United Nations Statistics Division

Oil and Oil Products

Leonardo Rocha Souza

Workshop on Energy Statistics for ASEAN Countries

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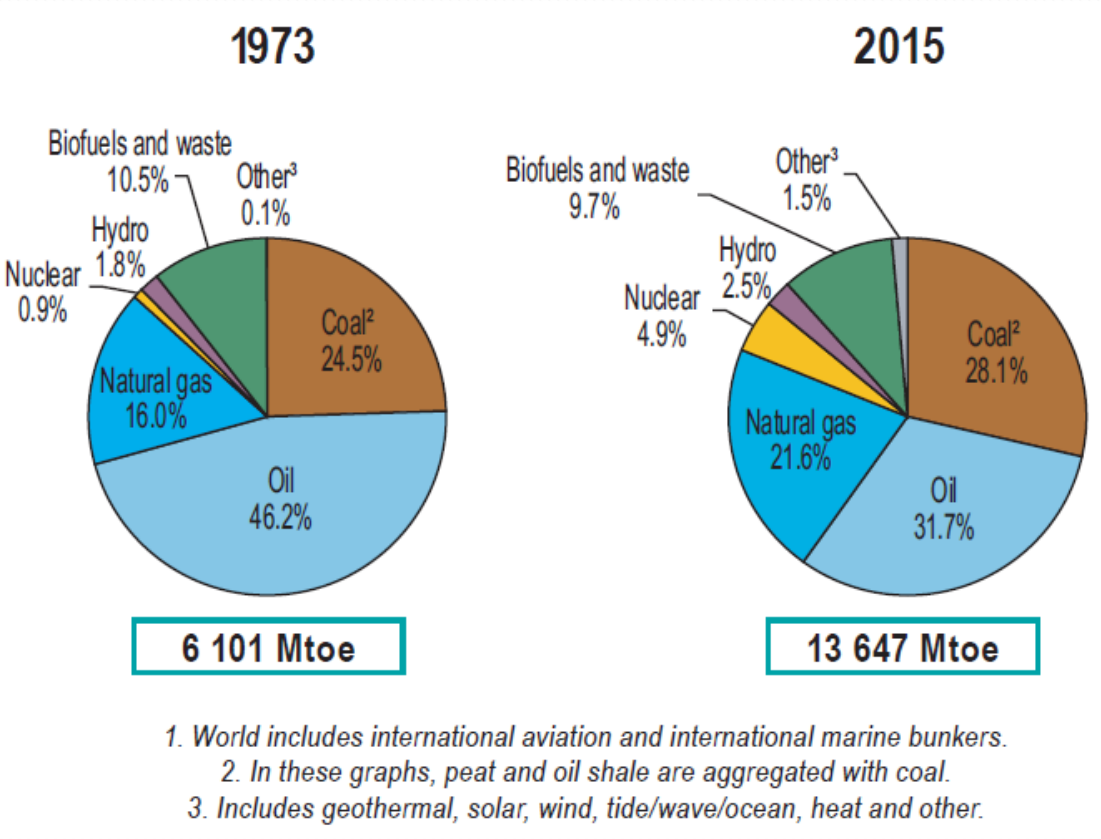
http://unstats.un.org/unsd/energy

Overview

1. Importance of oil
2. Oil classification
3. Refining processes
4. Compiling/Reporting oil data
5. Concluding remarks

Importance of oil

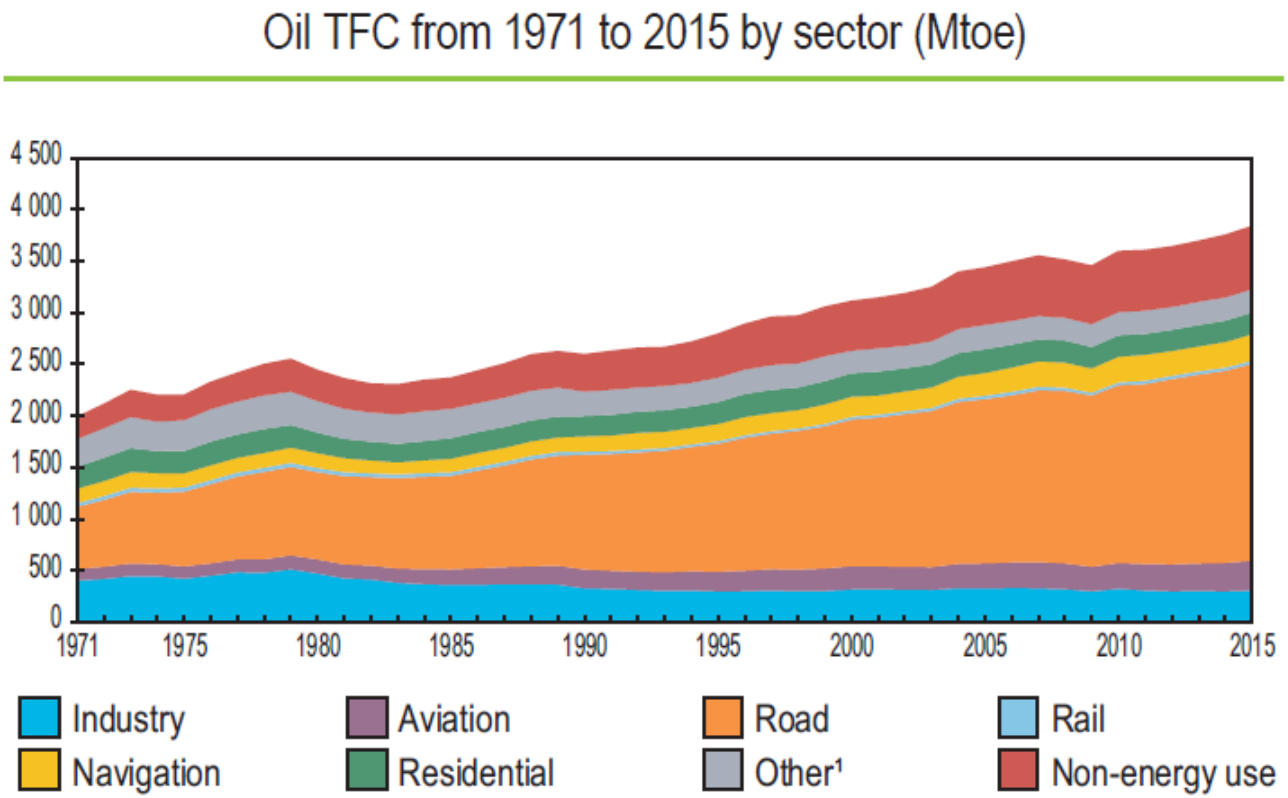
- World TES
- Still the largest source of world's energy supply in 2015
- Still fundamental for transportation (92.2% of energy used for transport)



- Source: IEA KWES 2017

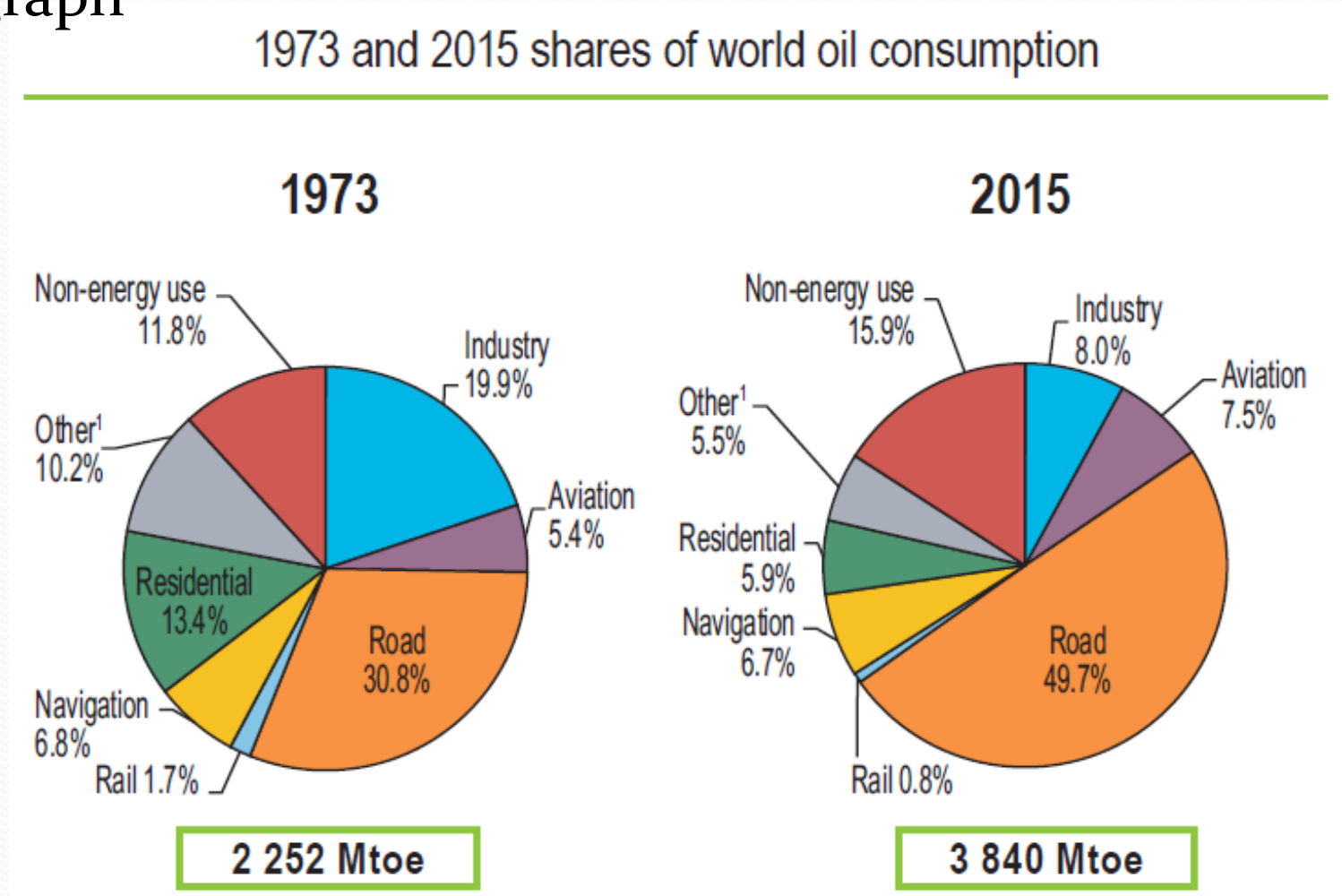
Importance of Oil

- Diversification in areas other than transport
- Even with the rise of liquid biofuels (biodiesel, bioethanol), oil is still much needed for transport



Importance of Oil

- Pie charts illustrating the cross-section of the previous graph



Oil classification

- With the distinction of primary and secondary energy products, the main primary oil products are:
  - Conventional crude oil
  - Natural Gas Liquids (NGLs)
  - Other hydrocarbons*
  - Additives and oxygenates*

* can also be secondary products

- Although Feedstocks are classified in SIEC together with the primary oil products, they are rather (2^{ary}) oil products that return to the refinery to serve as feedstock.

4		Oil
41 410	4100	Conventional crude oil
42 420	4200	Natural gas liquids (NGL)
43 430	4300	Refinery feedstocks
44 440	4400	Additives and oxygenates
45 450	4500	Other hydrocarbons
46		Oil products
461	4610	Refinery gas
462	4620	Ethane
463	4630	Liquefied petroleum gases (LPG)
464	4640	Naphtha
465		Gasolines
	4651	Aviation gasoline
	4652	Motor gasoline
	4653	Gasoline-type jet fuel
466		Kerosenes
	4661	Kerosene-type jet fuel
	4669	Other kerosene
467		Gas oil / diesel oil and Heavy gas oil
	4671	Gas oil / Diesel oil
	4672	Heavy gas oil
468	4680	Fuel oil
469		Other oil products
	4691	White spirit and special boiling point industrial spirits
	4692	Lubricants
	4693	Paraffin waxes
	4694	Petroleum coke
		Bitumen

Oil classification

- **Conventional crude oil**

A mineral oil of fossil origin extracted by conventional means from underground reservoirs, and comprises liquid or near-liquid hydrocarbons and associated impurities such as sulphur and metals

- **Natural gas liquids (NGL)**

Natural gas liquids are a mixture of ethane, propane, butane (normal and iso), (iso) pentane and a few higher alkanes collectively referred to as pentanes plus.

NGL are produced in association with oil or natural gas. They are removed in field facilities or gas separation plants before sale of the gas. All of the components of NGL except ethane are either liquid at the surface or are liquefied for disposal.

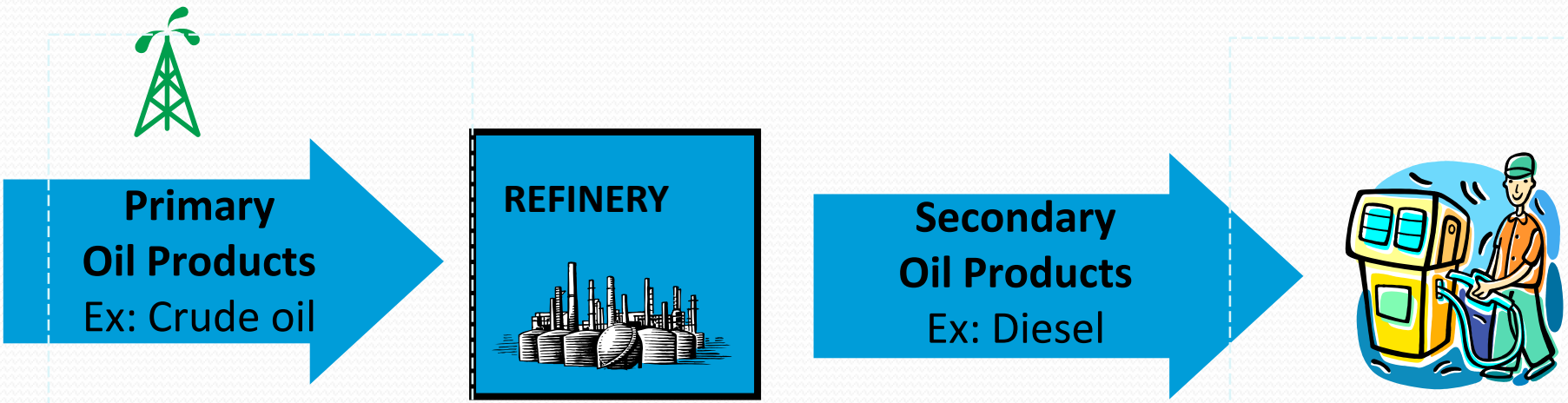
Oil classification

- **Other hydrocarbons**

includes non-conventional oils and hydrogen. Non-conventional oils refer to oils obtained by non-conventional production techniques, that is, oils extracted from reservoirs containing extra heavy oils or oil sands which need heating or treatment (e.g., emulsification) *in situ* before they can be brought to the surface for refining/processing. They also include oils extracted from oil sands, extra heavy oils, coal and oil shale which are at, or can be brought to, the surface without treatment and require processing after mining (*ex situ* processing). Non-conventional oils may also be produced from natural gas.

Oil classification/Refining process

- Primary and secondary oil products (simplified)



46		(Secondary) Oil products
461	4610	Refinery gas
462	4620	Ethane
463	4630	Liquefied petroleum gases (LPG)
464	4640	Naphtha
465		Gasolines
	4651	Aviation gasoline
	4652	Motor gasoline
	4653	Gasoline-type jet fuel
466		Kerosenes
	4661	Kerosene-type jet fuel
	4669	Other kerosene
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	4694	Petroleum coke
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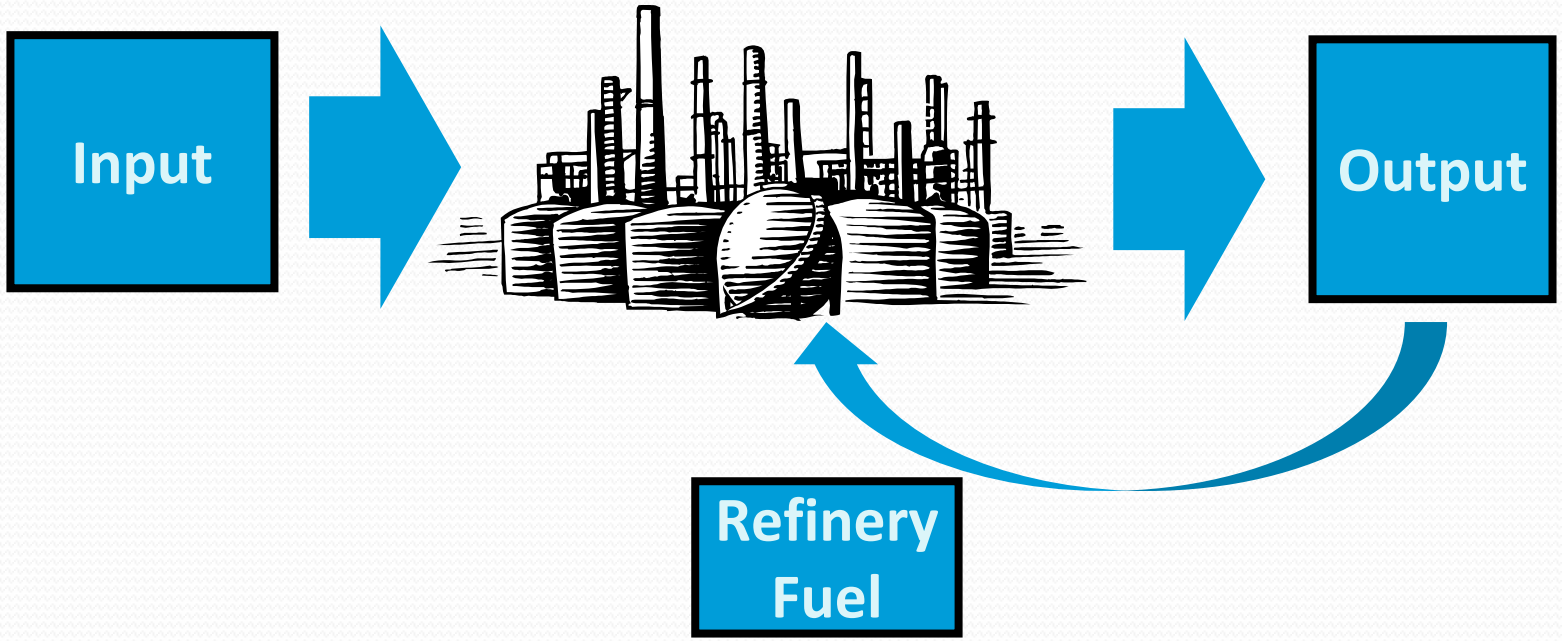
Refining process



Refining process

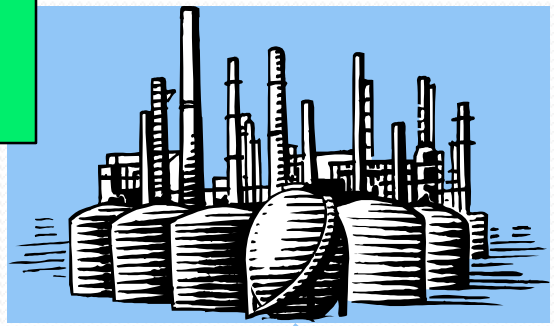
Fuels transformed into another energy form

Refinery fee[illegible]ks

Additives

Oth

Transformation



Fuels consumed to support operations

Refine

Fuel

Energy industry Own-use

Refinery Feedstocks

Refinery gas

Ethane

LPG

Naphtha

Motor gasoline

Aviation gasoline

JET Kerosene

Kerosene

Gas/Diesel Oil

Fuel oil

White Spirit and SBP

Lubricants

Bitumen

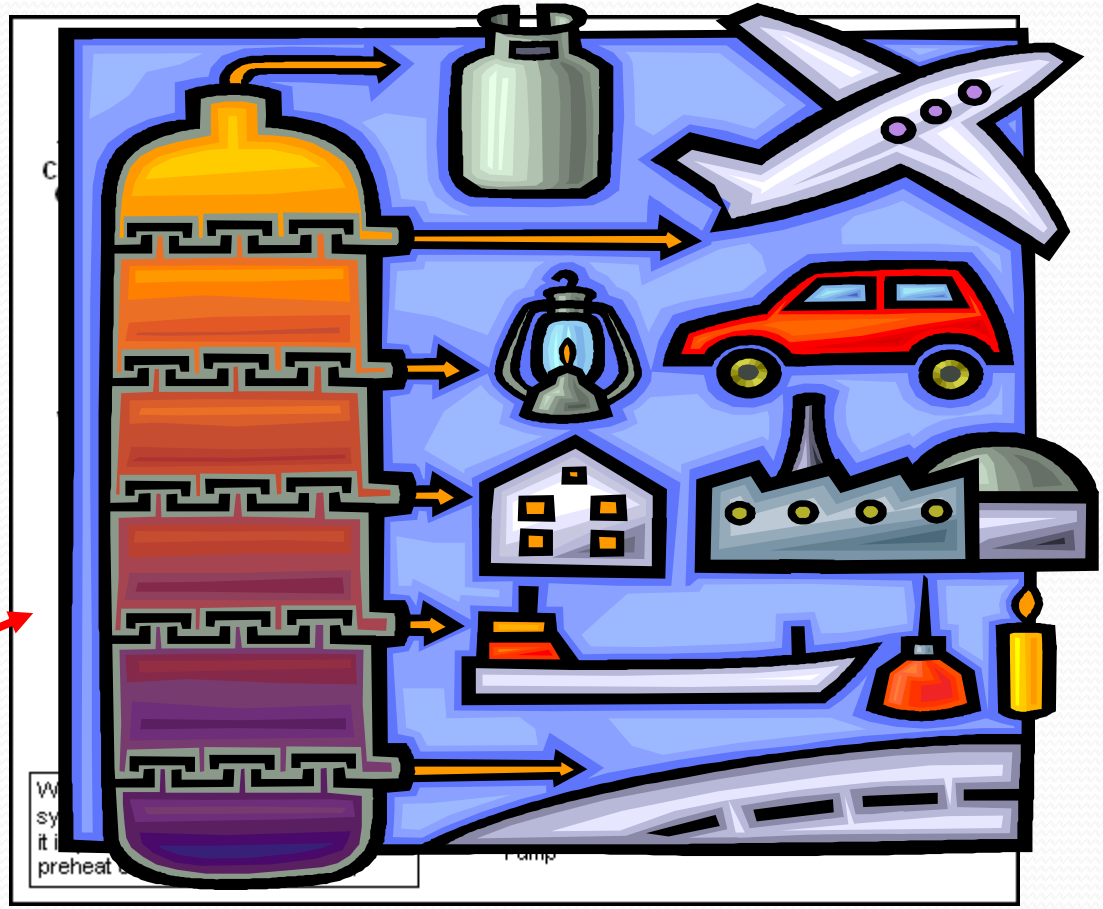
Paraffin Waxes

Petroleum Coke

Others

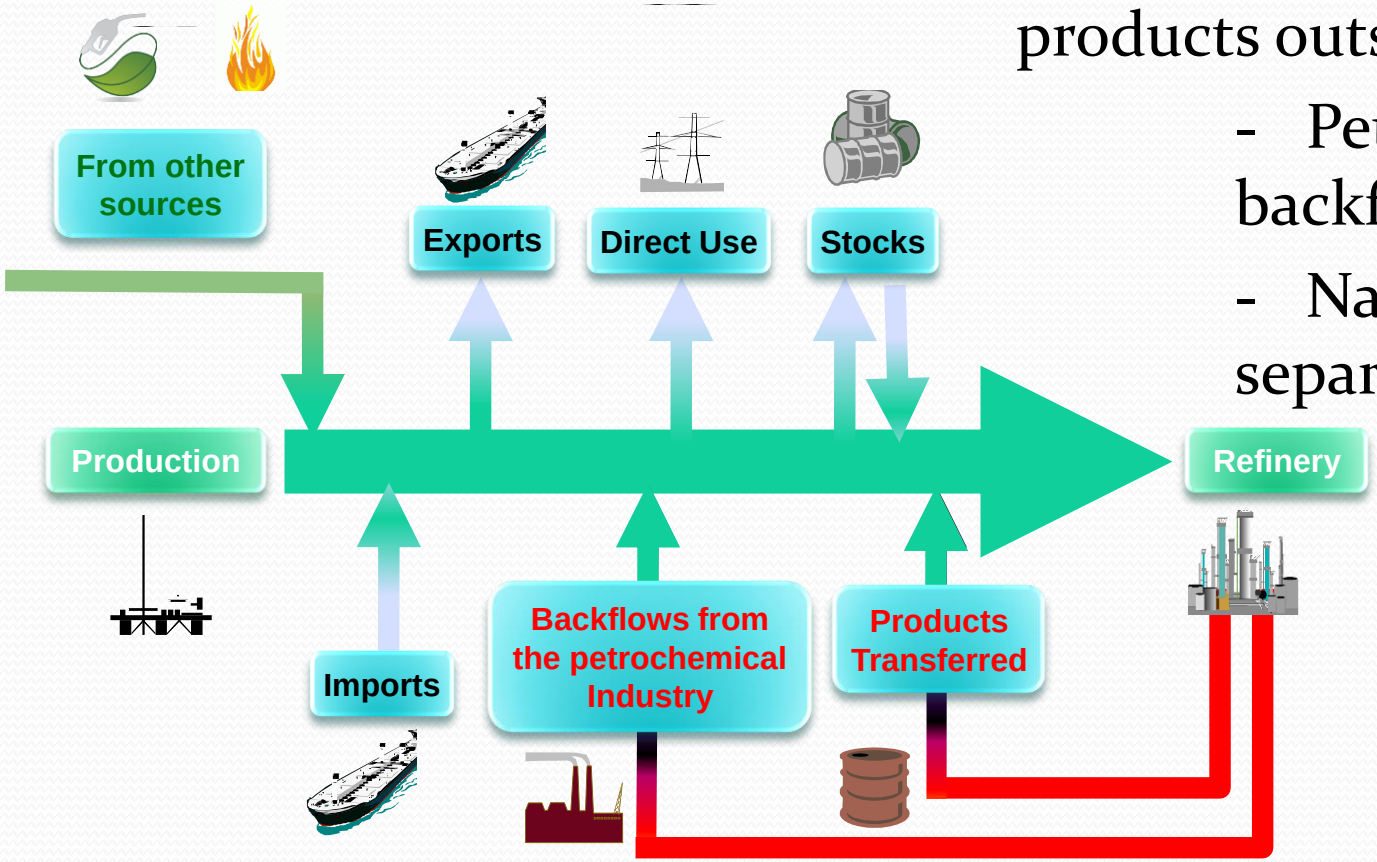
Refining process

- Output (kinds of oil products) depends on:
  - quality of input (crude, FS, NGLs – heavy/light oil, Sulphur content, etc), and
  - Processes employed within the refinery (**simple distillation**, catalytical reforming, cracking, etc.)



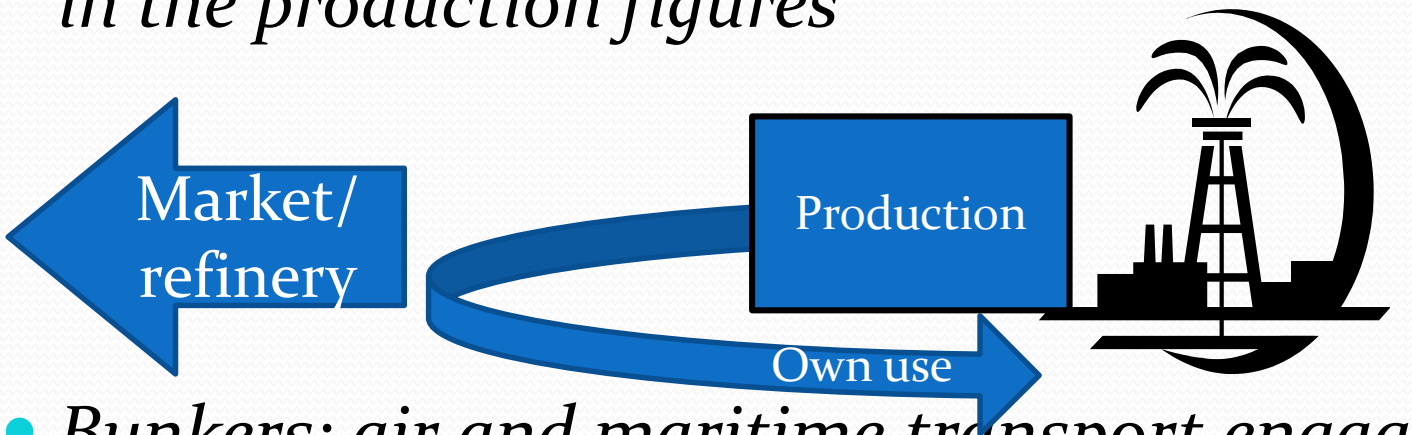
Refinery in a broader context

- Reporting Biofuels
- Production of petroleum products outside refineries
  - Petrochemical backflows
  - Natural gas separation plants

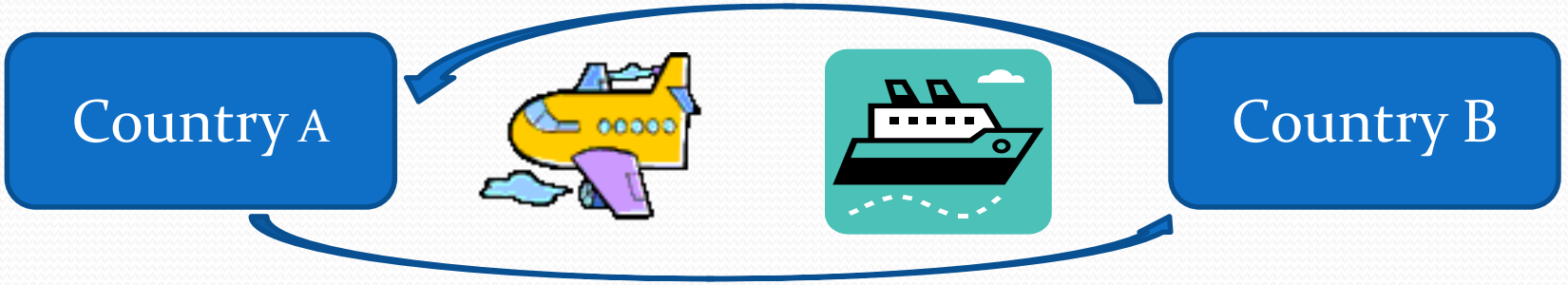


Compiling/Reporting oil data

- *Own use in production (direct use): must be included in the production figures*

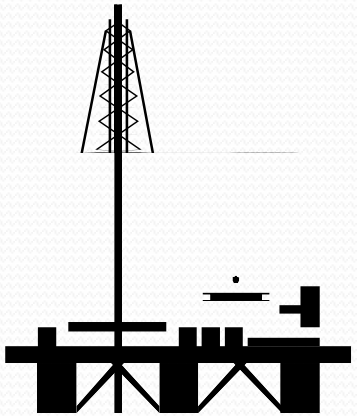


- *Bunkers: air and maritime transport engaged in international travel – excluded from supply/ exports/ final consumption/ GHG emission inventories.*



Compiling/Reporting oil data

- Data quality checks:
  - Numbers (sums, signs, etc.)
  - Statistical differences
  - Time series consistency
  - Calorific values
  - Transformation efficiency
  - Comparison between tables
  - Physical vs. energy content balance
  - Comparison with other questionnaires
  - Data are complete and tell the correct story
  - Comparison with secondary and partner sources



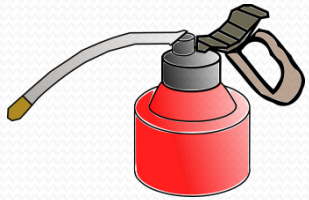
Potential sources of oil data

- Refineries – a very reliable source of information
  - Often only a few in a country, so easy to census
  - They hold very detailed information to monitor their activity
- Oil product distributors
  - data collection harder as more companies, so may need sample.
  - Not many data on final users
- Government sources
  - Customs for data on trade
  - Ministry of finance for fiscal data on oil companies
  - Tax services generally have data on transport fuels
- Surveys – often the only source on final use by households or businesses

Compiling/reporting oil data

- Energy use
  - Oil products used as a fuel
  - Example: fuel oil used for electricity generation.
  - Motor gasoline used in cars

- Non-energy use
  - Oil products used as a raw material
  - Example: oil used to make plastics.
  - Oil productions used for impermeabilization, lubrication, etc.



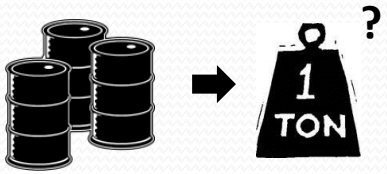
Compiling/reporting oil data

- International reporting uses kilo tonnes for reporting of oil
  - Because the calorific value (CV - energy content per unit of product) is less variable to measures in weight than in volume,
  - Since primary oil comes in different densities.
  - Ideally, specific CVs should be measured and applied/reported, but the use of default values is less consequential if quantities of oil products are measured in mass/weight.

Compiling/reporting oil data

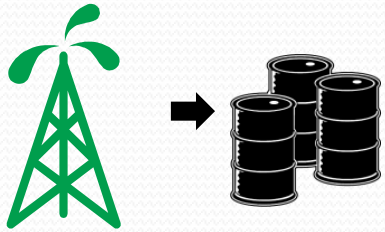
Conversion:

- From barrels to kilo tonnes



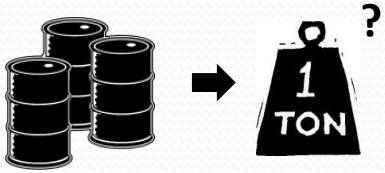
Ask the industry for the number of barrels per ton
Ex: 73 000 barrels/7.3 bbl/t = 10 000 t = 10kt

- From litres to barrels



1 barrel= 159 litres
Divide by 159
Ex: 11 607 000 litres /159 = 73 000 barrels

- From litres to kt (using default density of crude oil)



Default density of crude oil: 0.86 kg/l
Ex: 11 607 000 litres*0.86kg/l = 9 982 020kg = 9.98kt

Compiling/reporting oil data

Some fundamental checks:

- Is there a statistical difference?

  Statistical difference = Supply – Demand

- What are the refinery losses?

  Refinery losses = Refinery output – Refinery input

- What is the refinery utilization?

  Refinery utilization = Refinery input/Refinery capacity

Statistical difference/Supply <1%

Refinery losses <0 or over 5% of refinery input

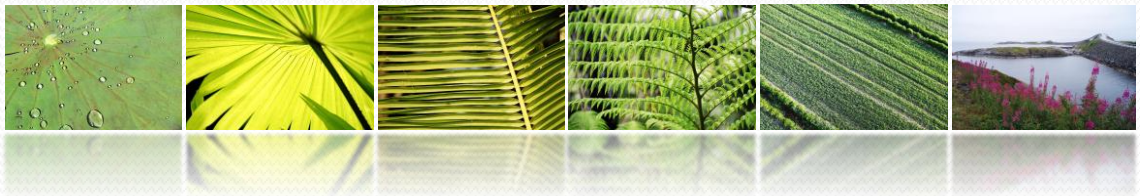
Utilization over 100%

Quality check: transformation efficiency

- Electricity plants: 10 – 50% depending on the fuel and main activity / autoproducer
  - fuel oil 17 - 33%
  - gas/diesel 35 - 41%
  - Anthracite 30 - 40%
  - natural gas 30 - 50%
- CHP Plants: 30 – 80%
- Heat Plants: 40 – 100%
  - natural gas 70 - 90%
- Refineries: 95 – 100%
- Charcoal: 25 – 55%

Concluding remarks

- Distinction between transformation and final use (by industry – mainly metallurgical) is important:
  - Recovered gases can be used to generate electricity, for example
  - Indicators based on final energy consumption (SDG 7.2.1)
- Distinction between transformation and own use (by industry – mainly metallurgical) is important:
  - To access efficiency of the process, which in turn can be used as a data quality check
- Assessing country-specific (and flow-specific) Calorific Values important (rather than using default CVs):
  - For the construction of accurate balances and indicators
  - For the accurate assessment of efficiencies



Thank you.

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