APEC EUROSTAT IEA IEF OLADE OPEC UNSD

JOINT ORGANISATIONS DATA INITIATIVE

JODI GAS MANUAL

1ST EDITION

www.jodidata.org

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ASIA PACIFIC ECONOMIC COOPERATION (APEC)

APEC is an intergovernmental grouping operating on the basis of non-binding commitments, open dialogue and equal respect for the views of all participants. It was established in 1989 to further enhance economic growth and prosperity for the region and to strengthen the Asia-Pacific community.

APEC's 21 Member Economies are Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; The Republic of the Philippines; The Russian Federation; Singapore; Chinese Taipei; Thailand; The United States of America; and Viet Nam.

Since its inception, APEC has worked to reduce tariffs and other trade barriers across the Asia-Pacific region, creating efficient domestic economies and dramatically increasing exports. Key to achieving APEC's vision are what are referred to as the 'Bogor Goals' of free and open trade and investment in the Asia-Pacific by 2010 for industrialised economies and 2020 for developing economies. These goals were adopted by Leaders at their 1994 meeting in Bogor, Indonesia. APEC's energy issues are the responsibilities of the Energy Working Group (EWG), one of its 11 working groups. The development and maintenance of the APEC Energy Database is assigned to EWG's Expert Group on Energy Data and Analysis (EGEDA) who has appointed the Energy Data and Modelling Centre (EDMC) of the Institute of Energy Economics, Japan (IEEJ) as the Coordinating Agency. One of the objectives of EGEDA is to collect monthly oil data of the APEC economies in support of the Joint Organisations Data Initiative.

Asia Pacific Economic Cooperation (APEC) – www.ieej.or.jp/egeda
INUI Bldg. Kachidoki, 13-1, Kachidoki 1-Chome, Chuo-Ku, Tokyo 104-0054, Japan

EUROSTAT

Eurostat is the statistical office of the European Union, situated in Luxembourg. Its mission is to be the leading provider of high quality statistics on Europe.

It therefore publishes official, harmonised statistics on the European Union (EU) and the euro area which offer an objective portrayal of social and economic trends. These statistics are available for EU Member States, and are sometimes broken down by region, thus enabling comparisons between countries or regions. Furthermore, some of the indicators are published for candidate countries and other non-member countries.

Eurostat was established in 1953 to meet the requirements of the Coal and Steel Community. Over the years its task has broadened and when the European Community was founded in 1958 it became a Directorate-General (DG) of the European Commission. Eurostat's key role is to supply statistics at European level to other DGs and supply the Commission and other European Institutions with data, so they can define, implement and analyse Community policies.

Eurostat collects data from national statistical institutes: the statistics are harmonised according to Europe-wide methodologies. Eurostat's data are comparable because they are based on a common statistical language that embraces concepts, methods, definitions, technical standards and infrastructures.

Eurostat releases a wide range of publications, all of which are free of charge on its website in electronic format, while Eurostat's website itself allows users to freely access EU statistics on-line.

Today, Eurostat is the synonym for a comprehensive and high-quality information service providing statistical data about and for the European Union. Using it means having a finger on the pulse of current social, economic, and environmental developments in Europe. The result is that Eurostat offers a whole range of important and interesting data that governments, businesses, the education sector, journalists and the public can use for their work and daily life.

Statistical Office of the European Communities (EUROSTAT) – epp.eurostat.ec.europa.eu
BECH Building, 5, rue Alphonse Weicker, L-2721 Luxembourg

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) works to ensure reliable, affordable and clean energy for its 28 member countries and beyond. Founded in 1974, the IEA's initial role was to help countries co-ordinate a collective response to major disruptions to oil supply primarily through the release of emergency oil stocks onto the markets. While this continues to be a key aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy policy, and now works closely with non-member countries to find solutions to shared energy and environmental concerns. It is one of the world's most authoritative sources for energy statistics, and produces annual studies on oil, natural gas, coal, electricity and renewables. The IEA also provides authoritative, unbiased research and analysis which focuses on:

- Energy security: Promoting diversity, efficiency and flexibility within all energy sectors and ensuring the stable supply of energy to IEA member countries.
- Economic development: Promoting free markets and energy sector investment to foster economic growth and eliminate energy poverty.
- Environmental awareness: Enhancing international knowledge of options for tackling climate change.

International Energy Agency (IEA) – www.iea.org
9, rue de la Federation, 75739 Paris Cedex 15, France

THE LATIN-AMERICAN ENERGY ORGANIZATION (OLADE)

The Latin-American Energy Organization (OLADE) is an international public entity of cooperation, coordination and advising. Its fundamental purpose is integration, protection, conservation, defence and rational use of energy resources of the Region. The fundamental objectives of the organisation are as follows:

- Political and technical tool for prompting better regional energy integration.
- Manage official statistics, products and services and regional energy planning.
- Encourage training inside the Energy Ministries of the Member Countries.
- Promote regional energy cooperation among countries.

Member Countries: Argentina, Barbados, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Chile, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Suriname, Trinidad & Tobago, Uruguay and Venezuela.

Latin-American Energy Organization (OLADE) - **www.olade.org**
Av. Mariscal Sucre No. N58-63 & Fernandez Salvador, OLADE Bldg, P.O. Box 17-11-6413 Quito, Ecuador

THE ORGANIZATION OF THE PETROLEUM EXPORTING COUNTRIES (OPEC)

The Organization of the Petroleum Exporting Countries (OPEC) is a permanent intergovernmental organisation of oil-exporting developing nations that coordinates and unifies the petroleum policies of its Member Countries. OPEC seeks to ensure the stabilisation of oil prices in international oil markets, with a view to eliminating harmful and unnecessary fluctuations, due regard being given at all times to the interests of oil-producing nations and to the necessity of securing a steady income for them. Equally important is OPEC's role in overseeing an efficient, economic and regular supply of petroleum to consuming nations, and a fair return on capital to those investing in the petroleum industry.

OPEC was formed on September 14, 1960, at a meeting in Baghdad, the Iraqi capital, attended by five countries that became the founding members. It was registered with the United Nations Secretariat on November 6, 1962, following UN Resolution No. 6363. Also in attendance at the Baghdad meeting were - Islamic Republic of Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. They signed the original agreement establishing OPEC. Currently, the organisation has twelve members, namely: Algeria, Angola, Ecuador, IR Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela.

Organization of the Petroleum Exporting Countries (OPEC) – www.opec.org
Helferstorferstrasse 17, A-1010 Vienna, Austria

UNITED NATIONS STATISTICS DIVISION (UNSD)

The United Nations Statistics Division (UNSD) collects, processes and disseminates statistical information covering a broad range of statistical domains, such as demography, energy, environment, industry, international trade, national accounts, social and housing statistics.

In addition to compiling and disseminating global statistical information, the Division's key activities include the development of standards and norms for statistical activities, assistance to countries in the implementation of these standards and general support to strengthen countries' national statistical systems.

UNSD serves as the central mechanism within the Secretariat of the United Nations to satisfy the statistical needs and coordinating activities of the global statistical system. UNSD also provides support to the functioning of the UN Statistical Commission, the apex entity of the global statistical system, which brings together the Chief Statisticians from United Nations member states from around the world.

In the field of energy statistics, UNSD started its regular data collection in 1950. It now compiles and disseminates energy statistics for more than 190 countries/territories, published in two annual publications, the Energy Statistics Yearbook and the Energy Balances and Electricity Profiles, as well as an electronic database, which can also be accessed through the UN data portal.

UNSD is cooperating with many international, regional and supranational agencies in the work on statistical standards, data collection and statistical capacity building, including in the field of energy statistics.

United Nations Statistics Division (UNSD) – unstats.un.org
2 UN Plaza, DC2-1414, New York, NY 10017, USA

INTERNATIONAL ENERGY FORUM (IEF)

The IEF aims to foster greater mutual understanding and awareness of common energy interests among its 75 member countries.

Covering all six continents and accounting for around 90% of global supply and demand for oil and gas, the IEF is unique in that it comprises not only consuming and producing countries of the IEA and OPEC, but also Transit States and major players outside of their memberships, including Argentina, China, India, Mexico, Oman, Russia and South Africa. Sitting alongside other important developed and developing economies on the 31 strong IEF Executive Board, these key nations are active supporters of the global energy dialogue through the IEF.

Recognising their interdependence in the field of energy, the member countries of the IEF co-operate under the neutral framework of the Forum to foster greater mutual understanding and awareness of common energy interests in order to ensure global energy security. The Forum's biennial Ministerial Meetings are widely considered to be the world's largest gathering of Energy Ministers. The magnitude and diversity of this engagement is a testament to the position of the IEF as a neutral facilitator and honest broker of solutions in the common interest. The IEF and the global energy dialogue are promoted by a permanent Secretariat of international staff based in the Diplomatic Quarter of Riyadh, Saudi Arabia.

International Energy Forum (IEF) – www.ief.org
Diplomatic Quarter, P.O. Box 94736, Riyadh 11614, Saudi Arabia

Comments on JODI can also be sent to the following e-mail address: **jodi.info@ief.org**

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Foreword

The importance of exchanging data as a means towards enhancing transparency in global energy commodity markets is recognised by IEF Energy Ministers as beneficial to energy security, and in the interest of producers and consumers alike. The Joint Organisations Data Initiative (JODI) is a concrete outcome of the producer-consumer energy dialogue. The Initiative relies on the combined efforts of producing and consuming countries and on the seven JODI partner organisations to build and maintain the timely, comprehensive, and sustainable energy data provision architecture that is a prerequisite for stable energy commodity markets. JODI aims to moderate undue price volatility, thereby increasing investor confidence and contributing to greater stability in energy markets worldwide.

Since 2006 Ministers have been calling to expand the JODI platform to cover other forms of energy; notably natural gas. In 2009, the JODI partner organisations agreed to start collecting monthly gas data through a common questionnaire. To help build momentum for the newly-launched gas data collection exercise, the IEF and JODI Partners organised the First Gas Data Transparency Conference (Moscow, October 2010) to help identify the necessary conditions for establishing a monthly gas data collection mechanism on a global scale.

The Second Gas Data Transparency Conference (Doha, May 2012) achieved consensus among the JODI Partners to strive to convert JODI-Gas from an exercise to a permanent reporting initiative similar to JODI-Oil, and concluded with an agreement among all JODI Partners to launch a beta version of JODI-Gas as soon as feasible. The beta version was launched in January 2013, and access was granted to countries and economies submitting JODI-Gas data.

The Third Gas Data Transparency Conference (Bali, June 2013) was organised to enable key actors to review findings from the on-going beta testing, to discuss challenges and countermeasures related to the collection and submission of gas data, to facilitate a discussion on this JODI-Gas Manual, and to define remaining steps prior to the launch of the JODI-Gas.

The public launch of JODI-Gas will represent another milestone in the on-going, collective efforts to promote gas market data transparency. The JODI-Gas website will make available for the first time consolidated official monthly data on production, consumption, exports, imports and stocks of natural gas, covering close to 80% of global gas markets.

Preparation of this JODI-Gas Manual was led by the UNSD, in close cooperation with the IEF and the other JODI partners (APEC, Eurostat, IEA, OLADE, & OPEC). This Manual's primary objective is to help professionals who collect and use gas data to understand the methodology and definitions in the JODI-Gas questionnaire, to conduct basic verifications of data, avoid common reporting errors and share examples of good practices. Our sincere and shared hope is that the JODI-Gas Manual will serve as a valuable resource to support gas data capacity building for years to come.

Aldo Flores Quiroga
Secretary General
International Energy Forum

Acknowledgements

Preparation of this Manual was conducted by the United Nations Statistics Division (UNSD) in cooperation with the partners of the Joint Organisations Data Initiative (JODI): Asia Pacific Economic Cooperation (APEC), the Statistical Office of the European Communities (Eurostat), the International Energy Agency (IEA), the Latin American Energy Organization (OLADE), the Organization of the Petroleum Exporting Countries (OPEC), and the International Energy Forum (IEF).

The success of JODI relies on the sustained participation of and support from numerous key actors. The preparation of this Manual is a concrete example of the active participation and exchange of ideas among experts from national administrations, regional and international organisations, and professionals from the private sector. Apart from the contributions of staff members within the JODI partner organisations, a special note of appreciation is due to Azerbaijan, Brazil, Thailand and the United Kingdom, who contributed the case studies that appear herein. Thanks also go to countries that provided additional feedback on the draft Manual during the consultation period.

In light of the dynamic nature of the natural gas industry, on-going user feedback is crucial for maintaining a high-quality document that provides guidance on both the collection and reporting of natural gas data. When guidelines warrant adjustments or clarifications in light of new products or processes, user input is critical. Users of this Manual are therefore strongly encouraged to send questions, observations or comments on the JODI-Gas Manual and more broadly on the JODI platform to **jodi.info@ief.org**.

Abbreviations and Acronyms

APEC .... Asia Pacific Economic Cooperation
Bcm .... Billion cubic metres
BTU .... British thermal unit
CCGT .... Combined Cycle Gas Turbine
CHP .... Combined Heat and Power
CNG .... Compressed Natural Gas
Eurostat .... Statistical Office of the European Communities
GCV .... Gross calorific value
IEA .... International Energy Agency
IEF .... International Energy Forum
InterEnerStat .... Intersecretariat Working Group on Energy Statistics
IRES .... International Recommendations for Energy Statistics
J .... Joule
JODI .... Joint Organisations Data Initiative
kt .... Kilotons, or thousand metric tons
LNG .... Liquefied Natural Gas
M-1 .... Read as “M minus one”: the month prior to the current month
M-2 .... Read as “M minus two”: two months prior to the current month
MMBtu .... One million British thermal units
mm Hg .... Millimetres of Mercury
MJ .... Megajoule
NCV .... Net calorific value
NGL .... Natural Gas Liquids
OLADE .... Latin American Energy Organization
OPEC .... Organization of the Petroleum Exporting Countries
SI .... Système International d’Unités
TJ .... Terajoule
toe .... Tons of Oil Equivalent
UNSD .... United Nations Statistics Division

Chapter 1. Introduction

The purpose of this Manual is to provide guidance on the concepts, methods and definitions used in the JODI-Gas (Joint Organisations Data Initiative-Gas) Questionnaire. This Manual is intended to support energy statisticians in reporting JODI-Gas data in a timely, accurate and comprehensive manner. It is also intended to guide data users so they can better understand the concepts and definitions behind the data. To make the data as consistent, reliable and transparent as possible, it is important both to provide clear definitions of flows and products, and to share common practices in the collection of natural gas statistics. It is for this reason that this Manual includes examples of country practices and common checking procedures.

The definitions of products and flows used in this Manual are aligned with those contained in the International Recommendations for Energy Statistics (IRES), adopted by the United Nations Statistical Commission in February 2011. The definitions have been developed by the Intersecretariat Working Group on Energy Statistics (InterEnerStat) through an extensive consultation process with international and regional organisations active in energy statistics and, as part of the preparation of IRES, they have been subject to worldwide consultation with countries and international/regional organisations. It should be noted that some of the JODI organisations may use slightly differing definitions than those presented in this Manual. Countries should check with their respective JODI organisation as to what specifically needs to be reported for their JODI-Gas submission.

Since its inception, JODI-Oil has proven to be an invaluable resource for analysts in the public and private sectors, providing simple, timely and consistent official data on a monthly basis. Following the success of JODI-Oil, the Initiative was extended to record accurate and timely natural gas data. The aim of JODI-Gas is to provide the same level of high quality data that has been enjoyed by the users of JODI-Oil. Gas data are relevant whether one is analysing today's market dynamics or looking farther afield. Market analysts scrutinise short-term data in part to develop a better understanding of the root causes of price volatility. Over the long-term, comprehensive data sets empower market actors engaged in strategic planning and making investment decisions. Of equal importance to the long-term stability and smooth functioning of the market is that companies and governments have sound analytical foundations upon which to build a better understanding of expectations for the future business environment.

This Manual consists of nine chapters and one annex. Following the introduction, Chapter 2 describes the JODI-Gas Questionnaire, the instructions for completion and a brief reporting guide designed to be a concise summary of the definitions used in the Questionnaire. Chapter 3 focuses on the description of natural gas and briefly presents the different geological formations from which natural gas can be extracted, in order to clarify the scope of natural gas in energy statistics. Chapter 4 focuses on the definitions of the flows and stocks collected in the JODI-Gas Questionnaire. Chapter 5 presents a discussion on measurement units, which are particularly relevant for natural gas (as compared to other fuels) because of widely-differing conditions for measurement. As data quality is an important aspect of any data collection effort, examples of methods that can be used to validate the data and ensure their quality are presented in Chapter 6. Chapter 7 describes data collection and compilation methods used in the collection of monthly gas data. The country practices in Chapter 8 give information on certain countries' data collection and good practices. Chapter 9 completes the Manual with a description of the JODI-Gas World Database available online. Annex 1 provides additional information on the units and conversion factors that are important to know when collecting data on natural gas. A diagram of the oil and gas industry value chain is featured in Figure A2.1(Page 54), which depicts a comprehensive flow from the production of natural gas to its final consumption.

Why collect data on natural gas?

Natural gas is an increasingly important source of energy at the global level: worldwide demand has steadily increased over the past 20 years and is expected to further rise over the next two decades. There are a number of reasons for this trend, which include: growing environmental concerns about climate change, new and improved technologies for the production, transportation and use of natural gas, and the availability of natural gas. Natural gas is considered one of the cleanest and most efficient fossil fuels and is becoming an increasingly important form of energy in part because of its role in helping to meet environmental challenges and mitigate climate change.

The development of new and improved technologies for the production, transportation and consumption of natural gas has also impacted the market and opened up new ways of using this fuel. The increase in liquefaction capacity has engendered an increase in the trade of Liquefied Natural Gas (LNG), which makes it more cost-effective to transport natural gas over long distances where pipelines do not exist. Once transported, LNG is re-gasified and distributed as pipeline natural gas.

Most energy analysts project that the use of natural gas for power generation will continue to rise, and this sector is expected to lead the demand for natural gas in most regions. In addition, because of the higher thermal efficiency of some types of gas power stations, such as Combined Cycle Gas Turbines (CCGT), natural gas presents environmental advantages over other fossil fuels. Further development of carbon capture and storage technology is expected to lower emissions from gas power plants and make natural gas even more environmentally-friendly.

The rise in use of natural gas as a road transport fuel, although still limited in terms of total final demand, is expected to grow in a number of countries and is a trend that merits close monitoring.

In terms of reserves/resources, the availability of natural gas in the environment is sufficiently abundant to cover global gas demands for many decades to come. While most of the reserves/resources consist of conventional gas, an increasing proportion constitutes unconventional gas, including shale gas, coal bed methane and tight gas.

In light of these recent trends in the natural gas market, it is important to have detailed, timely and reliable statistics on natural gas to accurately monitor the current situation and provide policymakers, analysts and other users with relevant information. In the short-term, better gas data can help market actors to better understand price shifts linked to market disruptions. Over the long-term, better gas data can empower market actors to make more informed upstream investment decisions, better structure long-term contracts and build out the right type of infrastructure.

The JODI-Gas World Database provides global and timely monthly data on the production, consumption, stocks and trade of natural gas data with the objective of enhancing energy data availability and transparency, and helping to ensure global energy security for producers and consumers alike.

Chapter 2. The JODI-Gas Questionnaire

This chapter describes the JODI-Gas Questionnaire and covers the instructions for reporting and the set of definitions that accompany the Questionnaire.

2.1 The Questionnaire

The JODI-Gas Questionnaire is the form used to collect data on natural gas on a monthly basis. It is shown below:

JOINT ORGANISATIONS DATA INITIATIVE GAS QUESTIONAIRE

Country ________________
Month ________________
Year ________________

	Natural Gas million m³ (at 15°C. 760mm hg)	**Natural Gas** Terajoules	***Natural Gas*** *1000 metric tons*
	A	***B***	***C***
Production			
Receipts from other sources			
Imports			
LNG			
Pipeline			
Exports			
LNG			
Pipeline			
Stock Change			
Gross Inland Deliveries (Calculated)	0	0	
Statistical Difference (Calculated)	*0*	*0*	
Gross Inland Deliveries (Observed)			
of which: Electricity and Heat Generation			
Closing stocks			

Mass to volume conversion factor of LNG (if you have a specific figure)

m³ / metric ton	**LNG**
Conversion factor	

The JODI-Gas Questionnaire is designed to be simple. It focuses on the main flows that are relevant to natural gas supply, such as Production, Receipts from Other Sources, Imports, Exports, Closing Stocks, Stock Change, and Gross Inland Deliveries.

Countries and economies are asked to provide data in both million cubic metres under standard conditions and in terajoules (TJ) on a gross calorific value (GCV) basis (more information on the measurement units and calorific values is provided in Chapter 5). In addition, since a number of countries may also have data on the trade of LNG on a mass basis, an extra column is provided. If a specific factor is available for the conversion between mass and volume for LNG, this should be reported in the conversion factor field at the bottom of the main table.

2.2 Instructions for completion

The JODI-Gas Questionnaire is accompanied by a set of instructions for data reporting as shown below and further described in subsequent chapters. These instructions cover general information on the reporting, such as deadlines for submission and contact information.

The JODI-Gas Questionnaire should be submitted to the relevant JODI organisation by the 25th day of each month. Countries and economies are encouraged to report data for the month prior to the current month (M-1) as well as revisions, if available, for the period two months before the current month (M-2). While there is emphasis on reporting the most recent month and correcting the previous month, countries and economies are encouraged to submit historical revisions whenever necessary for as far back as relevant, with no time limit or cut-off point.

Countries and economies are encouraged to send any additional related information if there are any deviations from the JODI-Gas definitions that can then be documented in metadata, for example if any data points are provisional or incomplete and can be used to provide an explanation for any unusual data.

If a data point is not available or confidential, data submitters are requested to label those data accordingly (with an NA or C) rather than report a zero or leave a field blank. Not available should be used when the flow or stock is relevant for a jurisdiction, but was not collected or reported (on either a normal or exceptional basis). This could arise, for example, if a company does not report the data for a particular month or the national administration does not collect the data regularly. Although some JODI organisations cannot yet reflect these qualifiers in their databases, it can still aid their understanding of the data received in each Questionnaire.

Instructions

Deadline for submission: 25th of each month

The Excel form includes two worksheets: one for month M-1 and one for month M-2.

1. Please do not change the format of the Excel form.
2. Please make sure that you indicate the **correct data month** in the cell for Month.
3. For specific details, please see the Brief Reporting Guide in this workbook.
4. The following qualifiers should be used when relevant:
    - C – Confidential
    - NA – Data are not available.

When completed, please save the Excel file and send to: ... [Organisation]
If you have other questions or want more information, please contact: ... [Organisation]

2.3 *Brief reporting guide*

The JODI-Gas Questionnaire Excel file is accompanied by a set of short "definitions" that provide quick guidance on reporting. For more complete explanations, the statistician is encouraged to consult this Manual.

Time	M-1 is last month, i.e. the month prior to the current month. M-2 is two months before the current month.
DESCRIPTION OF PRODUCT	
Natural gas:	Natural gas is defined as a mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts and some non-combustible gases such as nitrogen and carbon dioxide. It includes both "non-associated" gas and "associated" gas. Colliery gas, coal seam gas and shale gas are included while manufactured gas and biogas are excluded except when blended with natural gas for final consumption. Natural gas liquids are excluded.
DESCRIPTION OF FLOWS	
Production:	Dry marketable production within national boundaries, including offshore production, measured after purification and extraction of NGL and sulphur. Production does not include quantities reinjected, extraction losses or quantities vented or flared. It should include quantities used within the natural gas industry, in gas extraction, pipeline systems and processing plants.
Receipts from Other Sources:	Gas from energy products that have been already accounted for in the production of other energy products. Examples include petroleum gases or biogases that have been blended with natural gas.
Imports/Exports:	Amounts are considered imported or exported when they have crossed the physical boundaries of the country, whether customs clearance has taken place or not. Goods in transit and goods temporarily admitted/withdrawn are excluded but re-imports, that is domestic goods exported but subsequently readmitted, are included (same for re-exports). Deliveries for international bunkers should be excluded.

Pipeline Imports/Exports:	The import/export of gaseous natural gas through pipelines, to be reported in TJ and million cubic metres.
LNG Imports/Exports:	The import/export of liquefied natural gas (LNG) through ocean tankers, to be reported in TJ, million cubic metres or metric tons (always on a re-gasified equivalent basis).
Stock Change:	Stock Change should reflect the difference between the closing stock level and the opening stock level of recoverable gas, already extracted. A stock build is shown as a positive number, and a stock draw as a negative number.
Gross Inland Deliveries (Calculated):	This is defined as: Production + Receipts from Other Sources + Imports - Exports - Stock Change.
Statistical Difference (Calculated):	This is the difference between the Calculated and Observed Gross Inland Deliveries. Reasons for any major differences should be stated on the remarks sheet.
Gross Inland Deliveries (Observed):	This category represents deliveries of marketable gas to the inland market, including gas used by the gas industry for heating and operation of their equipment (i.e. consumption in gas extraction, in the pipeline system and in processing plants); losses in distribution should also be included. Deliveries to international marine and aviation bunkers should be included.
Of which: Electricity and Heat Generation:	This covers the deliveries of natural gas for the generation of electricity and heat in power plants. Both main-activity and autoproducer plants are included.
Closing Stocks	Closing Stocks refer to the stock level held on the national territory on the last day of the reference month.

Chapter 3. What is Natural Gas?

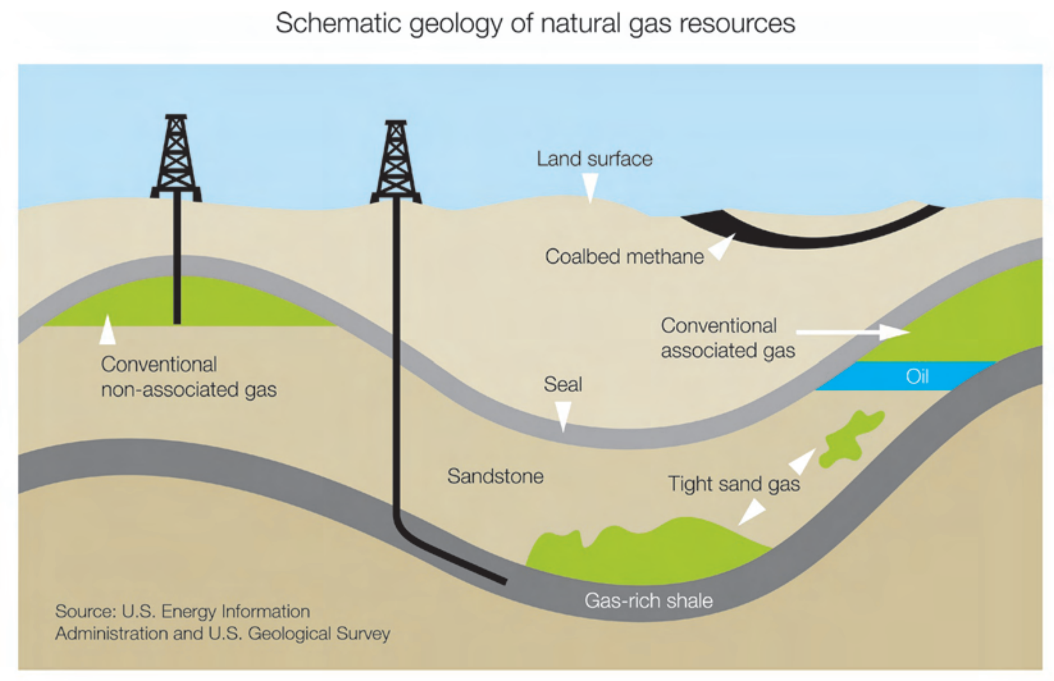
Natural gas is defined as a mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts, and some non-combustible gases such as nitrogen and carbon dioxide. When distributed, natural gas may also contain blended quantities of biogas, and manufactured gases such as gas works gas and coke oven gas.

The majority of natural gas is separated from both "non-associated" gas originating from fields producing hydrocarbons only in gaseous form, and "associated" gas produced in association with crude oil. The separation process produces natural gas by removing or reducing the hydrocarbons other than methane to levels that are acceptable in the marketable gas. The natural gas liquids (NGL) removed in the process are distributed separately.

Natural gas also includes colliery gas, coal seam gas and shale gas. Shale gas is becoming an increasingly important source of natural gas in certain countries. Shale gas is natural gas trapped within shale rock formations. Colliery and coal seam gas consist of methane produced at coal mines or from coal seams, which is piped to the surface and consumed at collieries or transmitted by pipeline to consumers.

Figure 3.1 below shows the different sources of natural gas.

Figure 3.1: Natural gas sources



As noted above the definition of natural gas excludes production of the manufactured gases produced from coal products (e.g. coke oven gas) and biogases. When these gases are blended with natural gas for final consumption, they must be reflected in the natural gas balance. These amounts appear in the supply under Receipts from Other Sources, then are implicitly included in the subsequent demand flow. Any use of these gases in their pure form should be excluded from this Questionnaire. For more information see Chapter 4.

LNG is obtained by reducing the temperature of gas to simplify storage and transportation. The volume of LNG occupies around 1/600th of its original volume in a gaseous state. The liquefaction of natural gas is opening up new markets for natural gas trade, as pipeline infrastructure is less of a constraint.

Chapter 4. Flow Definitions

4.1 Production

In general, energy statistics define Production as the capture, extraction or manufacture of fuels or energy in forms that are ready for general use.

In the case of natural gas, Production refers to the dry marketable production within national boundaries, including offshore production within territorial waters. Production is measured after the purification and extraction of NGL and sulphur.

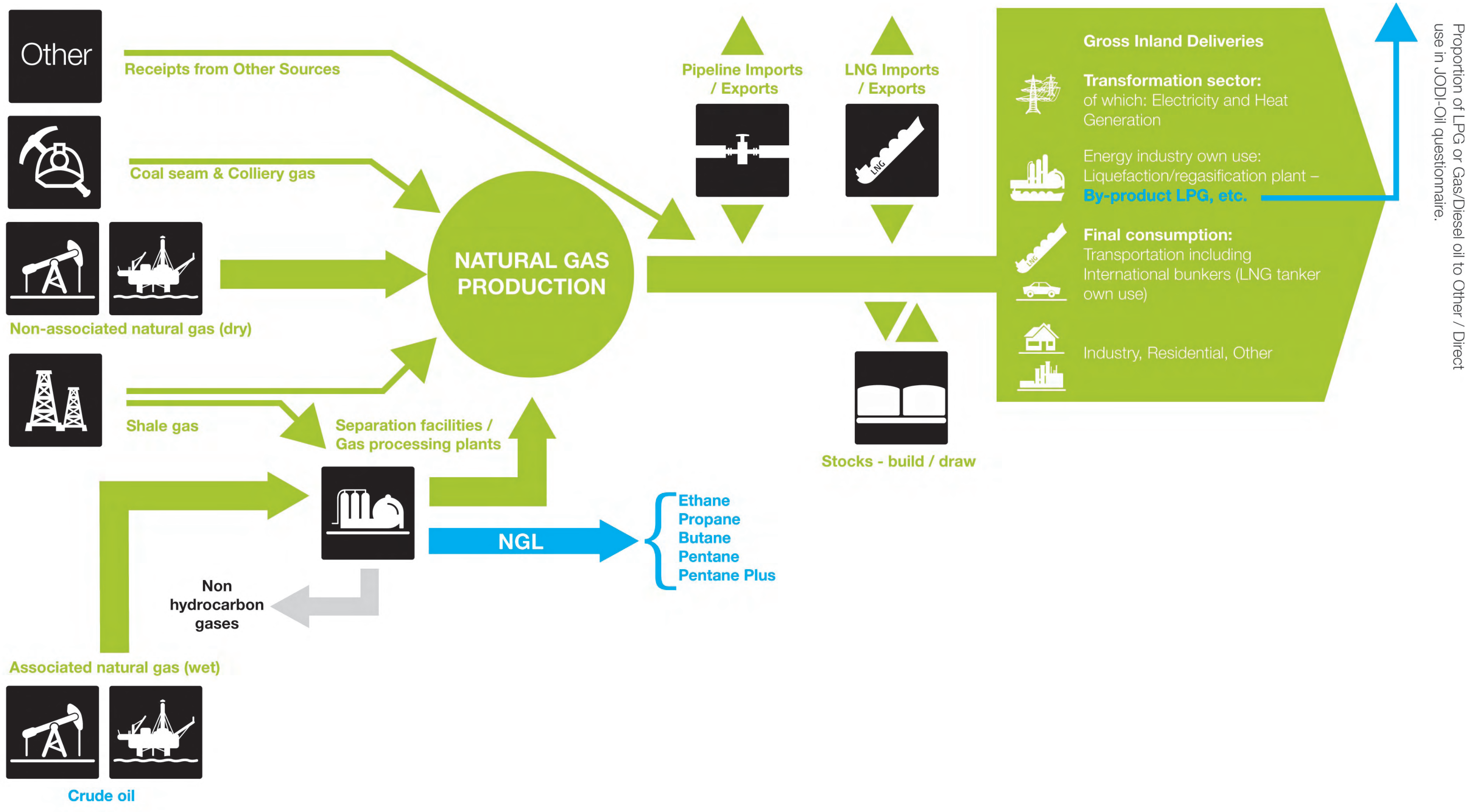
During the extraction process, natural gas may be re-injected into the deposit, vented or flared. Quantities of natural gas used in these manners are not included in production. However, Production of natural gas includes quantities used within the natural gas industry: in gas extraction, pipeline systems and processing plants.

In line with the definition of natural gas, the data reported for Production should include: the natural gas produced in association with crude oil; natural gas originating from fields producing hydrocarbons only in gaseous form; colliery and coal seam gas produced at coal mines or from coal seams; as well as shale gas. The production of manufactured gases and biogas should be excluded.

4.2 Receipts from Other Sources

The Receipts from Other Sources flow refers to the quantities of gases produced from coal, oil and biofuels that are blended in small quantities with natural gas. Common examples are biogas, ethane, coke oven gas and gas works gas. These gases should only be included in the JODI-Gas Questionnaire when they are blended with natural gas, so they can be accounted for in the natural gas supply. Any consumption of these gases in their pure form should not be reported in the JODI-Gas Questionnaire.

Figure 4.1: Production flow



4.3 Imports and Exports

In energy statistics, Imports comprise all fuel and energy entering the national territory. Goods simply being transported through a country (goods in transit) and goods temporarily admitted/withdrawn are excluded. However re-imports, which are domestic goods exported but subsequently readmitted, are included.

Similarly, Exports comprise all fuel and energy leaving the national territory. Goods simply being transported through a country (goods in transit) and goods temporarily withdrawn/admitted are excluded. Re-exports, i.e. foreign goods exported in the same state as previously imported, are included.

In some regions, particularly Europe with its complex network of pipeline trade, it is not always possible to exclude natural gas in transit through a country due to a lack of clear distinction between gas imported for subsequent export and gas imported for domestic use. If a country or economy cannot determine the quantity in transit then it should report trade including the gas in transit, noting this in the metadata.

Trade data should exclude international bunkers. In the JODI-Gas Questionnaire the fuels delivered to merchant ships and civil aircraft for international transport are included in Gross Inland Deliveries.

In the past, trade of natural gas took place mainly through networks of pipelines that would transport natural gas in its gaseous state across borders. With improvements in technology for liquefying natural gas, the trade of natural gas is no longer confined to the pipeline infrastructure. It can now be transported in vessels across oceans and seas. This however requires additional facilities that can liquefy the natural gas on the production side and re-gasify the LNG on the consumption side.

Because of the growing importance of the trade in natural gas, the JODI-Gas Questionnaire disaggregates the Imports and Exports of natural gas into LNG and Pipeline gaseous natural gas.

When LNG is imported, re-gasified and subsequently exported as pipeline gas, the country should report the Imports of LNG and then the Exports of pipeline gas. Similarly, when gas is imported through pipelines, subsequently liquefied and exported as LNG, this should also be reported as gaseous Imports and Exports of LNG. This is necessary because the gasification and liquefaction of natural gas entail a change in the characteristics of the original product.

LNG, because of its liquid form, can be measured in different units under different conditions. For example, it can be measured in metric tons, cubic metres or TJ, which the JODI-Gas Questionnaire allows. The JODI-Gas Questionnaire asks countries to report data for LNG trade in its **dry, marketable, re-gasified equivalent.** The total Imports or Exports should be equal to the sum of Imports or Exports of LNG and of natural gas through pipelines.

4.4 Closing Stocks and Stock Change

Stocks are defined as the quantities of fuels that are held on the national territory and can be used to maintain service under conditions where supply and demand vary in their timing or amount due to normal market fluctuations, or to supplement supply in the event of a disruption. Stocks used to manage a supply disruption may be called "strategic" or "emergency" stocks and are often held separately from stocks designed to meet normal market fluctuations.

To address expected fluctuations in supply and demand, gas may be injected into storage during periods of low demand and withdrawn from storage during periods of high demand. For example, demand for gas will usually be lower in summer and higher in winter months. It is also possible that demand in peak periods might exceed the production capabilities of the gas suppliers. The management of gas stocks generally helps to reduce price volatility and uncertainty. Fluctuations in gas prices can be managed by storing gas when the market price is low and releasing stocks when the price is high.

Gas suppliers and pipeline companies move gas in or out of stocks for commercial or operational uses. It is important for pipeline operators to maintain the pressure of gas in the pipeline within certain limits. Gas suppliers use storage to maintain deliveries of gas at a predetermined level.

The management of gas stocks is also critical to ensuring energy security. Specific storage facilities can be designated to supplement supply in the case of supply disruption due to natural causes, technical problems in the distribution system or political interruptions. This type of storage may be referred to as strategic gas storage.

Gas Storage Facilities

Gas stocks can be held at storage facilities such as tanks, aquifers, depleted oil or gas fields, salt caverns, LNG peak-shaving units, mined caverns, disused mines and gasholders.

Natural gas in its gaseous state is mainly stored in underground reservoirs, the main types of which are described below:

- Depleted oil and gas fields. These are usually fields that have produced their economically recoverable oil and gas, and are thus naturally capable of containing the gas and have existing installations for injections and withdrawal.
- Aquifers. These are areas of porous sedimentary rock overlaid by impermeable cap rock, which can be used as storage reservoirs provided they have suitable geological characteristics.
- Salt cavities. These may exist naturally or be formed by injecting water into a salt deposit and then removing the brine. They are generally smaller than the reservoirs provided by depleted oil and gas fields or aquifers but offer very good withdrawal rates and are well suited to peak-shaving requirements.

Other less common storage units include mixed caverns, disused mines and gasholders, the capacity of which is usually more restricted. Pipeline capacity can also be used for storage capacity. "Line pack", whereby gas is "packed" by increasing the pressure in the pipeline, is most often used for meeting peak demand. Neither pipeline capacity nor line pack is considered permanent gas storage.

The advantage of storing gas in underground facilities is that they are relatively less expensive than LNG tanks. Disadvantages are that their location may be remote from consuming areas and these facilities require a certain amount of cushion gas.

Liquefied Natural Gas is mainly stored in dedicated LNG storage tanks or in LNG carriers. The storage tanks can be above or below ground ("in-ground tanks"). The in-ground tanks feature a lower risk of accidents and are more visually discreet than above ground tanks. LNG tanks are usually close to LNG import terminals.

The advantages of storing gas in liquid form are that it occupies 600 times less space than gaseous gas stored underground, and it can be delivered at very short notice because LNG storage facilities are generally located close to market. Additionally, LNG gas storage does not need cushion gas to function and allows access to a global supply. LNG facilities are, however, currently more expensive to build and maintain than developing new underground gas storage facilities, such as those described above.

What to report in the JODI-Gas Questionnaire

Gas stock levels according to the JODI-Gas Questionnaire **exclude gas reserves and cushion gas.** The term **gas reserves** refers to quantities of gas not yet extracted, but which analysis of geological data demonstrates with reasonable certainty to be recoverable in future years from known deposits. **Cushion gas** denotes the volume of gas in a storage facility that must remain *in situ* to provide the required pressure to extract the remaining gas and, because it is considered unavailable for extraction, should be excluded from the Closing Stocks and Stock Change.

Gas stock levels in the JODI-Gas Questionnaire refer to the recoverable natural gas in the storage facilities described above. Pipeline gas and line pack are not included.

The JODI-Gas Questionnaire asks for Closing Stocks and Stock Change. **Closing Stocks** refer to the stock level held on the national territory on the last day of the reference month. For example, if data are reported for the month of January, then the Closing Stocks will be the stock levels held on 31st January. **Stock Change** refers to the difference between the closing and opening stock levels of the reference month (note that the opening stocks of the reference month are equal to the Closing Stocks of the previous month). A positive Stock Change represents an increase in the stock level (stock build) during the reference month, while a negative Stock Change represents a decrease in the stock levels (stock draw).

Stocks are to be reported on a national territory basis: all gas held within a country or economy's borders are to be reported, irrespective of the ownership of the gas. As stocks are reported on a national territory basis, this includes any floating storage at sea, as long as it is inside the national territory. Gas stocks can be publicly or privately held.

4.5 Gross Inland Deliveries (Calculated)

As the name suggests, the Gross Inland Deliveries (Calculated) is a calculated field in the JODI-Gas Questionnaire obtained through the following formula:

Gross Inland Deliveries (Calculated) = Production + Receipts from Other Sources + Imports - Exports - Stock Change.

This indicator represents the calculated amount of natural gas that is available for inland deliveries.

4.6 Statistical Difference

The Statistical Difference is a calculated field in the JODI-Gas Questionnaire obtained as the difference between the (Calculated) and (Observed) Gross Inland Deliveries. In principle, these two flows should be equal and lead to a Statistical Difference of zero. However, in practice due to different data collection methods, data sources, varying calorific values and compilation methods, the two quantities may not be the same. For example, data may be subject to sampling errors or other collection errors, and/or be taken from different data sources that use different time periods, different geographical coverage, different fuel specifications or different conversions from volume to mass or from mass to energy content in the supply and demand sides of the balance.

When the Statistical Difference is very large, it often provides an indication that the data collection and compilation methods should be reviewed to ensure accuracy and completeness of the data. When the Statistical Difference is large and the reasons are known (but cannot be reconciled), countries are asked to indicate the reasons on the remarks sheet submitted with the JODI-Gas Questionnaire.

4.7 Gross Inland Deliveries (Observed)

Gross Inland Deliveries (Observed) represent the deliveries of marketable natural gas (with or without small quantities of biogas and manufactured gas blended in) to the inland market. As such, this flow includes the deliveries to final consumers (for final energy consumption and for non-energy uses) as well as deliveries to economic units (plants) transforming natural gas into other energy forms (most notably, electricity and heat). Among the different uses of natural gas, only one is explicitly identified in the JODI-Gas Questionnaire: the deliveries for electricity and heat generation, described in the next section.

The flow of Gross Inland Deliveries also includes losses in distribution, international marine and aviation bunkers and an energy industry's own use. Note that international marine bunkers would include any gas consumed by an LNG tanker from its own cargo, assuming the ports of departure and arrival are in different national territories, consequently including this amount in Gross Inland Deliveries and not Exports.

4.8 Of which: Electricity and Heat Generation

Within the JODI-Gas Questionnaire only one flow of the Gross Inland Deliveries of natural gas is explicitly identified: deliveries for **electricity and heat generation.** This consists of the deliveries to electricity, Combined Heat and Power (CHP) and heat plants. **Electricity plants** are plants producing only electricity. **CHP plants** are plants that produce both heat and electricity from at least one generating unit in the plant. **Heat plants** are plants (including heat pumps and electric boilers) designed to produce only heat for deliveries to third parties.

Data from both **main activity plants** (i.e. plants generating electricity or heat as their principal activity) and **autoproducer plants** (plants that generate electricity or heat but for which this production is not their principal activity) should be included under this flow.

As JODI-Gas data are collected on an M-1 basis, it is recognised that accurate data for autoproducers may not always be available on time, and may have to be estimated or excluded altogether. If this is the case, countries and economies should report these discrepancies in the remarks sheet so they can be documented in the metadata.

Chapter 5. Measurement Units

5.1 Introduction

In natural gas statistics more so than in statistics for other energy products, the choice of measurement unit and the conditions under which the measurements are taken have significant importance. This arises from the fact that the most appropriate unit can differ depending on the area of activity that is being analysed. For example, an end-user of natural gas will normally be interested in the value of the gas on an energy basis (as it is purchased for its heating value); an LNG tanker will normally measure its cargo in tons; gas travelling by pipeline will often be measured on a volumetric basis.

These differing units can present challenges to the statistician when trying to present comparable data. In order to accurately convert among the units, the statistician must know:

a. The temperature and pressure at which the gas volume was recorded (when measured on a volumetric basis);

b. The calorific value of the gas.

The JODI-Gas Questionnaire asks countries to report data both in physical and in energy units. These are described below.

5.2 Volumetric units

Original units are the units of measurement employed at the point of measurement of the product flow that are best suited to its physical state (solid, liquid or gas) and that require the simplest measuring instruments. Natural gas in its gaseous state is generally measured in volumetric units such as cubic metres. However, temperature and pressure conditions affect the volume of the gas. Therefore it is common practice to report gas statistics under certain specific conditions that allow a true comparison among sources.
Two different conditions are normally used:

- **Standard conditions** refer to a temperature of 15 degrees Celsius and pressure of 760 mm Hg.
- **Normal conditions** refer to a temperature of 0 degrees Celsius and a pressure of 760 mm Hg.

The JODI-Gas Questionnaire asks countries and economies to report data for natural gas in million cubic metres under **standard conditions**. If data are collected at national levels under different conditions, submitting jurisdictions are asked to convert them into standard conditions. Annex 1 shows a table that converts volumes of gas under standard conditions into volumes of gas under normal conditions and vice versa.

5.3 Energy units

The JODI-Gas Questionnaire collects data on an energy basis in TJ. In order to obtain data in an energy unit, the heating value per physical unit, or **calorific value**, must be known. Two types of calorific values, the gross calorific value (GCV) and the net calorific value (NCV), are available for use. The GCV will include the latent heat of combustion, while the NCV will exclude it. When fossil fuels are burnt, water vapour is created that contains heat, and this heat is only released when the water cools as an exhaust gas. As the heat, known as **latent heat**, is not normally captured usefully, some compilers of energy statistics decide to exclude it from consideration when expressing fuels in an energy basis. The gross and net calorific values are sometimes called higher heating value and lower heating value, respectively. The difference between the gross and net values is typically about 10% for natural gas. A calorific value would typically be expressed in GJ/ton or GJ/m^3.

The utility of natural gas is determined by its energy content, which depends largely on the purity of the gas and on the number of carbon atoms per unit of volume. An example of a natural gas with a high GCV is the gas from Algeria's largest gas field, Hassi-R'Mel (around 42 000 kJ/m^3), whereas the gas from the Groningen field in the Netherlands is of a lower GCV (around 35 000 kJ/m^3). It is very unusual in commercial gas trade to find the calorific value of gaseous natural gas expressed in MJ per kg or gigajoule (GJ) per ton. However, for reference, the calorific value of pure methane at 25°C is 55.52 GJ/ton. Observed values will therefore be less. In contrast, the calorific value of LNG may be expressed in MJ per cubic metre of the liquefied gas or GJ per ton. The ratio between a cubic metre of LNG and its re-gasified volume depends on its composition and is about 1:600. The density of LNG is between 0.44 and 0.47 tons per cubic metre depending on composition. Calorific values for re-gasified LNG range from 37.6 MJ/m^3 to 41.9 MJ/m^3. Annex 1 includes a table that converts tons and cubic metres of LNG into "standard cubic metres", defined as 40 MJ.

When compiling an energy balance it is typical to use the NCV, as interest lies in how much useful energy each fuel can provide. However, when looking at natural gas statistics independently from other fuels, it is more common, purely by convention, to deal with energy data on a GCV basis. For collecting natural gas data in energy units, it is important to ascertain which calorific value has been used. If NCV is erroneously employed, the statistician should ask for the data to be reported on a gross basis; if this is not forthcoming, the data can be adjusted to reflect GCV by dividing by 0.9.

While natural gas is primarily methane, calorific values do not vary as much as those of other fuels. However, it is still important to use flow-specific calorific values when converting between physical units and energy units. Re-gasified LNG, for example, will often have higher methane content than gas travelling by pipeline, as the small quantities of higher hydrocarbons can freeze and are removed before liquefaction, thus changing the calorific value of the LNG. On the other hand, gas delivered to final consumers may have a blended component of biogas or manufactured gas, which can affect its heating value. Thus, if an average calorific value is required for Gross Inland Deliveries for a particular timeframe, a weighted average of all aspects of supply should be taken with each supply flow's weight based on its share.

While the trade of natural gas usually takes place based on its energy content, the upstream end of the natural gas value chain is often measured in volume only. As a result, energy statistics compilers can face challenges in reconciling these different units in order to complete the JODI-Gas Questionnaire. If a monthly GCV is not available, one possible solution is to use conversion factors taken from the latest available annual statistics. As annual data compilation takes careful consideration of data completeness and crosschecks against historical data sets, these factors are reliable references until real data become available. If the national administration decides to apply conversion factors derived from its annual statistics in this manner, then the methodology employed should be reported in the metadata.

5.4 Mass units

As mentioned in section 4.3 (Imports and Exports), when natural gas is liquefied and traded, the default unit of measurement is often the metric ton. In order to allow countries to report any LNG trade data in this unit, the JODI-Gas Questionnaire provides the option of reporting LNG trade data (and only LNG trade data) in metric tons.

For countries and economies reporting trade of LNG in tons, the Questionnaire requires a country-specific conversion factor between tons and cubic metres so that the JODI organisation can accurately convert the flow into cubic metres to compare against other flows. Alternatively, a jurisdiction can calculate and provide the LNG trade data point in cubic metres and TJ directly.

If a country-specific value is not reported, then the relevant JODI organisation will convert data using a standard conversion factor, which is 1360 cubic metres of gaseous natural gas per metric ton under standard conditions.

Chapter 6. Data Quality

Data quality is a fundamental factor in any data collection and dissemination exercise. Ultimately the quality of a set of data is the result of efforts aimed at ensuring high quality along all stages of the statistics supply chain. In the case of JODI-Gas, this applies to the collection of data from the data providers; the validation of data by the national administration; the submission of data to the international organisation; and finally the dissemination of the JODI-Gas World Database.

There are different dimensions of data quality, which include timeliness, completeness, relevance, reliability and sustainability. The JODI organisations perform a number of checks on the data they receive and compile indicators for the assessment of the country's participation in data collection in terms of timeliness, completeness and sustainability of data submissions (see Chapter 9 for more information on these indicators).

This chapter presents examples of data quality checks that can be done by national administrations to ensure the consistency and accuracy of the data. These checks are also performed by the international organisations collecting JODI-Gas data.

The accuracy of each data point is critical for the quality of the JODI-Gas World Database. Accordingly, national administrations should perform checks on data collected from different companies to carry out country-level validations. International organisations that receive JODI-Gas submissions also perform various accuracy checks in a similar way to national statisticians, and will also make an assessment of a country's data quality (details of which are given in Chapter 9). The rest of this chapter describes different validation checks that can be made by the national administration or by the relevant international organisation.

6.1 Examples of data quality checks

Below are some data validation checks that can be applied to JODI-Gas submissions:

1. Balance check
2. Stocks check
3. Calorific values check
4. Time series check
5. Visual check

Please note that these checks can only provide some indications of accuracy. It is important to always use a wide variety of checks in order to achieve the most accurate results.

6.1.1. Balance check

The balance check consists of the comparison between the calculated and observed Gross Inland Deliveries, namely the Statistical Difference.

This is the simplest form of accuracy check. The statistician should check that the Calculated Gross Inland Delivery is not very different from the Observed Gross Inland Delivery.

The difference between the Observed and Calculated Gross Inland Deliveries is automatically calculated in the JODI-Gas Questionnaire as the Statistical Difference. Ideally, the Statistical Difference should be less than 5% of the Gross Inland Deliveries (Calculated). If the deviation is outside this range, the statistician should review the data for all flows and make corrections where necessary. However, if after due verification the deviation is still large, the data may be submitted to the relevant JODI-Gas organisation. If more accurate data are subsequently received, then a revised and corrected balance should be resubmitted.

Table 6.1 shows an example of such a balance check. While any Statistical Difference should be checked and queried, in this example the difference is over 15%, which is not normally acceptable and should be reviewed.

Table 6.1: Example of a balance check

	Natural Gas **million m³ (at 15ºC. 760mm hg)**
	A
Production	6840
Receipts from other sources	
Imports	40
LNG	
Pipeline	40
Exports	
LNG	
Pipeline	
Stock Change	-200
Gross Inland Deliveries (Calculated)	7080
Statistical Difference (Calculated)	1120
Gross Inland Deliveries (Observed)	**5960**
Percentage statistical difference	*15.8%*

There could be a number of factors leading to the high Statistical Difference. A normal starting point is a review of the data submissions to check completeness. The statistician should verify that the sign of each flow, particularly the Stock Change sign, has been correctly applied. When different data sources are used, it is often useful to review their definitions and methods to identify possible sources of inconsistencies. High Statistical Differences could be caused by something as simple as a data entry error, an incomplete data submission or a missing response from a data provider.

6.1.2. Stocks check

Closing Stocks and Stock Change are clearly related concepts, as the Stock Change for a reference month is defined as the difference between the Closing Stocks of the reference month and the previous month. In other words, looking at month M-1, the relationship between Closing Stocks and Stock Change should be:

[Stock Changes for M-1] = [Closing Stock for M-1] – [Closing Stock for M-2]

If for any reason this is not the case, the statistician should investigate and make the necessary correction. A deviation could stem from the Stock Change for M-1 being obtained using preliminary Closing Stock levels for M-2. If M-2 stock levels have since been revised, then a revision for the previous month should be submitted so the stock levels and Stock Change agree.

Table 6.2: Example of checking consistency of stocks data

Reported Data	Country A	Country B
Closing level of stocks M-1 (March)	11550	8440
Closing level of stocks M-2 (February)	12562	7121
Stock Change in M-1 (March)	-1007	1122
Validation Checks		
Calculated stock change	-1012	**1319**
Difference	-5	**197**
Percentage difference (Difference/Reported stock change)	0.5%	**17.5%**

In Table 6.2 the Closing Stock levels for February and March are given, together with the reported Stock Change in M-1, for Countries A and B. Below these data are calculated fields, namely *calculated Stock Changes* (calculated as the difference between the reported Closing Stock level for M-1 minus M-2) and how this compares to the reported Stock Changes in absolute and percentage terms. For Country A the percentage difference between the reported and calculated Stock Changes is small, and it could be that a very small revision to M-2's Closing Stock level was not reflected in the latest month's report. For Country B, on the other hand, there is a 17.5% difference between the observed and calculated Stock Change.

In both examples the statistician should go back and check all data points to ensure all are correct and revisions have been correctly processed. For Country B, as the discrepancy is greater than 15%, the statistician should go back to the data providers and ascertain where the problem arises. If improved data are not forthcoming, then a recalculation may be required to reconcile the differing values. For Country A, this difference, although not desirable, could be attributed to rounding and may be left as is if better data are not available. Countries and economies are nevertheless encouraged to always provide Stock Change and Closing Stocks level data that agree completely.

6.1.3. Calorific values check

As the JODI-Gas Questionnaire asks for data in both physical and energy units, statisticians at both the national and international levels can check these two sets against each other to see if they agree. Dividing data in TJ (on a gross basis) by data in cubic metres will provide a GCV. This calculated GCV can be compared against default GCV for natural gas for reasonability. Since natural gas is predominantly methane, its calorific value tends to vary less than those of other energy sources such as coal and crude oil, whose composition can vary significantly depending on where they are extracted. Therefore one would not expect great deviation from the default values, nor significant variability across time periods.

An unusual GCV, for example less than 30 000 kJ/m^3 or more than 45 000 kJ/m^3, should be questioned, and it should be ascertained which of the volume or energy data points represent the correct value.

6.1.4. Time Series Check

Another method that the statistician can use to check the accuracy of data is the time series check. This check involves comparing the data point of the latest month to that of the preceding months and/or to the data point of the same month in the previous year (which is normally the most useful comparison when data show a strong seasonal trend, as natural gas data often do). The method is particularly useful for flows such as Production or Gross Inland Deliveries (Observed), which tend to follow a consistent trend. It is less useful for trade and Stock Change, which are in general expected to vary more erratically.

The statistician can compute monthly growth rates and use previous growth rates as an indication of the trend of the growth rate for the latest month, with the following formula:

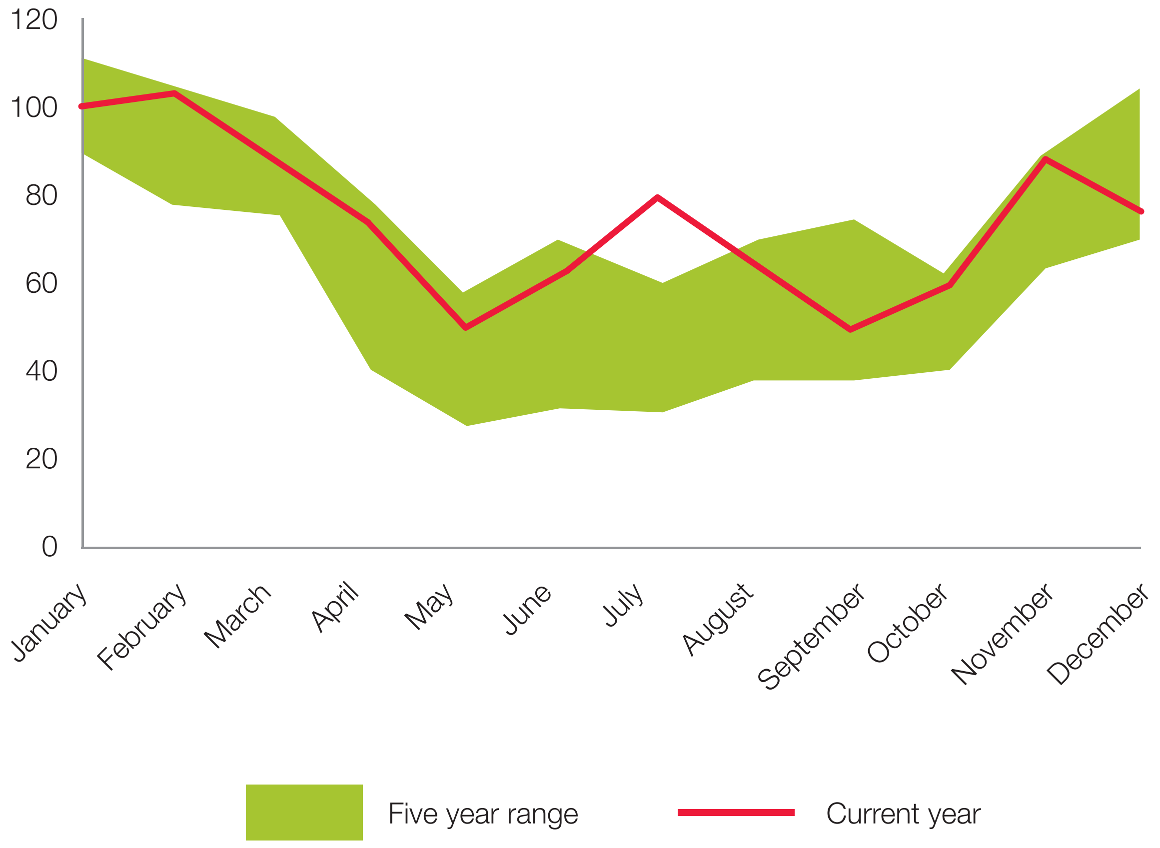
$$\textbf{Growth rate (\%)} = \frac{\textbf{Current Month's Data - Previous Month's Data}}{\textbf{Previous Month's Data}} \times 100$$

Should the growth rate be quite different from the previous months, the statistician should investigate and document any relevant explanation. Examples could include an exceptionally cold (or mild) winter, or a gas-fired power station shutting down for maintenance.

Where data show strong seasonality, a comparison with the same months in previous years can hold more insight than a comparison with recent months. A value may not seem too unusual when compared to values from the same month the previous year, but this can mask the fact that demand could be much higher in the winter than the summer. In order to check these types of data series, one can compare each data point with the same month over the last five years to see if it lies within the previously observed range.

Figure 6.1 shows the current year's demand for natural gas plotted against the five year month-by-month range. While the observed value for July in the current year seems reasonable compared to other values for the current year, when compared against the previous July values it lies distinctly outside of the five-year range. This would not have been spotted had the previous months been simply examined without considering seasonality.

Figure 6.1: Comparing recent data to the historical trend on a monthly basis



6.1.5. Visual checks

An easy method to rapidly verify time series is to graphically represent the data using a selection of graphs, such as line graphs and box plots. By using this method, outliers, which are data points far from the rest of the data, can be easily detected. To be able to graphically show time series, however, it is essential that the statistician develop and maintain a database of historical data.

The method for visually checking time series can be used for most of the flows, although it is more difficult to spot outlying data for Stock Change (and to a lesser extent trade data), as these fluctuate between positive and negative and will often vary significantly more than other series.

Figure 6.1 under Time Series Checks is also a good visual check, as a pattern that would not have necessarily been noticed in a database can be easily spotted.

6.2 Common reporting errors

Another way to improve data accuracy is by preventing common errors in data collection, processing and reporting. To ensure these errors are avoided, Table 6.3 shows frequent common errors and a corresponding suggestion on how to avoid them or an action to fix them:

Table 6.3:

Common Errors	Suggested countermeasures
1. Data are provided in TJ on an NCV basis.	1. Data should be reported on a GCV basis. To convert from net to gross, the statistician should divide the net data by the ratio of their natural gas' gross and net calorific values, which in the absence of any other data is normally assumed to be 0.9.
2. Data include pure biogas or manufactured gases.	2. Normally data should only represent natural gas, possibly including small amounts of blended biogas or manufactured gas for final consumption. The statistician should work with data providers to obtain data on this basis, and if it is not possible then describe in the metadata what the data do represent.
3. Data are only provided either on an energy or volume basis.	3. It is important to report gas data on both an energy and volume basis. If only one or the other is available, then the statistician should make efforts to collect the missing data or convert the available data into the missing unit using the GCV. While the trade of natural gas usually takes place based on its energy content, the upstream end of the natural gas value chain is often measured in volume only. As a result, energy statistics compilers can face challenges in reconciling these different units in order to complete the Questionnaire. If a monthly GCV is not available, one possible solution is to use conversion factors taken from the latest available annual statistics. As annual data compilation takes careful consideration of data completeness and crosschecks against historical data sets, these factors are reliable references until real data become available. If the national administration decides to apply conversion factors derived from its annual statistics in this manner, then the methodology employed should be reported in metadata.
4. Quantities of gas vented, flared or reinjected are included in supply, i.e. wellhead production figures are provided.	4. These quantities should be excluded from the Production data (even though data for gas flared and vented are relevant in other areas of statistics, particularly for greenhouse-gas statistics).
5. Data include NGL.	5. NGL should not be included with natural gas data.
6. The calorific value implied by the data provided on a volume and energy basis seems unrealistic.	6. The statistician should check with the data provider regarding any suspect calorific value. If no explanation is found, the original units the data were collected in should be determined, and then an appropriate replacement calorific value can be used to calculate the incorrect data point.

Common Errors	Suggested countermeasures
7. Only industry or government stocks are included in the total and not the sum of both.	7. By definition, the total national territory stocks should be the sum of government and industry stocks.
8 Some countries do not report stock data due to confidentiality.	8. Efforts should be made to report stock data. Data providers could be informed that **individual stock** information will not be divulged in the JODI-Gas Database; the national administration will only report the national total stocks level or change.
9. A stock build is submitted with a negative sign while a stock draw is shown with a positive sign.	9. Stock Change should be calculated as the difference between closing stocks and opening stocks, or of Closing (M-1) stocks–Closing (M-2) stocks.
10. Stock Change is estimated as the difference between supply and demand.	10. National administrations should collect data for both the Closing Stock levels and the Stock Change. Stock Change should not be used to hide a large Statistical Difference.
11. The difference in Closing Stock level of M-1 and M-2 is not equal to the reported Stock Change.	11. This may happen in some cases due to a revision of last month's Closing stocks. A revision has to be made to the Closing Stock level of the previous month.
12. Imports of natural gas include natural gas that is transported through the country (goods in transit).	12. Countries should do their best to determine which part of imported gas is simply being transited through the country and how much is actually being imported for domestic use. The line between goods in transit and re-imports/re-exports is not always clear, particularly for natural gas, where trade can often occur at a national hub.
13. Closing Stocks include quantities held abroad.	13. Only stock quantities that are within the national territory should be included, irrespective of ownership.

Chapter 7. Data Collection / Compilation

This chapter discusses in detail of where administrations might obtain data for each JODI-Gas flow; corresponding issues of comparability; what to do when data are missing and how to report these data in the JODI-Gas Questionnaire; and how to reconcile monthly gas data with "official" national sources reported on an annual basis.

7.1 Data collection and coverage

This section provides examples of different data collection methods and sources that are used for the different flows and stocks of the JODI-Gas Questionnaire.

Production and stock data are often collected through surveys from gas extraction and distribution companies every month. This can pose challenges for data collection, due to the reporting period being short. Countries and economies are encouraged to collect and submit the most comprehensive data available at the time. If only partially complete data points are submitted, then this should be noted in the metadata and, most importantly, complete data should be re-submitted as soon as possible.

Trade data (Imports and Exports) are often collected from customs offices. In some cases this can create a longer time lag for obtaining data (notably in some developing countries) compared with data from gas companies, as customs officials might only report data once a year (even if they collect data for each calendar month.) If this is the case, statisticians are encouraged to look for other sources in order to estimate these data. One idea would be to ask gas distribution companies for the quantities they have imported or exported, which would allow the statistician to make an accurate estimate of total Imports or Exports (which can be revised at a later date).

As customs data usually involves capturing the correct amount of excise and duty, data will often be collected on a value (rather than energy or volumetric) basis. If no further unit is recorded, then it will be necessary to derive the quantity of natural gas imported or exported from its value. Natural gas is normally traded based upon long-term contracts (in contrast to crude oil where a well-developed spot market exists). Where not commercially confidential, the volume can be derived using the agreed-upon price, which may or may not be linked to the current oil price.

Gross Inland Deliveries (Observed): As these are deliveries to final consumers, the gas distribution company will often have the necessary data. As energy industry own use is not collected separately in JODI-Gas, this should be collected from gas producing industries and included within this flow.

Data for deliveries to electricity and heat generation can be collected from power generating companies, unless the data are based upon deliveries by the gas supplier(s) to the power sector – in which case the gas distribution company could be the source. If the data are based upon receipts by the power plant, then it is important to identify only the natural gas (whether or not with a blended biogas or manufactured gas component) deliveries and exclude the use of pure biogas or pure manufactured gases.

7.2 Missing data

Data may be missing for a number of reasons:

- Data are not collected by the national administration;
- Data are not reported by the data provider (either exceptionally or consistently);
- Data are confidential.

JODI organisations do not estimate data that have not been submitted by participating countries or economies, nor do they change submitted data without a jurisdiction's consent as the data are considered officially sanctioned. When a JODI-Gas Questionnaire is submitted incomplete, JODI organisations may make efforts to solicit the missing data from the national administration, but ultimately the submission appears in the JODI-Gas World Database as it was received. The absence of data will be reflected under the completeness indicator of the country's or economy's data quality assessment. National administrations are thus encouraged to collect and report all data required for JODI-Gas.

Further, it is important to fill in all data points in the Questionnaire, even when the known value is zero. If a cell is left blank, then this can be considered an incomplete submission, which affects the data quality assessment and may give rise to incorrect estimates by users and analysts.

There may be situations where, due to confidentiality, a data point cannot be submitted in the JODI-Gas Questionnaire. It is important nonetheless to mark this data point as confidential, either with the C qualifier or by mentioning this in the country metadata.

For example, where one value of the JODI-Gas Questionnaire is confidential, this will affect the arithmetic of the whole Questionnaire. One possible approach is to combine this flow with another to remove the risk of publishing a confidential data point. For example, if the Exports flow is confidential for a particular month, this flow could be combined with Imports for the same month so only net Imports (or net Exports) are shown. This method allows a confidential flow to be concealed while still showing a "complete" balance in JODI-Gas.[1]

As mentioned in Chapter 2, the qualifiers for confidential and not available data points cannot at this point be shown in the JODI-Gas Database by all of the JODI organisations due to technical limitations. However, these qualifiers should still be used as this can aid the JODI organisation's comprehension of the data submission and the organisation can document the missing values in metadata to aid the user's understanding.

For countries where the national administration either does not collect the relevant data or data providers do not submit data on time, the list of flows in the JODI-Gas Manual – considered as an agreed minimum to effectively monitor market developments – establishes priorities for including these data items in future data reporting arrangements.

7.3 Reconciling monthly and annual data

Data reconciliation refers to cases where there are two sources of data for the same target variable, with different frequencies, and is concerned with correcting inconsistencies between the different series. Whether to reconcile monthly JODI-Gas submissions with annual data or not depends upon the data reporting mechanisms in the particular country or economy. In some countries all monthly data are considered to be estimates or preliminary, while the annual data are both official and final. If this is the case, then monthly data are generally revised in order to agree with these official data (in a process known as benchmarking[2]), and resubmitted.

[1] A discussion of techniques for dealing with data confidentiality can be found in Chapter IX, Section A of the International Recommendations for Industrial Statistics (UNSD, 2008).

[2] A discussion of benchmarking methods can be found in Chapter VII, Section E of the International Recommendations for Industrial Statistics (UNSD, 2008).

Chapter 8. Examples of Country Practices

This chapter describes selected countries' experiences in the collection, compilation and reporting of JODI-Gas data. Although it is recognised that each country may have unique and evolving data collection practices, it is still considered that some general guidance may serve as a reference for other countries to learn from and apply to their own data systems.

8.1 Azerbaijan

Introduction

Natural gas has historically been an important energy source for Azerbaijan. In early history Azerbaijan was called "the land of the sacred fire", due to the jets of flame that shot up from natural gas fields. Before the 20th century natural gas was mainly used for heating purposes but it is now used in many sectors, in particular generating electricity and heat. Following independence in 1991, Azerbaijan transformed from a net importer of gas to a net exporter by the beginning of the 21st century.

There are two dominant oil and gas companies operating in Azerbaijan: SOCAR (State Oil Company of Azerbaijan Republic) is the state-owned oil and gas company, and BP AMOCO is a private company. BP AMOCO opened their offices in Baku back in 1992. Two years later BP and a consortium[3] of international oil companies signed a major contract with the government of Azerbaijan. Today, the offshore Caspian region has become one of the world's leading hydrocarbon areas. The development of the region's offshore oil and gas fields and onshore pipelines made Azerbaijan a focal point of the global energy market and a gateway through which international investments reach the Caspian region and beyond.

Legal Basis

The reporting and improvement of energy statistics is considered a priority by Azerbaijan. The State Program on "Improvement of Official Statistics in 2008-2012" was approved directly by the President of the country in 2007. 11.5% (6 from 52) of activities in this program relate to energy statistics. The State Statistical Committee of the Republic of Azerbaijan should report to the Government and President of the Republic of Azerbaijan once a year about the progress of the works and submit tasks to the corresponding organisation for the allocation of state budget funds.

There is a strong legal basis in Azerbaijan for the collection and compilation of energy statistics defined by The Law on Official Statistics of the Republic of Azerbaijan. The State Statistical Committee (SSC) is the institution in charge of the management of implementation and coordination of statistical activities. The Law on Official Statistics reflects the fundamental principles of official statistics such as, for example, professionalism, independence, objectivity and confidentiality. All legal entities, as well as their representations or branches and natural entities acting in the Republic of Azerbaijan, are obliged to provide state statistical bodies with necessary statistical information for carrying out certain surveys during definitive time periods. The information is presented in free of charge, formal statistical reports and in electronic form (**www.stat.gov.az**).

[3] BP Amoco – Great Britain, Chevron Khazar Ltd – US, Inpex Southwest Caspian Sea – Japan, Azerbaijan (ACG) Limited – Azerbaijan, Den Norske Stats Oljeselkap a.s. – Norway, Exxon Azerbaijan Limited – US, Turkey Petrolleri A.O. – Turkey, Hess – US, Itochu Oil Exploration Azerbaijan Ýnc. – Japan. For all these companies the data of statistical accounting in monthly and annual statistical reports are brought to price and natural exponents by BP AMOCO.

Data Sources and Collection

Different data sources are used to fill in the JODI-Gas Questionnaire. The main data source is the monthly survey of all enterprises on the production of natural gas (Survey №6-Production (oil, gas)). Reports are submitted by industrial enterprises for which the main activity is the production of natural gas.

The №6-Production survey is sent to big enterprises on a monthly basis, and small enterprises on a quarterly basis. Therefore estimates are made only for small companies. Thus 100% of the market is covered in the monthly submission (a small quantity of which is estimated based on quarterly submissions).

The survey №2-Supply (gas) quarterly report provides information on the supply of natural gas to the domestic market. The deliveries of natural gas to electricity and heat plants are obtained through this survey. This report presents all the gas that is distributed in all regions on a quarterly basis. Monthly data are estimated based on this quarterly report. Monthly stock levels are also obtained from this survey, and in addition from publicly available data from SOCAR and BP AMOCO.

Monthly data on imports and exports of natural gas are obtained from the customs office. Additional sources for these data are the monthly reports about imports and exports of SOCAR and BP AMOCO.

All data on natural gas are collected in cubic metres under standard conditions, including customs data. Data in TJ are obtained on a GCV basis. The typical range of NCV for Azerbaijan gas is 35.9-39.06 GJ per cubic metre.

In addition, there are a number of annual surveys that are carried out in the country, which are used for the compilation of annual statistics on natural gas. These include:

- *№1- TIG technical-economic indicator* (gas): annual report on all gas wells representing all extracting enterprises:
- *4-fuel consumption* (monthly): a report on consumption of energy products including natural gas is presented to all big-enterprise consumers:
- *4-energy* (gas consumption, annual) representing all enterprises (big and small).

Each report has its own deadline as per regulations. For example, the deadline to report on №6-Production (gas) is the 5th working day of the following month for big enterprises, and the 20th working day of the following month for small ones.

The country has regional statistical offices, which examine both the monthly and annual reports, to check and help correct mistakes. Monthly and annual data are checked against the last month and the corresponding period of the previous year. The monthly, quarterly and annual surveys for natural gas are sent out mainly in electronic form, but they are also presented to the respondents in paper form or by mail.

When companies cannot report, data are inputted based on the previous month or quarter. This is the case for all small gas producing companies, which only report on a quarterly basis.

Dissemination

Data are first collected from local statistical offices where data are entered and compiled and further sent to the Main Computing Center of the Statistical Committee of Azerbaijan. The monthly data are processed, validated and stored in a database, which contains only data on a monthly and quarterly basis. If there is a request for any annual data, they are obtained from the monthly or quarterly calculated totals. Data are checked in regional statistical offices and then forwarded to the Main Computing Center. Totals are received by the SSC and validated.

Data are disseminated through both monthly and quarterly publications.

Future plans

For improving data collection, a monthly sample survey of household consumption of energy products (including natural gas) was started in 2007 and continued for three years. In 2012 a sample survey of physical persons consuming energy products and gas was started to eliminate problems in the collection of JODI-Gas data. Since the beginning of 2013, Azerbaijan has been receiving data on stock levels from these market actors.

8.2 Brazil

The supply of natural gas in Brazil, amounting to 35,000 million cubic metres annually, is composed of 30% imports (mainly from Bolivia) and 70% from national production. Gas is produced by both private and public companies. The granting of permission to produce and process natural gas is the responsibility of the federal government, while states grant permission to distribute gas.

The National Agency of Petroleum, Natural Gas and Biofuels (ANP) is the agency that owns and updates the regulations on monitoring the movement of hydrocarbons and biofuels. Thus, the energy chain of each fuel, which includes the activities of exploration and production, foreign trade, stocks, transformation, distribution and consumption, is tracked and monitored at different temporal levels (hour, day, month, year, depending on activity).

The amount and range of actors along the energy supply chain make the process of data collection and debugging a complex task, which requires continuous monitoring in regard to the term, range and quality. However, the legal requirement for data collection, which includes penalties for non-compliance in time and formats, states that most information should be submitted within a period not exceeding 60 days. The agents send the required information by e-mail, broken down by activity and product, both defined by codes.

For data on an M-1 basis, which JODI-Gas requests, it is not always possible to obtain a complete breakdown of data. The data derived from sales, for example, have a longer collection period, and it is presented to the JODI review which is done monthly.

For JODI-Gas, it will be possible to submit production data, foreign trade and changes in inventories, which give the domestic supply of gas (total primary energy supply), which are ultimately the most important data of the gas chain. For a monthly review, it will be possible to rely on marketing data and consumption.

Publication

Brazil's Ministry of Mines and Energy publishes a monthly bulletin of natural gas, compiling data on production, foreign trade, industry sales, prices and facilities, which is published an average of 60 days after the reference month.

The Brazilian Energy Balance (BEN) is prepared annually by the Energy Research Company (EPE), a public-private entity belonging to the Ministry of Mines and Energy. EPE has spread sheet software that enables agents to enter their respective primary data for the development of the BEN. A series of "business rules" enable data formatting to the methodology of BEN, accompanied by careful analysis of the quality of the final results. From January to April each year, virtual and on-site meetings are held by agents to supplement, amend and ratify information.

Two products are obtained that serve as fundamental resources: a) a matrix of 56 forms of energy per 90 activities in business units and b) a matrix with the consolidated balance sheet in thousand toe. These two products allow the verification of statistical adjustments, losses in processing centres and growth rates, which enhance the completed final results.

8.3 Thailand

Data Collection

The organisation in Thailand responsible for energy statistics in general, and gas statistics in particular, is the Energy Policy and Planning Office (EPPO) under the Ministry of Energy (MOE). Within EPPO, the Energy Forecast and Information Technology Center (EFIT) undertakes this task. By Ministerial regulations, EPPO has a mandate in energy information management, whereby its role is to collect, report and disseminate energy data, including natural gas statistics. EPPO finds appropriate and relevant gas data sources, i.e. production, trade, separation intake/output and demand in Thailand and then compiles it. EPPO then also looks for secondary data sources. These sources support EPPO data collection by giving their data to EPPO voluntarily. EPPO uses statistics not only for its own purpose as an energy policy maker, but also for the benefit of the general public. Furthermore, EFIT under EPPO uses gas statistics for energy balances and energy forecasts.

The Department of Mineral Fuels (DMF) under the Ministry of Energy and the PTT Public Company Limited (PTT) cooperate closely with EPPO in providing natural gas supply and demand information. The indigenous production statistics are recorded by the DMF. All gas production within Thailand's territory under gas concessions (both onshore and offshore) by the Petroleum Act must be reported to DMF. Furthermore, the DMF estimates gas reserves, which have been discovered in Thailand, defined as P1 (Proved), P2 (Probable) and P3 (Possible), and collects the gas-reserve statistics. For the gas consumption and gas imports, PTT is the company with the largest sales in the natural gas industry in Thailand. PTT also owns gas-importing facilities such as pipelines and LNG stations. Furthermore, PTT holds gas-separation units. Thus, PTT is able to provide information of imports through pipeline and LNG, gas demand for separation and gas consumption to the EPPO.

In general, in Thailand an additional survey is not necessary to obtain data on natural gas sales, since the retailing report from PTT is sufficient. The groups of gas users are few, consisting of power producers, gas separation plants, transportation and some in industry. The natural gas providers have only one major supplier. The reports that EPPO receives from both organisations are in Excel spread sheets, with their own design format.

All import and export data are provided by PTT. PTT imports gas from Myanmar through its gas pipeline, and recently PTT has also imported gas in liquid form (LNG) from overseas. This covers all gas import data in Thailand. Thailand does not yet export gas.

EPPO obtains the monthly data for gas supply and demand from both DMF and PTT. EPPO is thus able to report these data monthly. EPPO collects all gas data (Production, Imports and Consumption) less than one and a half months after the reference month ends. For example, for monthly gas data of March 2013, EPPO will finish collecting data by 10th May 2013.

Mistakes, inaccuracies and suspicious figures are checked occasionally when there is a perceived error, but this does not occur often. Even though EPPO does not meet the data providers regularly, EPPO checks with the original sources of data, or contacts the relevant person immediately when any mistake or possibly erroneous figure is found.

Data Processing and Overall Assessment of Collection System

The data are entered manually. EPPO has developed an SQL database system for Thailand's energy data. All data are kept in the database. The data management system is user-friendly and minimises errors.

Accuracy of data is verified by comparing not only with previous months but also year-on-year. In the process of entering data into EPPO's SQL database system, the data are reviewed at least twice during and after entering data. When the data have been confirmed for accuracy, the output is then released for official reports.

Data revision is always done at the end of the year. EPPO finds that monthly data do not need revisions since they are not estimated. However at year-end, there is a possibility to revise any errors of statistical inaccuracy. The adjustment of error correction might be made by either data providers to EPPO (DMF and PTT) or EPPO itself.

Suggested Improvements

EPPO constantly improves its database to enhance the system. This is necessary to expand its capability due to needs and requirements. Furthermore, greater user-friendliness of the system is another avenue for improvement.

8.4 United Kingdom

The UK data collection system relies on a range of data sources, some operated by the government itself, others by private operators. The principal returns are:

- ***Petroleum Production Reporting System (PPRS):*** Returns from the main reporting system for data collection is the PPRS. The PPRS is a census that requires all companies involved in extracting and processing oil and gas on the United Kingdom Continental Shelf (UKCS) to submit monthly details of their operations (both oil and gas) to the UK Government. PPRS is used to report flows from field level through to final input to the UK's gas transmission systems. The PPRS reporting manual, together with flow process charts showing the data streams reported, can be found on the Department of Energy and Climate Change (DECC) website at this address:**http://webarchive.nationalarchives.gov.uk/20121217190832/http:/og.decc.gov.uk/en/olgs/cms/tech_papers/pprs_2000/pprs_2000.aspx**
- ***National Grid operational data:*** Returns from National Grid, the owner and operator of UK's National Transmission System (NTS). The National Grid publishes a range of data on input and output from the NTS at **www.nationalgrid.com/uk/Gas/Data/**
- ***Miscellaneous commercial returns:*** Returns from various trade data are captured from the operators who trade gas either via pipeline or to the UK's LNG terminals. Some of these are in the public domain, others are ad-hoc collections run by the UK government in co-operation with industry.

Legal Basis

All operators of gas facilities on the UKCS, both offshore and onshore, require a licence to operate from the Government, in the form of approval from the senior minister within the DECC. As a condition of the licence, operators are required to supply any data required by the Secretary of State. The UK can also rely on various powers, particularly those in the Statistics of Trade Act, 1947.

Production Data

The gas production data are derived through the PPRS system. The PPRS began in 1975 when the UK began producing offshore oil. In 2000, the PPRS was revised and all UKCS operators were consulted to create a more efficient reporting system that would be beneficial to both the Department and the companies. This resulted in the current upstream PPRS2000 data collection system. One of the principal shifts between the two was the move from field data to terminal data. Prior to 2001 gas production was derived from field level data. Using PPRS2000 gas production is now derived from terminal data supplemented with gas utilised on the oil and gas fields. This has two benefits, as it considerably reduced processing time and improved data quality because feeds from the terminals are sales gas and are more accurate than the pipeline gas reported at field level.

The PPRS2000 data are in the form of a simple balance and data are automatically validated on receipt. Occasionally reporting errors are evident but it is not always possible to correct these errors within the JODI-Gas submission deadline. In such cases the data are adjusted to take account of the most likely cause of the error.

In the event that gas terminal data are not available, National Grid's entry day flows are used and if the entry point is off-grid then the previous month's data are used as the starting point for an estimate.

Gas Trade Data

The trade figures have a variety of sources. Whilst some overlap, this provides opportunities for cross-checking.

For Imports:

- Pipeline Imports of gas from Norway through the FLAGS and Frigg/Vesterled pipelines are captured within the PPRS.
- Norwegian Imports through the Langeled pipeline are reported by the Norwegian operator and National Grid also report these gas receipts on its website.
- Imports from Belgium and the Netherlands are reported on the operators' websites and the receipts are reported on National Grid's website.
- Shipped import data are supplied voluntarily by the LNG terminals, but as for all gas flows, there are provisions that could be used to legally enforce data supply.

The situation is similar for Exports:

- Exports of gas to the Netherlands (direct from the UK or UK share fields using the Dutch offshore pipeline infrastructure) and Norway (for injection into the Ula field) are captured within the PPRS.

- Exports to Belgium are published on Interconnector UK's website at **www.interconnector.com**

- Exports to Ireland and the Isle of Man are more complex. These are derived from data supplied by National Grid and the Local Distribution Zones (LDZs). The National Grid return (which covers Great Britain only) shows the volume of gas put into other companies' pipelines. After subtracting the gas receipts reported by the LDZs and any exports to Belgium, the resultant figure should be the gas exported via Moffat in Scotland. From this figure gas consumed in Northern Ireland is subtracted thus deriving gas exports to Ireland. Northern Ireland gas consumption is added to the Great Britain figure to create a UK consumption figure.

Consumption Data

These data are derived from a combination of data supplied by National Grid, the Local Distribution Zones, from the PPRS and gas used in Northern Ireland. Stock levels are published on National Grid's website. At the time the JODI-Gas Questionnaire is submitted, coverage for electricity generation is about 85 per cent of the market, with the remainder estimated.

Overall Assessment of the Data Collection System

As downstream reporting is completely separate from PPRS2000, the Department uses the Statistical Difference between calculated inland deliveries and observed inland deliveries as a quality assurance tool. Large Statistical Differences are investigated for data input and other quality issues and referred back to the reporting companies where appropriate. The Department works within a statistical tolerance level of 0.5% of supply.

All data used to produce JODI-Gas are required for the Department's own statistical reports, so it does not put an additional reporting burden on the data providers. Also, the Department has National Statistics accreditation which means that its statistical outputs, which can be found at this website address, are regarded as of high quality: **www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/source.aspx**

Future possible improvements

The gas industry's own use category currently excludes gas use at the LNG terminals. Historically this was because of concerns about commercial sensitivity. However, as the UK now has three LNG terminals, the department is investigating including these volumes into our various statistical reports.

Chapter 9. The JODI-Gas World Database

9.1 Background

The JODI-Gas World Database is a platform that provides access to all data reported through monthly submissions of the JODI-Gas Questionnaire by all participating countries and economies. The database is updated on a monthly basis around the 20th of each month, though there are possibilities for additional updates. Registered users are notified by e-mail alert each time the database is updated.

Modelled after JODI-Oil, which features monthly oil production, consumption, stocks and trade data from over 90 countries, JODI-Gas embodies the same objective of enhancing energy data transparency, with the ultimate goal of ensuring global energy security for producers and consumers alike.

9.2 Building the JODI-Gas World Database

The graphic below illustrates the four main steps involved in the JODI data collection, review and dissemination process. Solid commitment and smooth coordination are necessary at every stage to help ensure JODI's continued success.

Stage 1. National and international oil and gas companies submit data to their national administrations.
Stage 2. National administrations verify and submit data to their corresponding JODI Partner organisation.
Stage 3. JODI Partners review, check, assess and then submit data to the IEF.
Stage 4. The IEF reviews and reformats the data and then publishes it.

Figure 9.1: Dataflow of JODI-Gas Reporting

9.3 The JODI-Gas World Database

9.3.1. How to access?

The JODI-Gas World Database is accessible on the JODI Website. The website address is as follows: **www.jodidata.org**

Extensive background information as well as full explanations are provided on the website.

The data are presented using the Beyond 20/20™ browser software, available for download at the site.

9.3.2. What is included?

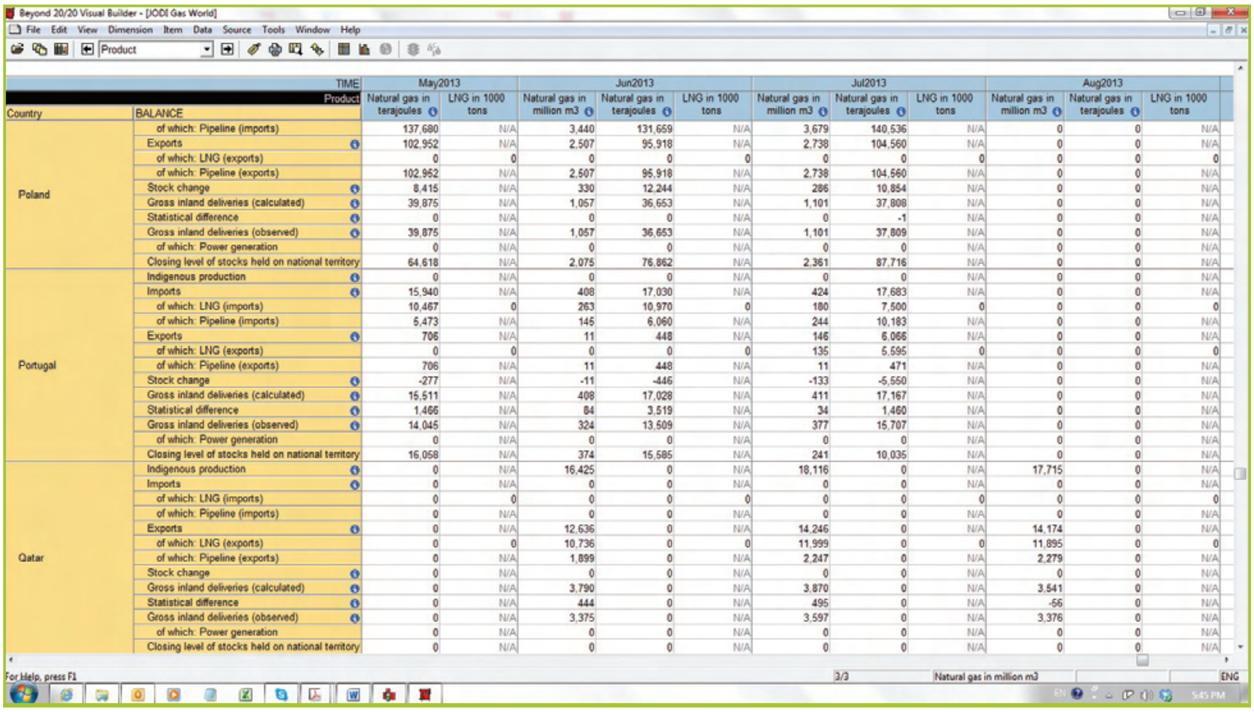
- Three product categories: Natural gas in million m³, Natural gas in TJ, LNG in 1000 tons.
- Twelve flows: Production, Receipts from Other Sources, Total Imports and Exports, as LNG and through Pipeline, Stock Change, Gross Inland Deliveries (Calculated), Statistical Difference (Calculated), Gross Inland Deliveries (Observed), Of which: Electricity and Heat Generation, and Closing Stocks.
- Data for around 70 participating countries.
- Historical data from January 2009: target is to release one month old data (M-1) every month for all participating countries.

9.3.3. Features

The database was designed with the goal of transparency squarely in mind:

- User may choose to browse data online or download data files in Beyond 20/20™ format
- Colour coding has been given to data cells to indicate the confidence evaluations of the data where possible (see below)
- Easy graphic representation
- Easy manipulation of products, flows and units
- Choice of language: English, French, German and Spanish
- Data downloadable in different formats, including the colour coding when downloading to Excel from a Beyond 20/20™ format

Figure 9.2: A view of the database



Country	BALANCE	May2013 Natural gas in terajoules	May2013 LNG in 1000 tons	Jun2013 Natural gas in million m3	Jun2013 Natural gas in terajoules	Jun2013 LNG in 1000 tons	Jul2013 Natural gas in million m3	Jul2013 Natural gas in terajoules	Jul2013 LNG in 1000 tons	Aug2013 Natural gas in million m3	Aug2013 Natural gas in terajoules	Aug2013 LNG in 1000 tons
Poland	of which: Pipeline (imports)	137,680	N/A	3,440	131,659	N/A	3,679	140,536	N/A	0	0	N/A
	Exports	102,952	N/A	2,507	95,918	N/A	2,738	104,560	N/A	0	0	N/A
	of which: LNG (exports)	0	0	0	0	0	0	0	0	0	0	0
	of which: Pipeline (exports)	102,952	N/A	2,507	95,918	N/A	2,738	104,560	N/A	0	0	N/A
	Stock change	8,415	N/A	330	12,244	N/A	286	10,854	N/A	0	0	N/A
	Gross inland deliveries (calculated)	39,875	N/A	1,057	36,653	N/A	1,101	37,808	N/A	0	0	N/A
	Statistical difference	0	N/A	0	0	N/A	0	-1	N/A	0	0	N/A
	Gross inland deliveries (observed)	39,875	N/A	1,057	36,653	N/A	1,101	37,809	N/A	0	0	N/A
	of which: Power generation	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	Closing level of stocks held on national territory	64,618	N/A	2,075	76,862	N/A	2,361	87,716	N/A	0	0	N/A
Portugal	Indigenous production	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	Imports	15,940	N/A	408	17,030	N/A	424	17,683	N/A	0	0	N/A
	of which: LNG (imports)	10,467	0	263	10,970	0	180	7,500	0	0	0	0
	of which: Pipeline (imports)	5,473	N/A	145	6,060	N/A	244	10,183	N/A	0	0	N/A
	Exports	706	N/A	11	448	N/A	146	6,066	N/A	0	0	N/A
	of which: LNG (exports)	0	0	0	0	0	135	5,595	0	0	0	0
	of which: Pipeline (exports)	706	N/A	11	448	N/A	11	471	N/A	0	0	N/A
	Stock change	-277	N/A	-11	-446	N/A	-133	-5,550	N/A	0	0	N/A
	Gross inland deliveries (calculated)	15,511	N/A	408	17,028	N/A	411	17,167	N/A	0	0	N/A
	Statistical difference	1,466	N/A	84	3,519	N/A	34	1,460	N/A	0	0	N/A
	Gross inland deliveries (observed)	14,045	N/A	324	13,509	N/A	377	15,707	N/A	0	0	N/A
	of which: Power generation	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	Closing level of stocks held on national territory	16,058	N/A	374	15,585	N/A	241	10,035	N/A	0	0	N/A
Qatar	Indigenous production	0	N/A	16,425	0	N/A	18,116	0	N/A	17,715	0	N/A
	Imports	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	of which: LNG (imports)	0	0	0	0	0	0	0	0	0	0	0
	of which: Pipeline (imports)	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	Exports	0	N/A	12,636	0	N/A	14,246	0	N/A	14,174	0	N/A
	of which: LNG (exports)	0	0	10,736	0	0	11,999	0	0	11,895	0	0
	of which: Pipeline (exports)	0	N/A	1,899	0	N/A	2,247	0	N/A	2,279	0	N/A
	Stock change	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	Gross inland deliveries (calculated)	0	N/A	3,790	0	N/A	3,870	0	N/A	3,541	0	N/A
	Statistical difference	0	N/A	444	0	N/A	495	0	N/A	-56	0	N/A
	Gross inland deliveries (observed)	0	N/A	3,375	0	N/A	3,597	0	N/A	3,376	0	N/A
	of which: Power generation	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A
	Closing level of stocks held on national territory	0	N/A	0	0	N/A	0	0	N/A	0	0	N/A

9.3.4. Colour coding

A unique colour cell feature provides the user with supplementary information on the assessment made:

- BLUE: indicates results of the assessment show reasonable levels of comparability with other sources;
- YELLOW: indicates the metadata should be consulted;
- WHITE: indicates data are not assessed;

How was the colour coding derived?

The assessment of the data is carried out on different levels:

- Comparability of the JODI-Gas data with other sources: monthly data from national and secondary sources are assessed.

- JODI-Gas data are compared with annual data (when available) in order to check whether the levels and trends over the years could be confirmed.

- When no other sources are available for comparison with the JODI-Gas data, internal consistency and balance checks are carried out.

The IEF and other JODI partner organisations conduct internal data consistency checks in their monthly procedures prior to updating the JODI Gas World Database. Chapter 6 provides comprehensive guidance for these internal consistency checks.

Although assessment methodologies mentioned above are discussed among JODI organisations in order to standardise the approach, one colour on one data point may differ from another data point for the same country during the same month. This is due to uneven availability of external data sources beyond JODI-Gas data submissions, and incomplete data submissions which limit applicable assessment methods.

To consult further details on the assessment methodologies and approaches used by respective JODI organisations please visit: **www.jodigas.org/database/data-quality-assessment.aspx**

Annex 1 Reference Units and Standard Conversion Factors

The most common units employed to express quantities of fuels and energy are those relating to volume, mass and energy. The actual units employed vary according to country and local conditions and reflect historical practices in the country, sometimes adapted to changing fuel supply conditions.

Annex 1 will first describe the various units in use and their interrelationships in general, and will then provide more specific information on units and conversion factors for natural gas.

The internationally recognised units that cover almost all of the measurements of fuel and energy quantities are the cubic metre, metric ton and joule. These all come from SI units[4]. However, over many years other units have been used and the sections below provide related background information and clarifications.

1. Decimal system prefixes

Table A1.1 shows the most common multiple and sub-multiple prefixes used in gas statistics. Note that the prefixes should be used exactly as given. In particular, prefixes in lower case should never be written as upper case.

Table A1.1: Most common multiple and prefixes

10^3	kilo (k)
10^6	mega (M)
10^9	giga (G)
10^{12}	tera (T)
10^{15}	peta (P)
10^{18}	exa (E)

[4] They are derived from the metre, kilogramme and second included in the *Système International d'Unités* and serve as an international basis for science, technology and commerce.

2. Conversion equivalents

Units of volume

The unit of length underlies the unit of volume. The SI unit of length is the metre, from which the cubic metre is derived. The gallon and litre were originally standards of liquid measure but are now formally defined in terms of the cubic metre.

Table A1.2: Conversion equivalents among units of volume

To:	Cubic Feet	Litres	Cubic Metres
From	multiply by		
Cubic Feet	1	28.3	0.0283
Litres	0.0353	1	0.001
Cubic Metres	35.3147	1000	1

Units of mass

The SI unit of mass is the kilogramme (kg); the ton (metric ton), equal to 1,000 kilograms, is widely used as the smallest unit in energy statistics. For most countries the national commodity balances will use the kiloton (1,000 tons) as the unit for presentation of commodities expressed in mass terms.

Table A1.3: Conversion equivalents among units of mass

To:	Metric tons	Long tons	Short tons	Pounds
From	multiply by			
Metric tons	1	0.984	1.1023	2204.6
Long tons	1.016	1	1.120	2240
Short tons	0.9072	0.893	1	2000
Pounds	4.54×10^{-4}	4.46×10^{-4}	5.0×10^{-4}	1

Energy units

The SI unit of energy is the joule. Many other units for energy are in use for the practical expression of energy quantities, partly for historical reasons and partly because the small size of the joule demands the use of unfamiliar (for non-scientists) decimal prefixes.

Historically the ton of coal equivalent was used but, with the ascendance of oil, this has been largely replaced by the ton of oil equivalent (toe) defined as 41.868 gigajoules[5].

There are several other energy units in use. The calorie is one, with a conversion equivalent between the calorie and the joule given by the International Steam Table (IT), defined as 4.1868 joules. Similarly, the internationally agreed value for the British Thermal Unit (BTU) is now 1 055.06 joules. The BTU is the basis for the Quad (10^{15} BTU) and the Therm (10^{5} BTU).

Table A1.4: Conversion equivalents between units of energy

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by				
TJ	1	238.8	2.388×10^{-5}	947.8	0.2778
Gcal	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
MBtu	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
GWh	3.6	860	8.6×10^{-5}	3412	1

3. Conversion between standard to normal conditions

Table A1.5 below shows the conversion factors to convert cubic metres of natural gas under normal conditions to cubic metres of natural gas under standard conditions and vice versa.

Table A1.5: Conversion equivalents between Standard cubic metres (m^3) and Normal cubic metres (m^3)

To:	Standard m^3	Normal m^3
From:	multiply by	
Standard m^3	1	0.948
Normal m^3	1.055	1

Note: Standard cubic metre (m^3) refers to standard measurement conditions at 15ºC and 760 mm Hg. Normal cubic metre (m^3) refers to normal measurement conditions at 0ºC and 760 mm Hg.

4. Conversion between LNG and natural gas units

Table A1.6 below shows the conversion factors among tons of LNG, cubic metres of LNG and standard cubic metres of natural gas.

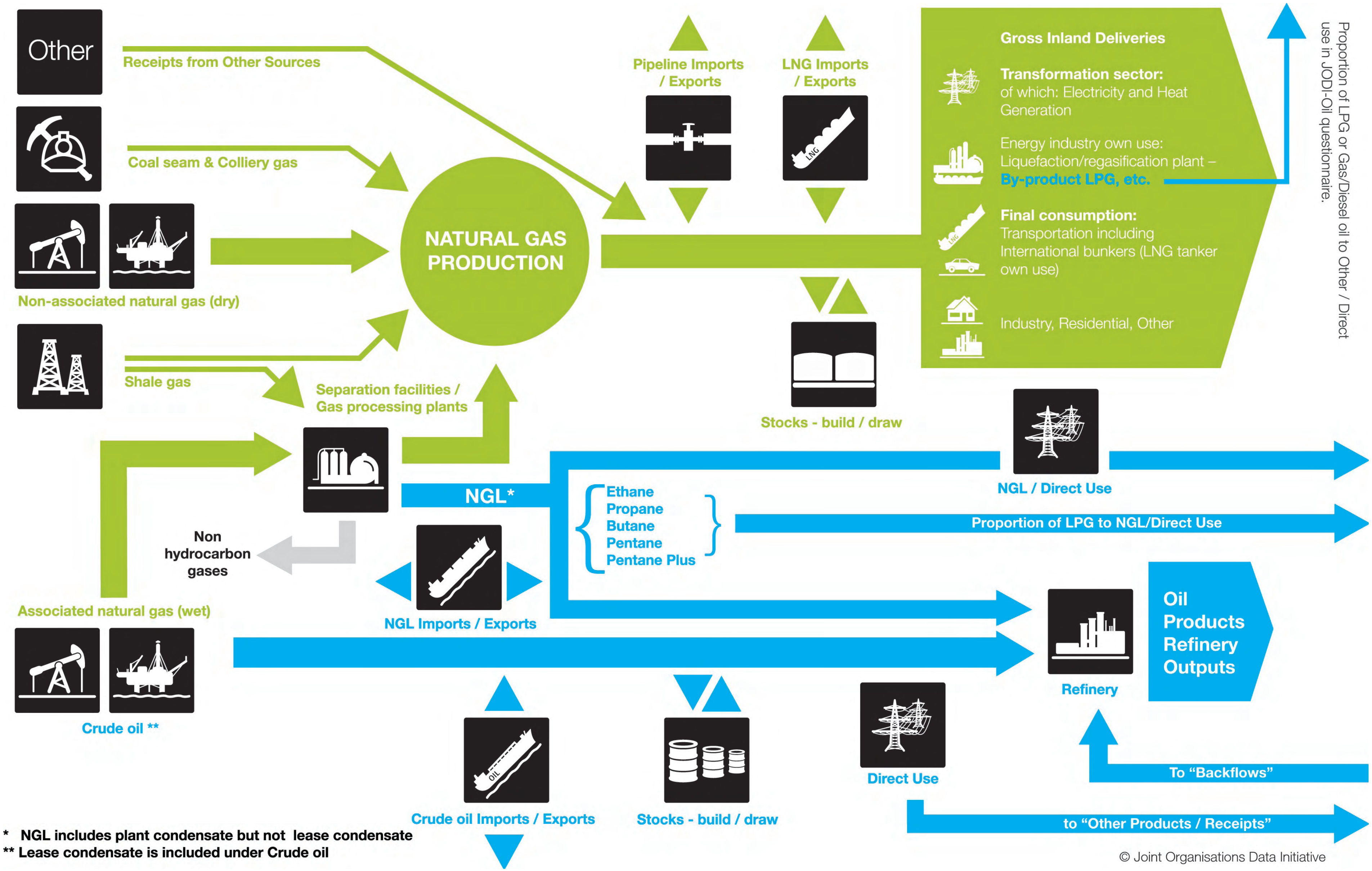
Table A1.6: Conversion equivalents among LNG and Natural Gas units

To:	Metric tons of LNG	m^3 of LNG	Standard m^3
From:	multiply by		
Metric tons of LNG	1	2.2	1360
m3 of LNG	0.45	1	615
Standard m3	7.35×10^{-4}	1.626×10^{-3}	1

(a) 1 Standard m^3 = 40 MJ.

5 This is approximately the net calorific value of 1 ton of crude oil.

Figure A2.1: Gas and Oil Industry Flow



* NGL includes plant condensate but not lease condensate
** Lease condensate is included under Crude oil

Notes		

Notes

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