United Nations Statistics Division

Natural gas

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http://unstats.un.org/unsd/energy

Overview

- Introduction
- Energy statistics
  - Scope of production (IRES)
  - Definition (SIEC)
  - Main flows
  - Additional data items
  - Common reporting problems
- Final remarks

Natural gas - Introduction

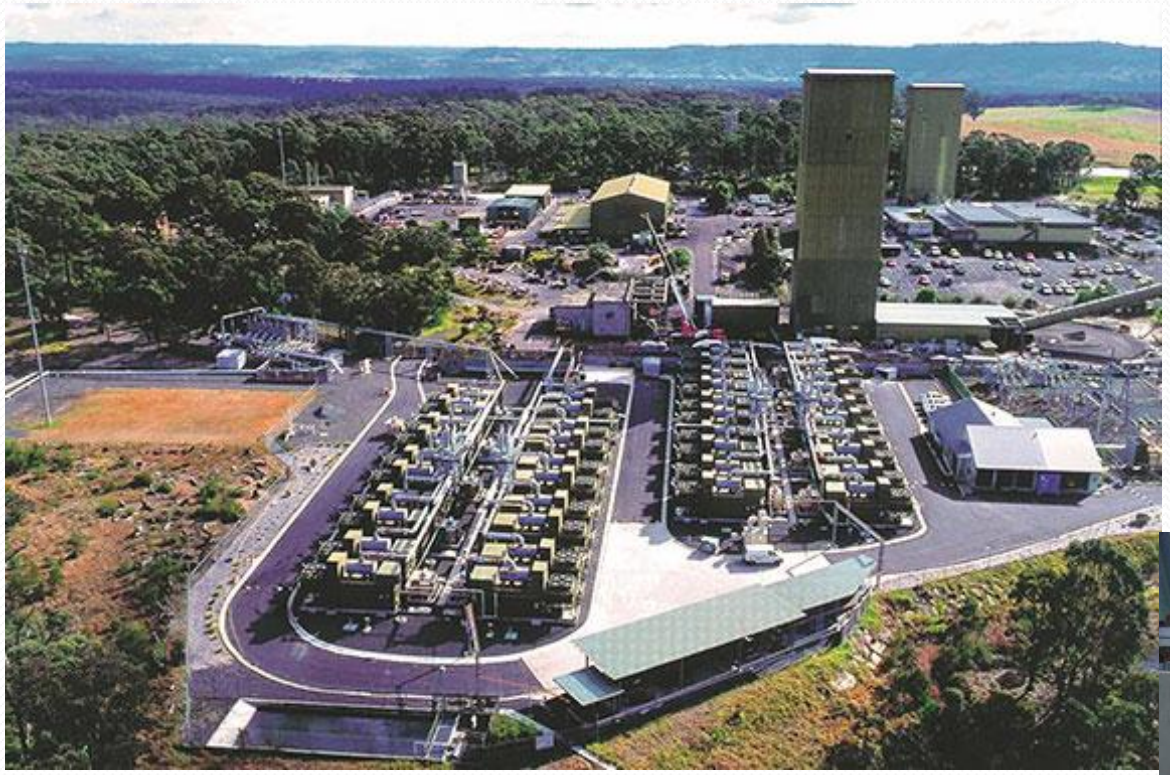
- First recorded use of natural gas for energy purposes:
  - Circa 500 B.C. the Chinese discovered the potential to use to seeping natural gas from rock fissures,
  - using crude bamboo pipelines to transport the gas,
  - where it was used to boil sea water, separating the salt and making it palatable. (source: http://naturalgas.org/overview/history/)
- Leap forward a couple of millennia, in the XIX Century, natural gas started being exploited commercially, starting in the US
  - (although the UK had already an established industry of manufactured gas from coal)

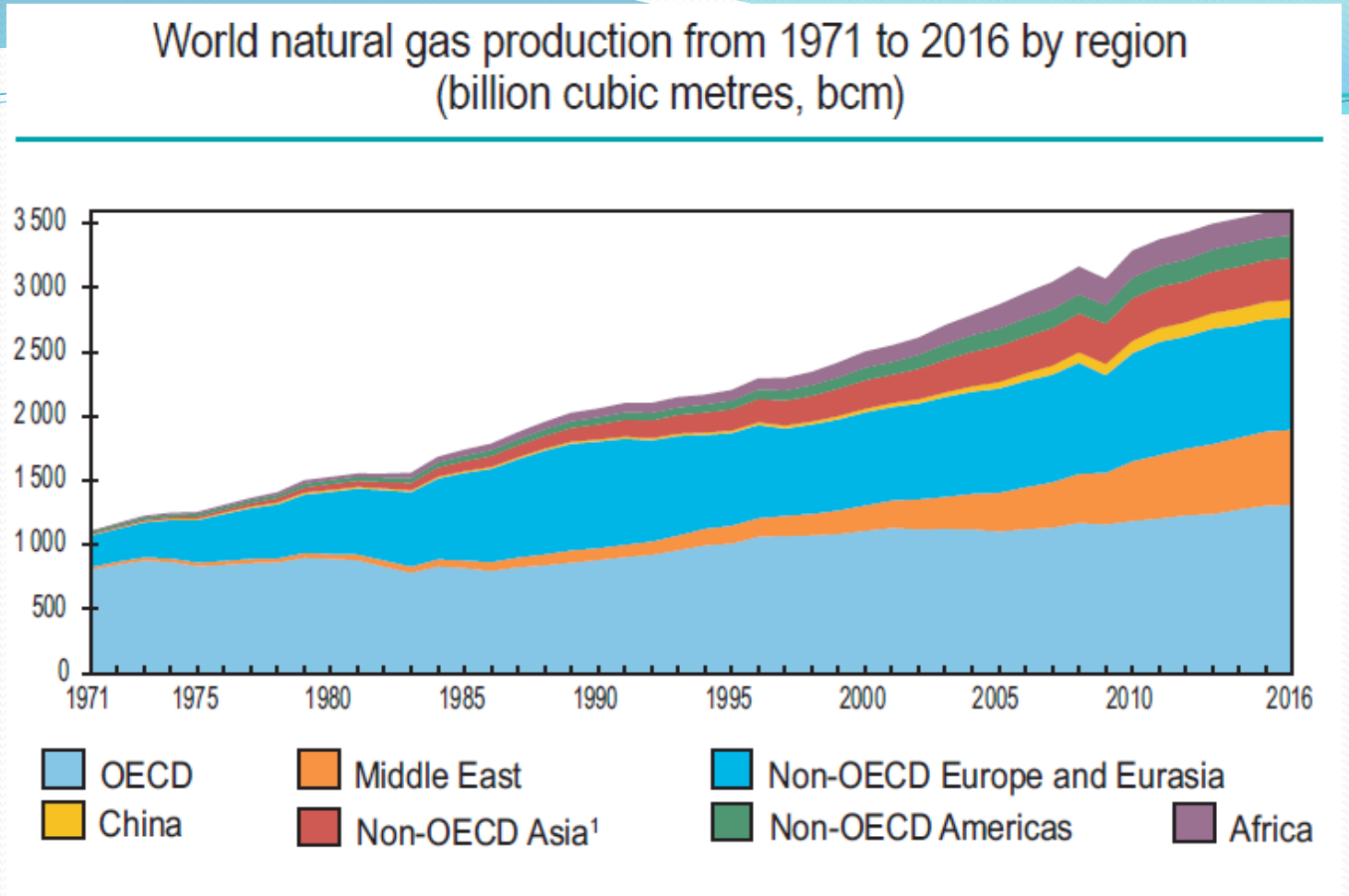
Natural gas - Introduction

- Natural gas can be mainly found natural in underground reservoirs that can be distinguished as:
  - associated gas (from fields producing both liquid and gaseous hydrocarbons), or
  - non-associated gas (from fields producing or
  - But includes also colliery g coal seam gas, c gas, shale gas

- It is the cle less po ting)
- Liquid hydr ns produced in a l gas are referred to as Natural Gas L

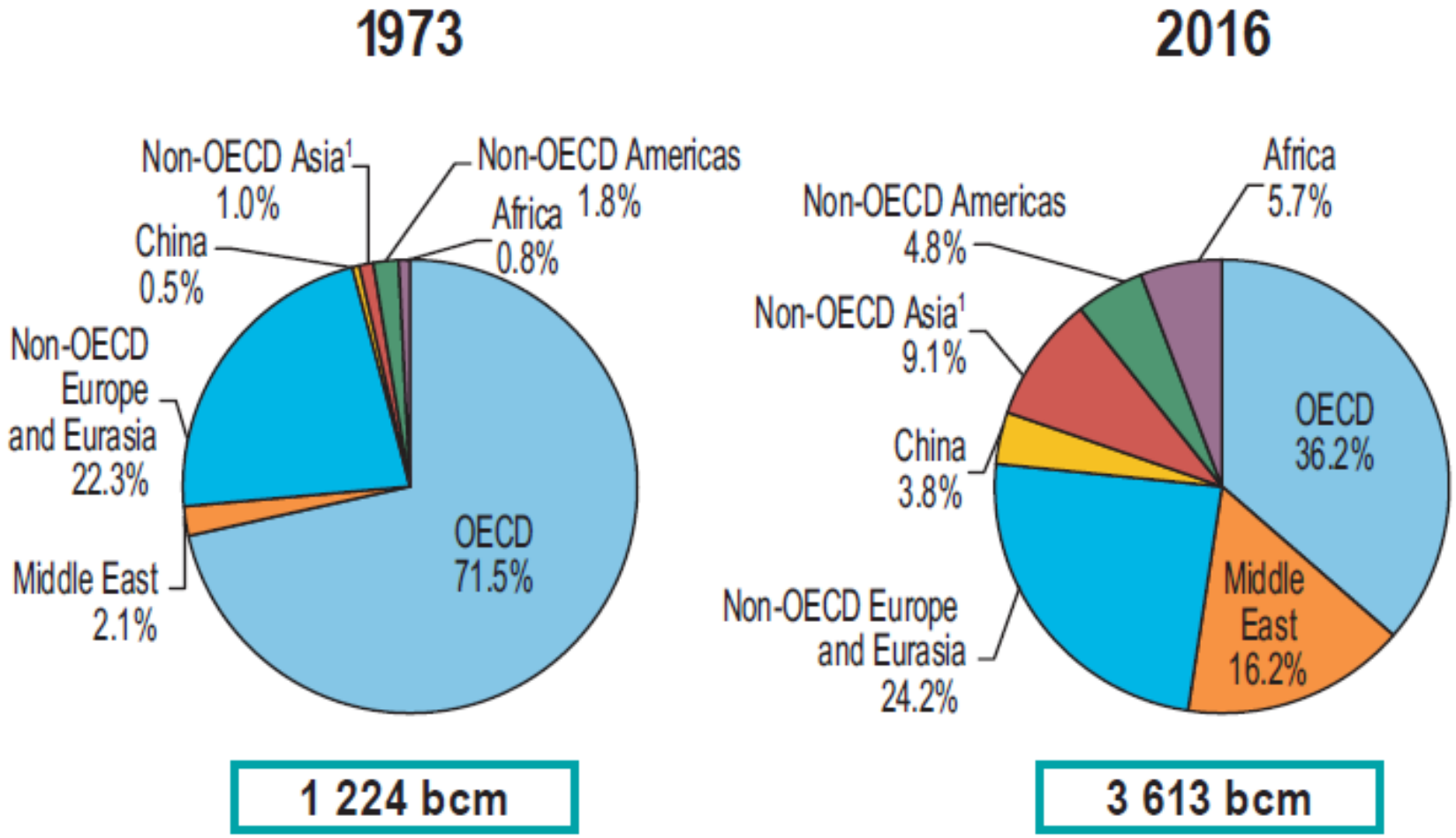
- Colliery gas as a source for generating electricity at the Appin and Tower coal mines in New South Wales, Australia.





- World production growth (1990-2016): 77.5%
- Non-OECD Asia production growth (1990-2016): 180%
  - almost 3-fold!
- Other regions combined: 71%

Production by region



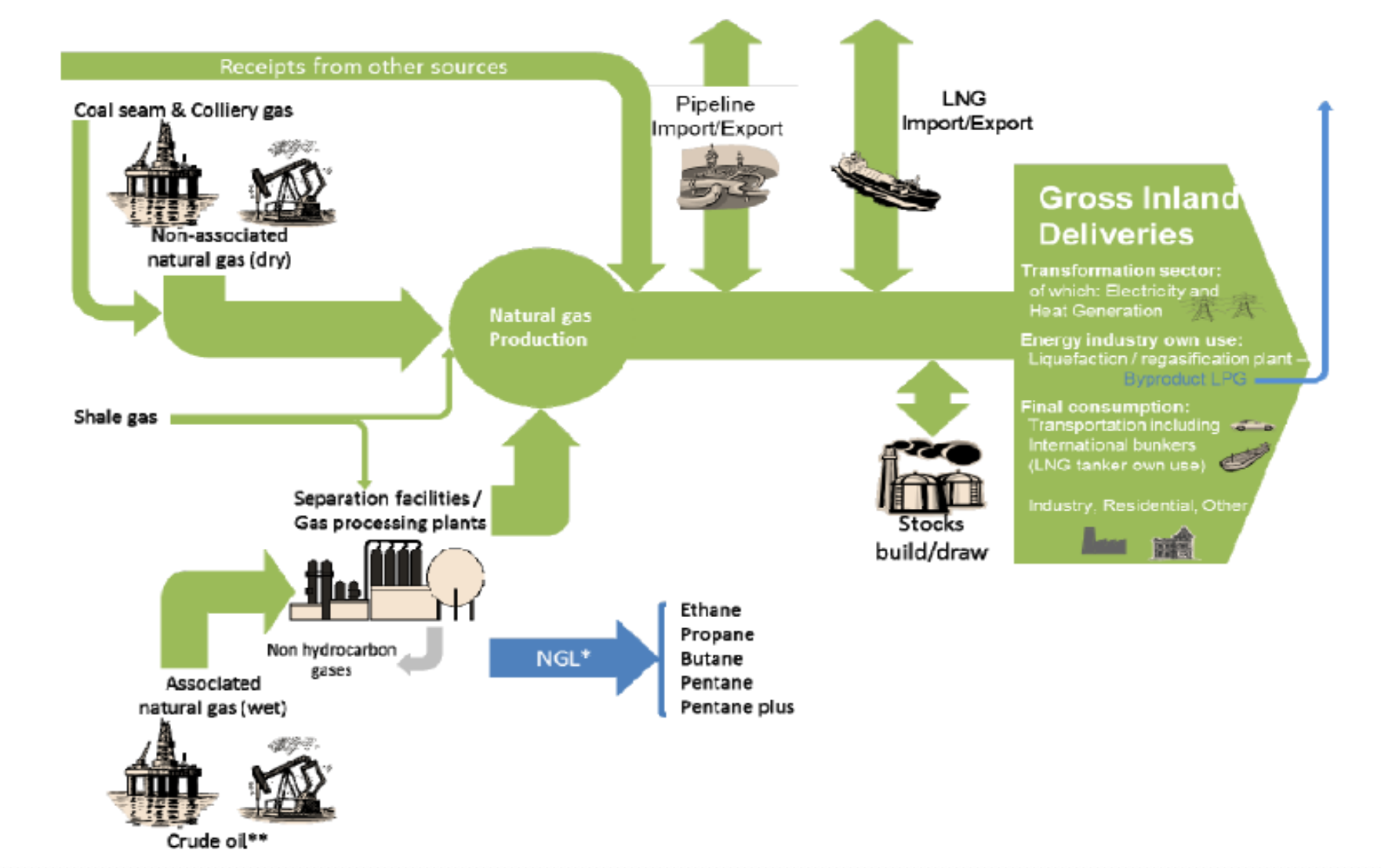
1. Non-OECD Asia excludes China.

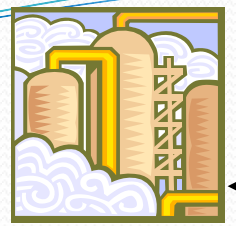
IRES – Scope of production

- **Primary production** is the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use.

- **Inert matter removed from the extracted fuels and quantities reinjected, flared or vented are not included.**

Natural gas flow





Extraction of associated gas

Extraction of non-associated gas

Flaring
Venting
Re-injection

Energy industry own use

Separation

Inert gases,
NGLs,
Sulphur,
Other impurities

Colliery gas,
coal seam gas,
shale gas

Production

Imports

Exports

Stock changes

Int. bunkers

Energy industry own use – liquefaction and regasification

Total energy supply

Transformation

Energy industry own use

Losses

Final consumption

Non energy use

Final Energy Consumption: Manufacturing, Transport, Other (Agric, Households, etc.)

JODI Example: where do data go?

200 TJ of wet associated gas produced onshore, including 50 TJ of propane that's separated at a NGL plant

NGLs are excluded from the JODI gas questionnaire!

	Natural Gas Terajoules	*Natural Gas 1000 tonnes*
	A	B	C
		150 TJ	
		50 TJ	
		1 TJ	
		1 TJ	
Exports			
LNG			
Pipeline			
Stock Change			
Gross Inland Deliveries (Calculated)			

Does not enter the natural gas chain, so is excluded from JODI gas.

15 TJ that are piped directly through the country (imported then exported); 1TJ is used for the operation of the pipe (so only 14TJ is exported).

100 TJ of biogas, produced at waste plant and used for power generation at same plant

exclude "goods in transit" whenever possible use here considere import and part of demand).

50 TJ of coke oven gas, blended in the grid for final delivery

Natural gas - SIEC definition

- 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.

- *Remarks (summarised)*:
  - Majority is separated from both "non-associated" gas and "associated" gas.
  - Separation removes or reduces others hydrocarbons to acceptable marketable levels.
  - NGLs removed in the process are distributed separately.
  - Also includes methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas) and shale gas.
  - Natural gas may be liquefied (LNG) to simplify storage and transportation

Measurement units

- Gaseous fuels are generally measured in Volume (e.g. m^3) and energy units (e.g. Joules)
  - Preferred reporting: energy units
  - If volume units are used, calorific values should be provided

- Volume measures generally based on 2 reference conditions:
  - Normal conditions: measured at 0° Celsius and at a pressure of 760 mm Hg
  - Standard conditions: measured at 15° Celsius and at a pressure of 760 mm Hg

Recommended standard conditions, particularly if NCVs not known or not provided

Conversion between Standard & Normal Conditions

Table A2.5: Conversion equivalents between Standard cubic metres (m^3) and Normal cubic metres (m^3)

To From:	Standard m^3	Normal m^3
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.

Conversion between LNG and Natural Gas Units

Table A2.6: Conversion equivalents between LNG and Natural Gas units

To: / From	Metric Tons of LNG	m^3 of LNG	Standard m^3(a)
Metric Tons of LNG	1	2.2	1360
m^3 of LNG	0.45	1	615
Standard m^3	$7.35*10^{-4}$	$1.626*10^{-3}$	1

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

- These conversion tables are default conversion tables.
- Actual conversion factors may vary according to the composition of the natural gas in question

Supply - Main flows

- Production
  - (+ receipts/production from other sources)
- Imports
- Exports
  - Pipelines and LNG
- Stock changes (closing minus opening stocks)
- Supply
  - (Production + imports – exports – stock changes)

Energy industries - Main flows

- Transfers
- Transformation
  - Electricity plants
  - Combined Heat and Power (CHP) plants
  - Heat plants
  - Gas-to-liquids (GTL) plants
  - Other transformation
- Own use by energy industries
  - Oil and gas extraction
  - Gasworks
  - Blast furnaces
  - Oil refineries
  - Liquefaction/regasification plants (LNG)
  - Electricity, heat and CHP plants
  - Other own use
- Losses

Final consumption - Main flows

- Manufacturing, construction and non-fuel mining industries
  - Iron and steel
  - Chemical and petrochemical
  - Break down as appropriate (as shown in the session on classifications for international purposes, but national needs may require a different break down)
- Transport
  - Road
  - Pipeline transport
- Other
  - Residential
  - Commerce and public services
- Non-energy use

Additional data items

Item number	Data item
3.1	Production
3.1.1	Of which: Associated gas
3.1.2	Of which: Non-associated gas
3.1.3	Of which: Colliery and Coal Seam Gas
3.2	Production from other sources
3.3	Extraction losses
3.3.1	Of which: gas flared
3.3.2	Of which: gas vented
3.3.3	Of which: gas re-injected
3.4	Gas flared (except during extraction)
3.5	Gas vented (except during extraction)

Additional data items

Data items on production, storage and transmission capacity

Item number	Data item
6.1	Peak output
6.2	Gas storage facility – Name
6.3	Gas storage facility – Type of storage
6.4	Gas storage facility – Working capacity

Additional data items

Data items on mineral and energy resources

Class A: Commercially recoverable resources
Class B: Potentially commercially recoverable resources
Class C: Non-commercial and other known deposits

Item number	Data item
8.1	Opening stocks of mineral and energy resources (by type of resources and by type of characteristics)
8.2	Closing stocks of mineral and energy resources (by type of resources and by type of characteristics)

Common reporting problems

- Sometimes data are reported in tons (of LNG).
  - Hard to make the conversion into Terajoules
- Calorific values are missing when data are reported in volume (cubic metres, cubic feet)
  - Conversion using default NCVs adds inaccuracy to figures
- Flaring and venting – often not reported
- Production reported includes quantities that should be excluded:
  - Such as re-injection, flaring, venting, shrinkage, inert matter
- Imports and exports (border crossing, not change in ownership)

Common reporting problems

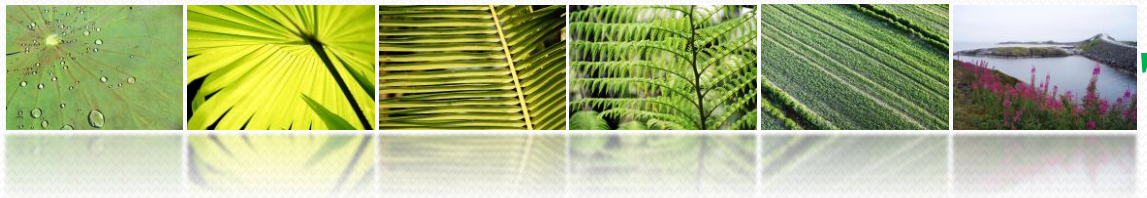
- Input into electricity and heat plants reported as final consumption
  - Particularly for autoproducers
  - Transformation vs final consumption
- Energy use vs non-energy use
  - Purpose of use (energy or feedstock)has to be inquired
  - Special attention to industries that can produce “non-energy products” from natural gas: fertilizers, plastics, etc
  - Feedstock for methanol can be a problem, depending on whether the methanol is used for energy or non-energy purposes
- Consumption in transport by pipelines is not reported
  - Instead this is reported as oil and gas industry

Final remarks

- Natural gas production = marketable production
  - Reinjection, flaring, venting excluded…
    - but important for emission estimates (to be provided separately)
  - After removal of NGLs, impurities, etc.
  - Includes own use in gas fields
    - natural gas used for energy purpose to extract natural gas or aid operations
  - Includes own use in liquefaction (LNG) and regasification plants
    - Even if the former are located at the wellhead
    - Or the latter located at import sites

Final remarks

- Non-energy purposes to be properly recorded
  - use as feedstocks to produce “non-energy products” such as plastics and fertilizers
- Data to be provided preferably in TJ (energy content)
  - Otherwise GCVs and NCVs to be provided



Thank you.

http://unstats.un.org/unsd/energy/