



**National Iranian Oil Company  
Research Institute of  
Petroleum Industry**

# **GTL & OCM**

**Engineering & Process  
Development Division**

# Conversion of Natural Gas to Valuable Products

## Introduction

Natural gas is considered as a clean source of energy and a feedstock for petrochemical industries. However, its transportation from gas fields to energy consumption centers and chemical plants is a major barrier to the development of natural gas industries. Pipeline transportation is one simple choice. Due to the gas low density, a high-pressure gas pipeline can transport only 20% of the energy, which can be displaced by a petroleum pipeline.

By lowering the gas temperature down to  $-160^{\circ}\text{C}$ , it is possible to liquefy the natural gas at high pressures and increase its energy density.



Using the gas in liquefied (known as LNG) or compressed state (known as CNG) requires further investment. The investment includes transportation facilities and modifications of the energy sinks (...e.g. fuel tanks and injection systems of internal combustion engines)

An attractive alternative in natural gas utilization is to convert the gas into more valuable and easily transportable products such as liquid fuels and/or olefins.

The gas conversion methods may be divided into two categories:

- Direct Conversion
- Indirect Conversion





The OCM (Oxidative Coupling of Methane) process is a typical example for the first category and the GTL (Gas to Liquids) process represents the second one. Although the OCM process is not commercialized yet, extensive research activities on this process at various academic institutes and chemical companies such as ARCO and Lyondell have been carried out. However, the GTL process has been commercialized since 1950 in the South Africa. Many chemical companies have developed or tried to develop their own GTL technologies; SASOL, Shell, Statoil, Syntroleum and Rentech are some examples.

RIPi has also conducted lots of research activities on gas conversion processes (especially on OCM and GTL) since the early 1990s.

### **Objectives of the Plan**

With its Know-how and experience in the fields of GTL and OCM, RIPi has embarked on a five-year plan to develop the gas upgrading technologies compatible with environmental and technical conditions of Iran.

To achieve this goal, RIPi has concluded joint technology cooperation agreements with a number of overseas technology partners.

## Advantages of the RIPI Processes

### 1- GTL

Direct conversion of syngas to High-Octane Gasoline with a Motor Octane Number (MON) of 92. There is no need for further upgrading units. Enhanced Carbon Efficiency is attained by utilizing CO<sub>2</sub> (Produced in the FT reactor) for syngas production. The product gasoline is absolutely clean (sulfur and nitrogen contents are almost zero)



### 2- OCM

Production of ethylene from natural gas increases the olefin production capacity and introduces the natural gas as one of the main sources of ethylene.

### Principal Projects

- 1- Catalyst investigations including synthesis, characterization, lifetime studies, scale-up, etc.
- 2- Kinetic studies of the OCM and Fischer Tropsch reactions
- 3- Mathematical modeling and reaction engineering studies
- 4- Pilot plant studies and data gathering for scale up purposes
- 5- Conceptual design of a commercial plant
- 6- Feasibility studies
- 7- Basic design of a commercial unit
- 8- Process integration studies

