GTL AS AN OPTION FOR MONETIZING THE NATURAL GAS FROM PRE-SALT

Rio Pipeline 2019 – EPE Stand

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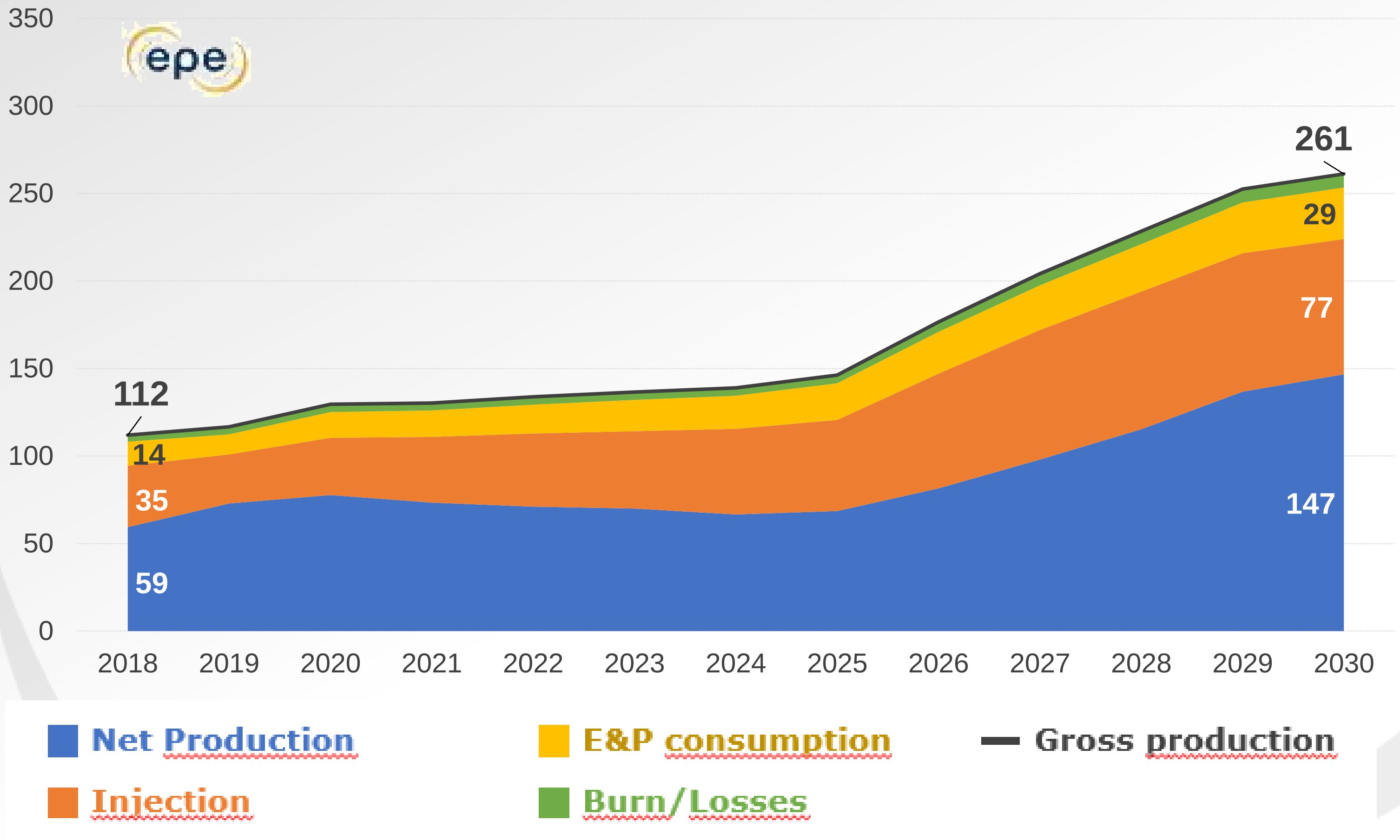
Agenda

- Introduction
- Monetization strategies via FGTL
- Case Study
  - Technical and economic assumptions
  - Results
  - Discussion – pros and challenges
- Final remarks

Introduction

Natural gas gross and net production (MMm³/d)



- Most of the increase in NG production will come from **pre-salt**
- **High** injection rates

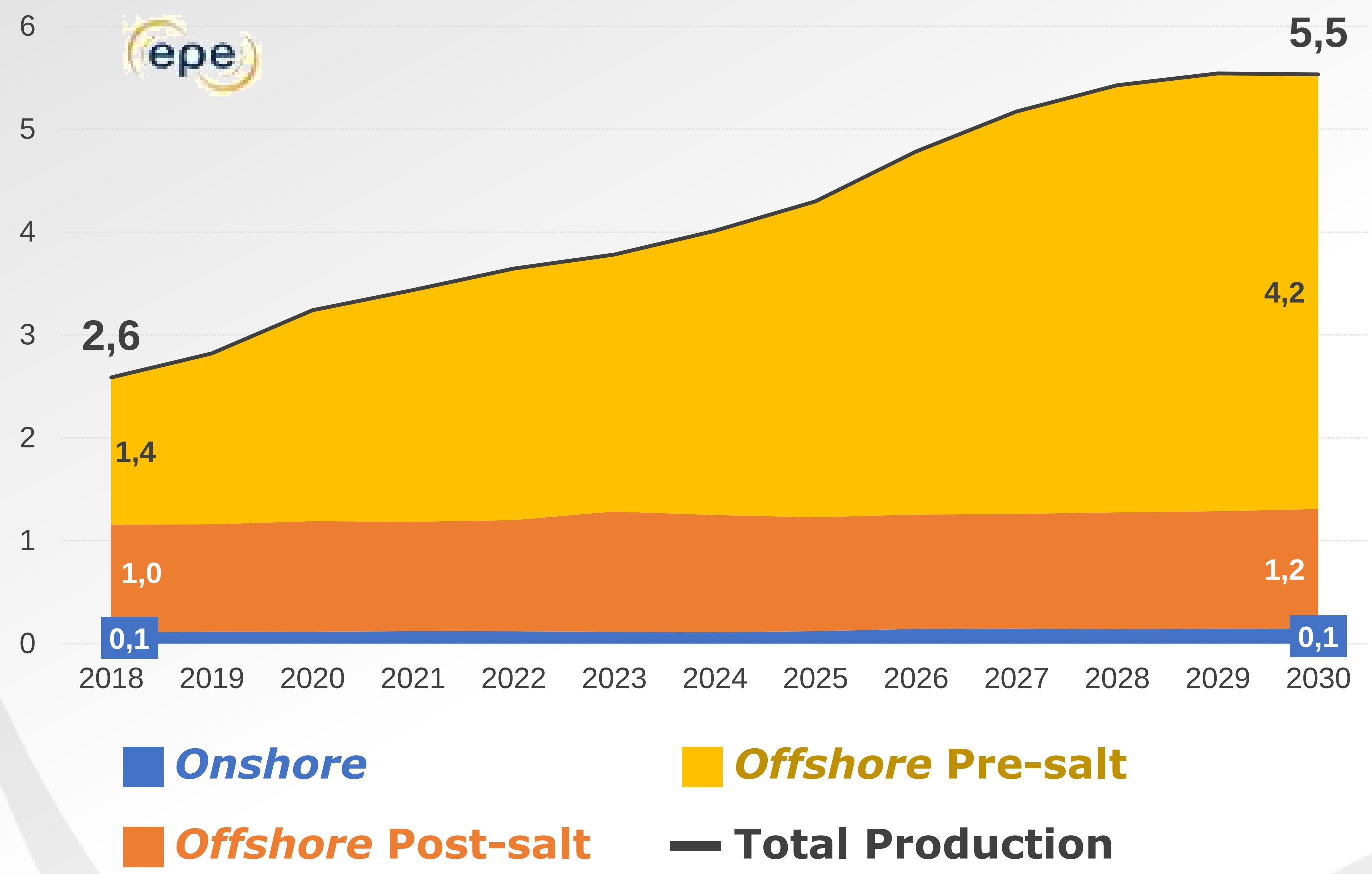
↓

FGTL

Source: EPE.

Introduction

Oil production by exploration environment (million barrels per day)



- Brazil will be one of the largest producers and exporters of oil in world

- However, it is estimated that Brazil will continue to be a net importer of fuels, mainly **naphta** and **diesel**

↓

FGTL

Source: EPE.

Introduction

FGTL technology

Natural Gas[1] → **Reforming** → **Syngas (mainly H_2 and CO)** → **F-T Process**[2] → **Syncrude** → **Upgrading** → **Diesel, Naphta Kerosene and LPG**

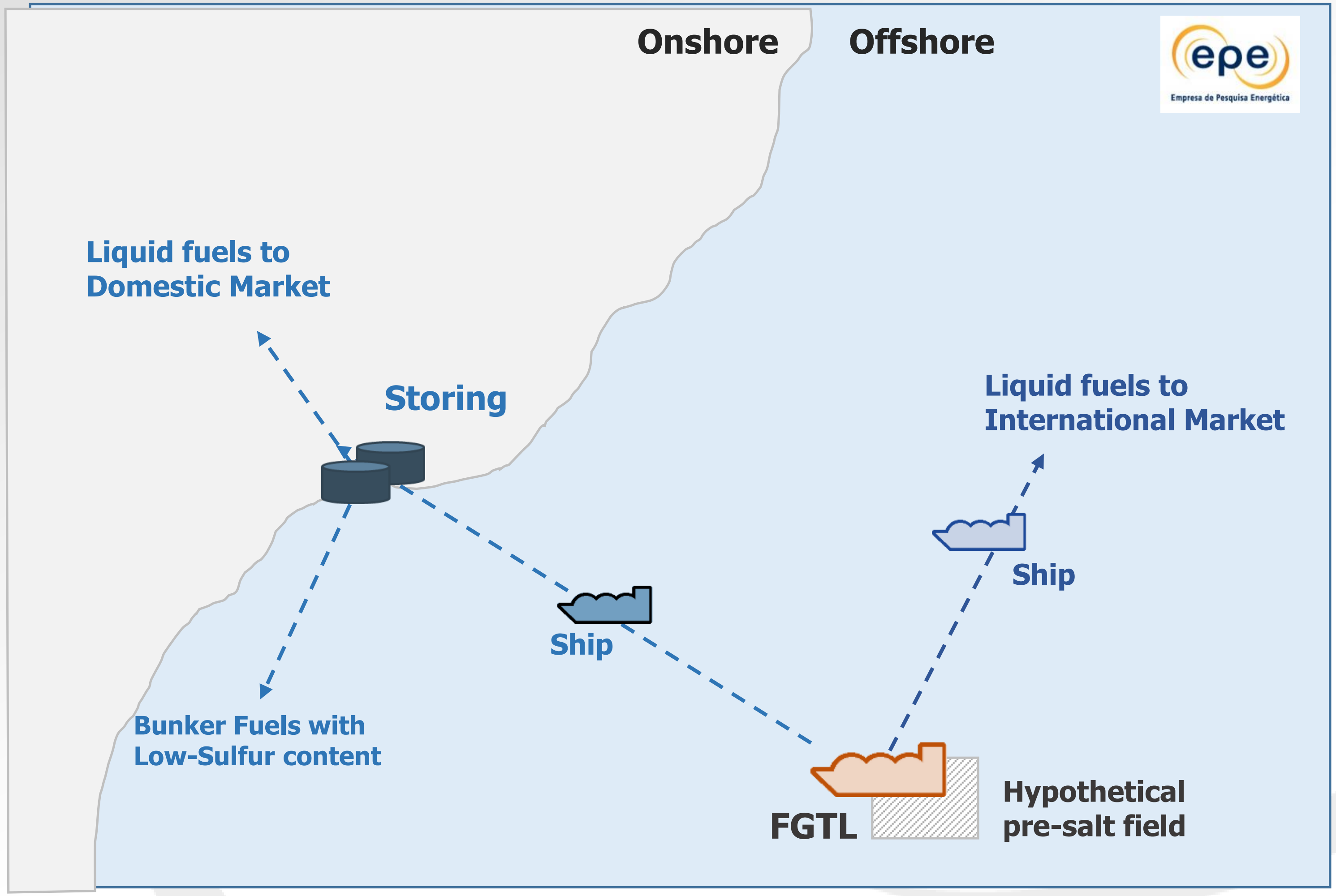
production of low sulfur petrochemicals – IMO 2020

There are no FGTL facilities in the world yet, although GTL onshore technology is already well established.

Pearl GTL -capacity of 140.000 bbl/d liquid fuels
Source: Shell

[1] Chemical reaction with water vapor and CO_2
[2] Fischer-Tropsch process

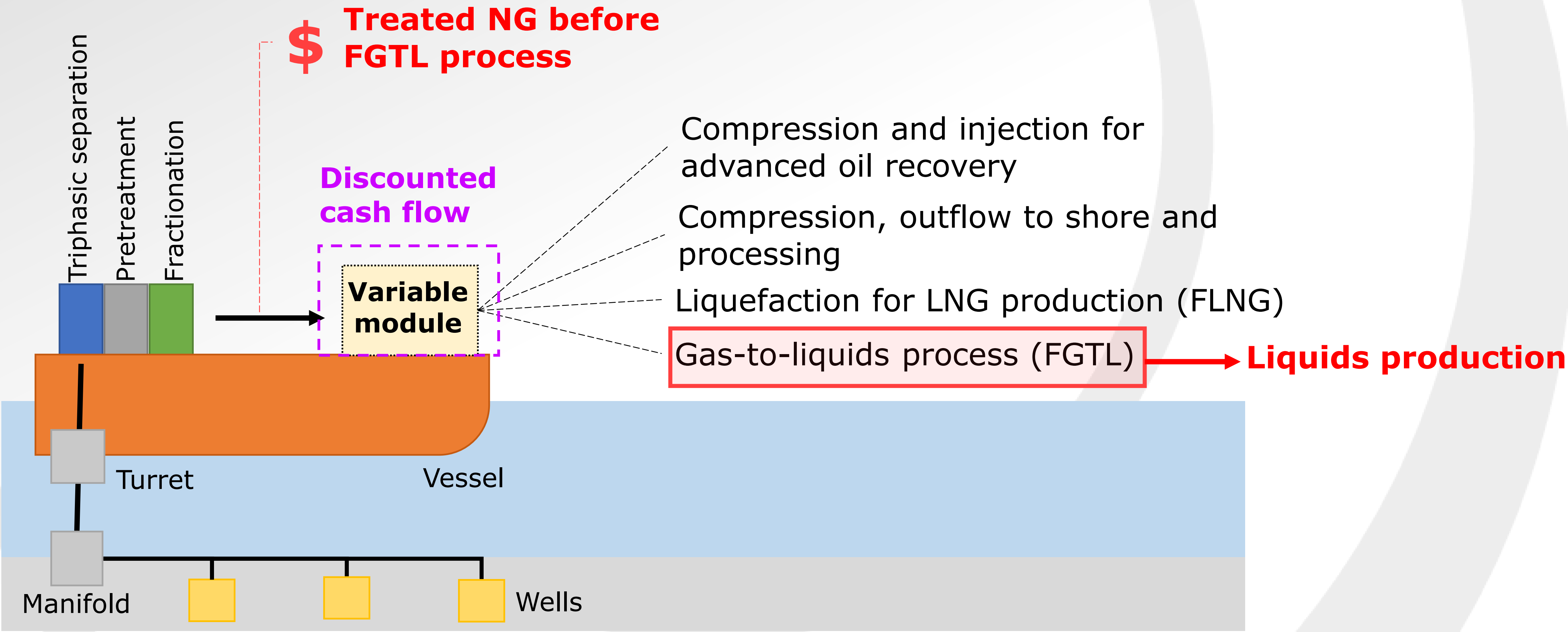
Monetization strategies via FGTL



Source: EPE.

Case study

Benchmark for price analysis of FGTL project



Source: EPE.

Case study

Technical and economic assumptions

Technical assumptions		
Capacity of liquid fuels production*	19.680	bbl / day
Conversion Rate	283	m^3 NG / syncrude bbl
Construction period	3	Years
Operation period	12	Years
Economic assumptions**		
CAPEX	805	MMUSD
OPEX	8.8%	CAPEX / year
Taxes and Fees		
WACC	10%	
Income Tax (IR)	25%	
Social Contribution on Net Income (CSLL)	9%	

* Corresponding to approximate production of pre-salt fields – 5,6 MMm^3/d
** Cost estimates were adapted from onshore GTL costs data using a marinization factor

Source: EPE, based on ETIM (2007).

Case study

Composition of FGTL plant products and their sales prices

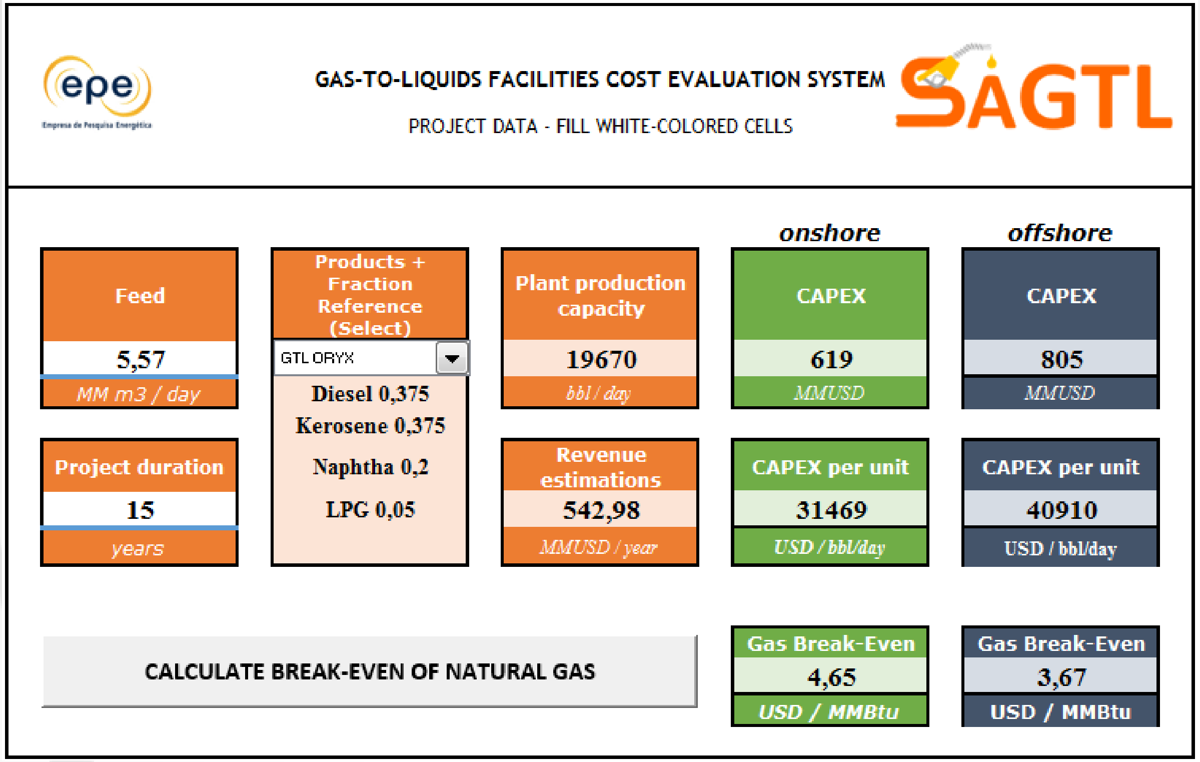
Product	Fraction[1]	Market Price[2] (US$/bbl)
Diesel ULSD	37.5%	82.39
Kerosene	37.5%	94.88
Nafta	20%	52.53
GLP	5%	28.41

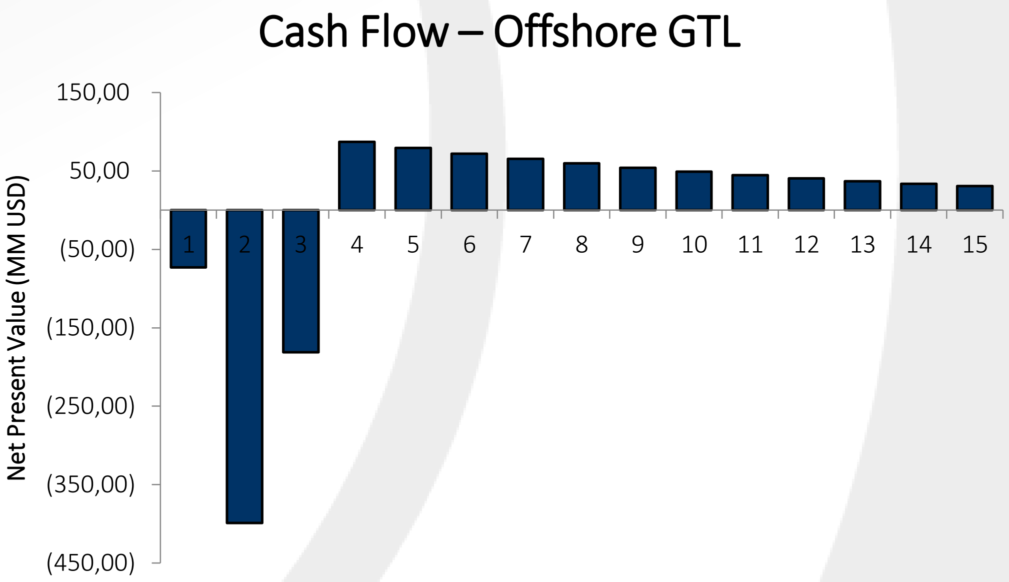
[1] Based on Oryx GTL onshore plant composition of products
[2] Market prices consulted from ANP data

Source: EPE, based on ANP (2019a); ANP, (2019b), GLEBOVA, (2013).

Case study

Results





Gas-to-liquids cost evaluation system - **SAGTL**

Case study
Results

Break-even prices for treated natural gas - before liquefaction stage

US$ 3.67 / MMBtu
Offshore GTL

compatible

Break-even price range for pre-salt natural gas* (CO_2 content up to 10%)

US$ 2.0 to 5.00 / MMBtu

Several fields whose NG price would be < US$ 3.67/MMBtu

FGTL strategy economically feasible, under the conditions studied

* Even after outflow to land and processing in NGPP, with sale of liquids

Case study

Discussion

Why FGTL? - Pros

Production of high purity fuels, reduced in content of sulphur.

Reduction of imports of liquid fuels and natural gas injection.

Why FGTL? - Challenges

FGTL application has not been yet applied in offshore environment

There are technical challenges inherent to GTL adaptation in pre-salt environment, with adverse meteo-oceanographic conditions

- height limits for shipping towers
- required dynamic stability of some equipments

Case study

Discussion

Why FGTL? - Challenges

FGTL market is pushing toward small-scale and modular units

- Compact GTL´s modular plant
- Calvert Energy Group /OxEon modular GTL

Commercial demonstration plant, designed to operate on a FPSO unit

Source: Compact GTL

Final Remarks

- ✓ The break-even value of an **FGTL unit** was calculated and resulted in **US$ 3.67/MMBtu.**
- ✓ However, the FGTL application needs to be further studied mostly due to adverse **meteo-oceanographic conditions of pre-salt.**
- ✓ Estimates of CAPEX and OPEX used were based on literature sources and **may vary** given the specificities of the projects.

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