provide a fully integrated and reliable execution plan for the FLNG project. To achieve this, Chiyoda will contribute to the EPC schedule reduction through close collaboration with the topside fabrication contractor. Approximately 10% increase from the original LNG production rate can be achieved through extensive process studies.

Based on Chiyoda's experience, the following optimizations can be achieved:

1. **Economic Efficiency**
   - Enhancing project viability for customers by optimizing production, facilities costs, operating costs, and facility maintenance to enhance the total project value.

2. **Safety**
   - Reducing operational safety risks during the initial stage, which is essential for the successful realization of FLNG facilities.

3. **Design Optimization**
   - From the initial stage, design optimization is key to success for FLNG facilities. It improves total economic efficiency.

- **Topside Design Optimization**
  - "Optimization from the initial stage is essential for the successful realization of FLNG facilities as it enhances project viability for Customers."

Creating an LNG Value Chain

Chiyoda is committed to providing customers with the most viable solutions to create an LNG Value Chain for offshore gas resources all over the world. This involves developing a range of technologies and expertise to support FLNG projects.

**Keys to Success…**

1. The Floating LNG Power Vessel has 4 functions which are berth facility, LNG storage, regasification, and thermal power plant, all in one floating unit.
2. By converting the surplus of LNG Carriers to Floating LNG Power Vessels with small scale (~72 MW) to medium scale (~400 MW), Chiyoda offers Power Generation facilities in remote areas.
3. By supplying electricity directly to land via heavy duty electrical cable, Chiyoda offers LNG Power Generation facilities in remote areas, including islands, by eliminating infrastructures such as LNG receiving facilities and onshore Power Generation facilities.

Chiyoda offers the Floating LNG Power Vessel with its inherent high reliability as one of Chiyoda's LNG Value Chain solutions. The demand for Natural Gas as a source of environmentally friendly clean energy has expanded rapidly in recent years. As a leading EPC contractor, Chiyoda has the number one share in the construction of LNG receiving terminals in Japan. In recent years, Chiyoda has leveraged its capabilities, including its management of Subsurface (SURF) projects and Floating Production Storage and Offloading (FPSO) projects, through its subsidiary company, Xodus Group (Holdings). As an EPCIC contractor, Chiyoda can provide Integrated Optimum Solutions combining Subsurface / SURF / Floater as a total development master plan and execute such plans.

Through our subsidiary company, Xodus Group (Holdings), Chiyoda can provide Integrated Optimum Solutions combining Subsurface / SURF / Floater as a total development master plan and execute such plans.

Chiyoda's global presence is evident with 14 offices worldwide, including locations in Houston, London, Stromness, Oslo, Perth, Southhampton, Yokohama (Chiyoda Corporation), as well as Aberdeen, Abu Dhabi, Doha (Chiyoda Corporation), Dubai, Edinburgh, Glasgow, New York, and Tokyo (Chiyoda Corporation). Chiyoda Corporation has 4-6-2, Minatomirai, Nishi-ku, Yokohama, Japan. The company operates from 240 offices, with technical personnel of about 5,000, in more than 20 countries.

**Contact us about FLNG :** chiyodaflng@chiyodacorp.com

The realization of FLNG has been drawing attention as a means of developing undeveloped marine gas fields and providing a liquefaction plant at sea. The realization of FLNG requires the development of a whole system including safety and related peripheral technology. Chiyoda has been engaged in projects aimed at meeting present-day needs by using advanced technology. With a uniquely skilled and experience workforce, Chiyoda offers global engineering, procurement and construction services for realizing FLNG facility through the integration of all kinds of technology. Please see five major key issues that would bring to success for the realization of FLNG.
Floating LNG (FLNG) refers to LNG plants in marine environments. To ensure operable and successful FLNG facilities, FLNG EPCI contractors should have extensive experience in LNG EPC projects. Chiyoda has a No.1 Rich FEED / EPC track record relating to its onshore LNG plants as well as extensive experience in Concept Studies and Pre-FEED and FEED work on many floating projects since 1998.

In 2012 it launched a professional department that deals with the FPSO in general including FLNG in order to accumulate more extensive know-how. Since then, as part of its portfolio of experience, Chiyoda has conducted FEED/Pre-EPC for Petrobras FLNG in Brazil, FEED for Abadi Gas Field Development FLNG in Indonesia, Pre-FEED/Optimization Study for SFLNG in Australia and FEED for Coral FLNG in Mozambique.

In February 2014 Chiyoda was awarded its first offshore EPCI project for Eni Muara Bakau’s Floating Production Unit (FPU) offshore Gas Processing Facility, as a consortium member. It was successfully handed over to the client in 2017 and the first ‘gas in’ was achieved just one month after the FPU arrived at site.

Through these projects, Chiyoda has accumulated optimization ideas not only for topsides but also for hull, turret & mooring, offloading, towing and installation, and offshore commissioning.

**Extensive Track Record**

Chiyoda can provide a wide variety of solutions from small size to large size FLNG and Gas FPSO/FPU.

- **CAPEX Minimization Solutions**
  - Non-Liquid Hydrocarbon Refrigerant Process for Small to Medium Sized FLNG projects offering CAPEX, process efficiency and safety
  - Design and project execution strategies based on past lessons learned
  - This means we can reduce or avoid redoing design work and errors
  - Chiyoda’s areas of expertise include outstanding engineering, non-refrigerant-related technologies, and extensive LNG modular experience, enables us to propose several hull and marine concepts for various site conditions.

- **Wide Variety of Floating Applications**
  - Conversion FLNG
  - Compact Module Design
  - Non-Liquid HC Refrigerant

**LNG Project Experiences**

- **Arzew, Algeria**
  - Gassi Touil LNG
  - Sonatrach 2015
- **Damietta, Egypt**
  - Egypt LNG
  - União Fenosa 2001
- **La Brea, Trinidad and Tobago**
  - Trinidad LNG
  - Atlantic LNG 1995
- **Santos Basin, Brazil**
  - Petrobras FLNG
  - Petrobras 2010

- **35 FEED/PS projects**
- **26 EPC projects**

*Plant capacity awarded since 2005*

![Image](https://skkmigas.go.id/)

Source: [http://skkmigas.go.id/](http://skkmigas.go.id/)

**Papua New Guinea LNG Project**

**Jangkrik Floating Production Unit Project**

**Keys to Success…**

**Natural Gas Demand**

**Chiyoda’s Unique LNG Value**

**LNG Value Chain**

**Creating an Solution Provider**

**Development**

**Floater with Chiyoda Affiliate**

**Know-how on LNG/Floaters**

**Accumulation of Extensive Design**

**Total Project Value Solutions**

**Compact Module Design**

**Non-Liquid HC Refrigerant / Refrigerant**

**CAPEX Minimization Solutions**

**Smaller and Lighter**

**No refrigerant storage requirement**

**“CAPEX reduction of 50 - 60%”**

**For Nearshore Projects**

Chiyoda can offer CAPEX minimization solutions with:

- Refrigerant: Non-Liquid HC
- Refrigerant: Non-Liquid HC

**Wide Variety of Floating Applications**

- Conversion FLNG
- Compact Module Design
- Non-Liquid HC Refrigerant
**Keys to Success...**

**CAPEX Minimization Solutions**

**Wide Variety of Floating Applications: Conversion FLNG**

Chiyoda can offer **CAPEX** minimization solutions with:

- **“CAPEX reduction of 30-40%”** for Open Sea
- **“CAPEX reduction of 50-60%”** for Nearshore

*for above 2.0 mtpa production capacity
*compared with New Build FLNG

**Wide Variety of Floating Applications: New Build FLNG Solution-Cylindrical Hull**

<table>
<thead>
<tr>
<th>Client</th>
<th>ExxonMobil Affiliate</th>
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</thead>
<tbody>
<tr>
<td>Country</td>
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</tr>
<tr>
<td>Liquefaction</td>
<td>ExxonMobil Proprietary</td>
</tr>
</tbody>
</table>

**Wide Variety of Floating Applications: Non-Liquid HC Refrigerant**

Non-Liquid Hydrocarbon Refrigerant Process for Small to Medium Sized FLNG projects offering CAPEX, process efficiency and safety

Benefits compared to Liquid Refrigerant:
- No refrigerant storage requirement
- Less hydrocarbon inventory on board
- Less exposure to cryogenic spill
- Smaller and Lighter
- No import of refrigerant or on board generation

**Wide Variety of Floating Applications: Compact Module Design**

Compact and Lightweight Topsides enabling optimum hull and marine concept. Hull and Marine are the key and major cost components of FLNG plants. Chiyoda’s “Compact Topside Design” concept, based on extensive LNG modular experience, enables us to propose several hull and marine concepts for various site conditions.

- Total of 167 modular construction projects implemented worldwide since 1972.
- 6,200 ton module for onshore LNG project in 2017

Chiyoda’s areas of expertise include outstanding engineering execution quality and design quality. This means we can reduce or avoid redoing design work and associated delayed engineering deliverables. Chiyoda will develop design and project execution strategies based on past lessons learned on Pre-FEED / FEED module projects.
**Keys to Success...**

**Design Optimization from the Initial Stage**

*Topside design “Optimization” from the initial stage is essential for the successful realization of FLNG facilities as it improves total economic efficiency.*

Since liquefaction, storage and offloading facilities need to be mounted on a vessel of limited size, FLNG facilities tend to become congested. Compared to an on-shore plant, there is a higher risk of major accident hazards (fire, explosion, cryogenic spill, etc.). Therefore, it is important to review all aspects of FLNG projects from the initial stage including operational safety, LNG production rates, facilities costs, operating costs, and facility maintenance, to enhance the total project value.

Based on Chiyoda’s experience, the following optimizations can be achieved:

- Approximately 10% increase from original LNG production rate through extensive process studies
- Optimal equipment arrangement and compact layout
- A production cost of less than US$1,000 USD/LNG ton with for large capacity FLNG
- Approximately 20% topside weight reduction due to compact module design concept
- Contributing to EPC schedule reduction through close collaboration with topside fabrication contractor

Chiyoda’s advanced engineering capabilities and extensive LNG experience enable it to provide economical, reliable and operable FLNG facilities suitable for diverse gas fields, locations, client requirements and environmental and technical considerations.

Chiyoda will work with the marine consultant/contractor, shipyard fabricator and topsides fabrication contractor from the initial stage to establish optimum and competitive design and execution plans for the topsides, hull, and turret, if necessary and to provide a fully integrated and reliable execution plan for the FLNG project.

**Optimization can improve the Total Project Value.**

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**Keys to Success...**

**Creating an LNG Value Chain**

By leveraging its vast LNG experience, which covers 40% of worldwide LNG production on a capacity basis together with our broad based LNG capabilities, Chiyoda is ready to provide customers with the most viable solution to create an LNG Value Chain for offshore gas resources all over the world.

Gas/LNG value chain creation is one of Chiyoda’s core values, and this enhances project viability for Customers.
**Floating LNG Power Vessel Technology**

As a leading EPC contractor, Chiyoda has the number one share in the construction of LNG receiving terminals in Japan. In recent years Chiyoda has actively developed Floating LNG (FLNG) technology. Based on these technologies and well proven experiences, Chiyoda has successfully completed the conceptual design of Floating LNG Power Vessels.

Key features of Chiyoda’s Floating LNG Power Vessels are:

1. The Floating LNG Power Vessel has 4 functions which are berth facility, LNG storage, regasification and thermal power plant, in one floating unit.
2. By converting the surplus of LNG Carriers to Floating LNG Power Vessels with small scale (~72 MW) to medium scale (~400 MW) power generation systems, Chiyoda offers Power Generation facilities at significantly “lower CAPEX” and with “shorter delivery times”.
3. By supplying electricity directly to land via heavy duty electrical cable, Chiyoda offers LNG Power Generation facilities in remote areas, including islands, by eliminating infrastructures such as LNG receiving facilities and onshore Power Generation facilities.

In May 2017, Chiyoda received Approval In Principle (AIP) on the Floating LNG Power Vessel concept from the American Bureau of Shipping (ABS).

The demand for Natural Gas as a source of environmentally friendly clean energy has expanded rapidly in recent years. Chiyoda offers the Floating LNG Power Vessel with its inherent high reliability as one of Chiyoda’s LNG Value Chain solutions.

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**Total Floater Development Solution Provider**

Through our subsidiary company, Xodus Group (Holdings), Chiyoda can provide Integrated Optimum Solutions combining Subsurface / SURF / Floater as a total development master plan and execute such plans as an EPCIC contractor.

- 4 million man-hours
- 14 strategically placed offices
- 8,500 projects
- 50,000 hours on largest project
- 300+ technical personnel
- 500+ clients
- 70+ MSAs

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14 offices: Aberdeen, Abu Dhabi, Doha (Chiyoda Corporation), Dubai, Edinburgh, Glasgow, Houston, London, Stromness, Olso, Perth, Southampton, Yokohama (Chiyoda Corporation)

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