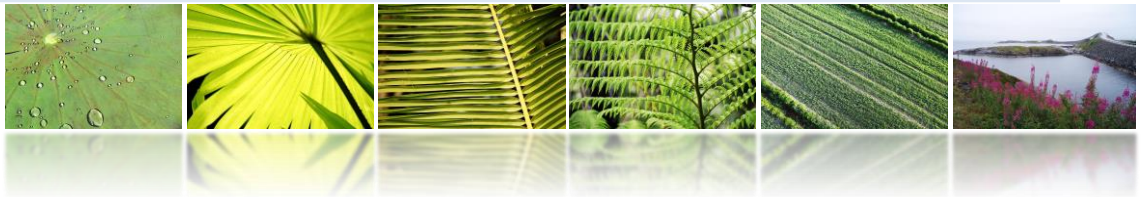
United Nations
Statistics Division

Natural gas



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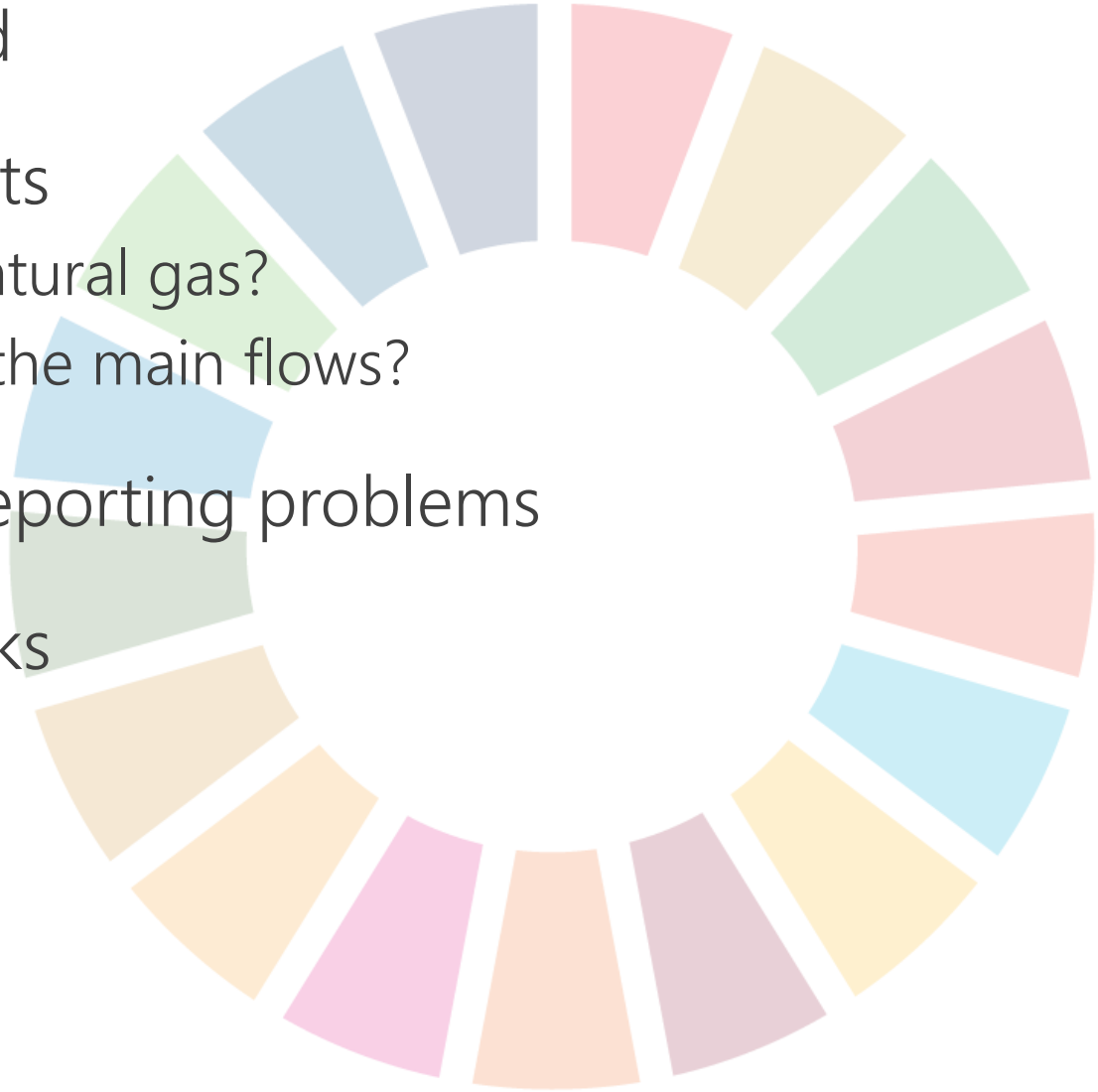
Energy Balance Workshop
Beirut, Lebanon, 12 December 2018

Overview

- Background
- Key concepts
  - What is natural gas?
  - What are the main flows?
- Common reporting problems
- Final remarks



Background

Natural gas - Introduction

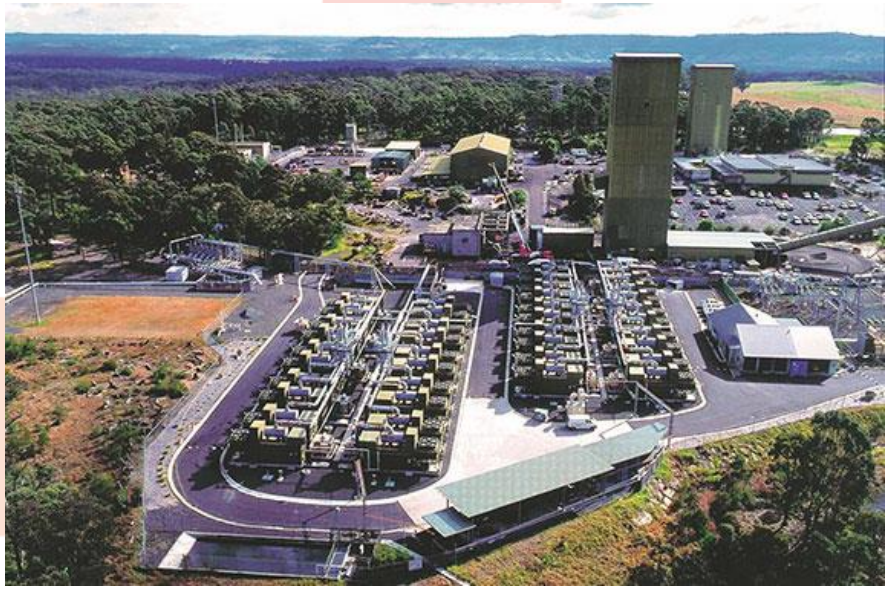
- First recorded use of natural gas for energy purposes:
  - Circa 500 B.C. the Chinese discovered the potential to use to seeping natural gas from rock fissures,
  - using crude bamboo pipelines to transport the gas,
  - where it was used to boil sea water, separating the salt and making it palatable. (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)

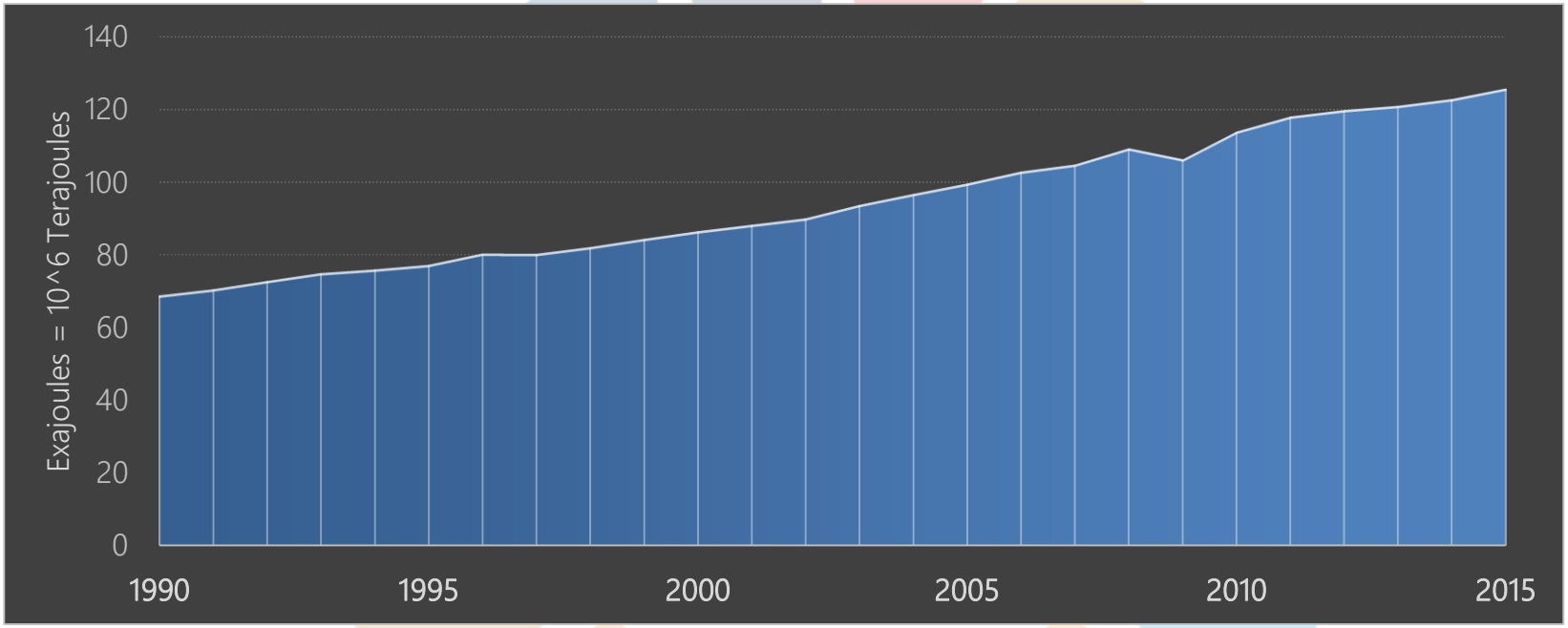
Examples

Colliery gas as a source for generating electricity at the Appin

Tower coal mines in New South Wales, Australia.



World gas demand



Source: Energy Statistics Pocketbook, UNSD 2018.

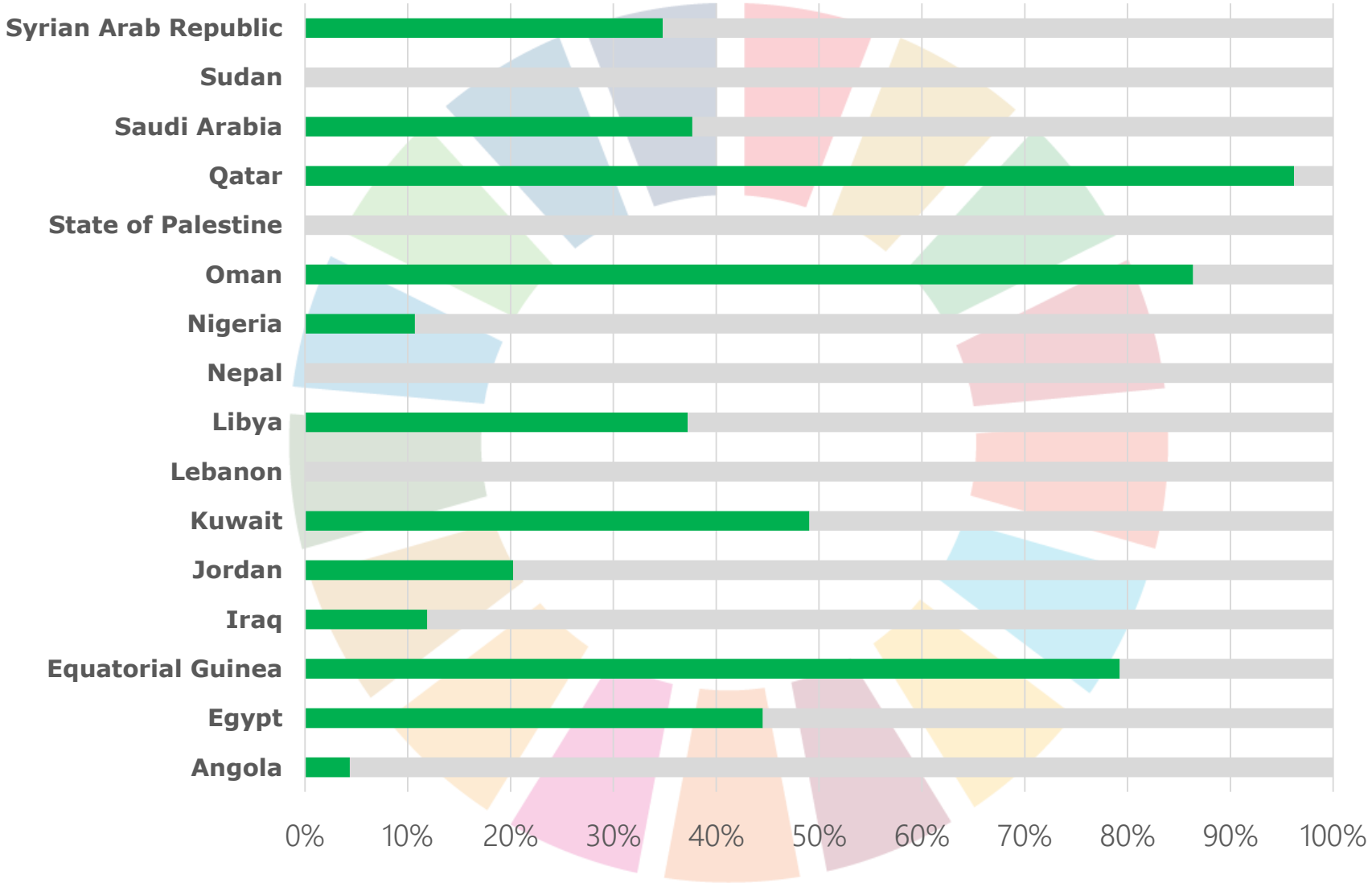
World gas demand steadily increased over last 25 years and is expected to further rise over next two decades.

Natural gas perspective

- The cleanest (or less polluting) fossil fuel, plentiful and dynamic fuel

- Recent increase in trade (LNG), and price volatility

Share of natural gas in TES 2015



Source: Energy Statistics Pocketbook, UNSD 2018.

Key concepts

What is natural gas?

What are the main flows?

Natural gas – definition

- A mixture of gaseous hydrocarbons, primarily **methane**, but generally also including ethane, propane and higher hydrocarbons [...] and some non-combustible gases. (SIEC)

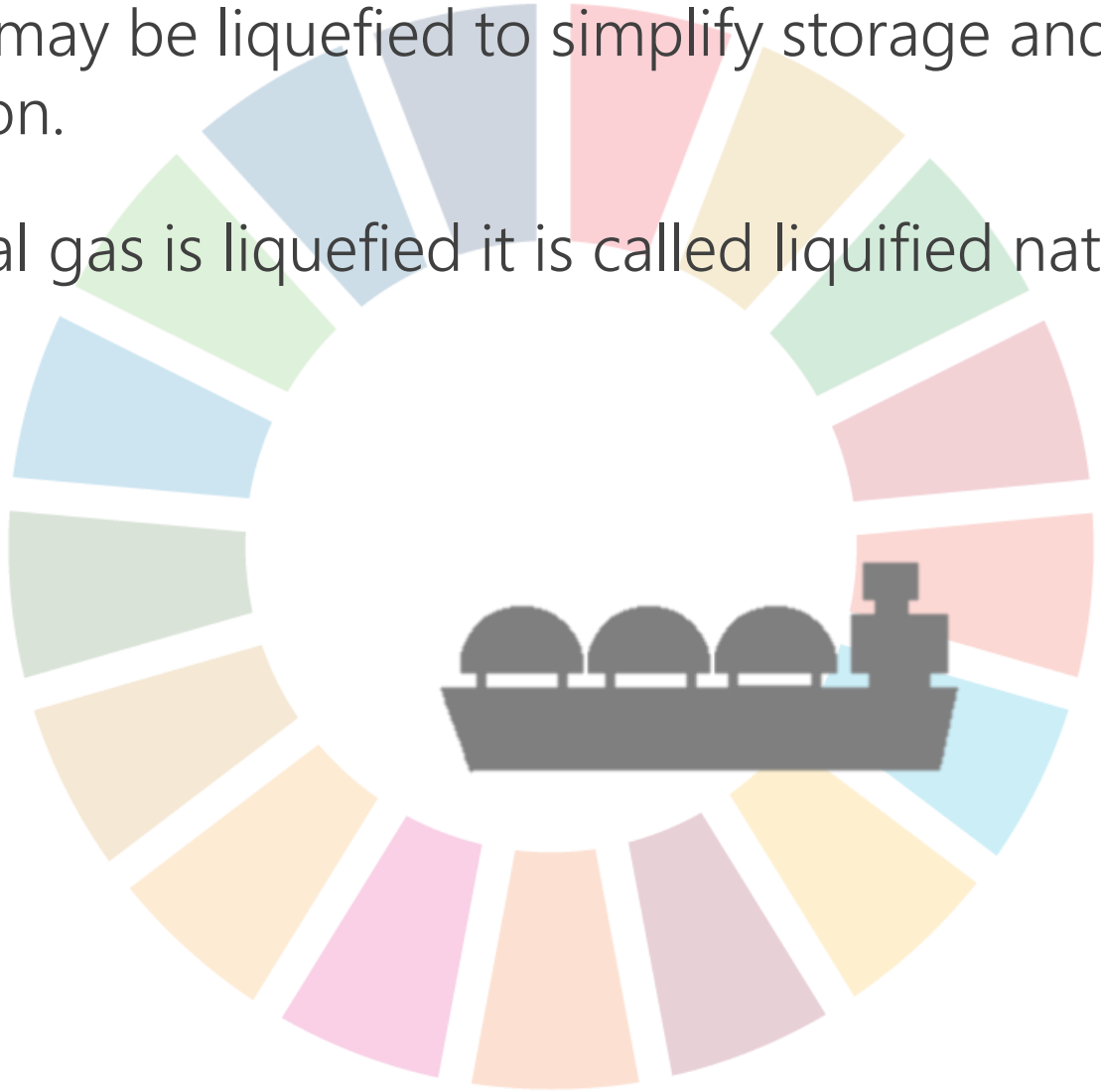
Associated gas	• Natural gas found in underground reservoirs/fields producing both liquid and gaseous hydrocarbons
Non-associated gas	• Natural gas found in underground reservoirs/fields producing only gaseous hydrocarbons.
Colliery/coal seam/shale gas	• Methane recovered from coal mines (colliery gas), or from coal seam (coal seam gas), and shale gas.

Marketable natural gas

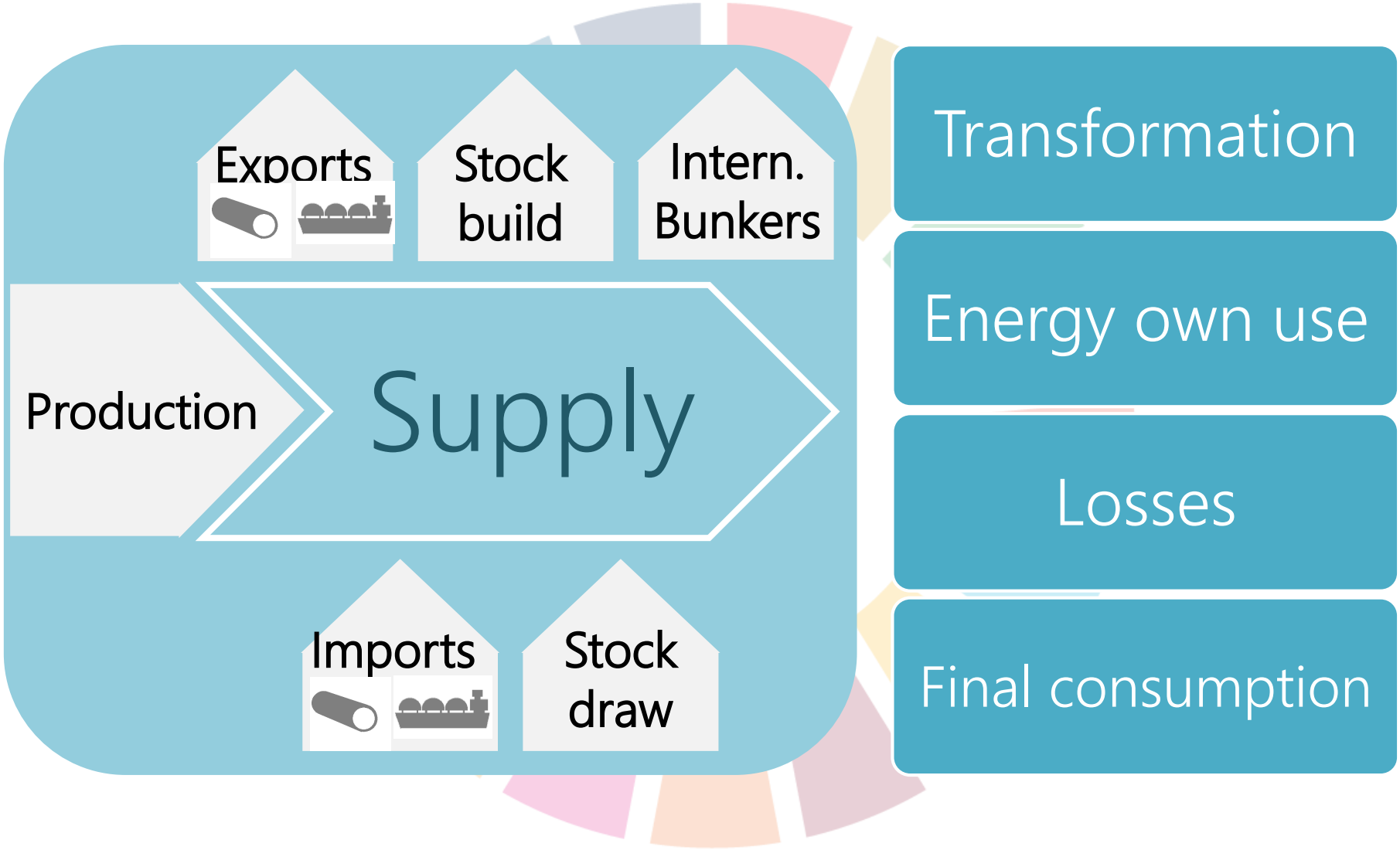
- Natural gas is not a chemically unique product.
- Some quantities are vented/flared/reinjected during production.
- Only after processing becomes marketable.
- Separation removes or reduces others hydrocarbons to acceptable marketable levels, but methane dominate the mix.
- Liquid hydrocarbons produced in association with natural gas are referred to as Natural Gas Liquids (NGL). NGLs removed in the process are distributed separately.

Liquified natural gas (LNG)

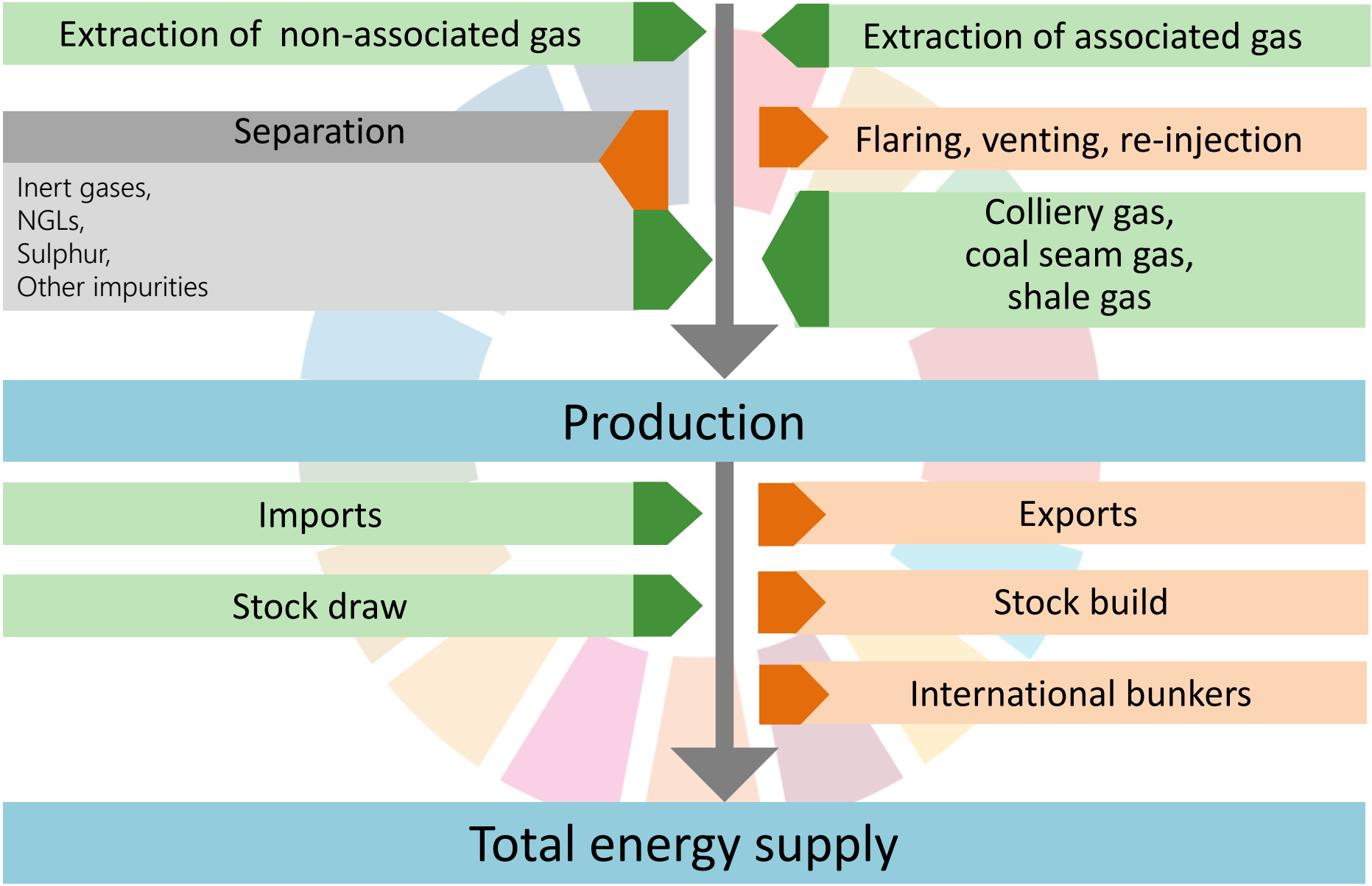
- Natural gas may be liquefied to simplify storage and transportation.
- When natural gas is liquefied it is called liquified natural gas (LNG).



Natural gas flows



Natural gas flows – supply



Natural gas flows – energy industries

Transfers

Transformation

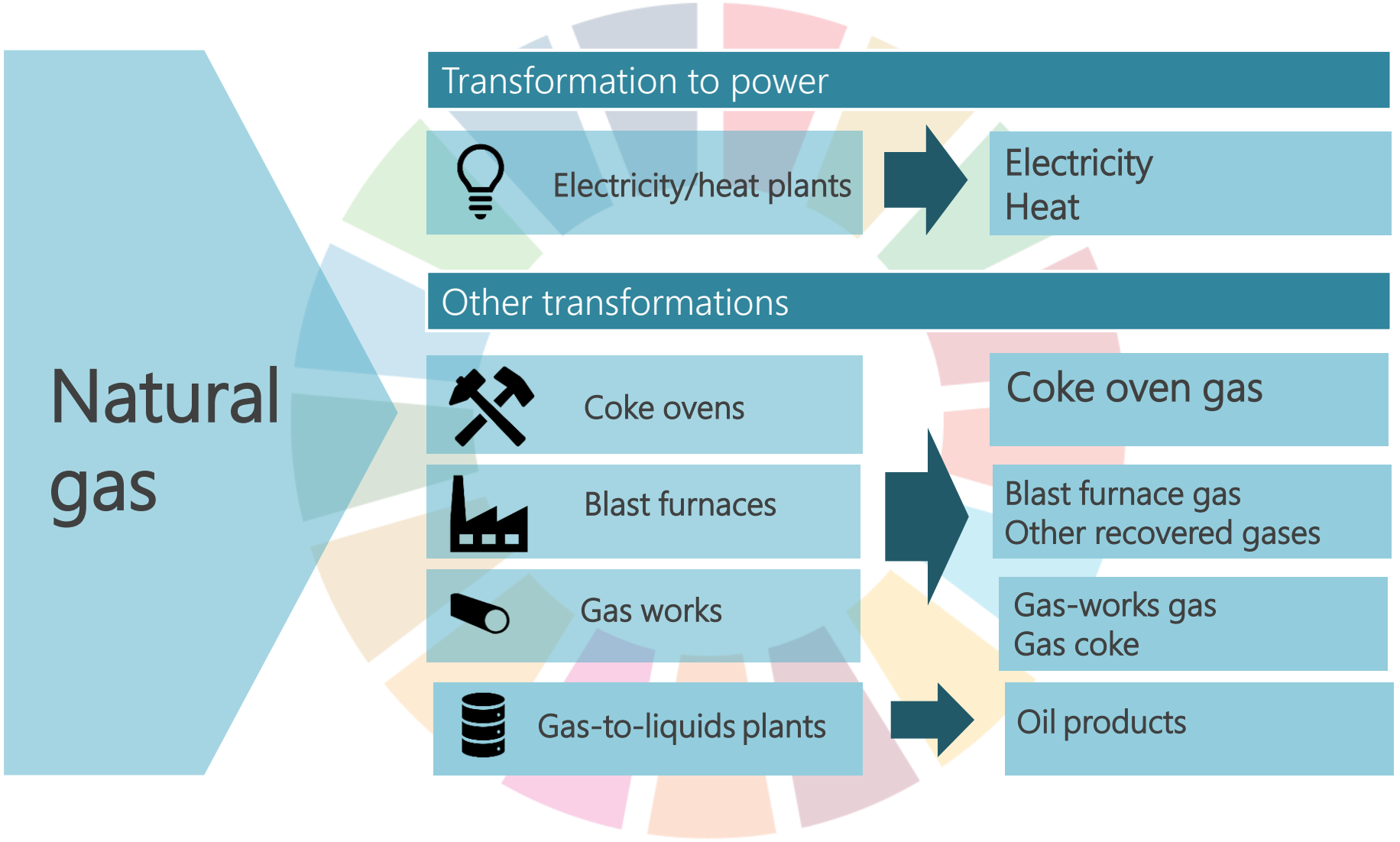
- Electricity plants
- Combined Heat and Power (CHP) plants
- Heat plants
- Gas-to-liquids (GTL) plants
- Other transformations

Own use by energy industries

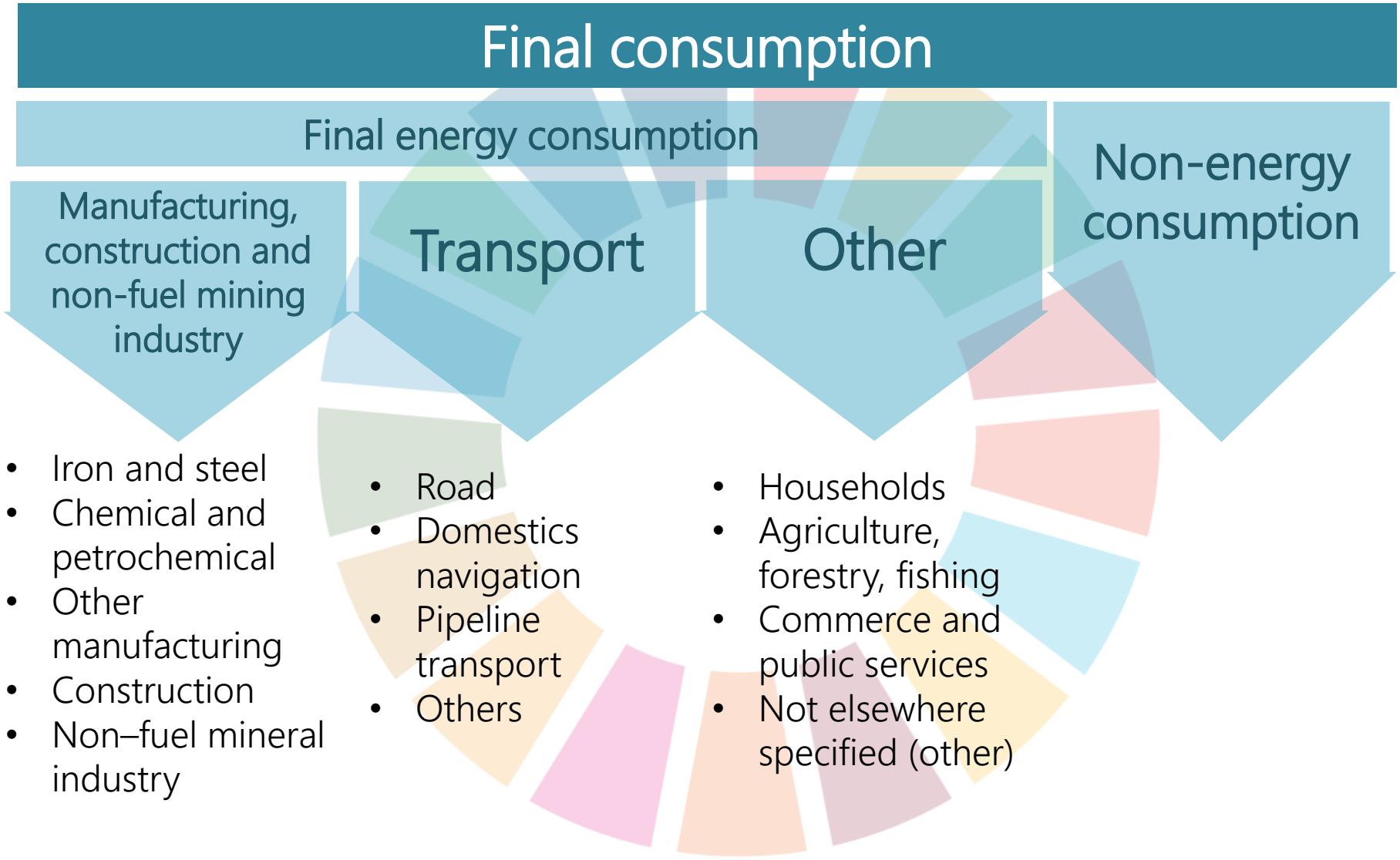
- Oil and gas extraction
- Gasworks
- Blast furnaces
- Oil refineries
- Liquefaction/regasification plants (LNG)
- Electricity, heat and CHP plants
- Other own use

Losses

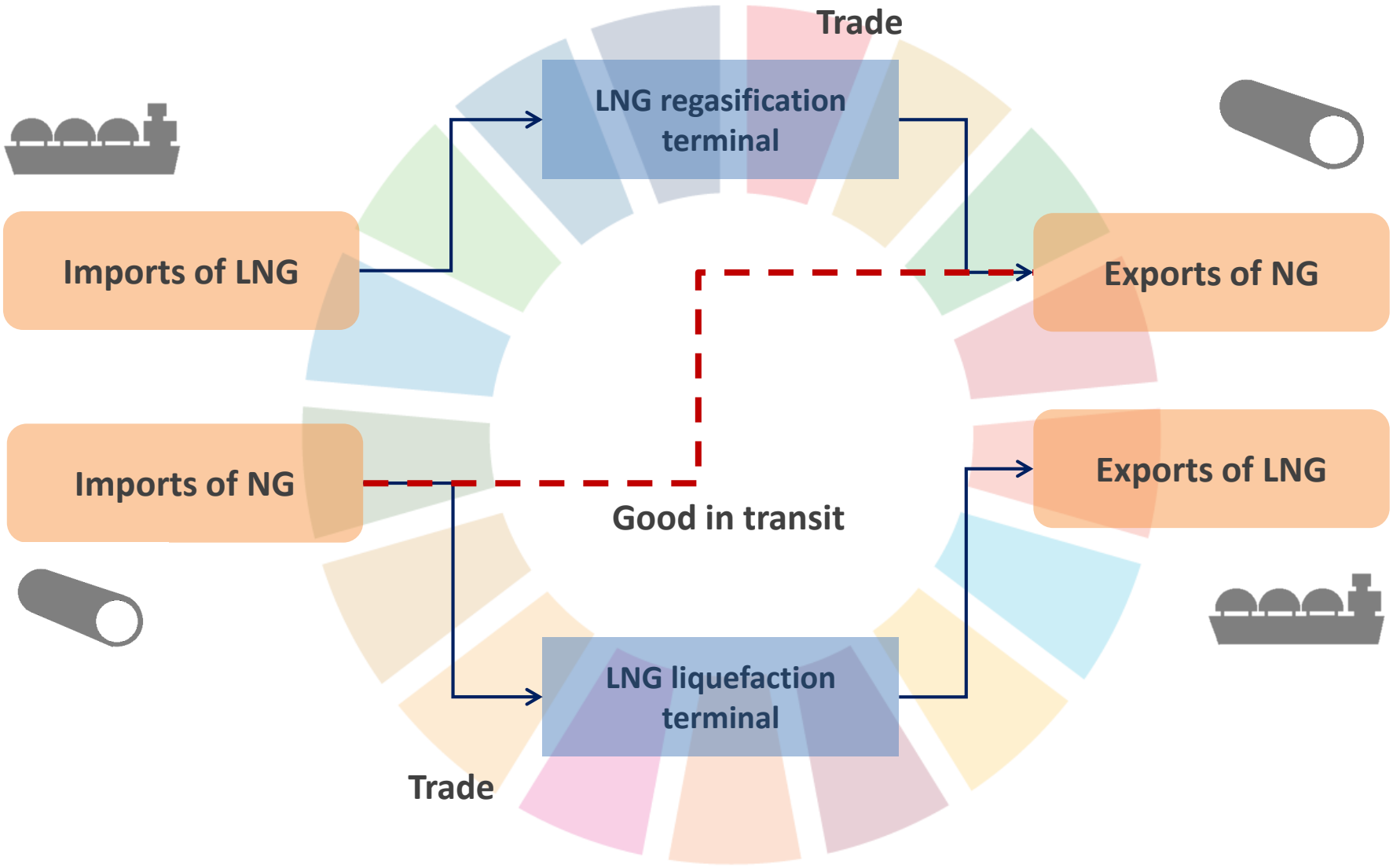
Natural gas flows – transformation



Natural gas flows – final consumption



LNG – trade and regasification



Additional data items – flows

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 – production, storage

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 – reserves

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)

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

Standard and normal conditions

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

From: \ To	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.

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

Common reporting problems

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

UN Energy Statistics Questionnaire

- Arranged by product and then flow
- Structure is constant across products (with a few exceptions)
- Questionnaire includes data for last six years for revisions (further revisions always possible)

Natural Gas (including LNG) (NG); Terajoules (HSO)	
NG01	Production
NG022	Receipts from other sources
NG03	Imports
NG04	Exports
NG051	International marine bunkers
NG052	International aviation bunkers
NG06	Stock changes
NGGA	**Total energy supply**
NGSD	Statistical differences
NG08	**Transformation**
NG088	Transformation in electricity, CHP and heat plants
NG082	Gas works
NG085GL	Gas-to-liquid (GTL) plants
NG09	Energy industries own use
NG101	Losses
NGNA	Final consumption
NG11	Non-energy uses
NG12	**Final energy consumption**
NG121	Manufacturing, construction and non-fuel mining industry
NG1211	Iron and steel
NG1213	Chemical and petrochemical
NG1214	Other manuf., const. and non-fuel min. ind.
NG122	Transport
NG123	Other
NG1231	Households
NG1232	Agriculture, forestry and fishing
NG1235	Commerce and public services
NG1234	Not elsewhere specified (other)
NG019	Memo: Gross Production
NG103	Re-injected
NG105	Extraction loss/shrinkage
NG104	Flared and vented

Final remarks

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

SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

http://un.org

http://unstats.un.org/unsd

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