

## High-efficiency Ethane & LPG Recovery Process

### Features

TOYO Engineering Corporation (TOYO) has developed COREFLUX (Cold Reflux), new processes to extract Natural Gas Liquid (NGL) from natural gas and/or LNG, utilizing a unique reflux enhancement method. The COREFLUX processes can achieve a high product recovery rate, with a relatively low energy consumption.

#### 1. COREFLUX®-C<sub>2</sub> (Cold Reflux Technology for C<sub>2</sub> recovery)

COREFLUX®-C<sub>2</sub> is a very efficient and competitive process technology to obtain a high ethane recovery rate from natural gas, oil associated gas and off-gas from refinery plants.

- High ethane recovery rate (>95%) with enhanced reflux.
- Low compression power with efficient use of a turbo expander.
- Easy modification of a conventional process.

#### 2. COREFLUX®-LNG Process (Cold Reflux Technology for LNG Processing)

COREFLUX®-LNG is an efficient LNG processing technology to recover ethane and LPG from LNG. This technology can reduce the heating value of LNG at an LNG regasification terminal and utilize the recovered ethane and LPG as petrochemical feedstock.

- High ethane recovery rate (>98%) with enhanced reflux.
- Low energy consumption with an advanced cold heat integration, and
- Simple flow scheme for easy operation and maintenance with reasonable initial investment cost.

#### 3. COREFLUX®-LPG Process (Cold Reflux Technology for LPG Extraction)

COREFLUX®-LPG is a unique LNG processing technology to extract LPG from LNG. This technology can reduce the heating value of LNG at an LNG regasification terminal and utilize the extracted LPG as petrochemical feedstock in a similar way to COREFLUX®-LNG.

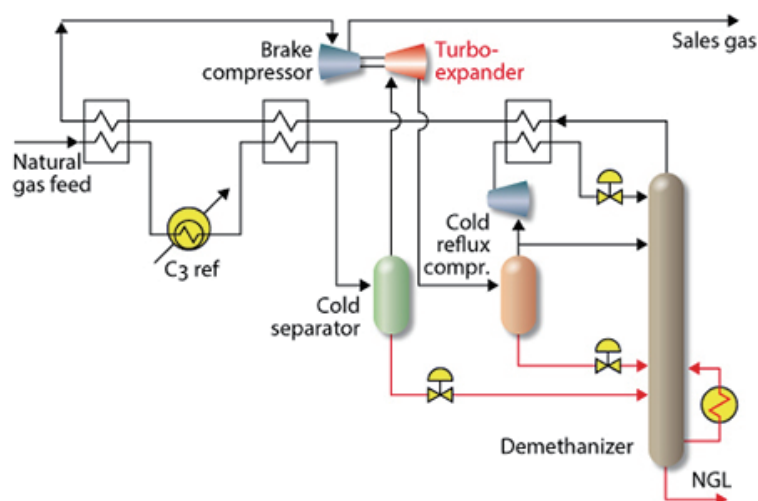
- High C<sub>3</sub>/C<sub>4</sub> recovery rate (> 99.5%) with enhanced reflux
- No vapor compression for reliquefaction of Demethanizer overhead
- Low energy consumption with low operation pressure of Demethanizer

### Basic Concept or Summary

#### 1. COREFLUX®-C<sub>2</sub> (Cold Reflux Technology for C<sub>2</sub> recovery)

COREFLUX®-C<sub>2</sub> utilizes a turbo expander to cool down the feed gas. However, unlike the conventional split vapor process, the entire amount of feed gas is sent to the turbo expander to maximize the power recovery. To produce a methane rich reflux, a gas-liquid separator is provided at the outlet of the turbo expander. The methane rich vapor from the separator is recompressed by a compressor and totally condensed for the cold stream from the Demethanizer overhead. The condensed liquid contains a high concentration of methane and works as an effective reflux. Maximum power recovery at the turbo expander and the methane rich reflux have resulted in a lower total compression power for COREFLUX®-C<sub>2</sub>, compared with conventional processes.

COREFLUX®-C<sub>2</sub> Process Flow

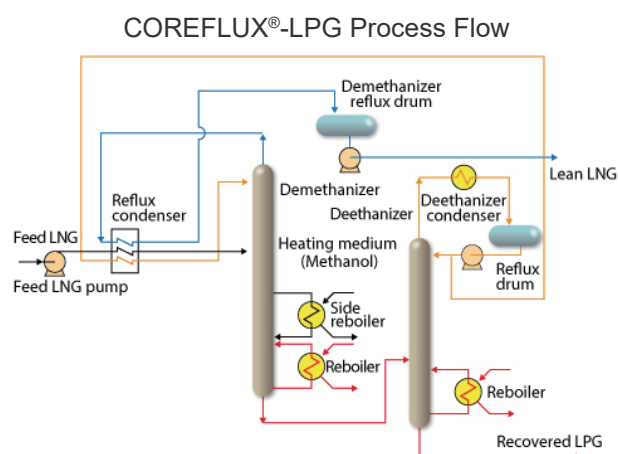
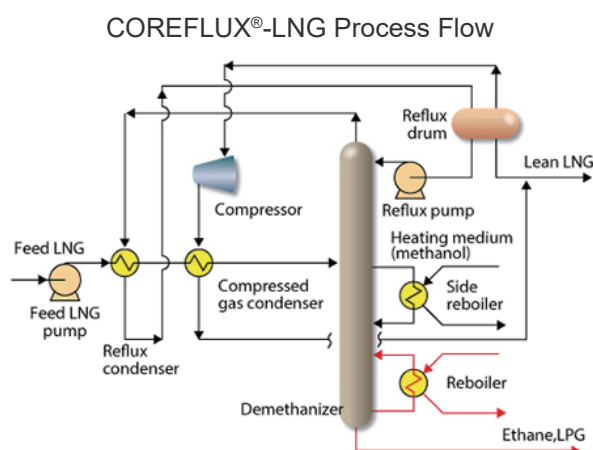


## 2. COREFLUX®-LNG Process (Cold Reflux Technology for LNG Processing)

COREFLUX®-LNG involves a condenser in a Demethanizer overhead, where the Demethanizer overhead vapor is partially condensed for the cold LNG feed stream. A part of condensed liquid from the condenser is returned to the Demethanizer as reflux. This reflux contains more than 99 mol% of methane. This is the reason the COREFLUX®-LNG can achieve more than 98% of ethane recovery rate. The remaining vapor from the condenser is compressed with an overhead compressor before being fully condensed against the feed LNG. A methanol heating medium, suitable for cold heat transfer, is applied to conserve energy.

## 3. COREFLUX®-LPG Process (Cold Reflux Technology for LPG Extraction)

COREFLUX®-LPG is a two column process, where a high propane recovery rate can be achieved with an ethane rich reflux recycled back from the Deethanizer to the Demethanizer. Overhead vapors from both the Demethanizer and Deethanizer columns are fully condensed by feed LNG and cold heat recovery from the Demethanizer. This unique reflux enhancement method enables total condensation of vapors without any overhead vapor compression at low operation pressure, which can maximize the separation efficiency of  $C_2$  and  $C_3$ .



## Effects or Remarks

### 1. COREFLUX®-C<sub>2</sub> (Cold Reflux Technology for C<sub>2</sub> recovery)

COREFLUX®-C<sub>2</sub> will achieve a high process performance for the following applications.

- High ethane recovery.
- Relatively rich feed gas.
- Revamp projects to increase feed throughput and/or ethane recovery rate.

### 2. COREFLUX®-LNG Process (Cold Reflux Technology for LNG Processing)

COREFLUX®-LNG will provide an additional value to LNG regasification terminal, i.e. an opportunity to sell petrochemical feedstock in addition to regasified natural gas and thus, will improve the economics of LNG regasification terminal.

### 3. COREFLUX®-LPG Process (Cold Reflux Technology for LPG Extraction)

COREFLUX®-LPG can be applied when LPG is sold as a product or supplied to petrochemical plants, such as a Propane Dehydrogenation (PDH) unit as feedstock.

## Installation in Practice or Schedule

### Overseas

- In 2014, COREFLUX®-C<sub>2</sub> was selected by State Concern "Turkmengas" for a five billion, m<sup>3</sup> natural gas per annum NGL recovery facility, located in Turkmenbashi, Turkmenistan.
- In 2006, the COREFLUX®-LNG Process was selected for a large scale C<sub>2</sub>-C<sub>4</sub> extraction facility in Dahej, India (LNG processing capacity of five million tons per year) by Oil and Natural Gas Corporation (ONGC).

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