# NETL Life Cycle Inventory Data
# Process Documentation File

**Process Name:** Methanol production from natural gas

**Reference Flow:** 1 kg of Methanol from natural gas

**Brief Description:** The production of methanol from natural gas

## Section I: Meta Data

**Geographical Coverage:** World **Region:** N/A

**Year Data Best Represents:** N/A

**Process Type:** Manufacturing Process (MP)

**Process Scope:** Gate-to-Gate Process (GG)

**Allocation Applied:** No

**Completeness:** Individual Relevant Flows Captured

**Flows Aggregated in Data Set:**

☑ Process ☑ Energy Use ☐ Energy P&D ☐ Material P&D

**Relevant Output Flows Included in Data Set:**

| | | | |
|---|---|---|---|
| Releases to Air: | ☑ Greenhouse Gases | ☐ Criteria Air | ☐ Other |
| Releases to Water: | ☑ Inorganic | ☑ Organic Emissions | ☐ Other |
| Water Usage: | ☐ Water Consumption | ☐ Water Demand (throughput) | |
| Releases to Soil: | ☐ Inorganic Releases | ☐ Organic Releases | ☐ Other |

**Adjustable Process Parameters:**

| | |
|---|---|
| NG_feedstock | *[kg/kg] Natural gas used as feedstock. Expected value from Franklin Associates, min and max values from ecoinvent* |
| NG_fuel | *[kg/kg] Amount of natural gas required for steam generation* |
| CH4_fugitives | *[kg/kg] Amount of fugitive methane emissions* |
| Electricity | *[kWh/kg] Electricity use at the methanol facility.* |

### Tracked Input Flows:

| | |
|---|---|
| Natural Gas | *[Technosphere] Pipeline natural gas for methanol feedstock* |
| Natural gas combustion in auxiliary boiler | *[Technosphere] Pipeline natural gas for steam generation* |
| Electricity | *[Technosphere] Purchased electricity* |

### Tracked Output Flows:

| | |
|---|---|
| Methanol from natural gas | *Reference flow* |

## Section II: Process Description

### Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_O_Methanol_from_NG_2013.01.xlsx*, which provides additional details regarding relevant calculations, data quality, and references.

### Goal and Scope

This unit process provides a summary of relevant input and output flows associated with the production of methanol from natural gas by steam reforming and low pressure synthesis. The reference flow of this unit process is: 1 kg of Methanol from natural gas

### Boundary and Description

Methanol is produced from natural gas in a 2 step process that begins with steam reforming to produce synthesis gas (a mixture of carbon monoxide, carbon dioxide, and hydrogen). The synthesis gas is then converted to methanol. Carbon dioxide is a by-product of methanol production that is released to the atmosphere.

The primary data source for this unit process is an American Chemistry Council (ACC) report on the production of resins (Franklin Associates, 2011). A report from ecoinvent serves as a second source, and is used to establish a range values for the natural gas feedstock input (Althaus, 2007). The release of carbon dioxide created during the steam reforming and methanol synthesis is calculated stoichiometrically, assuming that the

carbon entering the system as methane must leave the system as part of methanol, methane fugitive emissions, or carbon dioxide. This results in a different carbon dioxide emission than is given in the ACC report.

**Figure 1: Unit Process Scope and Boundary**

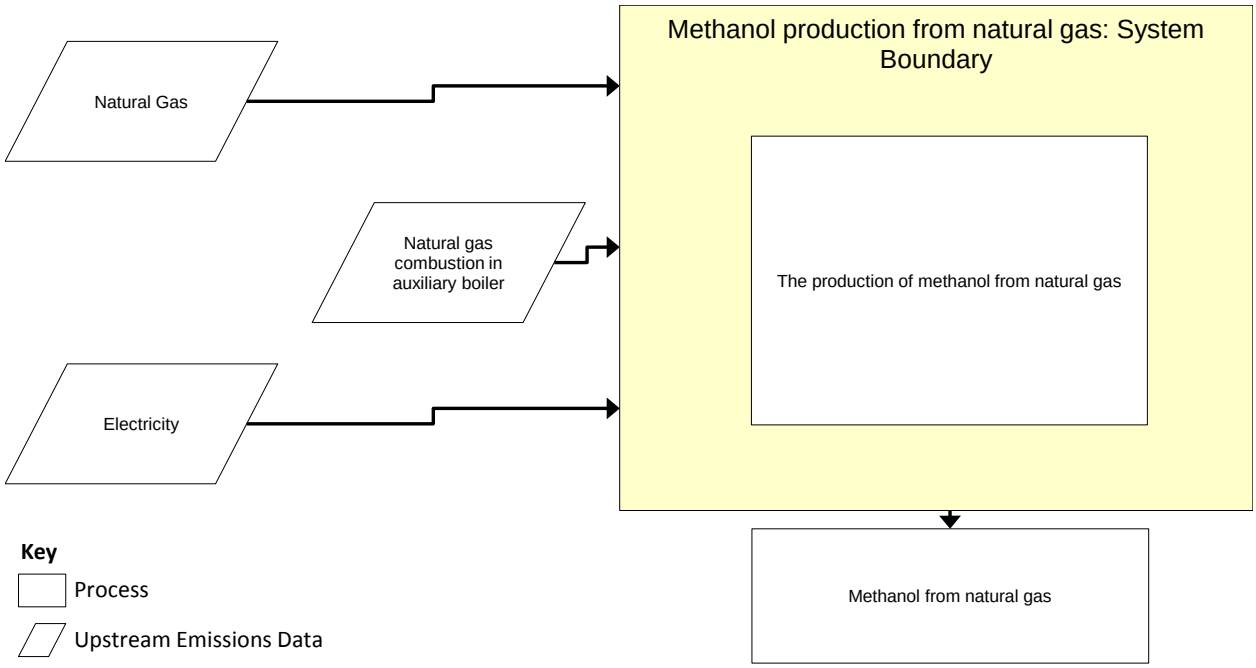

**Table 1: Unit Process Input and Output Flows**

| Flow Name | Expected Value | Low | High | Units (Per Reference Flow) |
|---|---|---|---|---|
| Inputs | | | | |
| Natural Gas | 6.20E-01 | 0.550 | 0.678 | kg |
| Natural gas combustion in auxiliary boiler | 8.75E-02 | | | kg |
| Electricity | 8.04E-03 | | | kWh |
| Outputs | | | | |
| Methanol from natural gas | 1.00 | | | kg |
| Carbon dioxide [Inorganic emissions to air] | 0.314 | 0.122 | 0.473 | kg |
| Methane [Organic emissions to air (group VOC)] | 5.00E-03 | | | kg |
| Biological oxygen demand (BOD) [Analytical measures to fresh water] | 5.80E-05 | | | kg |
| Total Suspended Solids [Analytical measures to fresh water] | 8.80E-05 | | | kg |
| Waste (solid) [Waste for disposal] | 5.00E-04 | | | kg |

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows.

## Embedded Unit Processes

None.

## References


Franklin Associates 2001 — Franklin Associates (2011). Revised Final Appendices: Cradle-to-Gate Life Cycle Inventory of Nine Plastic Resins and Four Polyurethane Precursors.

Althaus, H.-J. *et al.* 2007 — Althaus, H.-J., R. Hischier, M. Osses, A. Primas, S. Hellweg, N. Jungbluth and M. Chudacoff (2007). Life Cycle Inventories of Chemicals. ecoinvent report No. 8, v2.0.

## Section III: Document Control Information

**Date Created:** October 9, 2013

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Original/no revisions

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