

Lecture Note of Design Theories of Ship and Offshore Plant

# Design Theories of Ship and Offshore Plant

## Part I. Ship Design

### Ch. 2 Introduction to Offshore Plant Design

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1

## Contents

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- Ch. 1 Introduction to Ship Design
- Ch. 2 Introduction to Offshore Plant Design**
- Ch. 3 Hull Form Design
- Ch. 4 General Arrangement Design
- Ch. 5 Naval Architectural Calculation
- Ch. 6 Structural Design
- Ch. 7 Outfitting Design

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2

## Ch. 2 Introduction to Offshore Plant Design

### Natural Gas (NG)

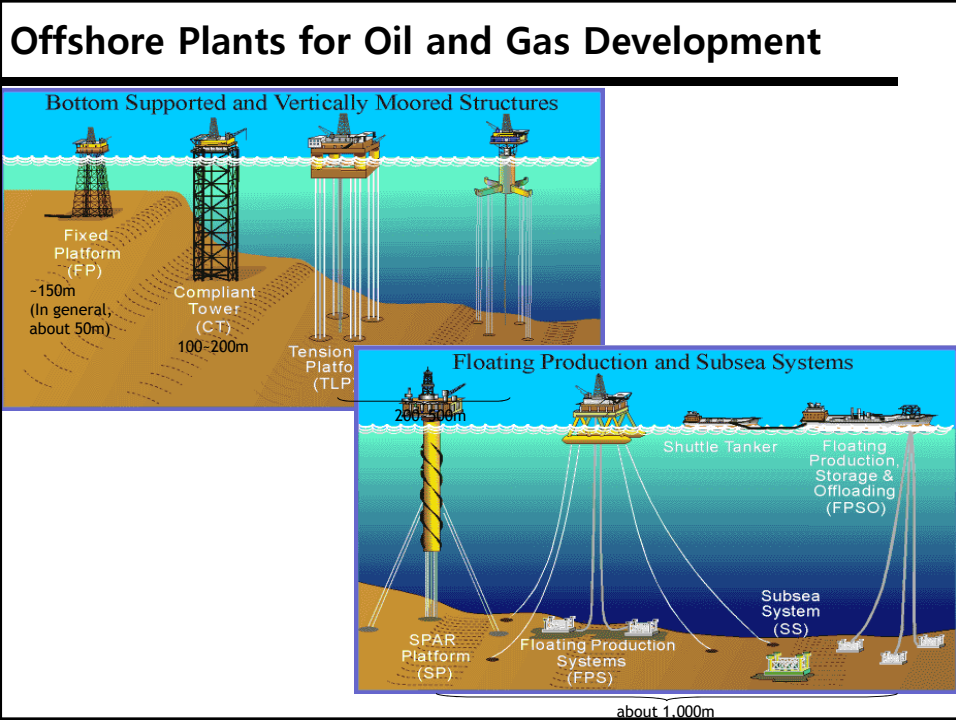
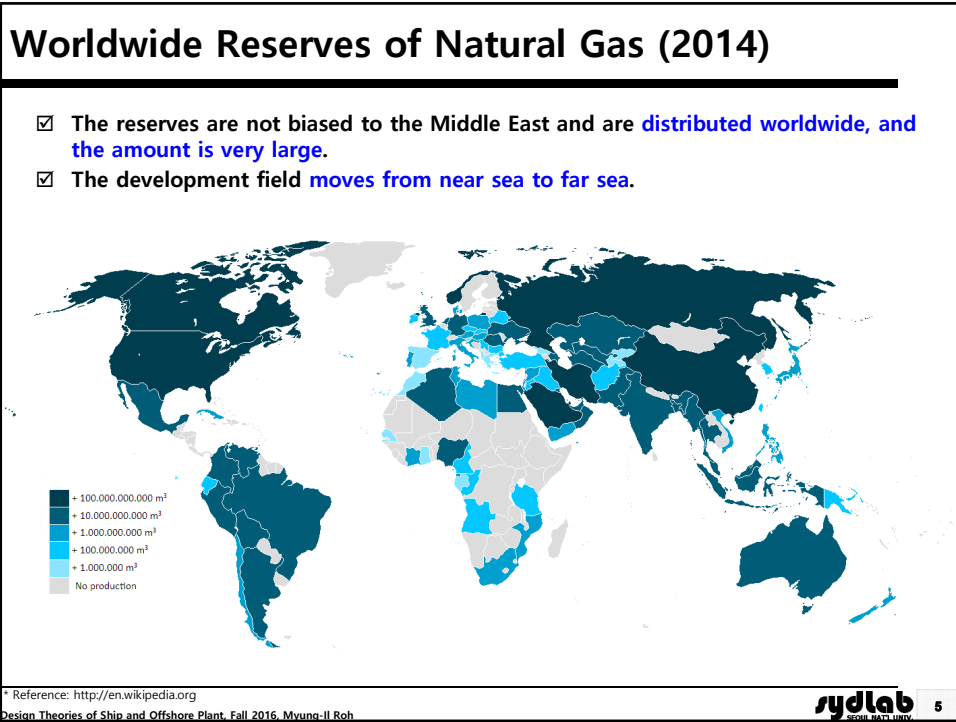
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#### Natural Gas

- Hydrocarbon gas mixture consisting primarily of methane ( $\text{CH}_4$ )
- Clean energy for preventing environmental pollution → Used for all fields of home, commerce, transportation, industry, etc.
- Providing about  $\frac{1}{4}$  of energy consumption of the world → It will be continuously increased.

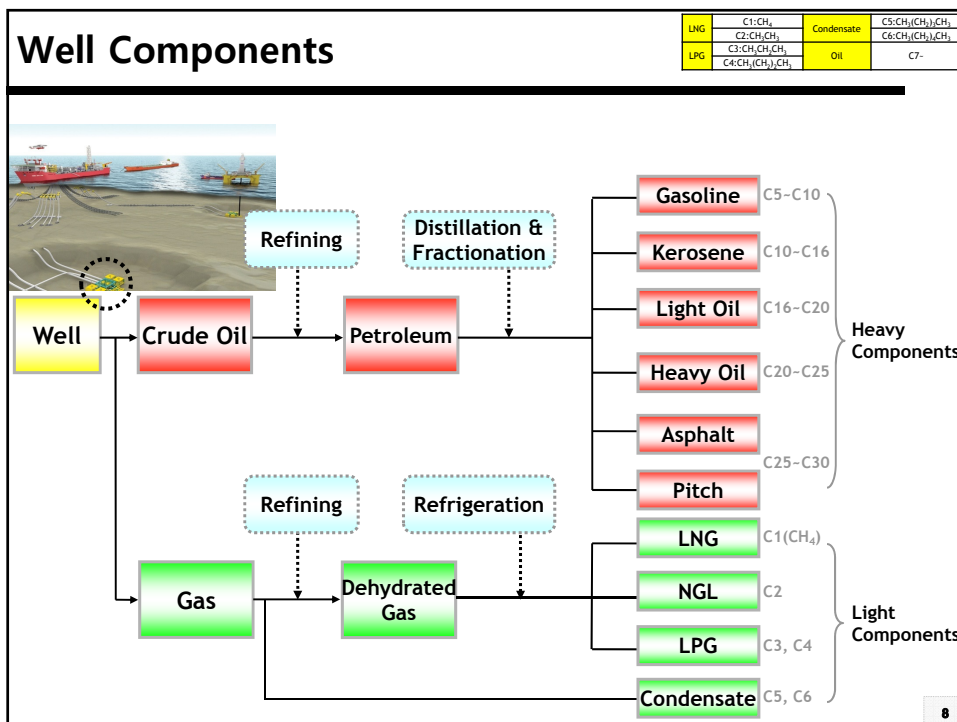
#### Special Features

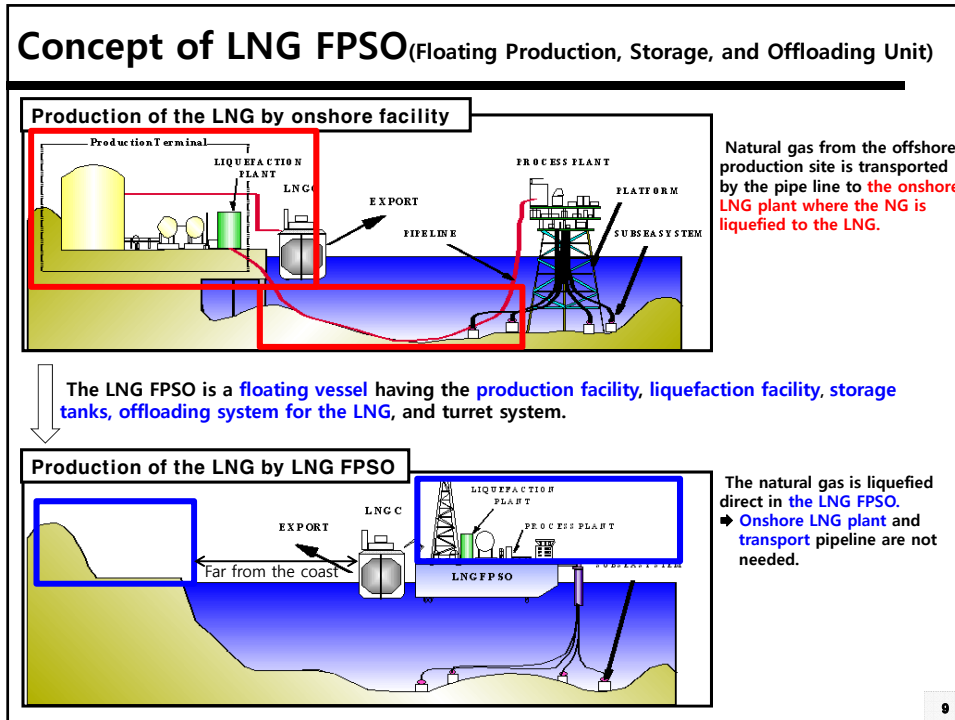
- Liquefied at  $-162^\circ\text{C}$  under atmospheric pressure → Liquefied Natural Gas (LNG)
- When liquefied, the volume becomes  $\frac{1}{600}$ . → Reason why we carry NG as LNG



## Offshore Plant for the Development of Deep Sea

- Production plant for separating the well stream into oil, gas, and water and then transferring them to onshore
- **Topsides** for the production and **Hull** for the storage of oil and gas
- **Process system** and **Utility system** for Topsides equipment and instruments
- Oil FPSO / LNG FPSO





### [Article] Shell decides to move forward with groundbreaking LNG FPSO.

**The World's First LNG FPSO**

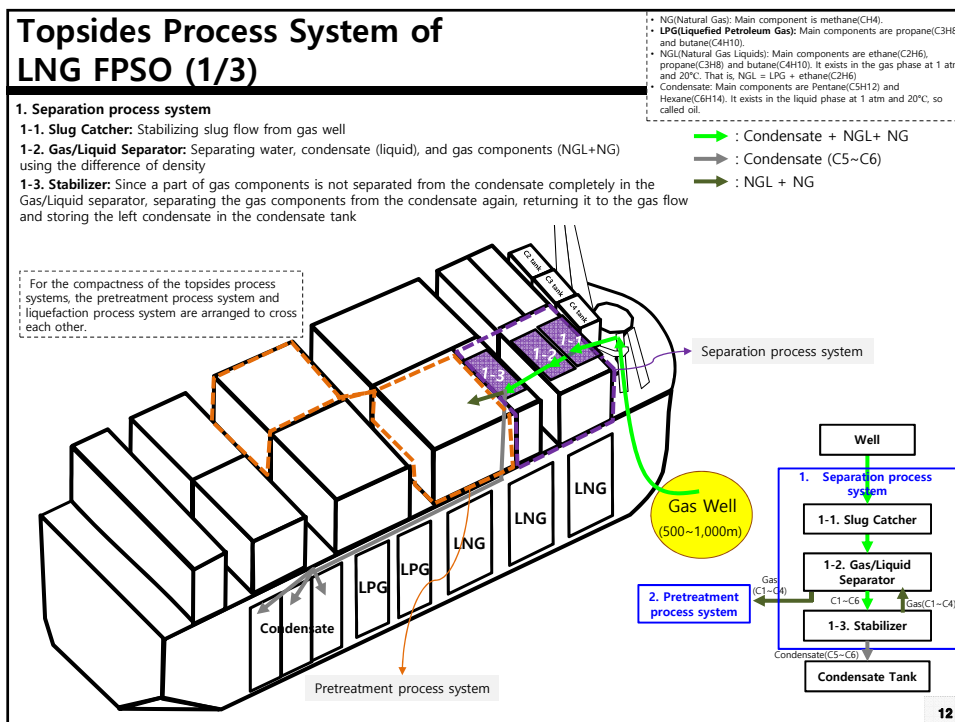
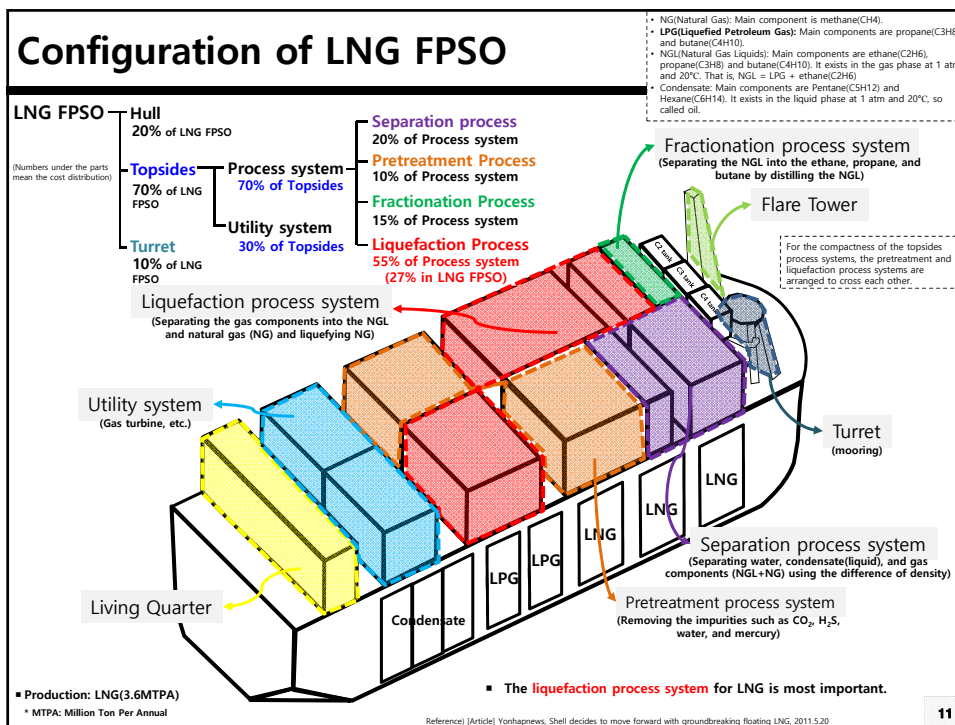
Shell, the world's largest oil company, is now ready to start construction of what will be the world's first LNG FPSO, in a ship yard, Samsung heavy industry, in South Korea.

LNG FPSO cools down the temperature of the natural gas (NG) from 27°C to -162°C to shrink in volume by 600 times.

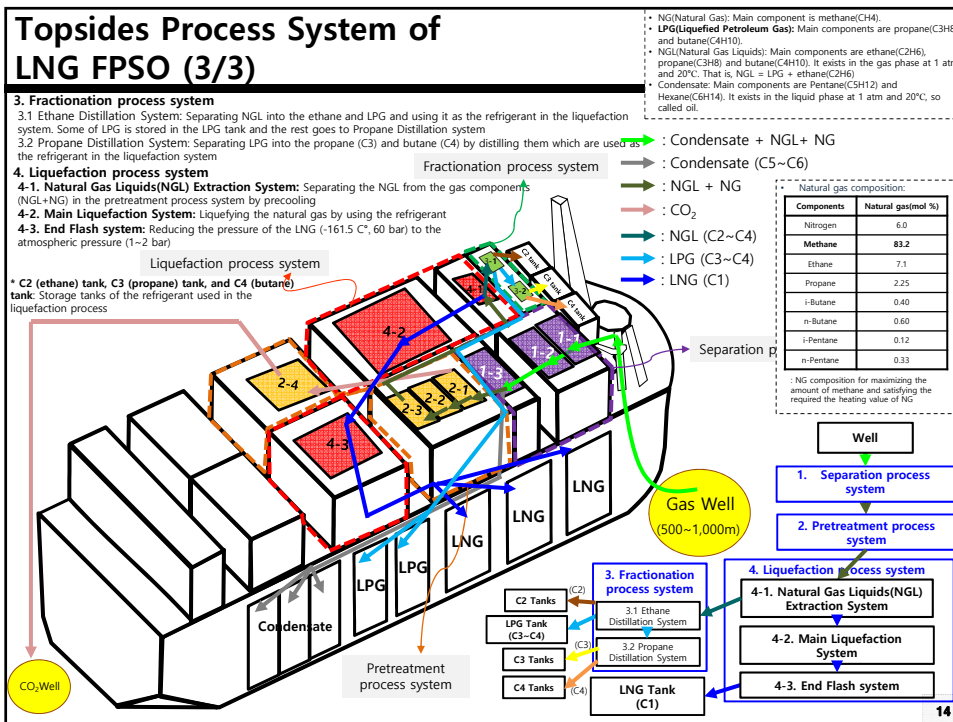
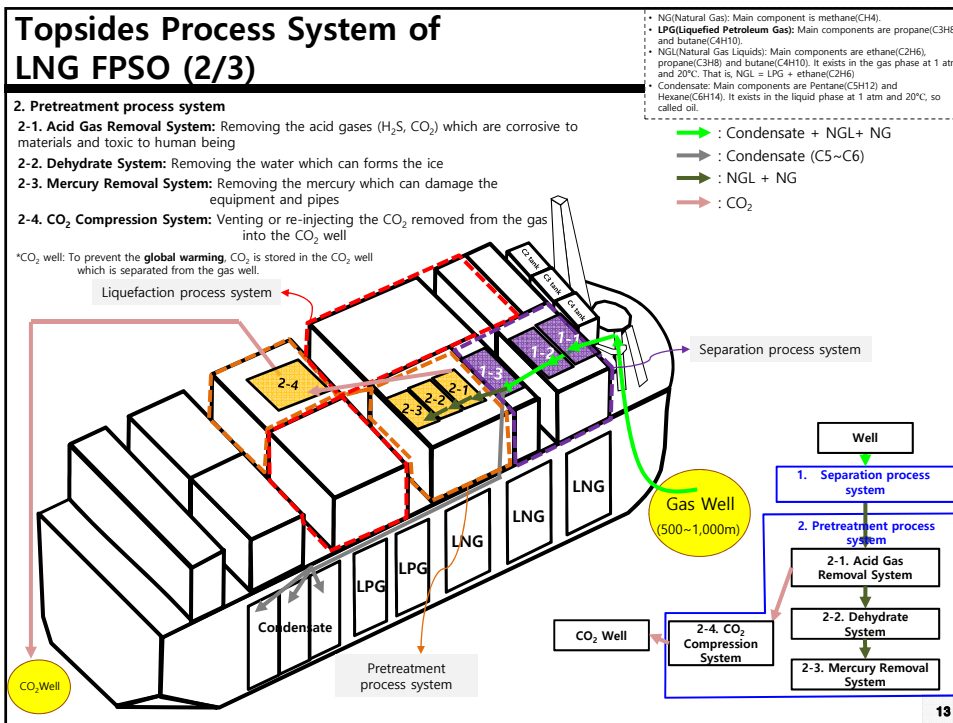
The liquefaction process system for LNG is most important system of the LNG FPSO.

\* MTPA: Million Ton Per Annual  
 \* Reference: [Article] Yonhapnews, Shell decides to move forward with groundbreaking floating LNG, 2011.5.20  
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10







## Development Procedures of FPSO and Importance of FEED

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### Development Procedures of FPSO

- ☑ **Topsides FEED(Initial or Basic Design): Estimation of building cost, total weight, and layout of topsides by determining specifications of all systems according to owner's requirements**
- ☑ **Our shipyards only take charge of after detailed design or production.**
- ☑ **In the case of topsides FEED, they are dependent on foreign design companies with about 10~20M\$ per offshore plant.**

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## Procedures of Topsides Process FEED of Offshore Plant

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**< Offshore Process FEED Activities >**

① Design Criteria

- ↳ Required Daily Consumption of Production
- Well Components and Physical Data
- Well Capacity
- Environmental and Geographical Factor
- Product Specification
- HSE(Health, Safety, Environment) Req.

② Process Simulation / Utility Consideration

↳ Determine physical, thermodynamic properties of each process stream = Heat & Material Balance

③ Process & Utility Calculations

↳ Determine the size & capacity of equipments & instruments

④ PFD(Process Flow Diagram)  
UFD(Utility Flow Diagram)

↳ Make a drawing to show the safety & control logic of overall topside systems and heat & material balance tables

⑤ PED(Process Equipment Datasheet)  
PID(Process Instrument Datasheet)

UED(Utility Equipment Datasheet)  
UID(Utility Instrument Datasheet)

↳ Make datasheets to show equipments and instruments data for performing procurement, construction, and operation of the topside systems

⑥ Preliminary P&ID (Pipe & Instrument Diagram)

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