Oil & Gas Climate Initiative Reporting Framework

Summary

Introduction

Disclosure of key climate change indicators is a relevant topic in the climate debate, especially for the Oil & Gas sector. Indeed, in order to demonstrate coherence with the OGCI mission and declarations, there is an increasing need to communicate adequate quantitative and qualitative information, able to give concreteness to any OGCI public commitment and declaration.

The credibility of messages brought forward by OGCI in its reporting rely largely on members' capacity to illustrate their actions with data that are reported and aggregated according to shared guidance and processes.

The objective of this framework is not to establish new methodologies for calculating indicators, but determine clearly, for each indicators included in the reporting process, a common approach in terms of boundary and definition, assuming that OGCI companies already use the most reliable publicly available guidance for the oil and gas sector. These include, but are not limited to, guidance and methodologies developed by IPCC, GRI, UN, World Bank, WBCSD, CCAC, IPIECA, OGP and API.

General principles and criteria

The OGCI data reporting process consists of the collection and aggregation of key indicators, assumed as relevant for tracking OGCI performance and for the communication strategy. The indicators selected by OGCI companies are aggregated in order to build specific OGCI figures to be published externally. Data must be provided by OGCI members ensuring:

- Transparency in the assumptions and methodologies used;
- Consistency internally within each company (regarding data sets considered and within the historical series);
- Comparability among companies in terms of methodologies and format;
- Completeness in terms of coverage of all significant activities (according to the boundary defined for each indicator);
- Accuracy of the estimation.

Indicators are collected on a yearly basis and refer mainly to the following categories:

- Activity: data related to hydrocarbon production levels and gas share in production portfolio of each company;
- GHG figures: data related to emission levels, including specific breakdown for selected categories, like flaring and methane emissions;
- Low carbon investment: information related to companies´ investment in low carbon energy, renewables, R&D on low carbon technologies.

The previous list is generic and can include additional indicators, periodically defined by OGCI according to the relevance for the communication process.

The boundary (business segment) and the approach (operational vs equity) for data collection is defined for each indicator in the detailed table.

In the definition of the key indicators to be reported, OGCI recognizes that most of them may already be reported by member companies within external frameworks or communication process, according to international recognized methodologies for the O&G sector. In order to ensure the consistency and comparability of figures published by single companies, OGCI supports the use of such external references, as specified for each indicators (see detailed list), providing that the coherence and comparability between OGCI companies is ensured.

To achieve this result, and in order to preserve the confidentiality of some information, data aggregation and consistency checks are performed by an external reviewer.

List of Indicators

This section provides the list of indicators to be reported within the yearly OGCI reporting process. The following sections detail the definition of each indicator.

Activity data	A-1	Total hydrocarbon production – operated

	A-2	Total gas production – operated
	A-3	Gas as a share of total production – operated
	B-1	Total hydrocarbon production – equity
Emission figures	C-1	Total operated GHG emissions – all sectors
	C-1a	*of which: upstream*
	C-2	Total gas flared – upstream sector
	C-3	Flaring GHG emissions – upstream sector
	C-4	Total operated CH_4 emissions – all sectors
	C-4a	*of which: upstream*
	C-6	Upstream GHG intensity
	C-7	Upstream flaring intensity
Investments	D-1	Total investment in low carbon energy technologies
	D-1a	*of which: acquisitions*
	E-1	Total R&D spent during the reporting year
	E-2	R&D spent on low carbon technologies during the reporting year
	E-3	Share of R&D budget spent on low carbon technology

Activity Indicators

Indicator	A-1. Total hydrocarbon production – operated
Definition and Boundary	Total hydrocarbon operated production along the reporting year Refer to definition of Operated Domain in Annex A - Definitions Both liquid and gas products must be included.
Methodology	**A-1** = Production out of the well – reinjection in the producing reservoir = Production distributed to the market (sold or for free) + auto consumption (fuel gas) + flaring/venting + injection in another reservoir than the producing one.
Unit of Measure	M boe/day

Indicator	A-2. Total gas production – operated
Definition and Boundary	Total gas operated production along the reporting year, including unconventional. Refer to definition of Operated Domain in Annex A - Definitions
Methodology	**A-2** = Production out of the well – reinjection in the producing reservoir = Production distributed to the market (sold or for free) + auto consumption + flaring/venting + injection in another reservoir than the producing one.
Unit of Measure	M boe/day

Indicator	A-3. Gas as a share of total production – operated
Definition and Boundary	Please refer to the definitions and boundaries introduced above for the **A-1. Total gas production – operated** and the **A-2. Total hydrocarbon production – operated**.
Methodology	**A-3 = A-2/A-1** Gas as a share of total production (operated) = Total gas production (operated) / Total hydrocarbon production (operated)
Unit of Measure	%

Note: The same indicator as A-1 are reported also in the Equity Share domain.

Emission Figures

Indicator	C-1. Total operated GHG emissions – all sectors

Definition and Boundary	Include GHG emissions from all relevant operated activities (Scope 1 only): - Upstream; - Downstream; - Other (e.g. power generation non associated with upstream or downstream activities) Include at least CO_2, CH_4; if available, N_2O and other gases (if significant).
Methodology	Companies can use the same methodology approach used for their public reporting of GHG emissions in other relevant documentation (e.g. Annual Report, Sustainability Report, etc.), assuming however that the figure is provided with the operational approach.
Unit of Measure	Million tonnes of CO_2 equivalent [t $CO_{2,eq}$], using the following GWP conversion factors: - 1 t CH_4: 25 t CO_2 - 1 t N_2O: 298 t CO_2

Indicator	**C-1a. *of which: upstream***
Definition and Boundary	Include GHG emissions from all **upstream** operated activities (Scope 1 only). Include at least CO_2, CH_4; if available, N_2O and other gases (if significant) **Upstream activities** comprise all operations from exploration to production and gas processing (up to the first point of sale), including LNG liquefaction plant.
Methodology	Companies can use the same methodology approach used for their public reporting of GHG emissions in other relevant documentation (e.g. Annual Report, Sustainability Report, etc.), assuming however that the figure is provided with the operational approach.
Unit of Measure	Million tonnes of CO2 equivalent [t $CO_{2,eq}$], using the following GWP conversion factors: - 1 t CH_4: 25 t CO_2 - 1 t N_2O: 298 t CO_2

Indicator	**C-2. Total natural gas flared – upstream sector**
Definition and Boundary	Volume of gas directed to operational flare systems, wherein the gas is consumed through combustion. Include only flaring from **Upstream Activities**. The perimeter of reporting to apply for this indicator is the operated perimeter.
Methodology	Companies can use the same methodology approach used for their public reporting of GHG emissions in other relevant documentation (e.g. Annual Report, Sustainability Report, etc.), assuming however that the figure is provided with the operational approach.
Unit of Measure	Mm^3

Indicator	**C-3. Flaring GHG emissions – upstream sector**

Definition and Boundary	GHG Emissions associated with combustion of gas sent to flare systems (both routine, non-routine, safety) - Include at least CO_2 and CH_4 (assuming that combustion is not 100%) - Include only flaring from Upstream Activities.
Methodology	Companies can use the same methodology approach used for their public reporting of GHG emissions in other relevant documentation (e.g. Annual Report, Sustainability Report, etc.); assuming however that the figure is provided with the operational approach. Include at least CO_2 and CH_4 (assuming that combustion is not 100%).
Unit of Measure	Million tonnes of CO_2 equivalent [t $CO_{2,eq}$], using the following GWP conversion factors: 1 t CH_4: 25 t CO_2 1 t N_2O: 298 t CO_2

Indicator	**C-4. Total operated CH_4 emissions – all sectors**
Definition and Boundary	Include total CH_4 emissions coming from operational perimeter (not only upstream but also other activities, including refineries, transport, pipelines, storage, etc.), in particular CH_4 emissions from flaring.
Methodology	Companies can use the same methodology approach used for their public reporting of GHG emissions in other relevant documentation (e.g. Annual Report, Sustainability Report, etc.), assuming however that the figure is provided with the operational approach.
Unit of Measure	Million tonnes of CH_4 [t CH_4].

Note: The same indicator as C-4 is reported also only for the upstream sector (C-4a). The upstream boundary is the same of indicator C-1a.

Indicator	**C-6. Upstream GHG intensity**
Definition and Boundary	This indicator is calculated based on C-1a (Total operated GHG emissions – upstream sector) and A-1 (Total hydrocarbon production – operated). Refer to these primary indicators for the relevant definitions and boundaries.
Methodology	Upstream carbon intensity = (Total operated GHG emissions – upstream sector)/ (Total hydrocarbon production – operated) **C-6 = (C-1a)/(A-1)**
Unit of Measure	$ktCO_{2e}$/Mtoe

Indicator	**C-7. Upstream flaring intensity**

Definition and Boundary	This indicator is calculated based on C-2 (Total Natural Gas Flared – upstream sector) and A-1 (Total hydrocarbon production – operated).
Methodology	Upstream flaring intensity = (Total gas flared – upstream sector)/ (Total hydrocarbon production – operated) **C-7 = (C-2)/(A-1)**
Unit of Measure	Mm^3/Mtoe
External references	N/A

Low Carbon Investments

Indicator	D-1. Total investment in low carbon energy technologies
Definition and Boundary	Low carbon energy technologies include but are not limited to: energy efficiency, CCUS and decarbonisation, wind, solar and other renewables, biofuels, GHG mitigation initiatives, sustainable mobility. Gas projects are excluded from this definition
Methodology	Investments include CAPEX and OPEX spent during the reporting year on low carbon energy projects. It should cover money spent on assets and projects, excluding R&D. Money spent on programs and partnerships with universities and other organisations are excluded.
Unit of Measure	Million USD [MM USD].

Note: The same indicator as D-1 is reported also only for acquisitions (D-1a).

Indicator	E-1. Total R&D spent during the reporting year
Definition and Boundary	Total R&D spent during the reporting year. Gas related activities are excluded from this definition.
Methodology	Report investment spent during the reporting year in R&D including money spent on programs and university partnership.
Unit of Measure	Million USD [MM USD].

Indicator	E-2. R&D spent on low carbon technologies during the reporting year
Definition and Boundary	R&D spent during the reporting year on low carbon technologies. Low carbon technology R&D include but are not limited to: energy efficiency, CCUS and decarbonisation, wind, solar and other renewables, biofuels, GHG mitigation initiatives, sustainable mobility, energy storage Gas related activities are excluded from this definition
Methodology	Report money spent during the reporting year in low carbon R&D including money spent on programs and university partnership
Unit of Measure	Million USD [MM USD].

Annex A - Methodologies and Guidance for estimating GHG emissions

Acronyms and Abbreviations

API	American Petroleum Institute
CCAC	Climate and Clean Air Coalition
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
GHG	Greenhouse gas
GWP	Global Warming Potential
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
kWh	Kilowatt-hour
MWh	Megawatt hour
ncm	Normal cubic meter
NCV	Net Calorific Value
OGCI	Oil and Gas Climate Initiative
IOGP	International Oil & Gas Producers
scm	Standard cubic meter
tCO_2e	metric ton of carbon dioxide equivalent
TJ	Terajoules
WBCSD	World Business Council for Sustainable Development

General principles

The GHG emissions inventory of an O&G company should fulfil certain requisites to be precise and reliable: be transparent, consistent, comparable, complete and accurate.

Transparency

Transparency means that the assumptions and methodologies used for reporting should be clearly explained to facilitate replication and assessment of the reporting by users. The transparency of reporting is fundamental to the success of the process for the communication and consideration of information. Records should be kept adequately in order to guarantee traceability of data during an external review.

Consistency

Consistency means that a reporting of an indicator should be internally consistent in all its elements with reporting of other years. Reporting is consistent if the same methodologies are used for the base and all subsequent years and if consistent data sets are used to estimate activities / source for each indicator.

Comparability

Comparability means that an indicator reported should be comparable among companies. For this purpose, companies should use the methodologies and formats agreed for estimating and reporting inventories.

Completeness

For an indicator considered relevant by a company and within the chosen scope, all significant activities / sources of emission should be accounted for. For some indicators, there could be a need to define a materiality threshold which applies to a site, a branch or the company. The choice of boundaries (organizational, operational) and environmental indicators should be representative of the company's activities and the sensitivity of the environments in which it operates.

Accuracy

Accuracy is a relative measure of the exactness of activities or sources. Estimates should be accurate in the sense that they are systematically neither over nor under true value for the indicator, as far as can be judged, and that uncertainties are reduced as far as practicable.

Definitions

Site

A site means any property, plant, building, structure, stationary source, stationary equipment or grouping of stationary equipment or stationary sources located on one or more contiguous or adjacent properties, in actual physical contact or separated solely by a public roadway or other public right-of way, and under common operational control. For offshore activities, a site could regroup several platforms as soon as there is an operational, technical or economic logic to do so.

Operated domain

The operator of an activity, an asset or a site is the corporation or unincorporated company (e.g. consortium, JV) which

- holds the operating licence issued by the administrative authority and is the operator, or
- holds jointly the operating license issued by the administrative authority and is the operator by virtue of a contract with the other holders of the operating license, or
- does not hold the operating license issued by the administrative authority, but is the operator by virtue of a contract with the holder(s) of the operating license.

The perimeter called the "operated domain" includes the activities, assets or sites whose operator (see above) is a corporation or an unincorporated company in which the Company is directly or indirectly shareholder or member, and has the control, namely:

- either has the power to appoint or remove the majority of members from the administrative, executive or supervisory bodies, or
- has the ability to impose decisions by itself at general meetings of shareholders, partners or members.

Particular case: Rotating management

A site is in "rotating management" when the operator is alternated over periods of time with a predefined order. These sites are not included in the operated domain.

Equity Share Domain

The perimeter called "equity share domain" includes all assets in which the Company has a financial interest with rights over all or part of the production (or storage capacity or transport capacity), whether they are part of the operated domain or are operated by third parties, in rotating management or by shared control.

The financial interests without operational responsibility and without rights to all or part of the production should not result in equity share accounting of Company's climate footprint.

Categories of GHG emissions

The GHG emissions can be classified, accordingly with the definitions used by IPIECA[1], as follow:

- **Direct GHG Emissions:** Emissions from sources at a facility owned (partly or wholly) and/or operated by the company, such as emissions from combustion in boilers or furnaces. (scope 1)
- **Indirect GHG Emissions from imported energy:** GHG emissions that occur at the point of energy generation (owned or operated by a third party) for electricity, heat or steam imported (i.e. purchased) for use on site by the reporting entity. These are also called indirect Scope 2 emissions.
- **Other Indirect Emissions:** all other indirect emissions (also called Scope 3 emissions) other than those from imported energy. They are a consequence of the activities associated with the intervention, but occur from sources not owned or controlled by the intervention. Examples of Scope 3 activities include extraction and production of purchased materials, transport of purchased fuels, and downstream emissions from use of products and services generated by the intervention.

Global Warming Potentials (GWPs)

The Global Warming Potential (GWP) measures the abilities of different greenhouse gases to trap heat in the atmosphere. The GWP of GHGs that are commonly emitted by the energy sector projects is provided in table 6. As there are several individual gases covered under some of the categories, all of those have not been provided. For further details, please refer to values provided by Intergovernmental Panel on Climate Change (IPCC)[2].

Activity data

Activity data means the data on the amount of fuels or materials consumed or produced by a process as relevant for the calculation-based monitoring methodology, expressed in appropriate unit, during a given period of time. For example, the annual activity data for fuel combustion sources are the total amounts of fuel burned.

Calculation factor

Calculation factors regroup net calorific value, emission factor, oxidation factor, conversion factor and design parameter.

Net calorific value

Net calorific value (NCV) means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions less the heat of vaporisation of any water formed.

[1] IPIECA/API/IOGP Oil and gas industry guidance on voluntary sustainability reporting, 2015

[2] http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14

Emission factor

Emission factor is a coefficient that relates the activity data to the amount of chemical compound which is the source of later emissions. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions.

Oxidation factor

Oxidation factor means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2. To simplify the approach, it should be considered an oxidation factor equal to 1 in all calculation.

Design parameter

Design parameter is the information provided by the manufacturer of the device (instrument, pump, generator, etc.) providing ratio or efficiency allowing to estimate an indicator.

Uncertainty

Uncertainty means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in per cent, and describes a confidence interval around the mean value comprising 95 % of inferred values.

Materiality threshold

The company should seek completeness of reporting. Wherever seeking completeness would lead to technically or economically non feasible actions, company may exclude from reporting sources estimated to account jointly for 10% or less of the total for the indicator at site level.

Methods of quantifying indicators

For topics tackled by the Initiative associated with quantitative indicators, several methods of quantification are possible. These methods can be divided into several categories. A degree of accuracy generally corresponds with each category. Three main categories are distinguished, and presented below by declining accuracy level:

- Methods based on **measurements**. This method is based on instrumentation allowing measuring a flow, consumption or a production of one or several parameters used in the reporting of the indicator. For instance, the greenhouse gases, the methods in which the emissions are calculated from the measurement of fuel multiplied by a specific emission factor are assimilated to this situation (eg: measured carbon content based on sampling).
- Methods based on **calculations** or using calculation factors. For instance, for the greenhouse gases, emission factors can be used. The ones used could be national or, preferably, those of recognized international bodies (API, OGP, IPCC, etc.), used by the profession or the one listed in Table 12-13-14
- Methods based on **estimates**: This method is based on design manufacturer information. For example greenhouse gas emissions may be calculated for a diesel engine from the design and operating hours.

Whenever economically and technically possible, the most accurate available category of quantification should be preferred.

Reporting perimeter and consolidation rules

Companies should report according to a current perimeter basis, as described below.

Divestment and acquisition

In the case of an entity sold during the year N, the indicators of the entity should be reported until the date of sales. The entity will be removed from the perimeter the following year.

In the case of an entity purchased during the year N, the indicators of the entity should be reported from the date of acquisition until the end of the reporting year (that is to say, to the extent that the new entity is able to respond).

Closure and start-up of an entity

In the case of a closure of an entity during the year N, the perimeter is not changed for the current year, and the indicators of the entity should be reported until the date of closure. The entity will be removed from the perimeter the following year.

In the case of a start-up during the year N of a newly constructed entity, the entity should be added to the perimeter and the indicator are taken into account from the date of opening of the entity until the end of the reporting year.

Operated / non-operated assets

When a site is operated by the Company, whatever is its share in the facility, 100% of the indicator should be reported.

The Company may also choose to report each of the indicators for non-operated site. In that's case, the Company may choose the most representative approach between considering a proportion of the indicators equivalent to

- the proportion of shares held,
- the proportion of interest (production, financial benefits, production capacity, etc.),
- other accounting practices in accordance with financial department recommendations.

In case of modification of shares or operational control during the reporting year

- in case of change in the operational control, the Divestment/Acquisitions rules should apply,
- in case of change in shares, the reporting should consider applicable share before and after the date of change for the reporting.

Calculation factors

Unit conversion

Multiple		Sub-multiple	
10^{1}	deca (da)	10^{-1}	deci (d)
10^{2}	hecto (h)	10^{-2}	centi (c)
10^{3}	kilo (k)	10^{-3}	milli (m)
10^{6}	mega (M)	10^{-6}	micro (µ)
10^{9}	giga (G)	10^{-9}	nano (n)
10^{12}	tera (T)	10^{-12}	pico (p)
10^{15}	peta (P)	10^{-15}	femto (f)
10^{18}	exa (E)	10^{-18}	atto (a)

Table 1: Decimal Conversion Table

To: ***From:***	**gal U.S.** multiply by:	**gal U.K.**	**bbl**	**ft^3**	**l**	**m^3**
U.S. gallon (gal)	1	0.8327	0.02381	0.1337	3.785	0.0038

U.K. gallon (gal)	1.201	1	0.02859	0.1605	4.546	0.0045
Barrel (bbl)	42.0	34.97	1	5.615	159.0	0.159
Cubic foot (ft3)	7.48	6.229	0.1781	1	28.3	0.0283
Litre (l)	0.2642	0.220	0.0063	0.0353	1	0.001
Cubic metre (m3)	264.2	220.0	6.289	35.3147	1 000.0	1

Table 2: Conversion Equivalents between Units of Volume

To: ***From:***	**kg** multiply by:	**t**	**lt**	**st**	**lb**
Kilogramme (kg)	1	0.001	9.84×10^{-4}	1.102×10^{-3}	2.2046
Tonne (t)	1000	1	0.984	1.1023	2204.6
Long ton (lt)	1016	1.016	1	1.120	2240.0
Short ton (st)	907.2	0.9072	0.893	1	2000.0
Pound (lb)	0.454	4.54×10^{-4}	4.46×10^{-4}	5.0×10^{-4}	1

Table 3: Conversion equivalents between units of mass

To: ***From:***	**TJ** multiply by:	**Gcal**	**Mtoe**	**MBtu**	**GWh**
Terajoule (TJ)	1	238.8	2.388×10^{-5}	947.8	0.2778
Gigacalorie	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
*Mtoe**	4.1868×10^{4}	10^{7}	1	3.968×10^{7}	11630
Million Btu	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
Gigawatt-hour	3.6	860	8.6×10^{-5}	3412	1

**Million tonnes of oil equivalent.Mtoe can be converted in Mboe (Million barrels of oil equivalent) using a conversion factor equal to 7.299 (Mboe/Mtoe)*

Table 4: Conversion equivalents between units of energy

To: ***From:***	**Standard cm** multiply by:	**Normal cm**
*Standard cm**	1	0.948
*Normal cm***	1.055	1

**1 Scm measured at 15°C and 760 mm Hg.*
***1 Ncm measured at 0°C and 760 mm Hg.*

Table 5: conversion equivalents between standard cubic metres (scm) and normal cubic metres (Ncm)

Global Warming Potential

Based on IPCC Fourth Assessment Report, Climate Change 2007: Working Group I: The Physical Science Basis, IPCCC, 2.10.2 Direct Global Warming Potentials, Table 2.14, IPCC, 2007

Common Name	**Chemical Formula**	**100-year GWP Value***
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298
Sulphur hexafluoride	SF_6	22 800

** In order to be, when necessary, aligned with national GHG inventories. See http://www.ipcc-nggip.iges.or.jp/faq/faq.html, Q1-2-11: "For the submissions of national GHG inventories from 2015, Annex I Parties shall use the GWP values provided in Table 2.14 of the errata to the IPCC WGI contribution to the Fourth Assessment Report (AR4), based on the effects of GHGs over a 100-year time horizon (Decision 15/CP.17)"*

Table 6: 100-years GWPs for GHGs

As there are several individual gases covered under some of the categories, all of those have not been provided. For further details, please refer to values provided by Intergovernmental Panel on Climate Change (IPCC)[3].

Black carbon alone is estimated to have a 100-year GWP of **1,055-2,240**, based on *Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming*, *Jacobson, 2005.*

Molar volume conversion

Based on Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry, API, 2009

Temperature	Molar Volume Conversion		
	(scf/lb-mole)	(scf/kg-mole)	(m^3/kg-mole)
0 °C	359.0	791.5	22.41
15 °C	378.8	835.0	23.64
20 °C	385.3	849.5	24.06
25 °C	391.9	864.0	24.47
60 °F	379.3	836.2	23.68
68 °F	385.3	849.5	24.06
70 °F	386.8	852.7	24.15

Table 7: Molar Volume Conversion

Default Net Calorific Value (NCV)

Based on the Energy Statistics Manual, IEA, Eurostat and OECD, 2005

Hard coals	Gross calorific value (MJ/kg)	Net calorific value (MJ/kg)	Mixture content (%)
Anthracite	29.65 - 30.35	28.95 - 30.35	10-12
Coking coals	27.80 - 30.80	26.60 - 29.80	7-9
Other bituminous	23.85 - 26.75	22.60 - 25.50	13-18
Metallurgical coke	27.90	27.45	8-12
Gas coke	28.35	27.91	1-2
Low-temperature coke	26.30	25.40	15
Petroleum coke	30.5 - 35.8	30.0 - 35.3	1-2

Table 8: Range of Calorific Values by Hard Coal and Coke Type

Product	Gross calorific value (MJ/kg)	Net calorific value (MJ/kg)
Methane	55.52	50.03
Ethane	51.90	47.51
Propane	50.32	46.33

[3] http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14

Butane	49.51	45.72
LPG*	50.08	46.15
Naphtha	47.73	45.34
Aviation gasoline	47.40	45.03
Motor gasoline	47.10	44.75
Aviation turbine fuel	46.23	43.92
Other kerosene	46.23	43.92
Gas/diesel oil	45.66	43.38
Fuel oil, low-sulphur	44.40	42.18
Fuel oil, high-sulphur	43.76	41.57

** Assumes a mixture of 70% propane and 30% butane by mass.*

Table 9: Range of Calorific Values by Petroleum Products

Gas type	Gross calorific value (MJ/m^3)[2]	Net calorific value (MJ/m^3)	Net calorific value (MJ/kg)
Coke-oven gas	19.01	16.90	37.54
Blast-furnace gas	2.89	2.89	2.24

Table 10: Calorific Values by Coal-derived Gases Type

Natural Gas	**LNG**		**Gas**							
			Norway		**Netherlands**		**Russia**		**Algeria**	
To:	**MJ**	**Btu**	**MJ**	**Btu**	**MJ**	**Btu**	**MJ**	**Btu**	**MJ**	**Btu**
From:	multiply by:									
*Cubic metre**	40.00	37912	42.51	40290	35.40	33550	37.83	35855	39.17	37125
Kilo- gramme	54.40	51560	52.62	49870	45.19	45.19	42830	54.42	20.56	47920

** at 15°C.*

Table 11: Conversion Factors from Mass or Volume to Heat (Gross Calorific Value)

Default emission factor

Fossil fuel

Based on IPCC Guidelines for National Greenhouse Gas Inventories (2006), Volume 2, Table 2.2.

kg of greenhouse gas per TJ on a Net Calorific Basis		CO_2	CH_4	N_2O
Crude Oil		73 300	3	0,6
Orimulsion		77 000	3	0,6
Natural Gas Liquids		64 200	3	0,6
Gasoline	Motor Gasoline	69 300	3	0,6
	Aviation Gasoline	70 000	3	0,6
	Jet Gasoline	70 000	3	0,6
Jet Kerosene		71 500	3	0,6
Other Kerosene		71 900	3	0,6
Shale Oil		73 300	3	0,6
Gas/Diesel Oil		74 100	3	0,6

kg of greenhouse gas per TJ on a Net Calorific Basis		CO_2	CH_4	N_2O
Residual Fuel Oil		77 400	3	0,6
Liquefied Petroleum Gases		63 100	1	0,1
Ethane		61 600	1	0,1
Naphtha		73 300	3	0,6
Bitumen		80 700	3	0,6
Lubricants		73 300	3	0,6
Petroleum Coke		97 500	3	0,6
Refinery Feedstocks		73 300	3	0,6
Other Oil	Refinery Gas	57 600	1	0,1
	Paraffin Waxes	73 300	3	0,6
	White Spirit and SBP	73 300	3	0,6
	Other Petroleum Products	73 300	3	0,6
Anthracite		98 300	1	1,5
Coking Coal		94 600	1	1,5
Other Bituminous Coal		94 600	1	1,5
Sub-Bituminous Coal		96 100	1	1,5
Lignite		101 000	1	1,5
Oil Shale and Tar Sands		107 000	1	1,5
Brown Coal Briquettes		97 500	1	1,5
Patent Fuel		97 500	1	1,5
Coke	Coke Oven Coke and Lignite Coke	107 000	1	1,5
	Gas Coke	107 000	1	0,1
Coal Tar		80 700	1	1,5
Derived Gases	Gas Works Gas	44 400	1	0,1
	Coke Oven Gas	44 400	1	0,1
	Blast Furnace Gas	260 000	1	0,1
	Oxygen Steel Furnace Gas	182 000	1	0,1
Natural Gas		56 100	1	0,1
Municipal Wastes (non-biomass fraction)		91 700	30	4
Industrial Wastes		143 000	30	4
Waste Oils		73 300	30	4
Peat		106 000	1	1,5
Solid Biofuels	Wood / Wood Waste	112 000	30	4
	Sulphite lyes (Black Liquor)	95 300	3	2
	Other Primary Solid Biomass	100 000	30	4
	Charcoal	112 000	200	4
Liquid Biofuels	Biogasoline	70 800	3	0,6
	Biodiesels	70 800	3	0,6
	Other Liquid Biofuels	79 600	3	0,6
Gas Biomass	Landfill Gas	54 600	1	0,1
	Sludge Gas	54 600	1	0,1
	Other Biogas	54 600	1	0,1
Other non-fossil fuels	Municipal Wastes (biomass fraction)	100 000	30	4

Table 12: GHG Emission factors for fuels

Emission factors for CO_2 are in units of kg CO_2/TJ on a net calorific value basis and reflect the carbon content of the fuel and the assumption that the carbon oxidation factor is 1.