

## Consulting services for establishing and operating LNG receiving terminals, based on more than 50 years of accumulated know-how

### Features

Knowledge, acquired through the operation of LNG receiving terminals for more than 50 years, is utilized to offer technical assistance for business planning, engineering, operating and maintaining activities.

- ◆ We support a broad range of considerations, spanning from the business planning phase of terminals to the operating phase, provided for the perspective of the terminal owner.
- ◆ We support the consideration of cold energy utilization facilities, as well as LNG shipping facilities (such as LNG tank lorries and coastal vessels and the like), at LNG receiving terminals.
- ◆ We offer evaluations on the current conditions and proposals to improve operations and maintenance at existing LNG receiving terminals.

### Basic Concept or Summary

Osaka Gas has operational experience of LNG receiving terminals for 50 years in Japan, through which a broad range of knowledge relating to business planning, engineering, operations and maintenance was cultivated. Such knowledge is utilized to potentially offer technical assistance in a broad area, not just for terminal owners considering the building of an LNG terminal, but also for terminal owners facing issues, following the start of operations. Support provided in the perspective of the terminal owner, gained through many years of operating terminals, can realize user friendly planning, design, construction and operation of LNG terminals.

#### A. Consulting services for LNG terminals

##### 1. Support service in FS phase

- User friendly and easy to use terminal design and terminal configurations considered
- Terminal concepts that offer high levels of safety, reliability and efficiency taken into consideration
- Highly reliable scheduling and cost calculations

##### 2. Support services in FEED phase

- Process designs
- Construction and design of facility configurations
- Risk assessment
- Preparation of competitive EPC purchase specifications and assistance in selecting EPC contractors

##### 3. PMC support services in EPC phase

- Various applications for administrative processing submitted at the respective countries
- Order receiving operations supported
- Construction operations management
- Operator training
- Commissioning

##### 4. Support services in O&M phase

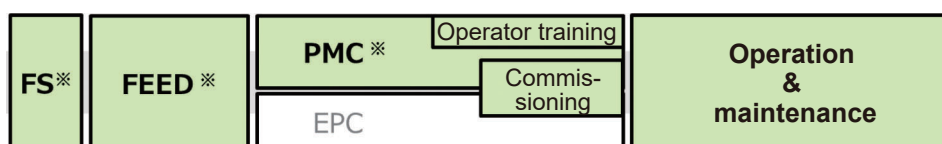
- Terminal operating efficiency improvements
- Rules and manuals checked and reviewed
- Maintenance plan reviewed
- Facility updating plan formulated



LNG receiving terminal



LNG tank lorry shipping facility



Scope of services provided by the Daigas Group

※ FS : Feasibility Study; FEED : Front End Engineering Design; PMC : Project Management Consultation

## B. Proposal for LNG cold energy utilization facilities

Technical support is provided for planning, design, construction and operation of the following LNG cold energy utilization facilities:

- Cold energy utilization air liquefaction separation facility (ASU)
- Cold energy utilization type CO<sub>2</sub> liquefaction facilities and dry ice manufacturing facilities
- Cryogenic crushing of food and resin facilities
- Cold energy utilization cooling of gas turbine intake air cooling
- Effective use of LNG cold energy for neighboring factories (Ethylene cooling and brine cooling)



Air liquefaction separation



CO<sub>2</sub> liquefaction facility

### Effects or Remarks

- Energy savings achieved by reducing energy consumption through utilization cold energy and improving gas manufacturing facility operating efficiency
- Energy supply stability increased by improving the reliability of LNG receiving terminals
- Technology transfers for the maintenance and operation of LNG terminals

### Installation in Practice or Schedule

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|-----------------|--|
| <b>Domestic</b> | <ul style="list-style-type: none"> <li>• Maintenance and operation of LNG receiving terminals (two locations) of Osaka Gas</li> <li>• LNG receiving terminal consultation services for domestic gas and power companies (7 terminals)</li> </ul>   |
| <b>Overseas</b> | <ul style="list-style-type: none"> <li>• Taiwan: FEED, PMC and LNG tank consultations</li> <li>• Thailand: Technology transfers for operations and maintenance</li> <li>• Korea: FEED and PMC tank consultation</li> <li>• Singapore: FS</li> <li>• Indonesia: PMC</li> <li>• Spain: FS</li> </ul> |

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