

Liquefied Natural Gas (LNG)

General Objectives:

To provide a comprehensive technical and economical review of the Liquefied Natural Gas industry.

Specific Objectives:

At the end of training the trainees will be able:

- ✓ To review the structure of an LNG chain and look over the world map of LNG plants;
- ✓ To understand main LNG physical properties and specificities;
- ✓ To assess LNG facilities hazards and HSE issues, along with risk mitigation and prevention techniques;
- ✓ To grasp main liquefaction process's operating principles, conditions and constraints;
- ✓ To glance at the technology of equipment used in the LNG industry;
- ✓ To grasp the essence of LNG markets and contracts.

Audience:

Professionals involved or interested in the LNG industry: technical and managerial staff in the LNG industry, equipment providers, personnel from engineering companies...

Workload: 40 hours

CONTENTS:

Module I – The LNG world

- ✓ The LNG chain – Order of magnitude and trends – Location of main plants worldwide;
- ✓ Base load LNG plants – Peak shaving LNG plants – Small LNG plants for LNG fueled vehicles;
- ✓ Receiving terminals – Regasification techniques – Satellite regasification techniques.

Module II – LNG specific properties and associated hazards

- ✓ Physical properties: Liquid-Vapor equilibrium, density, ratio of vapor methane / LNG, heat of vaporization, heat of combustion;
- ✓ Safety aspects: Flash Point, Fire Point, Auto-ignition Point, Minimum Spark Energy, Flammability Limits, Deflagration, LNG Vaporization, Rapid Phase Transition (RPT), Radiation Levels, Stratification / Roll-over, Sloshing, LNG clouds ignition, Asphyxiation risks, Cryogenic liquids jets, Piping behavior.

Module III – LNG hazard prevention and mitigation measures

- ✓ LNG spillage control at Design stage and in Operation;
- ✓ LNG clouds control in operation;
- ✓ LNG fires control at Design stage and in Operation.

Module IV – Liquefaction and regasification processes

- ✓ Feed pre-treatment: sweetening, dehydration, NGL extraction, Hg and aromatics removal;
- ✓ Different liquefaction processes: Pure Component Refrigerants, Pure Component(s) and Mixed Refrigerant(s), Mixed Refrigerants;
- ✓ Peak Shaving simplified scheme;
- ✓ Regasification process.

Module V – LNG storage, loading / offloading and transport

- ✓ LNG tanks: Single or Double or Full Containment (self standing, membrane) – Hazards;
- ✓ Jetty head, Jetty trestle, harbor;
- ✓ LNG Carriers: common features, technology, cargo operations, safety systems.

Module VI – Technology of LNG specific equipment

- ✓ LNG cryogenic heat exchangers: Spiral Wound Heat Exchangers, Aluminum Brazed Heat Exchangers;
- ✓ Technology of the Cryogenic Compressors and their drivers (Gas Turbines);
- ✓ LNG Vaporizers: Open Rack Vaporizers (ORV), Submerged Combustion Vaporizers (SCV) – Safety and Environmental aspects;
- ✓ Submerged LNG pumps: in-tank retractable pumps, cargo pumps, HP canned send out pumps;
- ✓ Liquid cryogenic turbo-expanders, Cryogenic Valves;
- ✓ Cryogenic personnel protection items.

Module VII – LNG plant operation

- ✓ Day to day activities in an LNG plant – Experience of some plants.

Module VIII – LNG trends – Research and new developments

- ✓ LNG trends since 70's – Equipment and concept development – Future.

Module IX – LNG economic aspects

- ✓ Gas markets: natural gas reserves and production, worldwide gas demands distribution, international natural gas trade;
- ✓ LNG contracts: specificities of LNG contracts, pricing, shipping contracts;
- ✓ LNG markets trends.