



HOW TO DEVELOP AN ECONOMICAL SMALL CAPACITY FLOATING LNG TAKING ADVANTAGE OF A DESIGN FOR A LARGER CAPACITY UNIT

By

ERIC JEANNEAU, TOTAL E&P FLNG Development manager
DENIS CHRETIEN, TOTAL E&P LNG process development manager
DOMINIQUE GADELLE, TECHNIP VP Upstream / LNG

18th April 2013

LNG17- HOUSTON 2013- TOTAL- How to develop an economical small capacity FLNG



Technip
take it further.



Agenda

- 16 years of Operating experience offshore
- 13 years of FLNG development
- Basis of Design of the Generic Total FLNG 2.5Mtpa
- How to develop an economical small FLNG
- Basis of Design for the 1Mtpa FLNG
- Process simplification
- Architecture simplification
- Layout which preserve the key criteria: safety, simplicity, operability
- Leverage on Technical Cost break down
- Conclusions
- film



- First oil 2009



- First oil 2011



- First oil 2012



- First oil 2014
- Contract execution



- Contract CFT



- First oil 2008



- First oil 2006

***PROJECT EXECUTION AND
OPERATIONAL FEED BACK
FROM FPSO-FPU TO FLNG***



- First oil 2001



- First oil 1996





Our **FLNG design philosophy** is based on TOTAL experience with LNG plants, LNG shipping and FPSO design and operation

Supported by **TOTAL corporate technical referential, certified ISO9001**

13 years of R&D program to support FLNG design

- Process, liquefaction optimization
- Transfer system and cryogenic flexible
- Qualification and implementation of new technology

FLNG basis of design

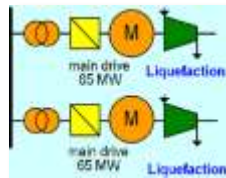
SAFETY , OPERABILITY, SIMPLICITY



<i>FLNG Basis of Design</i>	<i>TOTAL DESIGN</i>
Liquefaction process	Inert gas N2+CO2
Compressor drivers	Electrical drive
LNG storage	Membranes
LNG transfer	Tandem Offloading
flare position	at the stern
Living Quarter	up wind at the bow



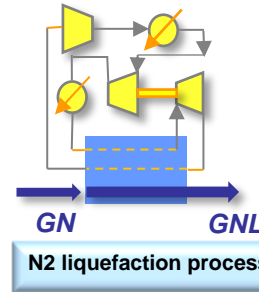
Internal Turret



E-FLNG



Tandem



N2 liquefaction process



Membranes

The main HSE Design criteria

- Protection of the personnel on board, LQ up wind at bow and flare at stern
- Reduction of Hydrocarbon inventory by using inert gas liquefaction process
 - Reduction of colision risk by using tandem LNG offloading
- No Hot point in the process by using Electric-only drive configuration

- Main challenges to down scale to a small FLNG
 - Process selection
 - Lay-out arrangement
 - Storage capacity plan optimization
 - Define what is the maximum-optimum size achievable for each equipment
 - No compromise on Safety & Operability

The aim of this study was hence to explore the means of simplification in order to reduce the investment as much as possible



Technip
take it further.

SMALL FLNG BASIS OF DESIGN



- Based on a Gulf of Guinea Generic field
- Process Basis of Design
 - 1.2 MMTPA of LNG FOB
 - CO₂<1%, No H₂S
 - No LPG's production.
 - Liquefaction pressure = 80 bars
- 3+1 Gas turbines generators
- Plant availability = 90%

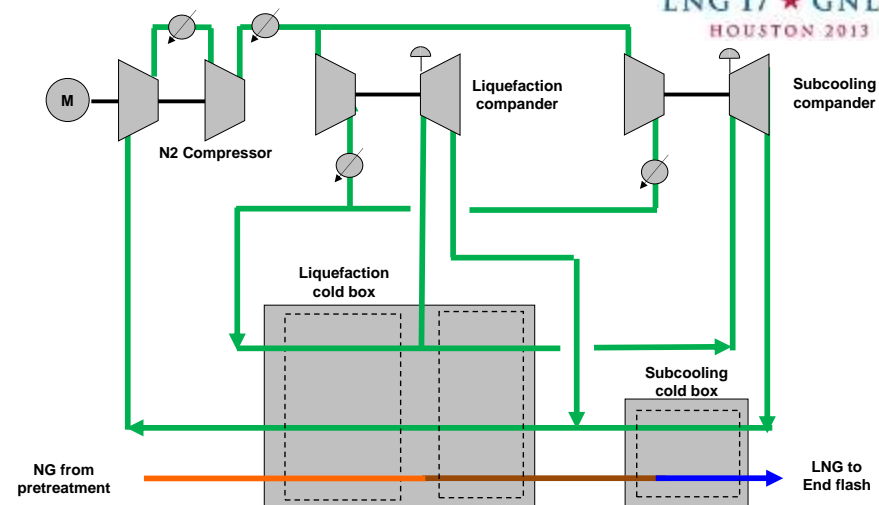
PROCESS SIMPLIFICATION



LNG 17 ★ GNL 17
HOUSTON 2013

2.5Mtpa FLNG

- 2 trains of liquefaction
- N₂ + CO₂ pre-cooling
- 5+1 gas turbines generators
- NGL recovery unit for heavies
- Heating medium : steam
- End flash and BOG compressors
- Cold recovery on EFG



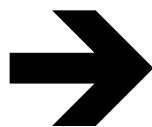
1.2Mtpa FLNG

- 2 smaller trains of liquefaction
- No CO₂ pre-cooling
- 3+1 gas turbines generators
- NGL recovery unit for heavies
- Heating medium : hot water
- End flash in tanks : EFG & BOG compressors merged
- No cold recovery on EFG



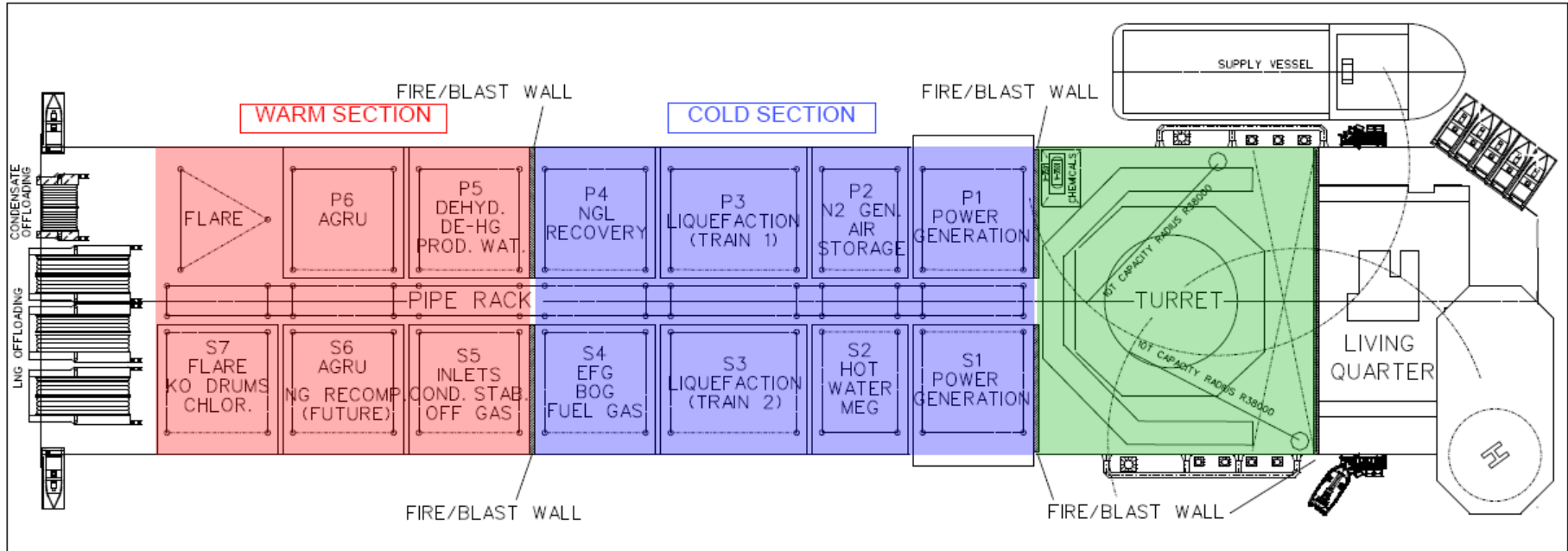
2.5Mtpa FLNG

- Storage based on 155,000 m³ Lot
- Tandem LNG offloading with hoses
- Module weight : max 2500 t
- Turret mooring
- Elec. & Inst. room on deck
- The power generation on deck



1.2Mtpa FLNG

- LNG storage 75,000m³
- Tandem LNG offloading with cryogenic hoses
- Module weight : max 2500 t
- Spread moored configuration
- Elec. & Inst. room in hull space
- The power generation on deck with cantilever



Main characteristic of the 1.2Mtpa (FOB) FLNG

- Hull size = 300m x 61m
- Topside Modules gross dry weight = 28.000 tons
- Electrical Power requirement = 100MW
- LNG & Condensate storage

Feed Gas transfer cost:

- Gas pipe price or
- Drillex + SPS + UFR

FLNG Upstream

- CGR, CO2
- Mooring type

FLNG downstream

- Liquefaction

OPEX

OTHER COST

- pre-FID cost
- insurance
- taxes

Economical interest

- Return On Investment
- Pay out Time
- Government Taxes

Small FLNG architecture can present economical interests

- Based on its experience in building and operating FPSO's, TOTAL has decided upon some options in the design of the FLNG whatever the production between 1Mtpa to 4Mtpa

SAFETY, SIMPLICITY and OPERABILITY

- The main applications for which such small FLNG can be considered economical are as follows:
 - Offshore stranded gas field with low CO₂ content + high CGR
 - Associated gas available from offshore oil field
 - Near shore location to liquefy country excess gas or shale gas

Floating LNG
Exit



INTERVIEWS
DOCUMENTATION

Floating LNG

A solution focused on innovation, safety and operability

Total's design is based on an inert-gas liquefaction cycle, tandem offloading and electric-only drive: choices that ensure the safest and most reliable solution on the market. Our FLNG vessel is ready to produce, liquefy and offload natural gas on the high seas.





New gas resources

The economically viable solution for difficult-to-access reserves



The expertise of a major player

The solution of a specialist in FPSOs, the deep offshore and LNG processes



Safety, an absolute priority

The foundation of the design process: managing risks and keeping people safe



Operability and performance

Flexible, straightforward technologies to overcome the challenges of the offshore environment

©Total 2012 | Legal terms

DICLAIMER and COPYRIGHT RESERVATION

The TOTAL GROUP is defined as TOTAL S.A. and its affiliates and shall include the party making the presentation.

Disclaimer

This presentation may include forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995 with respect to the financial condition, results of operations, business, strategy and plans of Total that are subject to risk factors and uncertainties caused by changes in, without limitation, technological development and innovation, supply sources, legal framework, market conditions, political or economic events.

Total does not assume any obligation to update publicly any forward-looking statement, whether as a result of new information, future events or otherwise. Further information on factors which could affect the company's financial results is provided in documents filed by the Group with the French *Autorité des Marchés Financiers* and the US Securities and Exchange Commission.

Accordingly, no reliance may be placed on the accuracy or correctness of any such statements.

Copyright

All rights are reserved and all material in this presentation may not be reproduced without the express written permission of the Total Group.