Annual Natural Gas Questionnaire Overview

Joint CSO/India Energy Statistics Training
Greater NOIDA, Nov. 11 – 15, 2013

Claire Morel
Non-OECD statistics
Towards a golden age of gas?

World - Total Primary Energy Supply - Mtoe

- Oil
- Coal/peat
- Natural gas
- Biofuels and waste
- Nuclear
- Hydro
- Other*

- 16%: 895 Mtoe
- 21%: 2787 Mtoe
How does IEA collect natural gas statistics?

<table>
<thead>
<tr>
<th></th>
<th>OECD</th>
<th>Non-OECD</th>
<th>India</th>
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<tbody>
<tr>
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<td>CSO: Energy statistics</td>
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<tr>
<td>Monthly</td>
<td>MOS (M-2) Gas Trade map (GTF) JODI (M-1)</td>
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<td>PPAC website</td>
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**INDIAN PETROLEUM & NATURAL GAS STATISTICS**
Security of supply: an important policy issue in gas consuming countries

In case of supply disruption it is important to know the available storage facilities in a region.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Working Capacity (mcm)</th>
<th>Peak Output (mcm/day)</th>
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<tr>
<td>TOTAL</td>
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</table>
Gases occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane.

- **Associated gas**
  Found in association with crude oil

- **Non-associated gas**
  Originating from fields producing gas only

- **Colliery gas**
  Methane removed from coal mines and coal seams
Annual questionnaire – Questionnaire structure

Production
From other sources
Imports
Exports
Stock changes

Supply
Inland consumption (calculated)

Statistical difference

Transformation
... 
Energy sector
... 
Final consumption
Transport
... 
Industry
... 
Other sectors
... 

Demand
Inland consumption (observed)
Pression and temperature affect gas volume

A
T = Medium
P = Medium

B
T = High
P = Low

C
T = Low
P = High

T = Medium

Standard conditions: 15°C, 1 bar
Normal conditions: 0°C, 1 bar
Gross and net calorific values

GCV

Heat in water

Useful heat content

NCV

GCV/NCV approximately 10% natural gas
How is gas production defined?

Extraction of crude oil and associated gas

Extraction of non-associated gas

Wellhead separation (onshore wells)

Removal of liquids in natural gas processing plants

Removal of sulphur and impurities

Gas flared or reinjected

Vented

Colliery gas

Crude oil

Associated gas

Non-associated gas

Marketed production

NGL

Oil questionnaire

Natural gas questionnaire

Coal mines

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Oil questionnaire

Natural gas questionnaire
## Natural Gas Statistics

### Annual questionnaire – Supply of natural gas, Table 1

<table>
<thead>
<tr>
<th>Year &amp; Country</th>
<th>Million m³ (at 15°C, 760 mm Hg)</th>
<th>TJ (Gross calor. value)</th>
<th>Average GCV (kJ/m³)</th>
<th>Average NCV (kJ/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indigenous production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associated gas</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-associated gas</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Colliery gas</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Receipts from other sources</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Imports (Balance)</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exports (Balance)</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>International marine bunkers</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stock changes (National territory)</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inland consumption (Calculated)</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Statistical difference</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inland consumption (Observed)</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Trade: Imports and Exports

- Imports: ultimate origin of gas (country of production)
- Exports: ultimate destination (country of consumption)
- Transit and re-exports are not included in trade balances
### Natural Gas Statistics

**Annual questionnaire - Imports/Exports, Table 3/4**

<table>
<thead>
<tr>
<th>COUNTRY OF DESTINATION</th>
<th>Million m³</th>
<th>TJ (GCV)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Exports</td>
<td>of which: LNG</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Belarus</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Our challenges with Indian gas data

- **Units**: are we using correct calorific values?
- **Production**: are we making the proper calculation to match our definition and make the data comparable with other countries?
- **Trade**: LNG imports reported only in tons
- **No stocks data**
- **Consumption**: breaks in time series, difficulty understanding consumption categories
Exercises
Units of Measurement

In the questionnaire, data **must** be reported:

- For energy: $TJ$ on the basis of **Gross calorific value (GCV)**
- For volume: $Mm^3$ in the **standard condition**
- Volume varies with **temperature** and **pressure**

<table>
<thead>
<tr>
<th>Standard Condition</th>
<th>Normal Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15 , ^{\circ}C \ (288.15 , K)$, $760 , mm , Hg \ (1 , atm)$</td>
<td>$0 , ^{\circ}C \ (273.15 , K)$, $760 , mm , Hg \ (1 , atm)$</td>
</tr>
</tbody>
</table>

**Conversion Factors**

- $1 \, m^3 \times 0.948 = 0.948 \, m^3$
- $0.948 \, m^3 \times 1.055 = 1 \, m^3$
Calorific values

- The calorific value is heat value obtained from one volume unit of gas (e.g. $TJ/Mm^3$)
- Gross calorific value (GCV) includes all the heat released by the fuel
- Net calorific value (NCV) excludes the latent heat of vaporization
- The difference between NCV and GCV is typically about 10% for natural gas.

For natural gas: $NCV \approx 0.9 \times GCV$
Calorific values

- Gases from different sources can have different calorific values

- Use a **weighted average** that takes into account the proportional magnitude of each component rather than treating the components equally
**Weighted Average Calorific Value**

**Example:**

**Country A**

<table>
<thead>
<tr>
<th>Fields</th>
<th>Production</th>
<th>Calorific Value</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>10 Mm$^3$</td>
<td>30 TJ/Mm$^3$</td>
<td>300 TJ</td>
</tr>
<tr>
<td>Site 2</td>
<td>20 Mm$^3$</td>
<td>35 TJ/Mm$^3$</td>
<td>700 TJ</td>
</tr>
<tr>
<td>Total</td>
<td>30 Mm$^3$</td>
<td>?</td>
<td>1 000 TJ</td>
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## Natural Gas Questionnaire

### Weighted Average Calorific Value

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<td>700 $TJ$</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30 $Mm^3$</strong></td>
<td><strong>33.3 $TJ/Mm^3$</strong></td>
<td><strong>1 000 $TJ$</strong></td>
</tr>
</tbody>
</table>

\[
\frac{(30 \times 10) + (35 \times 20)}{10 + 20} = 33.3 \frac{TJ}{Mm^3}
\]
Weighted Average Calorific Value

Definition:

\[
\frac{\sum_i (CV_i \times \text{Quantity}_i)}{\sum_i \text{Quantity}_i}
\]

where:

- \( CV \) = Calorific value (e.g. kJ/m\(^3\))
- Quantity = Physical quantity (e.g. m\(^3\))
Natural Gas Questionnaire

Russia

Poland
50 mcm consumed

Czech Rep.
50 mcm consumed

Ukraine
100 mcm consumed

200 mcm
Electricity and Heat Generation

Generation plants classified by main function:

- Main activity producers
- Autoproducers (e.g. steel mills producing electricity)

And by output:

- Electricity-only plants
- CHP (Combined heat and power) plants
- Heat-only plants
Thank you

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