Conversion Factors
(volume to mass and vice versa)

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Outline

- Conversion factor
    - What is it?
    - Why is it relevant?
- Illustrative examples
- Q&A
- Conclusion

Conversion Factors

- **Conversion factor -** what is it?
    - A multiplier used to convert a quantity expressed in one set of units, into an equivalent expressed in a different set of units.
    - For oil data usually **mass** is converted to **volume** and vice versa
    - For natural gas data usually **volume** is converted to **energy/mass**

CRUDE OIL

Standard factors	Barrels	Metric tonne	Cubic metres
Barrels	1	0.136	0.159
Metric tonne	**7.33**	1	1.165
Cubic metres	6.289	0.858	1

Conversion Factors

- **Conversion factors** are used to standardize seemingly comparable products measured in volumes into the same units of measurement

- **Crude oils** can differ from each other in lightness/heaviness (API gravity), sweetness/sourness (sulfur content) and other factors
    - **Brent** – 7.52 barrels per metric tonne
    - **Dubai** – 7.20 barrels per metric tonne

- Conversion factors for **petroleum product categories**
    - **LPG** – 11.00-11.80 barrels per metric tonne
    - **Motor gasoline** – 8.00-9.00 barrels per metric tonne
    - **Naphtha** – 7.88-9.55 barrels per metric tonne
    - **Diesel oil/jet kerosene** – 6.90-7.80 barrels per metric tonne
    - **Residual fuel oil** – 6.2-6.9 barrels per metric tonne
    - **Other products** – 5.9 – 6.3 barrels per tonne

Conversion Factors – Examples (1)

- **Crude oil** – conversion factors roughly within the range of **5.5-8.6**

  - Country A produces **180,000 barrels per day (b/d)** of heavy oil with a barrel to tonne conversion factor of **6.0**. That equates to **… metric tonnes per day**
  - Country B produces **200,000 b/d** of light oil with a barrel to tonne conversion factor of **8.0**. That equals to **… metric tonnes per day**

Conversion Factors – Examples (1) continued

- **Crude oil –** conversion factors roughly within the range of **5.5-8.6**
    - Country A produces **180,000 barrels per day (b/d)** of heavy oil with a conversion factor of **6.0**. That equates to **30,000 metric tonnes per day**
    - Country B produces **200,000 b/d** of light oil with a conversion factor of **8.0**. That equals to **25,000 metric tonnes per day**
    - If the conversion factors are not submitted to JODI, then the standard **7.33** conversion factor will be used. Then a statistician/analyst/researcher would report that Country A produced **… metric tonnes per day** (error of **…%**) and Country B produced **… metric tonnes per day** (error of **…%**)

Conversion Factors – Examples (1) continued

- **Crude oil –** conversion factors roughly within the range of **5.5-8.6**
    - Country A produces **180,000 barrels per day (b/d)** of heavy oil with a conversion factor of **6.0**. That equates to **30,000 metric tonnes per day**.
    - Country B produces **200,000 b/d** of light oil with a conversion factor of **8.0**. That equals to **25,000 metric tonnes per day.**
    - If the conversion factors are not submitted, then the standard **7.33** conversion factor will be used. Then a statistician would report that Country A produced **24,556 metric tonnes per day** (error of **18.15%**) and Country B produced **27,285 metric tonnes per day** (error of **9.1%**)
    - **18%** of error enormous for sufficient market assessment
    - Submitting **accurate conversion factors** to **JODI** is essential

Conversion Factors – Examples (2)

- **Motor gasoline** – mass to volume conversion factors of different spec of gasoline are within the range of **8.0-9.0**
- Illustrative conversion factors:
  - I. Gasoline RON 90 – **8.1**,
  - II. Gasoline RON 95 – **8.3**,
  - III. Gasoline RON 98 – **8.5**
- Country C reports the following numbers in relation to gasoline: refinery production of **40,000 b/d**, exports of **15,000 b/d** and domestic demand of **25,000 b/d**
- How to report in JODI the applicable conversion factors for production, exports and demand?

Conversion Factors – Examples (2) continued

- Detailed information on the composition of the refinery production, exports and demand is required
- **Weighted average** for each flow would be applied

	Conversion Factor	Refinery production	Exports	Demand
Gasoline 90	8.1	20,000	2,000	18,000
Gasoline 95	8.3	10,000	5,000	5,000
Gasoline 98	8.5	10,000	8,000	2,000
Total		40,000	15,000	25,000
Conversion factor		…	…	…

Conversion Factors – Examples (2) continued

- Detailed information on the composition of the refinery production, exports and demand is required.

- **Weighted average** for each flow is the correct solution

	Conversion Factor	Refinery production	Exports	Demand
Gasoline 90	8.1	20,000	2,000	18,000
Gasoline 95	8.3	10,000	5,000	5,000
Gasoline 98	8.5	10,000	8,000	2,000
Total		40,000	15,000	25,000
Conversion factor		**8.25**	**8.38**	**8.17**

Conversion Factors – Examples (3)

- **Crude oil** – Country D reports:

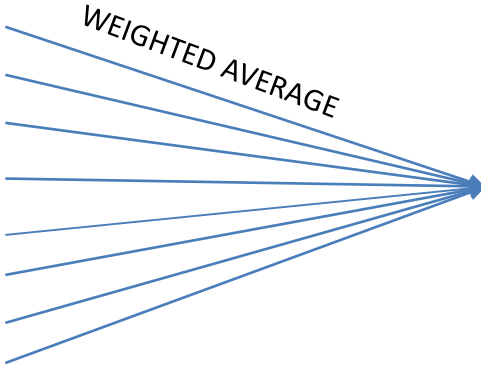| Production	Quantity (1,000 b/d)	Conversion factor
Stream 1	5	7.2
Stream 2	10	7.7
Stream 3	20	6.5
Stream 4	20	7.9
Stream 5	5	6.8
Stream 6	50	7.6
Stream 7	10	7.1
Stream 8	100	7.3

- The appropriate conversion factor for crude oil for Country D is **…?**

Conversion Factors – Examples (3) continued

- **Crude oil** – country D reports:

Production	Quantity (1,000 b/d)	Conversion factor
Stream 1	5	7.2
Stream 2	10	7.7
Stream 3	20	6.5
Stream 4	20	7.9
Stream 5	5	6.8
Stream 6	50	7.6
Stream 7	10	7.1
Stream 8	100	7.3

WEIGHTED AVERAGE

Production	Quantity (1,000 b/d)	Conversion factor
TOTAL	220	**7.35**

- The appropriate conversion factor for crude oil for Country D and the flw of production is **7.35**
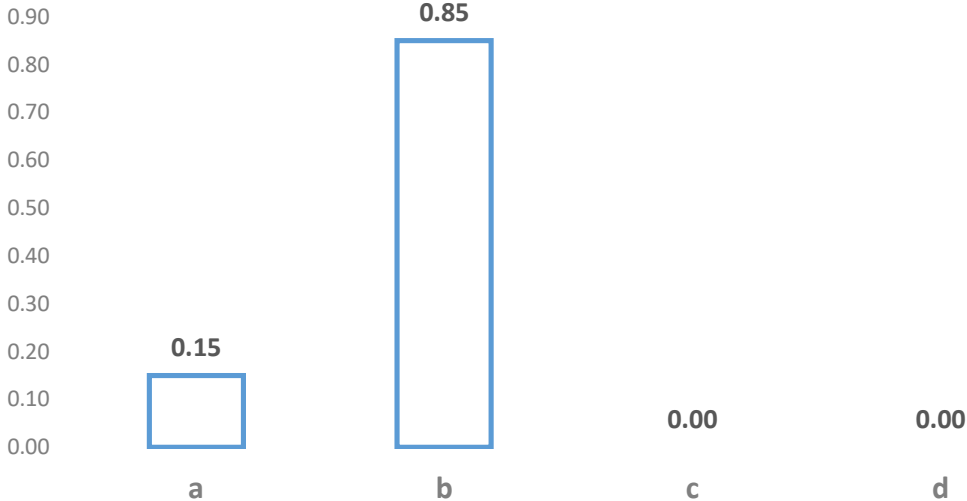
Reported conversion factors should reflect

a. Averages for each flow and product category

b. Minimum for each flow and product category

c. Maximum for each flow and product category

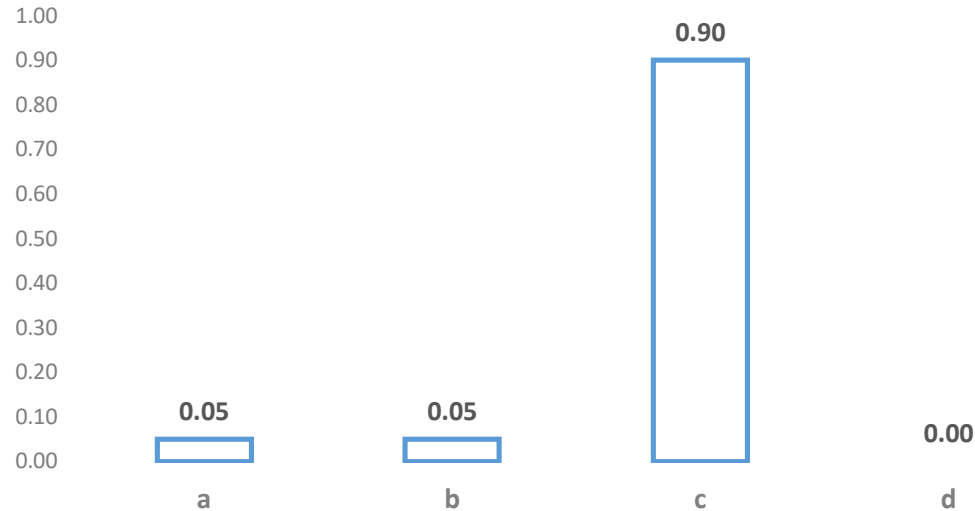d. Weighted averages for each flow and product category
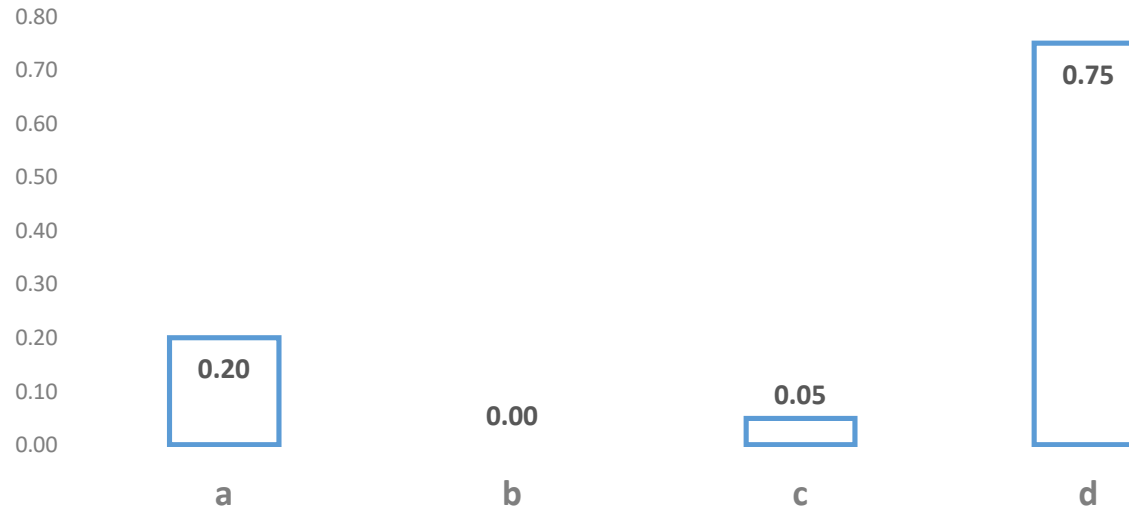
Barrels are measures of

a. Mass
b. Volume
c. Energy
d. None of the above.
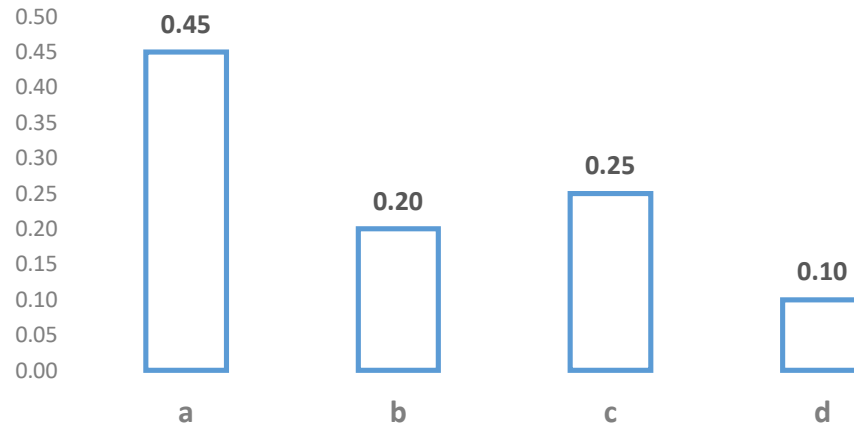
Tonnes of oil equivalent (toe) are measures of

a. Mass
b. Volume
c. Energy
d. None of the above.

Determinants of mass to volume conversion factors:

4. Determinants of mass to volume conversion factors:
   a. Specific gravity
   b. Pressure
   c. Energy content
   d. None of the above

Conclusion

- **Conversion factors** allow to accurately convert a quantity expressed in one set of units into an equivalent expressed in a different set of units
- **Conversion factors** facilitate comparison of slightly different but comparable products using the same units of measurement
- **Conversion factors** empower the statistician to standardize and perform comparisons across **countries**, **flows** and **time**

Submission of accurate conversion factors is essential for accurate JODI data

JODI Meeting Today…

Thank you.

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Conversion Factors – Q&A

1. Reported conversion factors should reflect
   a. Averages for each flow and product category
   b. Minimum for each flow and product category
   c. Maximum for each flow and product category
   d. Weighted averages for each flow and product category

2. Barrels are measures of
   a. Mass
   b. Volume
   c. Energy
   d. None of the above.

Conversion Factors – Q&A

3. Tonnes of oil equivalent (toe) are measures of
   a. Mass
   b. Volume
   c. Energy
   d. None of the above.

4. Determinants of mass to volume conversion factors:
   a. Specific gravity
   b. Pressure
   c. Energy content
   d. None of the above