BAT). National BAT Reference Documents have been developed taking into account EU BAT Reference Documents.

Industry-specific BAT on energy use and methane emissions per unit of production are provided in form of thresholds and / or average best values in the following applicable BAT reference documents, applicable to the Project activities [37]:

- ITS 29-2017 Natural gas production;
- ITS 50-2017 Processing of natural and accompanying gas;
- ITS 38-2017 Fuel combustion at large plants for production of energy;
- ITS 48-2017 Increasing energy efficiency of economic and/or other activities.

ITS 29-2017 Natural gas production lists BAT aimed at increasing energy efficiency and resource savings in gas production:

- BAT 1. Environmental management system;
- BAT 2. Energy management system;
- BAT 7. Well operation technologies without emission of air pollutants;
- BAT 8. Technologies of intensification of gas inflow to the well;
- BAT 14. Optimization of booster compression stations;
- BAT 15. LNG production technology;
- BAT 16. Associated petroleum gas utilization.

In line with ITS 29-2017, BAT for LNG production involve implementation of technological solutions ensuring reduction of air pollutant emissions, including:

- the use of isothermal tanks for initial storage of LNG and use of boil-off gas as fuel;
- the use of flare units, that allow to exclude emissions of non-ignited hydrocarbon gas into the ambient air.

[35] RF Government Decree "On approval of the rules for establishment of energy efficiency requirements for buildings, structures and facilities and requirements of rules for defining energy efficiency class of apartment blocks" of 07.12.2020 No. 2035.
[36] RF Minstroy Order "On approval of the EE requirements for buildings, structures and facilities" of 17.11.2017 No. 1550/pr
[37] http://burondt.ru/index/its-ndt.html

Specific levels of energy and resource consumption for gas production is provided in Section 3 of the BAT reference document. BAT levels of resource consumption for gas, gas condensate, oil and gas condensate fields are provided in Table 2-4.

Table 2-4 Average specific resource consumption for gas, gas condensate, oil and gas condensate fields [ITS 29-2017]

Specific energy consumption, GJ/TOE	Specific natural gas consumption, GJ/TOE
0.000001 – 0.041	0.00001 – 0.5136

BAT technological thresholds for methane emissions applicable to natural gas production are provided in Table 2-5. The methods selected for the Project are presented in Section 7.

Table 2-5: BAT technological thresholds for methane emissions applicable to natural gas production[38]

Production process	Pollutant	Unit[39]	Value
BAT 7,8 Well operation (gas, gas condensate, oil and gas condensate fields)	Methane	kg/TOE (of product, annual; the same below)	≤1.0
BAT 9 Preliminary separation of formation gas	Methane	kg/TOE	≤25.0
BAT 10 Pretreatment of combustible natural gas for transport using absorption gas dehydration	Methane	kg/TOE	≤0.2
BAT 11 Pretreatment of combustible natural gas for transport using adsorption gas dehydration	Methane	kg/TOE	≤0.01
BAT 12 Pretreatment of combustible natural gas for transport, unstable gas condensate treatment using low-temperature separation method	Methane	kg/TOE	≤0.2
BAT 13 Pretreatment of combustible natural gas for transport using low-temperature absorption method	Methane	kg/TOE	≤0.01
BAT 14 Optimization of booster compression stations	Methane	kg/TOE	≤1.0

Table 2-6: BAT technological thresholds most commonly applicable to operation of onshore facilities in natural gas production[40]

Polluting substance	Specific emission value, kg/TOE of product (annual)
Low-temperature absorption	
Application of BAT 1, 6, 7, 12, 13	
Methane (CH_4)	≤0.5
Preliminary separation, low-temperature absorption	
Application of BAT 1, 8, 12, 13	
Methane (CH_4)	≤2.0

In accordance with ITS 50-2017, BAT involve gas condensate stabilization technology providing for the use of combined condensate stabilization units (separation and fractionation), multistage degassing and stabilization in fractionation columns.

[38] In line with the Order of the RF Ministry of Natural Resources of 17.07.2019 No.471 "On approval of environmental regulation document "Process parameters of the best available technologies for natural gas production"
[39] TOE - tonne of oil equivalent (1,000 m3 of natural gas equivalent to 0.8 TOE, 1 tonne of condensate/ oil equivalent to 1 TOE)
[40] In line with the Order of the RF Ministry of Natural Resources of 17.07.2019 No.471 "On approval of environmental regulation document "Process parameters of the best available technologies for natural gas production" and ITS 29-2017

Table 2-7: BAT technological thresholds for methane emissions applicable to gas condensate stabilization[41]

Polluting substance	Specific emission value, kg/t of product (year)
Methane (CH_4)	≤0.02

Table 2-8 Average specific energy consumption for gas condensate stabilisation technology [ITS 50-2017]

Electricity	Thermal power	Fuel gas
KW*h/t	Gcal	m^3/t
≤430000	0.12-1800	≤45

The average energy efficiency index related to use of BAT on new gas-fired power plants are described in ITS 38-2017.

Table 2-9: Efficiency of new gas power plants, related to BAT application[42]

Type	Efficiency, %	Efficiency of fuel heat use, %
Gas turbine	36-40	-
Gas engine	38-45	-
Gas engine with waste heat boiler in a cogeneration mode	> 38	75-85
Combined cycle with or without additional combustion in waste heat boiler (electricity production only)	54-58	-
Combined cycle without additional combustion in cogeneration mode	< 38	75-85
Combined cycle with additional combustion in a cogeneration mode	< 40	75-85

BAT reference document ITS 48-2017 on energy efficiency does not include industry-specific technological thresholds and contains general information and recommendations to approach and management measures to enhance energy efficiency at Category 1 facilities.

There are no specific BAT requirements developed for LNG production.

The Project benchmarking overview is provided in Section 7 below.

[41] In line with the Order of the RF Ministry of Natural Resources of 21.05.2019 No.319 "On approval of environmental regulation document "Process parameters of the best available technologies for natural and accompanying gas processing" and ITS 50-2017

[42] ITS 38-2017 Fuel combustion at large plants for production of energy;

3 THE COMPANY POLICY SETTINGS

3.1 NOVATEK GHG Management System and Climate Policy

In 2017, PJSC "NOVATEK" developed and adopted a corporate Greenhouse Gas Emission Management System compliant with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the RF Government Resolution 02.04.2014 No. 504-R, and the Guideline Methodology for GHG emissions assessment approved by the RF MNR Order 30.06.2015 No.300.

The GHG Management System is considered as an essential component of the Integrated Environmental, Occupational Health and Industrial Safety Management System of NOVATEK and aligned with the requirements of ISO 14001-2015 and ISO 14064-1:2007.

The guidelines on the GHG Management System is provided in the corporate standard SK ISU-0-012 ("the NOVATEK Standard") that establishes a set of consistent approach to GHG emission accounting and management in the controlled entities (subsidiaries) including LLC "Arctic LNG 2".

Further guidance and procedures are included as Appendixes to the Standard:

- Development of a GHG emission register, planning and monitoring (Appendix A);
- Identification of GHG emission sources and quantitative assessment of GHG emissions (Appendix B);
- GHG management system verification procedure (Appendix C).

The Standard includes the Climate Policy which principles and provisions are presented as an integral part of the NOVATEK Environmental, Industrial Safety and Occupational Health Policy (2016, the NOVATEK EHS Policy).

The NOVATEK EHS Policy declares the intention to:

- "2.4 Consider risks and provide assessments of the climate change impact on operations of the Company and its controlled entities, regularly carry out cryological monitoring, develop a system of reporting on greenhouse gas emissions, apply innovative technologies to reduce greenhouse gas emissions" and
- "2.5 Support the scientific research and development of innovative projects aimed at increasing energy efficiency and use of renewable energy".

NOVATEK developed the following sustainable development objectives in respect to energy efficiency and GHG emission management:

- Decrease of specific methane emission in production, treatment and LNG sectors by 4% (from 10,44 tCH_4/th.BOE);
- Decrease of specific GHG emission in production sector by 6% (from 12,58 tCO_{2eq}/th.BOE);
- Decrease of specific GHG emission in LNG production by 5% (from 0,263 tCO_{2eq}/t LNG).

The baseline performance indicators are taken from the 2019 Sustainability report. These objectives are to be reached by 2030.

3.2 GHG and energy efficiency management in Arctic LNG 2

LLC "Arctic LNG 2" is fully aware of possible consequences of climate change in the global context and the need to focus on minimizing and effective management of GHG emissions.

The corporate HSE and Social Responsibility Policy approved by the order of LLC "Arctic LNG 2" of 24.05.2019 No.109-PR includes commitments to minimize the negative environmental impacts and use the natural resources in a reasonable manner.

The NOVATEK EHS Policy, the Climate policy and the NOVATEK Standard on GHG Management System are adopted by the Arctic LNG 2. The approach to accounting, assessment, reduction, monitoring and control of GHG emissions approved by the NOVATEK Standard are equally applicable to the Project.

GHG emissions and energy efficiency issues will be managed with due care as other significant environmental aspects of the Project in the framework of Integrated Management System of Arctic LNG 2.

For the purpose of GHG emissions reporting, the preliminary Project inventory of emission sources for the construction and operation phases is prepared and provided in the GHG and Energy Efficiency Management Plan and will be maintained up-to-date in the future along with the Project progress.

The total amount of the Project's GHG emissions is determined in accordance with the applicable national laws and international practice.

The summary of the Project GHG emission sources is given in Section 5 and outcomes of GHG emission assessment is presented in Section 7.1.

4 PROJECT DESCRIPTION

4.1 The Project overview

Arctic LNG 2 is a project for gas extraction, production and loading of liquefied natural gas (LNG) and stabilized gas condensate (SGC) for further transportation. The Project is operated by Arctic LNG 2, LLC. The resource base of the Project is the Salmanovskoye (Utrenneye) oil, gas, and condensate field (OGCF) located on the Gydan Peninsula in the Tazovskiy Municipal District of the Yamal-Nenets Autonomous Okrug of Russia.

Key components of the Arctic LNG 2 Project (hereinafter – the Project) are:

- the Salmanovskoye (Utrenneye) oil, gas, and condensate facilities setup (the Field);
- the GBS Plant for liquefaction of natural gas and stabilization of gas condensate (the GBS LNG & SGC Plant or the Plant). The Plant includes three LNG trains on the artificial land plot to be constructed in the Ob Estuary;
- the Utrenniy LNG & SGC Terminal (the Utrenniy Terminal, the Port) intended to provide offshore logistics for gas carriers and tankers, offloading of LNG and SGC, reception and storage of cargoes for operations and construction.

The Project structure is provided on the Fig. 1.1 below.

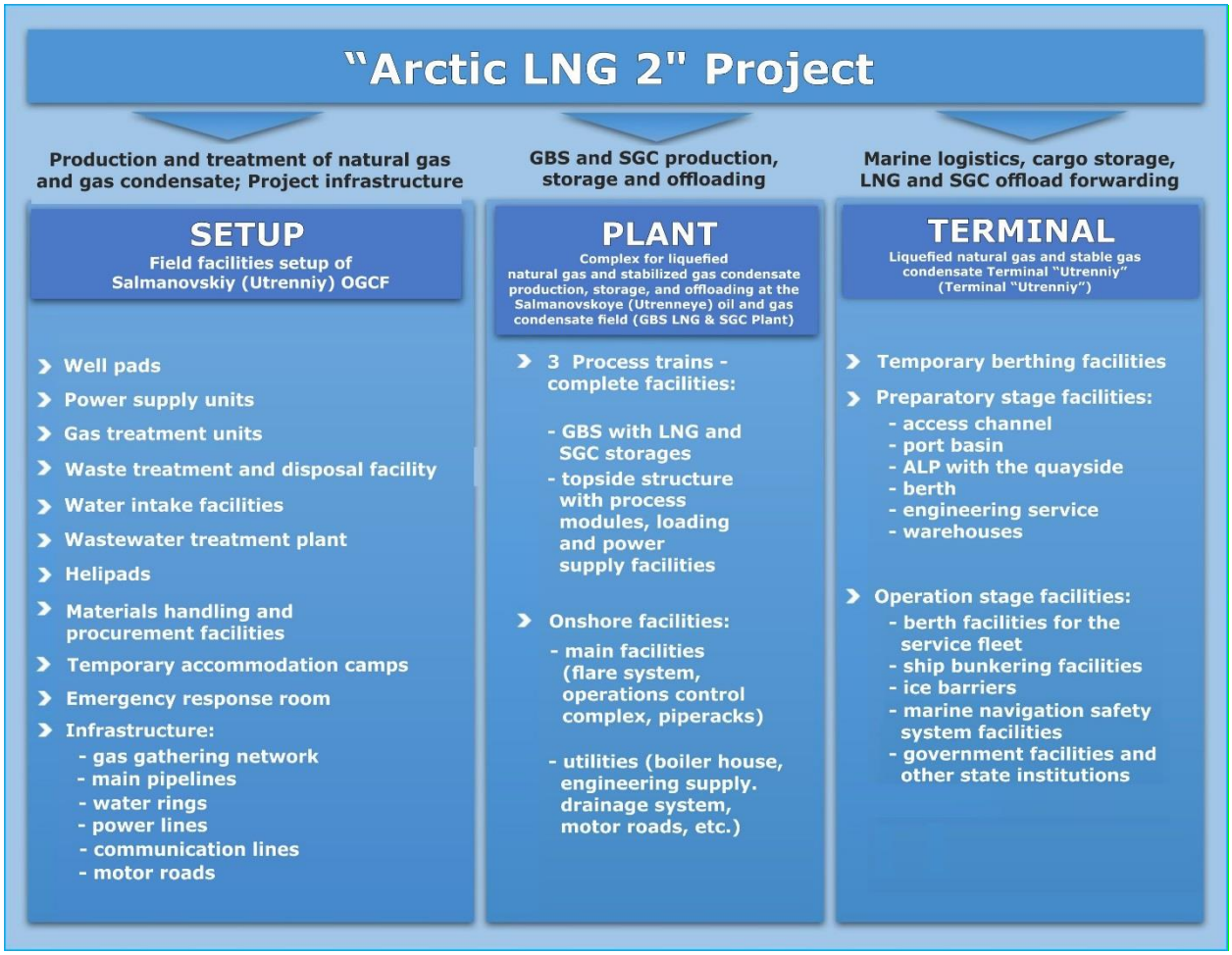

Figure 4.1: The Arctic LNG 2 Project structure

The **Field** includes gas, gas condensate and oil deposits and is planned to be drilled by 213 wells clustered in 20 well pads. The Salmanoye field is intended for production of gas and gas condensate; oil production is not planned. Exploration and development of the Salmanovskoye (Utrenneye) OGCF are carried out by ARCTIC LNG 2 LLC on the basis of the license valid until 2120.

The **Plant** on gravity-based structures will comprise three process trains for production, storage and offloading of liquefied natural gas and stabilised gas condensate with the declared annual capacity of around 6.6 MTPA of LNG each. The total SGC capacity of the Complex during the peak period is up to 1.6 Mtpa of SGC.

The **Terminal** Utrenniy is to be operated as a section of the port Sabetta (located on the Yamal Peninsula on the left shore of the Ob Estuary) and is designed for providing marine logistics functions for gas carriers and tankers for LNG and SGC offloading, and for the reception and storage of process and construction cargoes for the Project.

Construction of the Arctic LNG 2 Project facilities is carried out in successive stages, starting from the exploration of the Salmanovskoye (Utrenneye) OGCF and ending with commissioning of the third process train of the GBS LNG & SGC Complex in 2026. The majority of the field and seaport facilities will be built ahead of the Complex construction schedule.

The Project operational lifetime is estimated as 25 years with a possibility for extension.

4.2 Salmanovskoye (Utrenneye) OGCF Facilities Setup

4.2.1 The Field facilities

Due to the peculiar geological structure of the Salmanovskoye (Utrenneye) OGCF, the Field facilities are grouped within three production zones, so-called Domes: Northern, Central and Southern. The gas condensate well pads are confined to the domed structures of the field.

The main Salmanovskoye (Utrenneye) OGCF setup facilities are:

- 213 gas condensate wells clustered in 20 well pads;
- complex gas treatment plants (CGTP) N. 1 и No. 2 and a preliminary gas processing terminal (PGPT) No. 3;
- gas gathering network (gas pipelines – flowlines);
- interfield pipelines;
- condensate pipelines;
- methanol pipelines;
- field support base;
- temporary gas turbine power plant (GTPP) in Energy Centre No. 2
- GTPP;
- camp for the rotational personnel accommodation;
- water supply and wastewater removal systems, including wastewater treatment plant (WWTP);
- solid municipal, construction and industrial waste landfill;
- emergency rescue centre;
- helipads;
- motor roads;
- overhead power transmission lines; and
- fiber optic communications.

Complex gas treatment units are designed for treatment of reservoir fluids coming from well pads to ensure the required quality of natural gas fed to the LNG Complex and to separate gas condensate and water-methanol solution. The treated natural gas and unstable gas condensate are supplied from the CGTP via separate pipelines to the GBS LNG & SGC Complex. Water-methanol solution is fed to the regeneration and recovery plant, designed as part of the CGTP and PGPT system, for methanol recovery and reuse.

The temporary accommodation camp at Salmanovskoye (Utrenneye) OGCF will accommodate the rotational personnel of the Field, the Plant and the Terminal. There will be also a boiler house, a canteen, a laundry, warehouses, a health center and other facilities necessary for the personnel accommodation.

4.2.2 Power and heat supply

Power supply for the Field will be provided from two main sources. At the construction and early operation stages electricity will be generated on temporary power plant called Energy Centre No.2. Power plant will consist of 16 PAES-2500 mobile automated gas turbine power plants fed by fuel gas (power generating capacity is 2.5 MW per unit). Energy Centre No.2 will be used until the commissioning of GTPP on the PGTP-3. During this period, it is planned that heat will be generated by electric radiators.

Other main source of electricity and heat is a GTPP near the PGPT-3. The power plant consists of six gas turbine units (five operational and one standby) with the electrical capacity of 12 MW and the thermal capacity of 17.7 MW per unit that will supply the Field development facilities with electricity and heat at the operation phase.

Buildings and structures at the GTPP site will include power modules, substation 10/35kV comprising switchyard 10kV, step-up transformers 10/35kV and switchgear 35kV, as well as site Package Transformer Substations (PTS, 2 units).

Emergency power supply will be provided by emergency (reserve) diesel power stations (EDPS), and uninterrupted power supply system with batteries. The reserve power supply scheme is decentralized, with locally installed package container automated EDPSs with output voltage 0.4 kV.

4.2.3 Water supply and wastewater disposal

Most part of the water for water supply will be abstracted from the local lakes that do not freeze to the bottom in winter. In some cases, abstraction of water for technical water supply will be arranged in hydraulic fill quarries of construction materials. From the intake facilities water is pumped via two pipelines to the water treatment facilities of the early development and gas treatment facilities. All facilities at the Field will be served by two systems of water supply, i.e. potable water and process-and-fire water.

The Field design provides for several different systems for collection and disposal of wastewater. WWTP will be constructed at all sites with significant wastewater streams (otherwise, storage tanks are provided for collection and transportation of wastewater to WWTPs at other sites).

The treated wastewater is planned to be pumped back into the deep aquifer horizons near the sites of CGTP1, CGTP2 and PGTP3. For this purpose, deep (injection) wells will be drilled. The need for additional wells will be determined after the injection of water into the intake horizon. The maximum possible number of wells is 22.

A part of treated wastewater will be discharged into surface waterbodies - lakes (during hydraulic production of sand), inland water courses and the Ob Estuary (controlled discharge).

4.2.4 Waste management

The waste disposal site is intended for centralized collection, thermal treatment (incineration) and disposal of industrial, construction and solid municipal wastes of hazard classes III-V generated during construction and operation of all the Project components including the Field, the Plant and the Utrenniy Terminal.

The waste treatment methods are selected to minimise the volume of buried wastes and to recycle / reuse the wastes prohibited for acceptance at the disposal site. Incineration is intended to minimise the amount of wastes to be buried in the landfill.

The waste disposal site will comprise of the waste storage areas, the administrative building (office) and wastewater pumping station and several process facilities, namely:

- Isolating soil site;

- Bulky waste site;
- Area for collection of municipal solid waste produced during operations at the waste disposal site;
- Site for temporary accumulation of compacted and crushed wastes in containers;
- Parking space for specialized vehicles;
- Covered site for wastes crushing and compaction;
- Waste incineration system;
- Weighing bridge with a radiation control station;
- Fire water tanks

4.3 GBS LNG & SGC Plant

The total SGC capacity of the Complex during the peak period is up to 1.6 Mtpa of SGC.

The Plant will comprise three process trains built on gravity-based structures (GBS) with the installed annual capacity of ~6.6 Mt of LNG each. The total SGC capacity of the Plant during the peak period is up 1.6 Mtpa of SGC. The adjacent coastal area will be used for construction and operation of auxiliary facilities and infrastructure and the Utrenniy liquefied natural gas and stabilised gas condensate Terminal.

Each of the three process trains will include the following:

- Gravity-based structure with integrated tanks for storage of LNG and SGC, as well as other technical and process fluids and gases;
- Topside modules comprising several decks to accommodate process facilities for production and offloading of commercial LNG and SGC products, as well as main and emergency power generation systems.

The below onshore facilities will be constructed and commissioned in parallel with the first process train of the Complex:

- Onshore pipe rack;
- Central Control Building;
- Main electrical switchgear;
- Flare unit; and
- Operation control system (OCS).

An artificial land plot will be filled in between the GBS and the onshore structures to accommodate the berth embankment and the process rack for natural gas and gas condensate supply to the Plant.

Figure 2 illustrates the Project processes at the Plant. The processes carried out in the main part of the gravity-based structure are contoured yellow ("GBS") and the processes of the topside structures are contoured light blue.

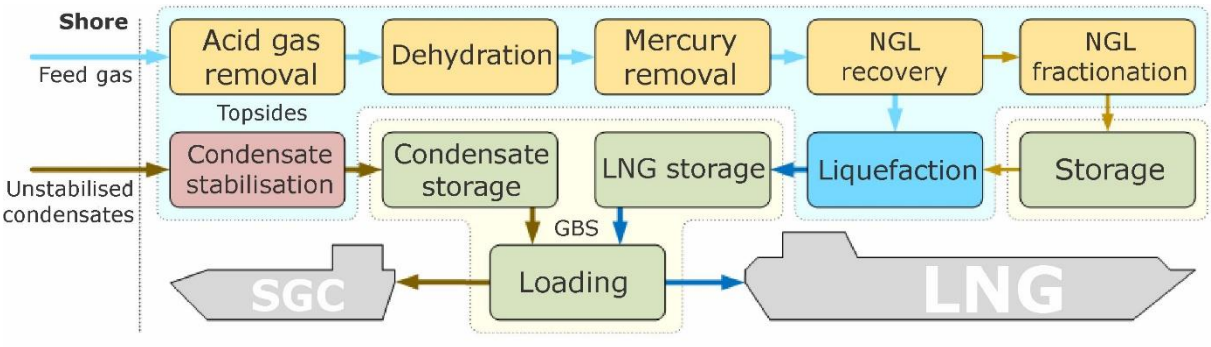

Figure 2: Diagram of the process train of the Complex (Source – NOVATEK PJSC, 2018)

The main processes of the Complex are supplemented by functioning of auxiliary systems of refrigerant storage and circulation, LNG storage and offloading, boil-off gas compression (i.e. treatment to certain specifications), condensate storage and offloading, electricity generation, main heat transfer fluid circulation, glycol water solution circulation, fuel and technical gas supply, discharge and purge (with flare facilities), water supply and sewage, and management of solid waste of various origins.

4.4 Utrenniy Terminal

The Utrenniy LNG and SGC Terminal (Port) is designed to provide marine logistics support for gas carriers and tankers, LNG and SGC offloading, reception and storage of operational and construction cargoes. It is planned to site offshore facilities of the Terminal in the Ob Bay between outlets of the Khaltsyney-Yakha and Nyaday-Pynche rivers.

The designed facilities will be developed in two sites: the administrative area close to the existing general-purpose berth which is subject to reconstruction; and the quay area to be developed within the designed site of the LNG & SGC Plant on three gravity-based structures.

The existing berth facilities operated since 2015 will be reconstructed as a part of work on Early Port Facilities (EPF) and integrated into the Terminal infrastructure. The design cargo turnover of the berth is 140 thousand tons for the navigation period, beyond this time the facilities are not in operation.

Construction of seaport water area and access channel, general-purpose berth; utility systems, tide gauge, ALP-1 (artificial land plot) and onshore infrastructure will be also a part of EPF.

Operation phase facilities (OPF) include reconstruction of seaport water area and construction of:

- Ice barriers;
- Berth for the port fleet and emergency response facilities with an extension for reception of rolling cargo integrated with the general-purpose berth;
- Methanol reception system;
- Bunkering infrastructure for the port fleet at the berth;
- Components of the ice management system;
- Onshore infrastructure;
- Premises for the state institutions (federal property): RF state border checkpoint and traffic safety facilities; facilities of the federal services including indoor parking; offices and domestic facilities; transport and utility infrastructure.

4.5 Project Phasing

Construction of the Arctic LNG 2 Project facilities is carried out in successive stages, starting from the exploration of the Salmanovskoye (Utrenneye) OGCF and ending with commissioning of the third process train of the GBS LNG & SGC Complex in 2026. The majority of the field and seaport facilities will be built ahead of the Complex construction schedule.

Since 2014, LLC "Arctic LNG 2" is the sole holder of subsoil license that includes the Salmanovskoye (Utrenneye) OGCF. The license which is valid till year 2120[43] permits exploration and production of hydrocarbons in the Salmanovskiy (Utrenniy) license area.

In 2015-2016, the preliminary front-end engineering design (pre-FEED) for the LNG & SGC Plant was prepared and identified the mixed fluid cascade process by Linde (Germany) as preferred method of liquefaction of natural gas. At the same time, GBS (gravity-based structure) was considered as an option for the Plant construction.

In 2017-2020, the design documentation was developed, and the key equipment and installations procured. The Engineering, Procurement and Construction Contracts for the Project were signed with

[43]Subsoil license СЛХ 15745 НЭ of 20.06.2014 for exploration and production of crude hydrocarbons in subsoil area of federal significance including Salmanovskoye (Utrenneye) oil, gas, and condensate field / Consolidated National Register of Subsoil Areas and Licenses. - Russian Federal Geological Fund of the Federal Agency for Mineral Resources. As amended by Addendum No.3 dated 29.03.2018.

NOVARTIC / GYDAN LNG (lead by TechnipFMC) for the Topsides and SAREN (lead by SAIPEM) for the GBS part.

Further Project plans provide for phased commissioning of the Field facilities, as soon as the Plant process trains are available. It is planned that the Plant will become fully operational in 2026, with the three process trains running at full capacity.

The berths are the first facilities constructed of the Project facilities and were put in operation in 2016. It is part of the Terminal "Utrenniy" which is under construction currently. The Terminal will finally be commissioned in the first half of 2023.

Construction of the Field facilities started in 2018. Wells are to be drilled from 2020 to 2026. Other Field facilities (gas treatment plants, waste landfill site, and others) are planned to be operational by the end of 2023.

Construction of The Plant started in mid-2019, with commissioning scheduled for early 2026.

The Plant topside modules and process piping are designed for a minimum operation life of 25 years. Regular inspections during the operation period will identify the need for the equipment repair and/or replacement to extend operation of the modules.

The operation life of the hydraulic structures related to the Port (the ice barriers, drainage channel, and berths) is less than 50 years. The gravity-based structures of the Plant Process Trains and related LNG and SGC storage tanks are designed for 40-year operation. At the end of the above period, industrial safety review will either demonstrate their fitness for further safe operation or identify the need for decommissioning, dismantling and disposal.

4.6 Associated facilities and activities

In accordance with IFC Performance Standard 1 (PS1), Associated Facilities of a Project are those activities and facilities that are not financed within the scope of the Project and would not be conducted, built or expanded if the Project was not carried out, and without which the Project would not be viable. The list of Associated Facilities as well as activities and facilities considered as not associate with the Project was identified in the framework of ESHIA and respective supportive documentation development and agreed with Independent Environmental and Social Consultant.

5 APPROACH TO GHG ACCOUNTING AND REPORTING

5.1 International approach

5.1.1 International Requirements

In 1987-1988 the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) established a dedicated international scientific organization - Intergovernmental Panel on Climate Change (IPCC) - that provides information on climate change, its impact on natural and economic systems, human health, and on the ways the anthropogenic impact on climate can be mitigated.[44] Results of the IPCC work are issued in the form of scientific reports. The Fifth Assessment Report was published in 2013-2014.

The IPCC Task Force on national greenhouse gas inventories develops methodology guidance for the national inventories of GHG sources and sinks. The IPCC Guidelines for National Greenhouse Gas Inventories were published in 2006[45] to facilitate preparation of the national GHG inventories by the member countries. The Guidelines provide default values of various parameters and emission factors for various sectors of industry, to enable estimation of GHG emissions using the national economic data. Also, the countries are free to use more detailed methodologies, provided that data reported by different countries are compatible, comparable and consistent.

On August 5, 2019, IPCC issued updated version of the methodology[46]. The 2019 Refinement provide more methods to be used for evaluation of GHG emission sources and sinks. It further considers the identified scientific gaps, new technologies, processes, sources and sinks that were not covered by the IPCC 2006 Guidelines.

5.1.2 The WBCSD / WRI GHG Protocol

The GHG Protocol[47] is a partnership between World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), which establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains and mitigation actions.

The GHG Protocol Initiative comprises two separate but linked standards:

- GHG Protocol Corporate Accounting and Reporting Standard (provides a step-by-step guide for companies to use in quantifying and reporting their GHG emissions)[48];
- GHG Protocol for Project Accounting (a guide for quantifying reductions from GHG mitigation projects)[49].

GHG Protocol develops guidance to provide clarity on how specific sectors can apply GHG Protocol standards, including direct emissions, Scope 2[50], Scope 3 Calculation[51].

To make the GHG emissions reporting more structured, the Greenhouse Gas Protocol: Corporate Accounting and Reporting Standard[52] introduces the concept of "scope" of direct and indirect emission sources according to the organizational and operational boundaries of the assessment:

- Scope 1: Direct GHG emissions - Direct GHG emissions occur from sources that are owned or controlled by the company.

[44] http://www.meteorf.ru/activity/international/mgeik/
[45] IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Prepared by the Task Force on National Greenhouse Gas Inventories of the IPCC. Edited by Simon Eggleston, Leandro Buendia, Kyoko Miwa, Todd Ngara and Kiyoto Tanabe . Published by IGES, Japan
[46] 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories
[47] https://ghgprotocol.org/
[48] https://ghgprotocol.org/corporate-standard
[49] https://ghgprotocol.org/sites/default/files/standards/ghg_project_accounting.pdf
[50] https://ghgprotocol.org/scope_2_guidance
[51] https://ghgprotocol.org/scope-3-technical-calculation-guidance
[52] The Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard (revised edition). http://ghgprotocol.org/corporate-standard

- Scope 2: Power indirect GHG emissions account for GHG emissions from the generation of purchased electricity consumed by the company (for production processes, heating, cooling).
- Scope 3: Other indirect emission. This is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company but occur from sources not owned or controlled by the company, i.e. extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services. Therefore, emissions from the associated facilities/activities and supply chains can be considered as Scope 3.

The tools advised by the GHG Protocol are consistent with those proposed by the Intergovernmental Panel on Climate Change (IPCC) for compilation of emissions at the national level (IPCC, 2006). The default emission factors are averages based on the most extensive data sets available and used by the Intergovernmental Panel on Climate Change (IPCC), the premier authority on accounting practices at the national level. However, the GHG Protocol recommends that businesses should use custom values whenever possible, as the industrial processes or the composition of fuels used by businesses may differ with time and by region.

5.2 National approach

As described in Section 2.2.2, no specific requirements for the inventory, timeframe and reporting format have been developed by present. At the same time, methodology framework for assessment of direct and indirect GHG emissions by industries is provided in two following documents:

- RF Ministry of Natural Resources, Order of 30.06.2015 No. 300 "On approval of "Methodology instructions and guidelines for quantitative assessment of GHG emissions from entities conducting economic and other activities in the Russian Federation" ("Order 300"); and
- RF Ministry of Natural Resources, Order of 29.06.2017 No. 330 "On approval of "Methodology instructions and guidelines for quantitative assessment of indirect energy GHG emissions" ("Order 330").

The general approach to GHG accounting is adopted from IPCC Guidelines for national inventories (2006) supplemented by emission factors for various composition of fuels and technologies typical for the RF.

In accordance with the "Concept of the system of GHG emissions monitoring, reporting and verification in the Russian Federation"[53] adopted in 2015, the assessment of anthropogenic emissions of greenhouse gases refers to the following substances: carbon dioxide, methane, nitrogen monoxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride. It shall be noted that emission of methane and nitrogen monoxide is scoped out for stationary combustion, and nitrogen monoxide emission is scoped out for flaring by the requirements of Order 300.

5.3 GHG accounting approach and consistency

5.3.1 Identification of Method of Quantitative Assessment of GHG Emissions

The 2006 IPCC Guidelines provide for three tiers of quantitative assessment of the emissions, depending on the available data on the operations, fuel, feedstock and processes:

- **Tier I** relies on application of generic average emission factors recommended by IPCC 2006, with no regard to the country-specific attributes of the processes;
- **Tier II** suggests that region-specific or country-specific emission factors are applied to account for local specifics of the processes, properties of the fuel, feedstock and/or materials;
- **Tier III** provides for the use of emission factors that account for specifics of the production processes of specific company. Such factors should be calculated on the basis of detailed

[53] Concept of the system of GHG emissions monitoring, reporting and verification in the Russian Federation (adopted by the RF Government Instruction No.716-r of 22.04.2015

information on composition of fuel, feedstock and materials, and on the technological process that produces the emissions.

The methodology approach to quantitative assessment of GHG emissions is selected with due regard to availability of data on the planned operations and the current stage of design development, namely predicted values and known planned parameters of various fuels used at different stages of the Project implementation. This method is adopted to minimise uncertainty of the assessment result and the risk of underestimating or overestimating the emissions (the accuracy principle).

The quantitative assessment results for each source have been compared against the selected level of significance. In accordance with the Methodology Instructions for quantitative assessment of GHG emissions #300 and recommendations of the GHG Protocol[54], the threshold level for summary significance of non-included sources is 5% of the total emissions volume, but not more than 50,000 t CO_2-equivalent per year. However, if this approach is adopted, many sources fall below the significance threshold, therefore, reliable calculated values at each source that contribute more than 1% to the total GHG emissions volume have been considered, as far as possible.

The assessment has been conducted using the selected method depending on the reliable available data (Tier II). The preliminary assessment of the Project GHG emissions including description of assumptions made in the calculations is provided in the GHG and Energy Efficiency Management Plan.

5.3.2 Selection of the Assessment boundaries

The main GHG emissions from the Project are generated in the process of production, treatment and liquefaction of natural gas and stabilization of gas condensate. These emissions are considered under the Scope 1 assessment.

Given that energy supply for the Project will be provided from the generation facilities (power and heat) specifically designed for the Project, the associated GHG emissions are estimated as direct emissions, based on the quantity of fuel used for generation and included in the Scope 1 assessment. Therefore, separate assessment of Scope 2 emissions is not required.

Scope 3 assessment is *not required* for the Project in the framework of international ESHIA provision by the international requirements (see Section 2.1 for details), however, the Company decided to conduct the assessment of its carbon footprint as far possible, in order to further consider potential compensation mechanisms and reduction of GHG emissions at the associated facilities and activities and in the Project supply chain, including, inter alia, transportation of products and their use. The depth of such assessment depends on the available information at this stage, selected boundaries of the system, and how reasonable (from the Company's perspective) the investing will be in regard to reduction of GHG emissions at suppliers, contractors and customers. The GHG and Energy Efficiency Management Plan provides for assessment of the Scope 3 GHG emissions at the extent possible at this stage (based on the availability of reliable information). Based on the availability of the Scope 3-related information, this assessment will be improved in the future.

The Project GHG emissions were assessed for content of the substances that are generated/released by the Project during production, transportation and storage of the feed gas and LNG, namely carbon dioxide, methane, and nitrogen (I) oxide. The GHG precursors (SO_2, CO, NO_x, etc.) have been scoped out, due to the lack of reliable methodology for their estimations in CO_2 equivalent.

[54] GHG Protocol: A Corporate Accounting and Reporting Standard http://www.ghgprotocol.org/corporate-standard

6 GHG EMISSION SOURCES OVERVIEW

6.1 GHG emission sources at the construction phase

During the construction phase, GHG emissions will arise as a result of both construction of the Project facilities described above and initial operation of ancillary facilities/supporting infrastructure required to support the construction of the main facilities at the Field, the Port and the GBS LNG & SGC Plant. Taking into consideration the complex structure of the Project, the types and number of emission sources will vary throughout the construction stage.

Table 6-1 Main GHG emission sources during construction phase

Project component	Emission source types	Facilities / Activities
General	Combustion	Construction vehicles and equipment Road vehicles Mobile diesel power generators (at the initial stage)
The GBS LNG & SGC Plant	Combustion	Diesel power plants Boiler house Loading machinery engines Use of watercrafts
The Field	Combustion	Diesel power plants GTPP based on 16 PAES-2500 2.5 MW (use at the construction phase only) Flaring at the power generation site Oil cuttings treatment units
	Fugitive	Drilling operations (vents) Fuel gas treatment unit Gas production at the first wells (vents)
The Port	Combustion	Use of watercrafts Loading facilities

6.2 GHG emission sources at the transition and operation phases

During the transition phase the Project activities will comprise both construction of the remaining facilities, gradual commissioning and start of operation of all permanent Project facilities.

The Project's operational GHG emissions are generated in the process of production, treatment and liquefaction of natural gas and stabilization of gas condensate, including main process units, gas turbine units, boilers, compressors, flare system, etc., as well as emissions related to the energy systems of the production facilities, buildings and structures, LNG and SGC storage and offloading facilities. Main GHG emission during the operation phase is described in Table 6.2.

The GHG emission sources at the transition phase will include both construction and operation sources.

Table 6-2 Main GHG emission sources during operation phase

Project component	Emission source types	Facilities / Activities
The Project		
General	Combustion	Road vehicles
The GBS LNG&SGC Plant	Combustion	Gas turbine power plant Gas turbine compressors for cooling agents Boiler house Flaring system
	Technological process	Acid gas removal
	Fugitive/venting	Process Trains equipment
The Field	Combustion	GTPP on PGTP-3 Boiler houses on CGTPs Flaring system Waste thermal disposal Sludge incineration unit Waste transportation (trucks)
	Fugitive/venting	WWTP Landfill gas at waste disposal site
The Port	Combustion	Watercrafts
	Fugitive/venting	Local wastewater tanks
The associated facilities / activities		
Airport	Combustion	Aircraft landing and take-off (personnel transportation)
		Boiler
		Diesel generation
LNG transportation to Murmansk and Kamchatka transhipment floating storage units (FSUs)	Combustion	Boiled-off gas consumption, including operations: waiting at anchorage, sailing, loading-offloading, consumption at FSU and other related operations; ship-to-ship consumption Transshipment floating storage unit consumption Marine diesel oil consumption by marine vessels Safety flaring

The preliminary inventory of emissions sources and the current GHG emission assessment for the Project is provided in the GHG and Energy Efficiency Management Plan.

The highest annual GHG emissions will be generated during the operational phase. More detailed inventory of operational GHG emissions shall be developed prior commissioning of the Plant.

7 THE PROJECT BENCHMARKING

7.1 The Project GHG emissions and carbon intensity

According to the GHG emission assessment results, expected level of GHG emissions from the Project is 1.63 million t $CO_{2\text{-}e}$ during the whole period of construction. During operation (starting from 2026), the Project emissions of GHG are not likely to exceed 6.20 million t CO2-e per year. More information on the Project carbon footprint is presented in GHG and Energy Efficiency Management Plan.

The Arctic LNG 2 Project adopted the feasible energy efficient solutions and appropriate BATs at the planning and design stage (see Sections 7.2 and 8.1 below), and this approach helps to achieve the specific GHG emissions of 0.27 t CO_{2eq} / t LNG comparing to the sector-average value of 0.42 t CO_{2eq} / t LNG[55] (lower by 36%). The best current performance in LNG production is summarised in Table 7-1 below.

Table 7-1 Carbon intensity of LNG production

Project	Annual capacity, MTPA LNG	Project Status	Carbon intensity, t CO2eq / t LNG	Region
Gladstone LNG	7.8	Operation, 2019	0.35[56]	East Australia
Nigeria LNG	22	Operation, 2019	0.34[56]	Western Africa
Oman LNG	10.4	Operation, 2019	0.28[56]	The Persian Gulf Region
Yamal LNG	17.5	Projection, 2014	0.33[57]	The Russian Arctic
		Operation, 2019	0.26[58]	
Arctic LNG 2	19.8	Projection, 2020	**0.27**	The Russian Arctic
Snohvit LNG	5.6	Operation, 2019	0.22[56]	The Norway Arctic
Sector best average	-	Operation, 2015	0.42	Worldwide

This comparison demonstrates that the resource- and energy efficiency principle has been successfully implemented in the Project design.

It is expected that the actual GHG emissions from the Project will be lower than the estimated values, as the calculation is based on a conservative approach, using the projections in the design documentation and operation of facilities at full capacity. Furthermore, actual consumption of fuel gas for generation may be lower, due to better gas quality and optimization of combustion mode. The comparison of projections and actual carbon intensity of the Yamal LNG project in Table 7-1 provides a good example of implementation of such assumption.

Before the Field' full operation and the Plant' commissioning, more detailed inventory and assessment of GHG emissions shall be developed based on as-built documentation. The actual emissions reporting shall be based on the exact understanding of the fuel characteristics and measured consumption, and the assessment results are to be compared to the sector best practice again.

7.2 Best practice on GHG emission and EE performance

The Project demonstrates the full compliance with the EHS Guidelines for Liquefied Natural Gas Facilities (2017), being in the lowest part of the best energy performance range[59].

[55] Life Cycle Assessment of LNG. International Gas Union (IGU), June 2015.
[56] https://context.capp.ca/infographics/2020/infographic_the-worlds-best-lng
[57] Estimations from Environmental and Social Impact Assessment of the Yamal LNG project. – LLC "ENVIRON CIS". – 2014 - 953 p.
[58] Sustainability report 2019, NOVATEK. – 2020 – 187 p. https://www.novatek.ru/common/upload/doc/NOVATEK_FULL_RUS_2019.pdf
[59] https://www.ifc.org/wps/wcm/connect/ab72db72-736a-43e7-8c81-f2d749ec3ad1/20170406-FINAL+LNG+EHS+Guideline_April+2017.pdf?MOD=AJPERES&CVID=lJuCgVs

Table 7-2 Energy efficiency of LNG production

Parameter	Unit	Industry Benchmark	The Project performance	Reference
Energy consumption – LNG liquefaction process	kWh/t LNG	275-400	**276-285**[60]	EHS Guidelines for LNG Facilities

The Project EE management will aim at confirmation of the actual compliance after commissioning of the Plant and further improvement of the energy efficiency performance.

The project is well positioned both in respect to the requirements of EHS Guidelines for Thermal Power Plants[61] and best performance values set by BAT Reference Document for Large Combustion Plants[62] (2017) for large power generation and combustion plants. These BAT-associated efficiency levels (BAT-AEELs) and the Project performance is compared below.

Table 7-3 Typical CO_2 emissions and energy efficiency performance

Efficiency	Arctic LNG 2	CO_2 emission (gCO_2 / kWh – Gross)	Arctic LNG 2	Project facility / activity
Efficiency (% Net, lower heating value)				
36-40 (simple Cycle GT)	**40.2-41**[63]	505-561 (Net)	**482**	The Plant: GT generator 73.5 MW
	40-44		**482**	GT compressor 71.1 MW
36-40 (simple Cycle GT)	**40.2-41**	505-561 (Net)	**482**	The Field: Gas Turbine 12 MW
40-42 (Boiler)	**42**	481-505 (Net)	**481**	The Field Boilers
	41		**481**	The Plant Boilers

Table 7-4 Energy efficiency performance of power generation

Type of combustion unit	BAT-AEELs[64]		Arctic LNG 2		Project facility / activity
	Net electrical efficiency (%)	Net total fuel utilization (%)	Net electrical efficiency (%)	Net total fuel utilization (%)	
Gas-fired boiler	39 – 42.5	78 – 95	**42**	**92**	Boilers at the Field
			42	**92**	Boilers at the Plant
Open cycle gas turbine, ≥ 50 MW_{th}	36 – 41.5	No BAT-AEEL	**40.2-41**	Not compared (NC)	Aeroderivative gas turbines at the Plant

[60] Arctic LNG GBS Project - Stage 3. Stage 3 Options Evaluation and Recommendation Report. Pressmark: G098-KBRKCS-ALNG2-DOC-2057. Attachment 1: Stage 3: Option selection study evaluation criteria.

[61] https://www.ifc.org/wps/wcm/connect/f82a5f06-f3f7-4033-8ea6-b767523cda8e/FINAL_Thermal%2BPower.pdf?MOD=AJPERES&CVID=jqeD9Eg&id=1323162579734

[62] https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC_107769_LCPBref_2017.pdf

[63] Tables 4-1, 5-2, 5-3, 5-4 from Greenhouse Gas Emissions Report – Company document reference code 3000-D-EC-000-HS-REP-2006-00 – TechnipFMC, 2020. 41 p.

[64] In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or heat generation).

In respect to the national requirements on BAT stated by Order of the RF Ministry of Natural Resources of 17.07.2019 No.471 "On approval of environmental regulation document "Process parameters of the best available technologies for natural gas production", the Project demonstrates the outstanding performance regarding natural gas production (see Table 7-5 for details).

Table 7-5 BAT technological thresholds for methane emissions applicable to natural gas production[65]

Production process	Pollutant	Unit[66]	Value	Arctic LNG 2
BAT 7,8 Well operation (gas, gas condensate, oil and gas condensate fields)	Methane	kg/TOE (of product, annual; the same below)	≤1.0	**0.004**
BAT 9 Preliminary separation of formation gas	Methane	kg/TOE	≤25.0	**0.04**
BAT 12 Pretreatment of combustible natural gas for transport, unstable gas condensate treatment using low-temperature separation method	Methane	kg/TOE	≤0.2	**0.004**

[65] In line with the Order of the RF Ministry of Natural Resources of 17.07.2019 No.471 "On approval of environmental regulation document "Process parameters of the best available technologies for natural gas production"
[66] TOE - tonne of oil equivalent (1,000 m3 of natural gas equivalent to 0.8 TOE, 1 tonne of condensate/ oil equivalent to 1 TOE)

8 ARCTIC LNG 2'S GHG REDUCTION AND EE COMMITMENTS

8.1 Prevention – planning and design stage

The most efficient way to minimize GHG emissions is to employ the prevention principle, starting from the early planning stage, alternative analysis throughout planning and design and adoption of the feasible best available techniques during the design.

The following approach of energy and resource efficiency and reasonable use of natural resources are adopted in the Project to minimize GHG emissions, starting from the design development for the planned investments (the Project overview is provided in Section 4):

- Optimal location of facilities and infrastructure for production, transportation, treatment, liquefaction of natural gas and stabilization of gas condensate, and offloading of LNG and SGC to minimize energy consumption and losses;
- Selection of the most effective technologies and equipment for construction and operation;
- Efficient water supply and wastewater disposal schemes and heat, steam and electricity generation and supply;
- The liquefaction technology is based on a consecutive process of natural gas liquefaction with application of mixed cooling agents for efficient liquefaction of natural gas;
- Use of efficient power generation units, turbines and boilers throughout the Project;
- Energy generation at the Plant is arranged using efficient aero-derivative gas turbines instead of large industrial installations based on the higher thermal efficiency (41% comparing to 36-40%);
- Use of waste heat recovery units to recover waste heat from liquefaction compressor drivers turbines and utilize it in the process heat cycle or space heating;
- Optimising energy generation and supply schemes including use of heat exchangers utilizing cold and heat in the technological process and optimizing water heating in boilers for own needs and for glycol solution;
- Boil-off gas (methane) from the technological processes and LNG storage is collected and returned for utilization of cold in heat exchangers in the liquefaction process, or utilized locally as fuel gas;
- No routine flaring at the Project facilities and during the LNG transportation;
- Use of advanced smart controls for fuel combustion and thermal treatment of waste, for minimization of N_2O emissions.

The analysis of the Project alternatives meaningful in respect to the GHG emissions and the GHG emission assessment as per the Project phases are provided in GHG Management and Energy Efficiency Plan.

8.2 GHG Emission and EE Management

A range of specific measures have been developed to enhance energy efficiency and minimize GHG emissions during facility operations in line with the NOVATEK and Arctic LNG 2 policies and the Project design documentation, including ***prevention, engineering, management, monitoring and control*** measures which are described further in the GHG Management and Energy Efficiency Plan and briefly listed below.

The basis for the Project GHG Management System is provided by the corporate guidelines of NOVATEK - the standard SK ISU-0-012 establishing a consistent approach to GHG emission accounting and management. The overall GHG management will be provided in the framework of Integrated Management System of Arctic LNG 2.

8.2.1 Energy Efficiency Measures

The following measures are to be implemented aimed at increasing energy efficiency:

- Development and implementation of effective energy management system in line with ISO 50001, including commitments to:
    - Implementation of Arctic LNG 2 and NOVATEK policies in area of energy efficiency and saving;
    - Conduct the energy audit;
    - Establish the baseline, objectives, targets and action plans in accordance with potential opportunities to improve energy performance;
    - Develop and implement the energy management action plans;
    - Develop the energy performance indicators (EnPIs) and take actions to continually improve energy performance;
    - Measure and monitor key characteristics of the Project operations that determine energy performance against the energy policy and objectives and report the results.
    - Review the effectiveness of the policy;
    - Continually improve energy management
- Implementation of legally required measures in area of management of energy saving:
    - Provide for reduction of consumption of energy resources
    - Conduct energy audits and development of 'energy passport';
    - Account for energy resources using modern technological solutions and legislative requirements for subsequent analysis of energy resources balance for type of production and the entire enterprise;
    - Use of energy saving technologies;
    - Conduct training workshops on technical and organisational aspects of optimal use of energy resources;
    - Develop measures for sustainable reduction of energy resources consumption. Define timeframes for implementation, finance sources and responsible persons for implementation of developed proposals and activities.
- Development of energy efficiency performance parameters for the Project and compare them with other LNG plants.
- Development of policies, procedures and standards regarding energy efficiency management process in Company. Development of methodological base for confirming of compliance of energy efficiency parameters to their standard values.
- Monitoring of thermotechnical characteristics of heat insulation of the buildings and structures, systems and mains during construction and operation. Measures should be taken in a timely manner for recovery of thermotechnical characteristics in case of changes.

Potential sensible energy-saving solutions should be also identified, explored and implemented whenever possible in accordance with new international guidelines and up-to-date best practice.

8.2.2 Mitigation at the construction phase

A range of specific measures have been developed to enhance energy efficiency and minimise GHG emissions during construction works. These are detailed further in the construction management plans and GHG and Energy Efficiency Management Plan, and include, but are not limited to:

- Use of modern diesel generators and PAES 2500 running on gas that meet applicable project emission standards, instead of diesel-fired generation;
- Regular maintenance of stationary and mobile equipment and vehicles;
- Avoid unnecessary running of engines on idle when not in use;
- Using closed tanks for fuels;
- Ban burning of any wastes other than in dedicated incinerators;
- Construction logistics management and control, to avoid unnecessary emission from ships and watercrafts.

Implementation of the designed resource and energy efficient solutions for the Project will be ensured through the designer supervision and oversight of the practices at the stage of construction and commissioning, through monitoring of process performance over the transition period till full-scale operation, monitoring of implementation of the Environmental and Social Management Plans in terms of air emissions.

8.2.3 Mitigation at the transition and operation phases

The location of facilities, design, processes and equipment configurations have been carefully selected with reference to the best available techniques, and with a view to optimising the production and auxiliary processes and logistic schemes. Therefore, appropriate implementation of the designed schemes will minimise direct and fugitive emissions of greenhouse gases, due to the use of the most efficient generation processes and reasonable use of heat and electric energy, as well as reduction of potential losses of natural gas and gas condensate in the process lines and at transportation and processing.

The key factors for effective management of GHG emissions during the operation phase are the following:

- Timely maintenance of equipment and infrastructure;
- Smart gas and power metering to enable monitoring of energy usage;
- Use of advanced equipment and process performance monitoring during daily operation enabling timely corrections to maximize efficiency including gas combustion regime control and management;
- Emissions monitoring and control;
- LNG and SGC transportation logistics management and control, to avoid unnecessary emission from ships and cargoes.

The inventory of GHG emission sources shall be regularly updated. The assessment of total and specific GHG emissions of the Project is required on an annual basis for reporting needs (see Section 8.5 for respective information).

Scope 3 GHG emissions shall be estimated carefully in order to further consider potential compensation mechanisms and reduction of GHG emissions at the associated facilities and activities and in the Project supply chain, including, inter alia, transportation of products and their use. The depth of such assessment depends on the Company plans to invest in reduction of GHG emissions at suppliers, contractors and customers.

8.3 Carbon Capture and Storage

NOVATEK considers the possibility of introducing Carbon Capture and Storage sub-projects into their main Arctic projects, including the Arctic LNG 2 Project.

One of the possibilities is to capture CO_2 from the emissions of gas-treatment plant at the GBS LNG & SGC Plant and inject into the deep formation at the Field under special conditions.

8.4 Carbon Offsetting

Currently the carbon offsetting opportunities (investments into external projects devoted to GHG reduction, carbon capture and storage or GHG sinking, reforestation or afforestation) are reviewed by the Project. Such investments could be considered for the purposes of achieving an overall "zero" balance in the Company's GHG emissions in LNG production and / or "carbon-neutral" LNG cargoes by purchasing emission certificates or investing in respective environmental projects elsewhere.

8.5 Company reporting commitments

The annual GHG emissions of the Project are higher than the reporting threshold of 50,000 t CO_2-equivalent set by RF Government Directive No.716-r dated April 22, 2015. This value also exceeds the threshold of 25 thousand ton of CO2-e/year set by the IFC Performance Standards for annual reporting of direct and indirect emissions of GHG from the Project.

Exceedance of the threshold of 100,000 t CO_{2eq}/year also triggers the requirement to publish annual reports on Scope 1 and Scope 2 GHG emissions during the Project operation stage.

In this regard, the Project will provide for the compilation of annual reports on the actual amount of greenhouse gas emissions, which will be available to relevant government agencies and lenders, and will be published in open sources where they can be accessed by all stakeholders.

9 CONCLUSION

Arctic LNG 2 is aware of potential of GHG to impact the environment on a global scale through their contribution to the climate change and is committed to actively promoting the reduction of GHGs across its operations in a safe, technically and commercially viable manner. The Arctic LNG 2 Project supports also the use of LNG worldwide instead of more carbon-intensive fuels, such as coal or oil, for power generation.

Arctic LNG 2 confirms its full commitment to manage GHG emissions of the Arctic LNG 2 Project responsibly, including identification, accounting and reporting, monitoring and control, prevention and minimization of the Project carbon footprint and increase of the Project energy efficiency.

For this purpose, two guiding documents are developed and will be implemented in the framework of the Project implementation, and namely the current GHG and Energy Efficiency Philosophy and GHG and Energy Efficiency Management Plan.

The Project benchmark assessment was conducted in respect to the Project GHG and energy efficiency performance in gas abstraction and LNG production in compliance with World Bank / IFC EHS guidelines, EU and national BAT guidelines and best practice documents.

Based on the current benchmarking results the Project proved to be compliant with all applicable requirements and most of the BATs. The Project is well positioned among other comparable state-of-the-art projects being designed as one of the most efficient in the LNG production sector.

The Arctic LNG 2 Project adopted the feasible energy efficient solutions and appropriate BATs at the planning and design stage, and this approach helps to achieve the specific GHG emissions to 0.27 t CO_{2eq} / t LNG comparing to the sector-average value of 0.42 t CO_{2eq} / t LNG[67] (lower by 36%). In addition, the Project demonstrates the full compliance with the EHS Guidelines for Liquefied Natural Gas Facilities (2017), being in the lowest part of the best energy performance range.

The GHG and Energy Efficiency Philosophy forms the basis of the development of GHG and EE Management System of the Project as an essential part of the Company's Integrated Management System.

The GHG and Energy Efficiency Management Plan is developed as a supporting document comprising detailed information on the GHG and EE performance assessment, monitoring and management.

Arctic LNG 2 will continue to assess GHG abatement options in order to define an appropriate plan to manage and further reduce GHG emissions, taking into account the costs and risks associated with each option.

[67] Life Cycle Assessment of LNG. International Gas Union (IGU), June 2015.