



Oil Statistics Overview

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Key oil trends



Key concepts

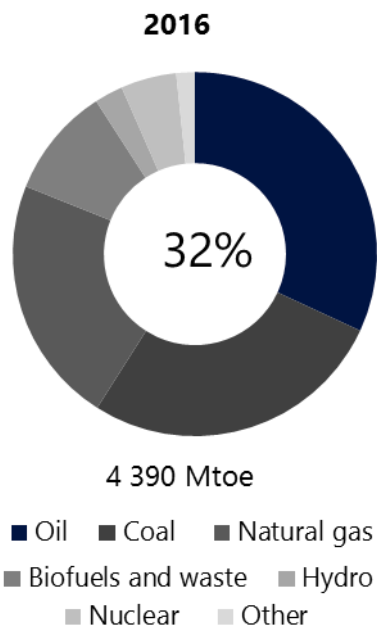


Key points for reporting oil data



Key oil trends

Largest source of primary energy in 2016



A changing production landscape...

2016

Producers	Mt	% of world total
Saudi Arabia	583	13.5
Russian Federation	546	12.6
United States	537	12.4
Canada	220	5.1
Islamic Rep. of Iran	200	4.6
People's Rep. of China	200	4.6
Iraq	191	4.4
United Arab Emirates	182	4.2
Kuwait	159	3.7
Brazil	135	3.1
Rest of the world	1 368	31.8
World	4 321	100.0

2016 provisional data

2017

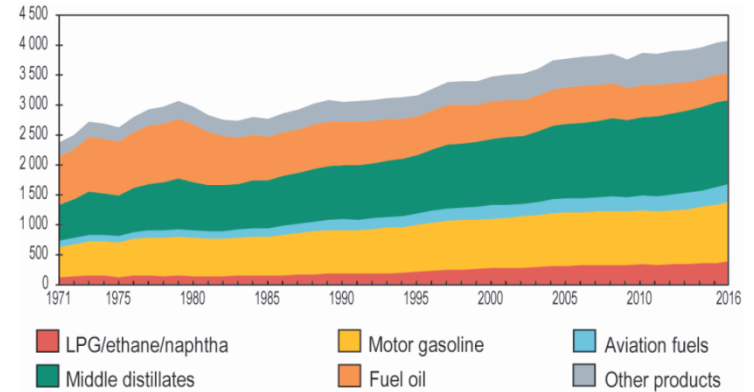
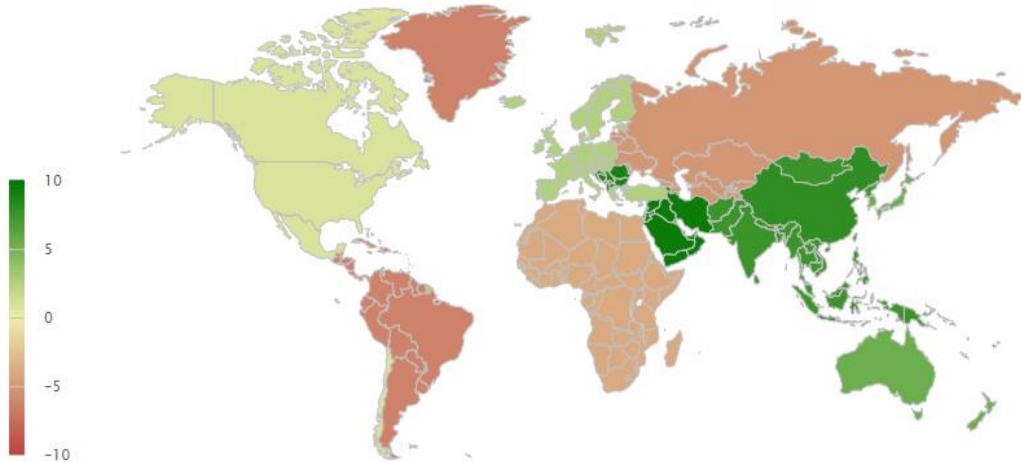
Producers	Mt	% of world total
United States	563	12.9
Saudi Arabia	560	12.8
Russian Federation	548	12.6
Canada	237	5.4
Islamic Rep. of Iran	229	5.2
Iraq	225	5.2
People's Rep. of China	192	4.4
United Arab Emirates	178	4.1
Kuwait	149	3.4
Brazil	137	3.1
Rest of the world	1 347	30.9
World	4 365	100.0

2017 provisional data

Most of the growth in refining has taken place in the Middle East and Asia Oceania.

Output of fuel oil and diesel is declining...

Refinery throughput growth in 2016



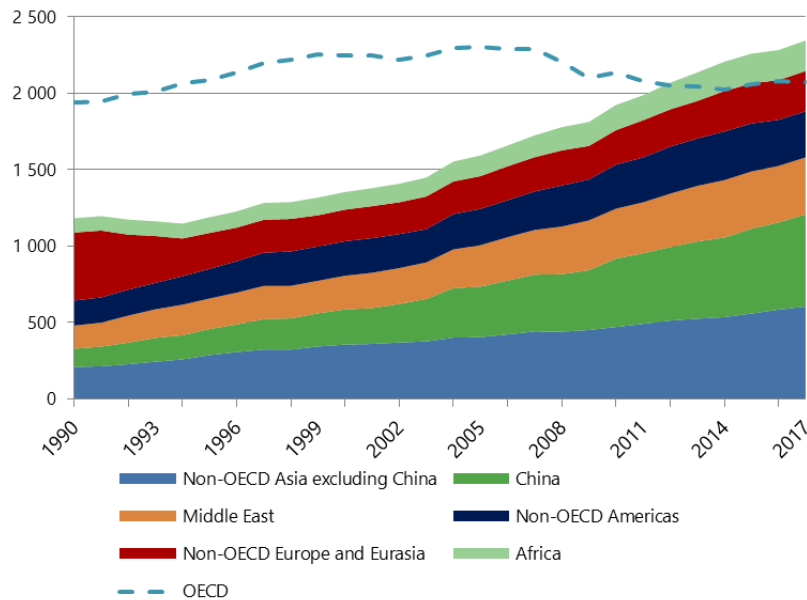
This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Key oil trends – Demand

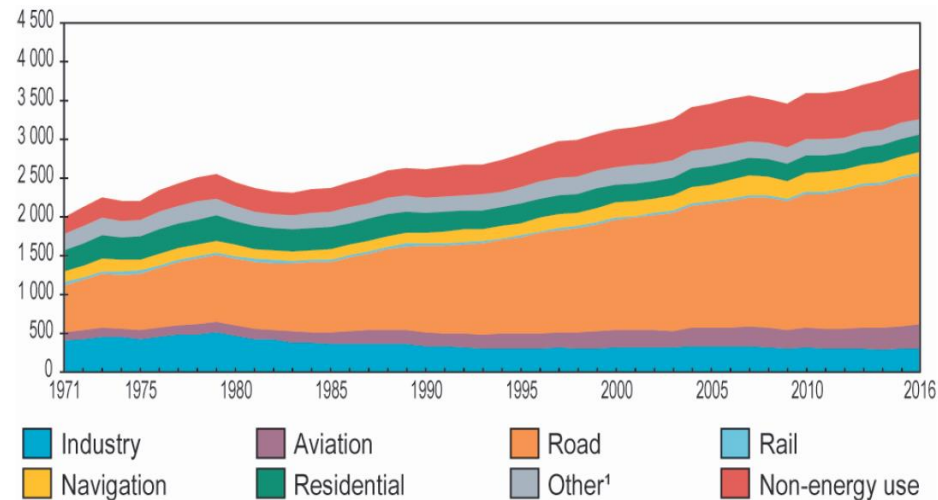
Growth in oil demand is driven by non-OECD countries

Oil product demand by geographical region

Million tonnes

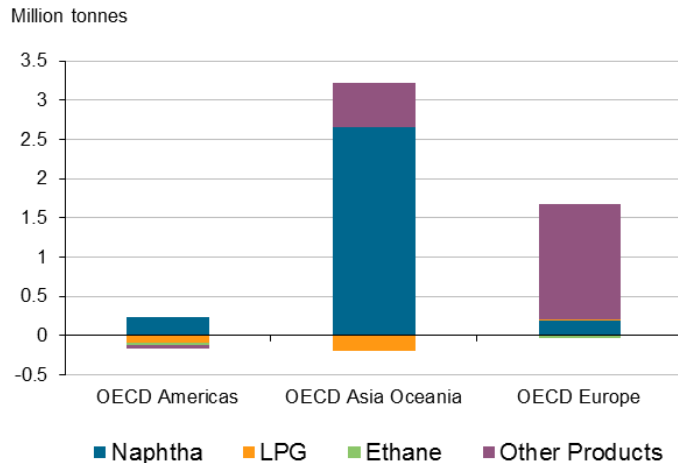


Key demand trends

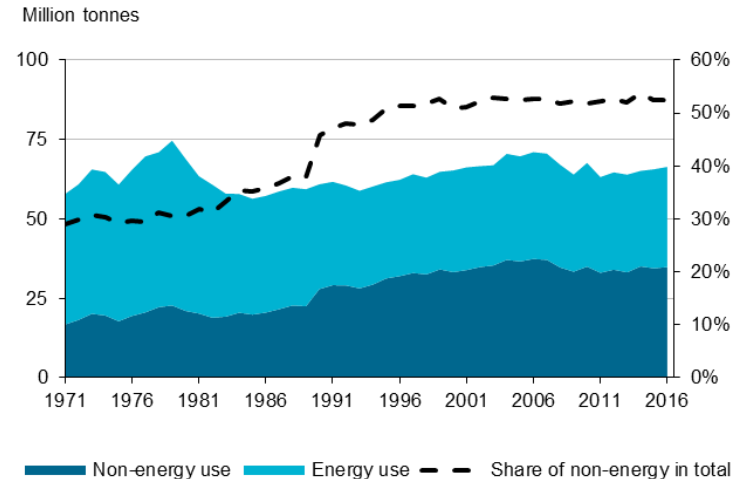


- By the end of 2019 it is expected that 13 MT/y of petrochemical capacity will come online.
 - This will impact demand for petrochemical feedstocks of oil origin, traditionally: **naphtha**, **LPG**, **ethane** and **other oil products**.

Refinery output of petrochemical feedstocks growth between 2015 and 2016



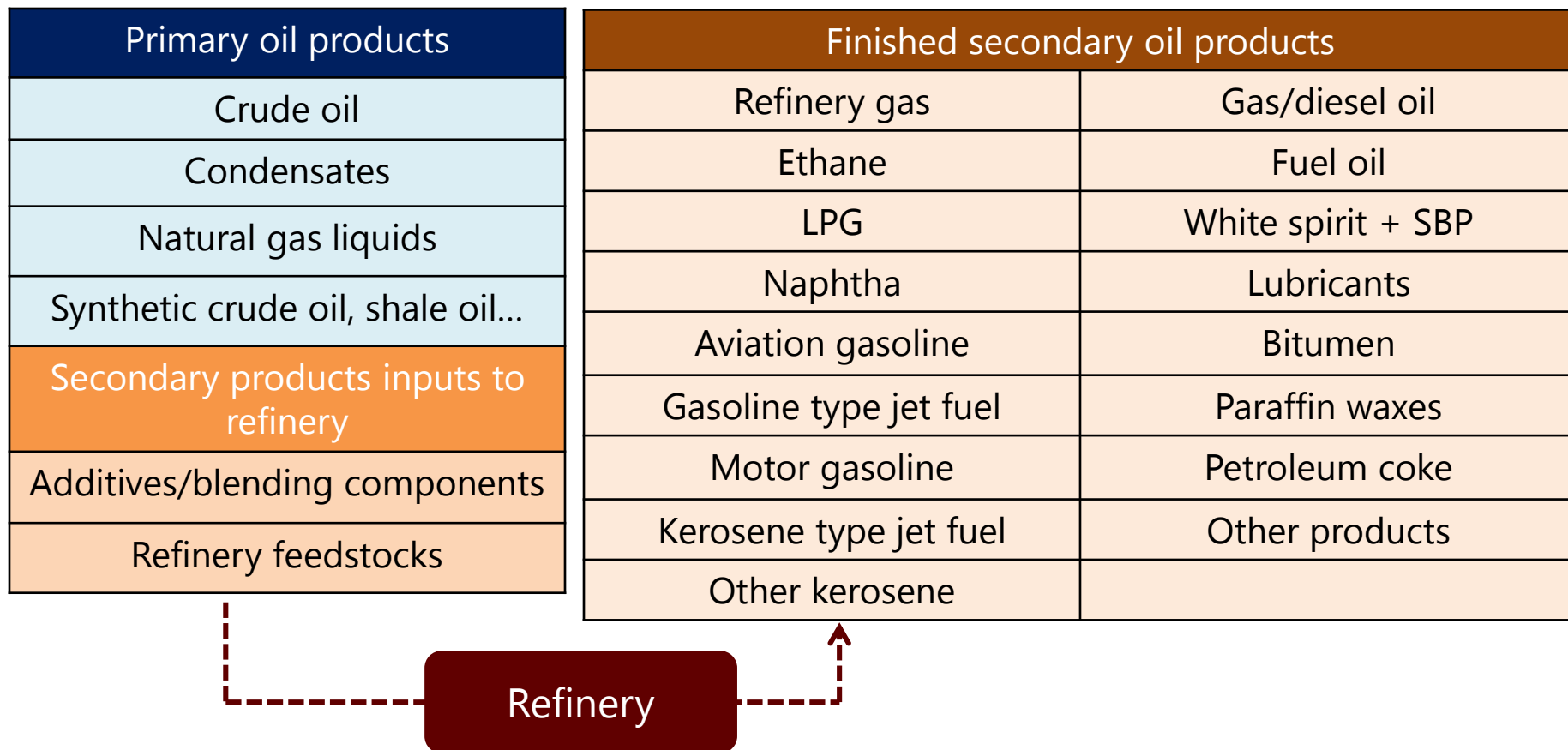
Global consumption of oil in industry





Key concepts

Oil classification – Primary and secondary oil products



- **Condensate** is a *high-quality light oil* recovered from associated or non-associated gas reservoirs.
- In comparison to normal crude oil, condensate needs to undergo *fewer refining* processes and is therefore *versatile* and in *high demand*.
 - Condensate used directly (petrochemicals) or further processed to produce secondary oil products.



Field condensate

Recovered from associated and non-associated gas *fields* and is normally intermixed with the crude oil stream.



Plant condensate

Recovered in natural gas processing plants or separation facilities.

- Because oil products can vary greatly in their characteristics it is key to collect net calorific values information.
 - Production
 - Imports
 - Exports
- This information is essential to compile the energy balance and to derive CO2 emissions.

Example net calorific values of United States crude oil.

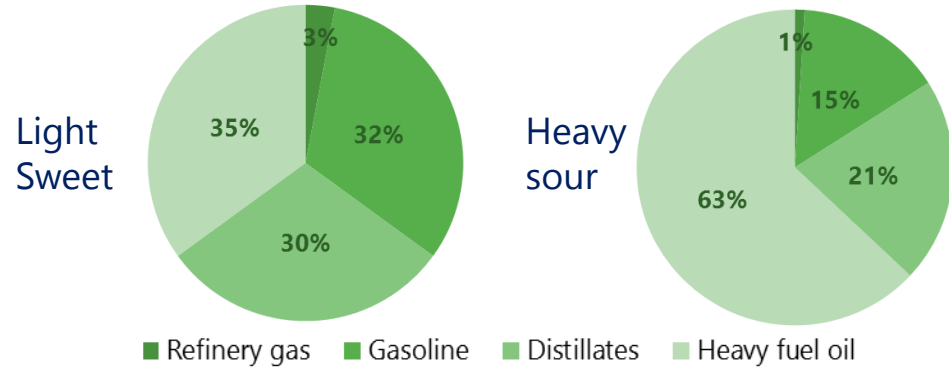
Flow	kj/kg
NCV Production	42 679
NCV Imports	43 604
NCV Exports	42 694
Average NCV	42 871

**Weighted
average!**

Oil classification – Density, Sulphur and refinery yields

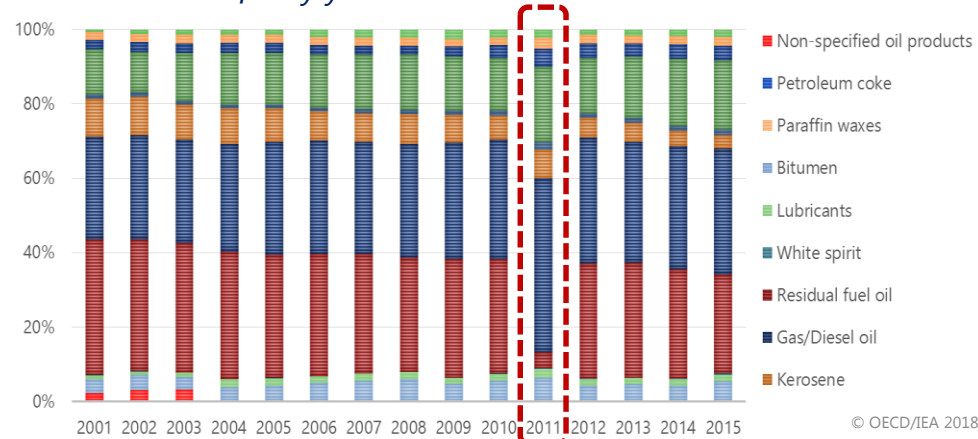
- Crude oils have a wide range of physical and chemical properties.

Example of inherent yields from different crude oil types

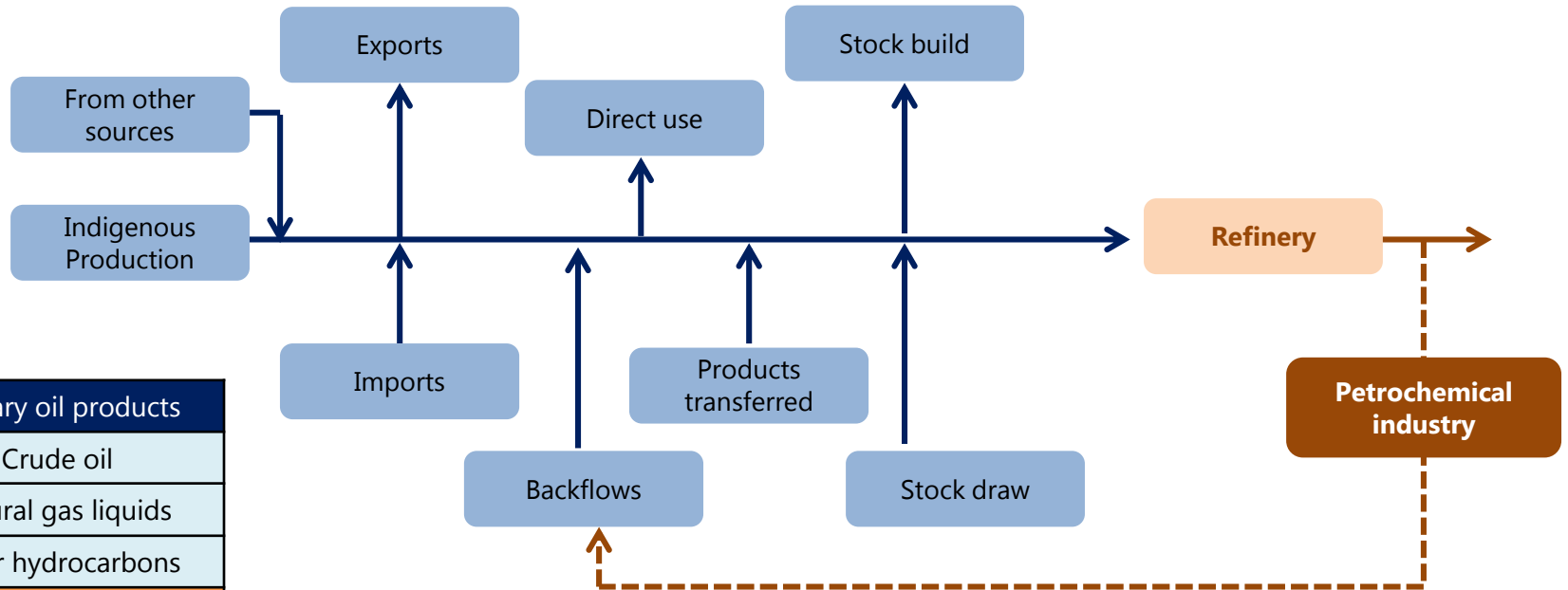


- Refinery specifications determine the type of input and output (refinery yield)
 - Reconfiguring a refinery is expensive, so refinery yields tend to remain stable over time

As a result refinery yields are consistent over time...



Oil balance – Supply of primary oil products

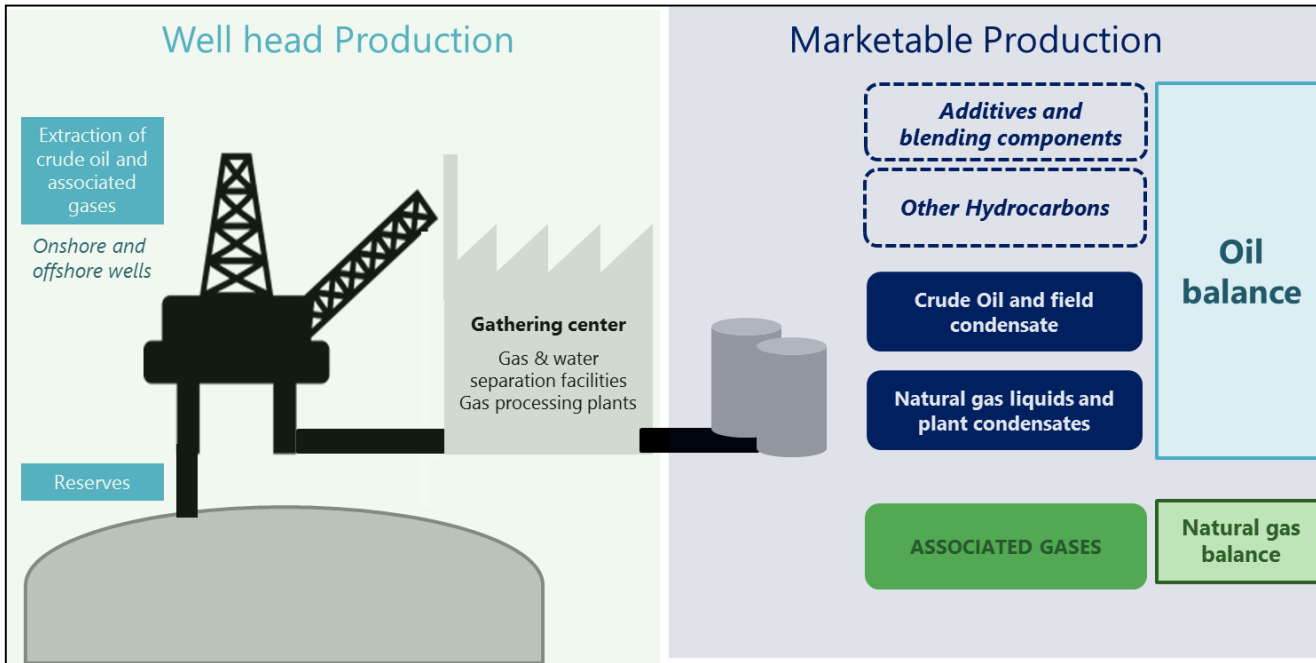


Primary oil products
Crude oil
Natural gas liquids
Other hydrocarbons
Secondary products inputs to refinery
Additives/blending components
Refinery feedstocks

Refinery intake is mostly crude oil but they also process other primary and unfinished secondary oil products.

Oil balance – Indigenous production

- Production should include both onshore and offshore production and exclude amounts returned to formation.
- It is important to determine the point of measurement of production.



- Stocks are held for three main reasons: logistics, security and business.
- Stocks can be divided into three categories:

Primary stocks

Held in the **supply chain** (producers, importers, refiners, etc.) and for **strategic purposes** by government or stock holding organizations.

Secondary stocks

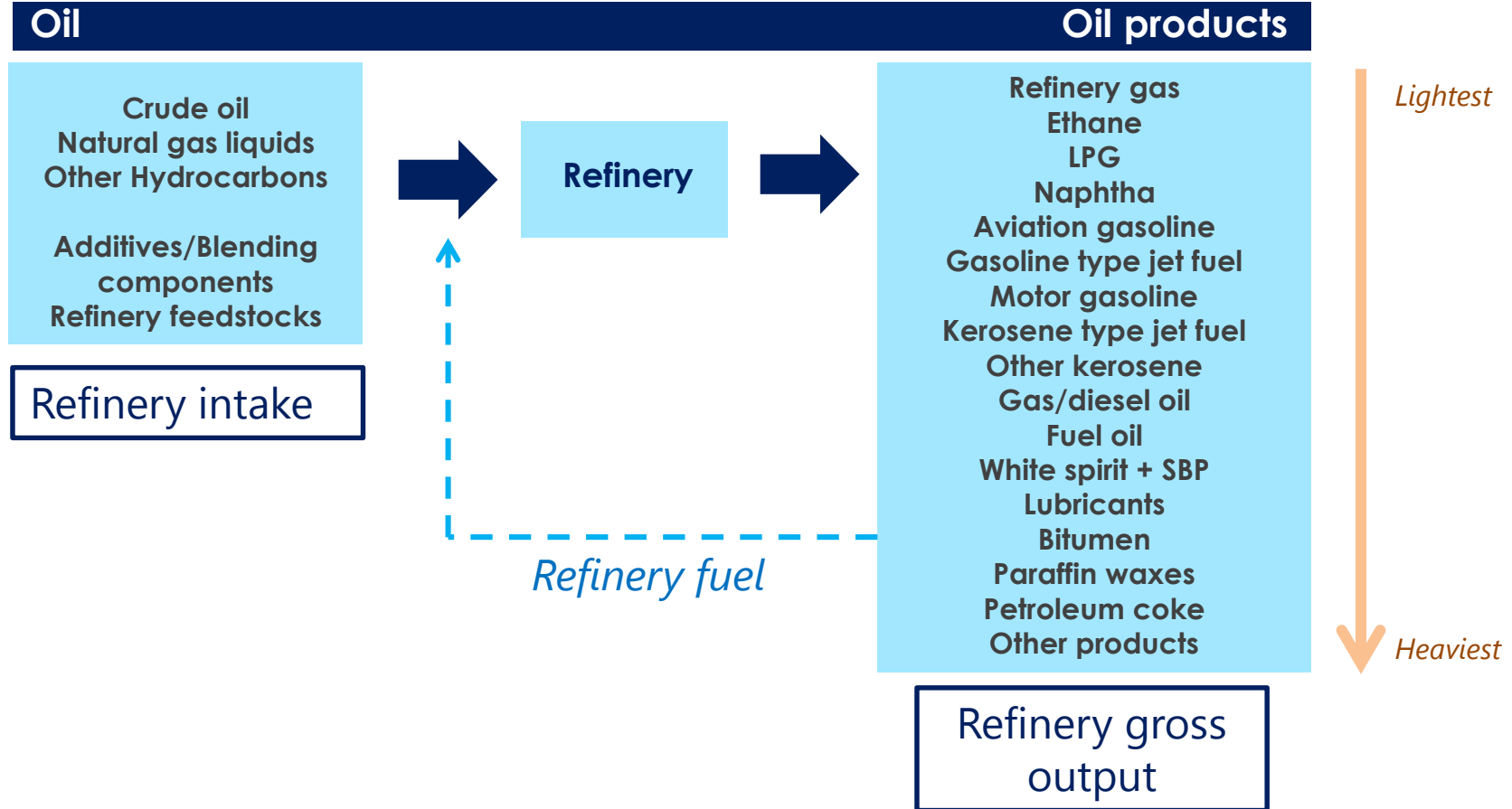
Held in small bulk plants (marketing facilities below a certain capacity) and retail establishments.

Tertiary stocks

Held by final end-consumers (power plants, industrial entities, or consumers in the residential/commercial sector)

- They can be further divided based on the stockholding structure: industry stocks, government stocks and agency stocks.

Oil balance – Transformation



Oil

Primary oil products
Secondary oil products (input
to refinery)



Refinery



Secondary finished oil
products

Refinery intake

Refinery gross output

Losses can occur during the refining process due to evaporation.

When refinery intake > refinery gross output =
refinery losses.

When refinery intake < refinery gross output =
refinery gains.

The units matter!

Mass units – small losses with no gains.

Volume units – gains are likely because lighter products are produced.

Energy units – small losses with no gains.

$$\text{Refinery Yield (\%)} = \frac{\text{Refinery Output of Total Secondary Products}}{\text{Refinery Intake of Total Primary Products}} \times 100$$

Refinery yield < 100% = Losses

Refinery yield > 100% = Gains

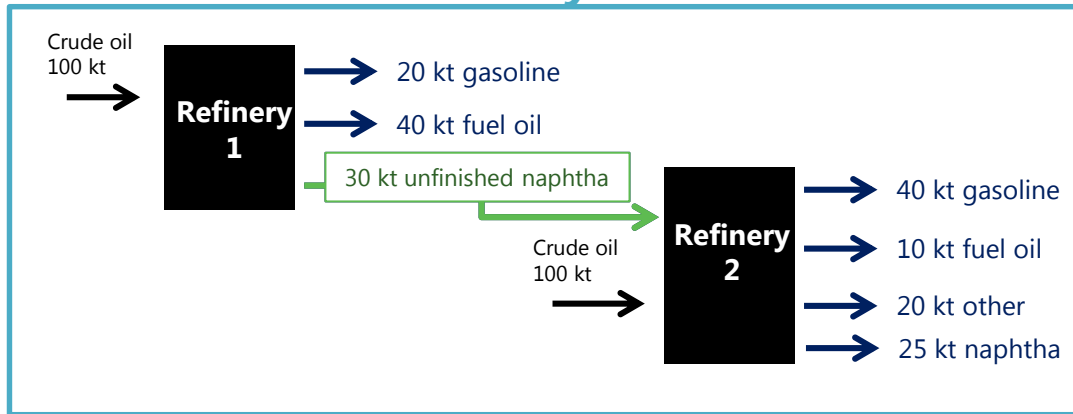
- Reclassification of products within a refinery is common.
 - Change in **specification**
 - **Blended** into other products.
- We refer to these as **inter-product transfers**, this does not involve further processing.
- The *density* and *value* of the oil products will impact the reclassifications.
- When products are *reprocessed* in a refinery we consider these “**products transferred**”, these products are not delivered to the market.

Possible	
Kerosene to gasoil Jet kerosene to diesel	Naphtha to gasoline Diesel to fuel oil
Possible but not very likely	
Fuel oil to gasoil	Kerosene to LPG
Not likely	
Gasoline to naphtha LPG to fuel oil	Diesel to jet kerosene
More generally heavy to light products	

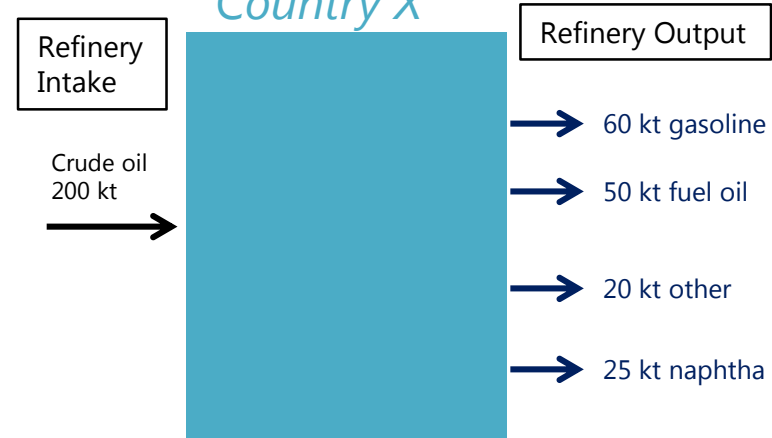
Oil balance – Inter and intra refinery flows

- It is common for refineries in the same country, and for different units in the same refinery, to exchange unfinished products for further processing.
 - Care should be taken to **avoid double counting**.

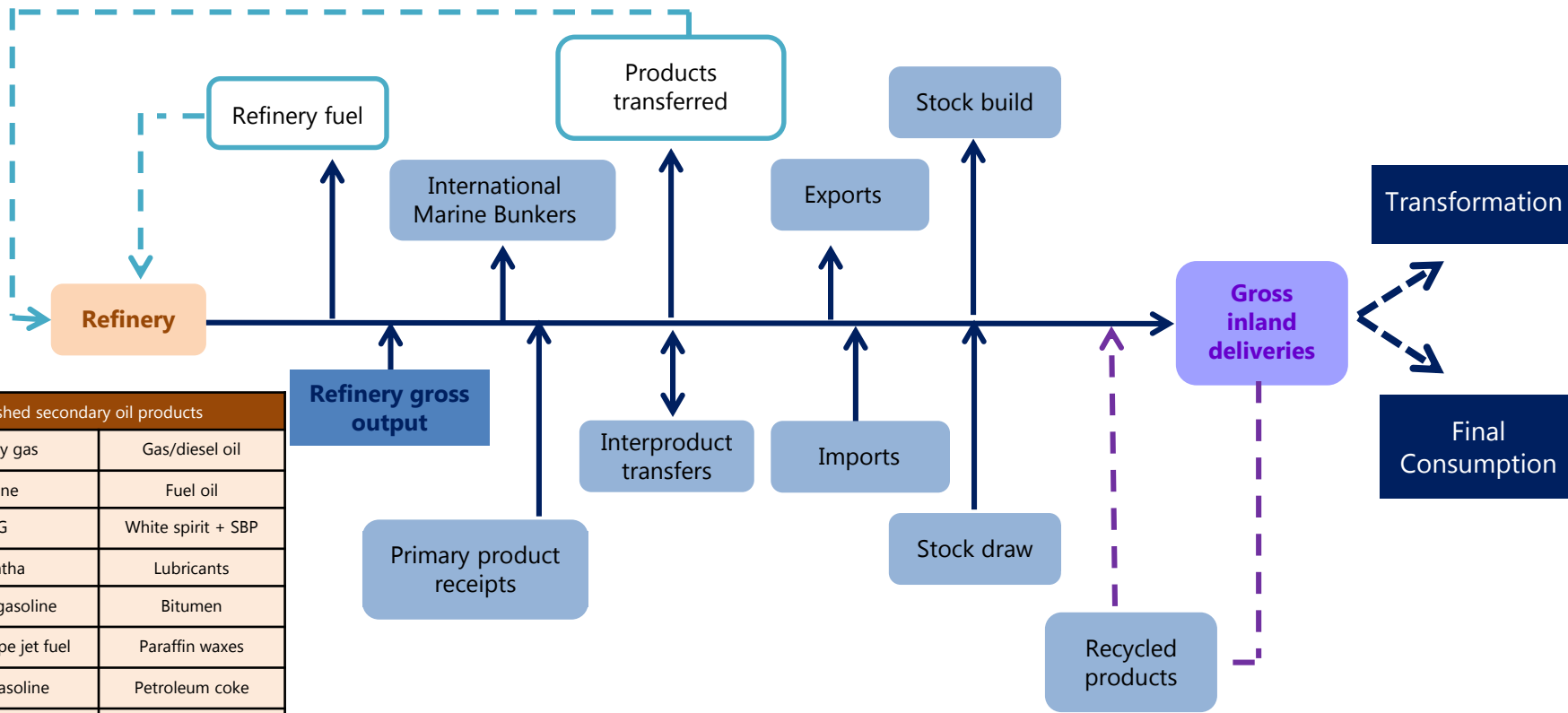
Country X



Country X



Oil balance – Supply of secondary oil products



Finished secondary oil products	
Refinery gas	Gas/diesel oil
Ethane	Fuel oil
LPG	White spirit + SBP
Naphtha	Lubricants
Aviation gasoline	Bitumen
Gasoline type jet fuel	Paraffin waxes
Motor gasoline	Petroleum coke
Kerosene type jet fuel	Other products
Other kerosene	Primary products used directly

- This flow covers the deliveries of oil to:
 - Ships of **all flags** undertaking an **international** voyages.
- Domestic navigation and consumption by fishing vessels are covered elsewhere in the balance.

The domestic/international split should be determined on the basis of **port of departure and port of arrival.**










Why it matters:

- Important **outlet** for the **refining industry**.
- Important part of **demand** for oil in a country.
- 80% of global trade in physical goods is done by sea – key to track **policy impact**.
- The distinction between national and international navigation matters for **emissions** calculations (they are excluded from national inventories).

- Due to their specific properties, different oil products have specific uses.

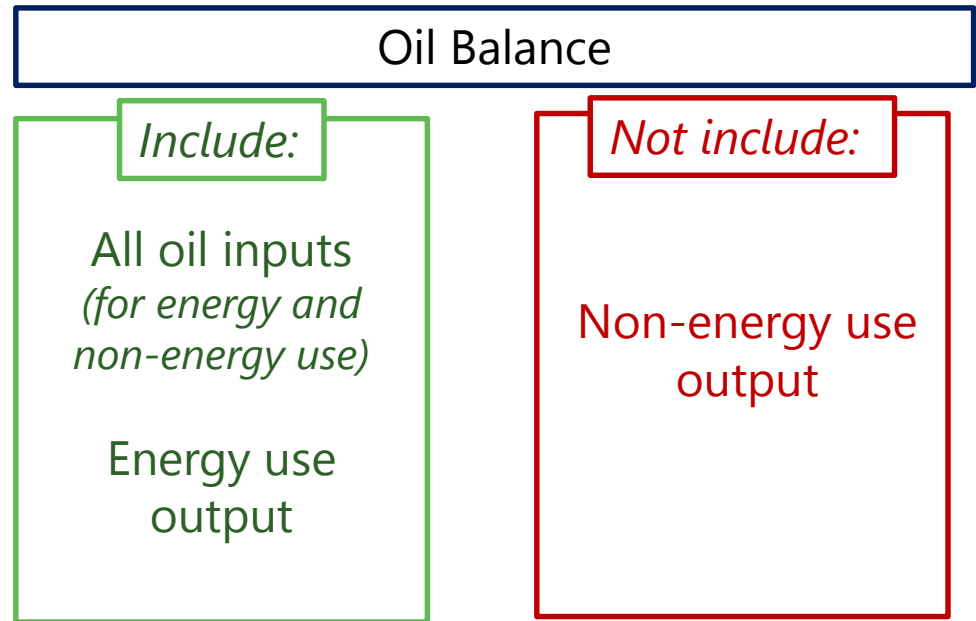
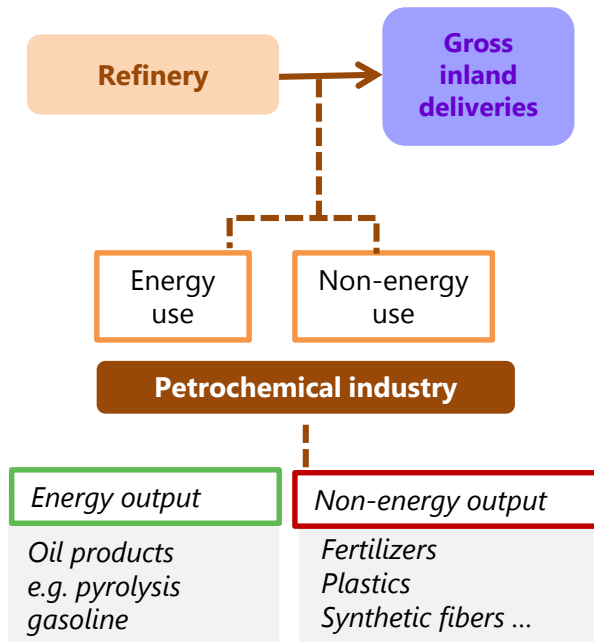
Examples of the types of oil products one can expect to find in different consumption sectors

Electricity plants	Chemical and Petrochemical	Aviation	Road transport	Navigation	Residential	Non-energy use
Crude oil Diesel	Naphtha Diesel LPG Ethane Kerosene Other products	Jet kerosene	Gasoline Diesel	Heating oil* Fuel oil	Naphtha Kerosene Heating oil	Bitumen Paraffin waxes
						

**The category Heating oil includes marine diesel and diesel used in rail traffic.*

Oil balance – The petrochemical sector

- The petrochemical industry is a special case as it is not only a large consumer of oil but also a producer of oil products. Therefore, it is an integral part of the oil balance.





Key points for reporting annual oil

Tables and products in the IEA questionnaires

1

		Crude Oil	Natural gas liquids	Refinery feedstocks	Additives / oxygenates	Of which Biofuels	Other hydrocarbons	TOTAL (A to F, excl. E)
		A	B	C	D	E	F	G
Indigenous production	(+) 1							0
Receipts from other sources	(+) 2							0
Backflows	(+) 3							0

2a

		Crude oil	Natural gas liquids	Refinery gas	Ethane	LPG	Nap
		A	B	C	D	E	F
Primary product receipts	(+) 1						
Refinery gross output	(+) 2						
Recycled products	(+) 3						

2b

		Crude oil	Natural gas liquids	Refinery gas	Ethane	LPG	Naphtha	Total motor gasoline
		A	B	C	D	E	F	G
Gross inland deliveries (Observed)	1		0	0	0	0	0	0
<i>Of which: Petrochemical flows:</i>								
Gross deliveries to the petrochemical industry	2							

3a 3b

		Crude oil	Natural gas liquids	Refinery gas	Ethane
		A	B	C	D
Gross inland deliveries for energy/non energy use		0	0	0	0
Transformation sector	2	0	0	0	0

4 and 5

Country of Origin	Crude oil	Natural gas liquids	Refinery Feedstock	Additives
	A	B	C	D
Algeria				
Angola				
Argentina				

6

Name/Location	Atmospheric Distillation	Of which not in operation and not in active repair	Vacuum Distillation	Cracking (Thermal)	Of which Visbreakin g	Of which Coking	Cracking (Catalytic)	Of which Fluid catalytic cracking (FCC)	Of which Hydro-cracking (HCK)
A	B	C	D	E	F	G	H	I	J
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Primary oil products

Crude oil

Natural gas liquids

Other hydrocarbons

Secondary products inputs to refinery

Additives/blending components

Refinery feedstocks

Finished secondary oil products

Refinery gas

Gas/diesel oil

Ethane

Fuel oil

LPG

White spirit + SBP

Naphtha

Lubricants

Aviation gasoline

Bitumen

Gasoline type jet fuel

Paraffin waxes

Motor gasoline

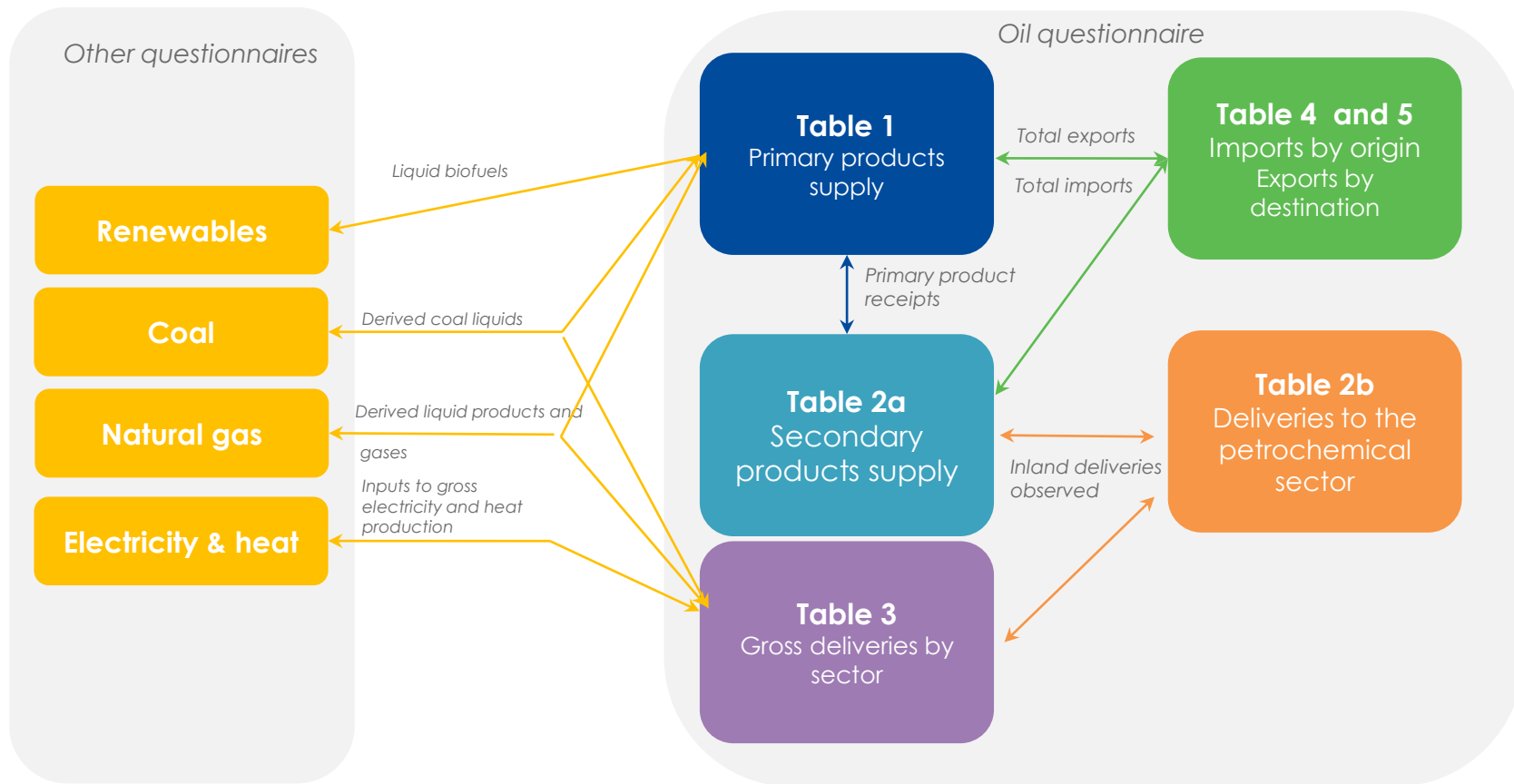
Petroleum coke

Kerosene type jet fuel

Other products

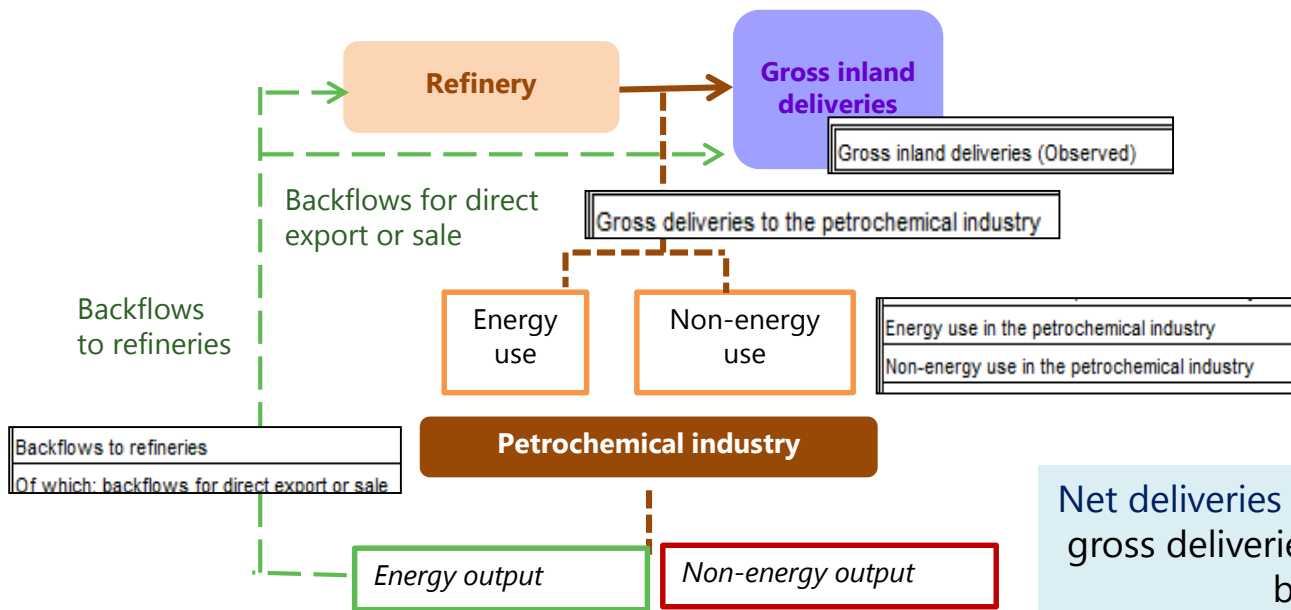
Other kerosene

Tables and questionnaire relationships



Reporting of petrochemical flows

- The IEA Oil questionnaire has a table dedicated to capturing the deliveries to the petrochemical sector (Table 2b).
- In order to capture the production of oil products in petrochemical plants we use the flow “Backflows”.

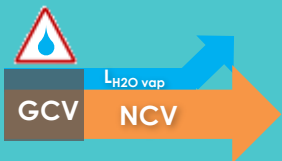


Net deliveries to the petrochemical industry = gross deliveries to the petrochemical industry – backflows to refineries

Final check list

1

Do I have the NCV for the products and flows I have reported?



2

Is the data in each table reported in the correct unit ?

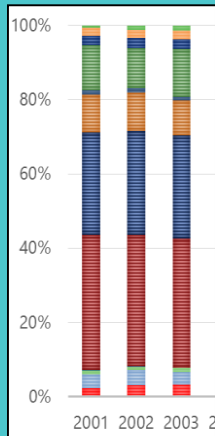


Should be in thousand metric tonnes

If your data source is in volume have you converted appropriately?

3

Do I have a full picture of the refinery intake and output?



4

Have I captured demand and do my trends make sense?



5

What are the **refinery losses**? Do they fit within the expect range?



Refinery yield < 100% = Losses

Refinery yield > 100% = Gains

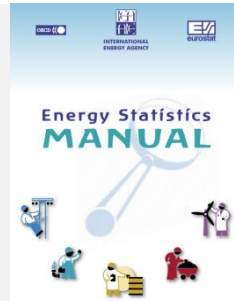
Learn more about Energy Statistics



The IEA produced a comprehensive Energy Statistics Manual covering most of our data collection methodologies, consistently with the IRES framework.

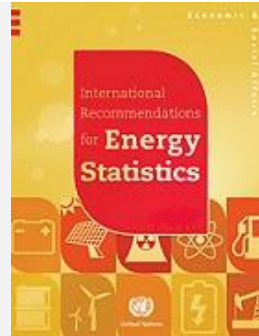
A comprehensive Energy Statistics Manual available in 10 languages.

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Visit the [IEA's Statistics website](#) to access additional resources, including our [webinars](#), questionnaires, glossary and documentation related to our data collection methodologies.

To learn more about the international framework for energy statistics, please refer to the United Nations' International Recommendations for Energy Statistics (IRES).





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