Colombia – LNG Supply Options

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Agenda

- Introduction
- Why does Colombia need LNG
- Overview of the LNG value chain
- Overview of floating regasification
- Potential application of FSRU schemes in Colombia
- Commercial structures for Colombia

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Scope of Work agreed between David Ledesma – South-Court Ltd dated 1st March 2011

Task 1 - To identify high level technological alternatives for the import of LNG into Colombia during El Niño

Task 2 - To design alternatives of business schemes for the development of facilities that were studied in task 1

Task 3 - To arrange meetings about schemes identified in task 2 to potential developers

Task 4 - To evaluate the interest of potential developers.

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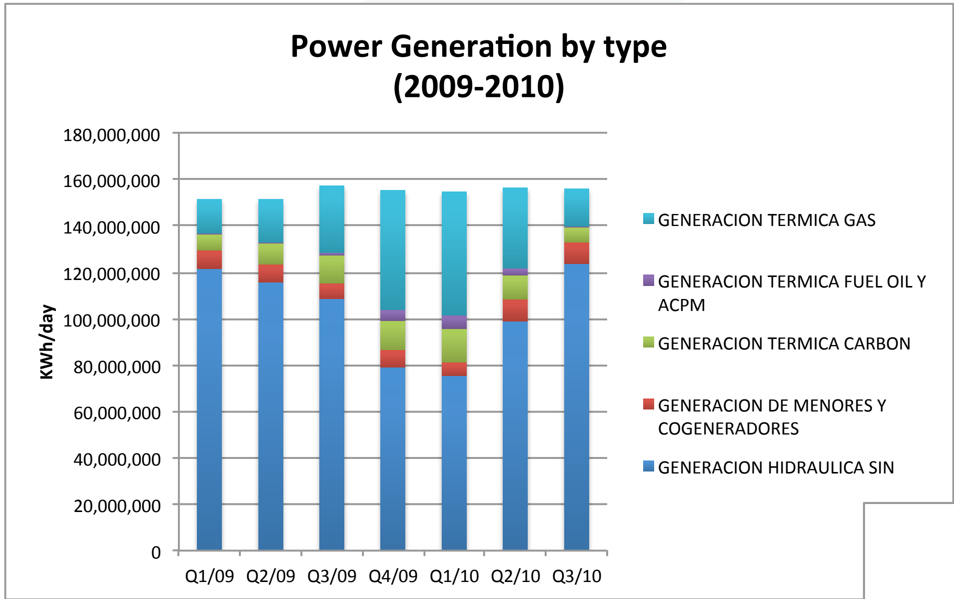
Why does Colombia needs LNG?

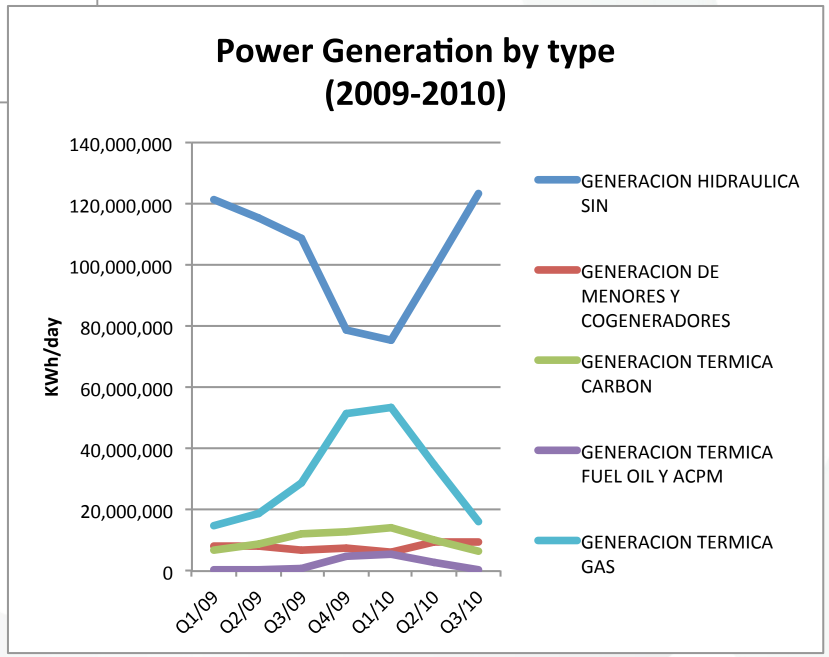
- The system is seemingly balanced
  - Production ~ 1.09 bcf/day
  - Consumption ~ 0.83 bcf/day
  - Export ~ 0.25/ bcfday
- The problem is during El Niño

Period	Power from Hydro	Power from Gas	Power from coal/oil/other
Q1/09-Q3/10	67%	20%	13%
Q1/09-Q3/10 EXCL Q4/09 & Q1/10 the period of El Niño	74%	15%	11%
Q4/09-Q1/10 - the period of El Niño	50%	34%	16%

During El Niño power generation from gas increases

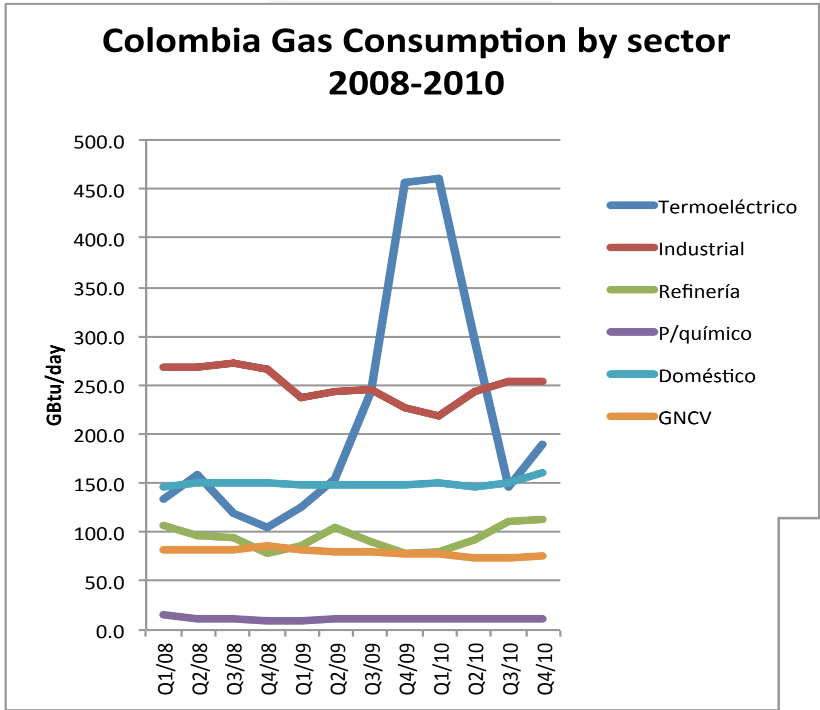


Power generation from gas increases from ~ 22,570,000 KWh/day to ~ 52,500,000 KWh/day during El Niño

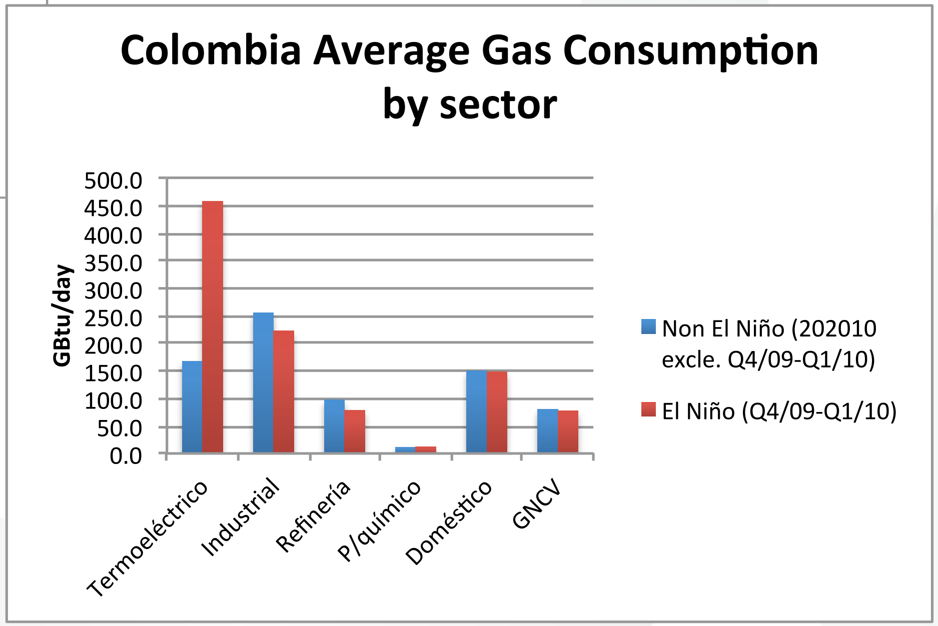


Source: Data from CREG, South-Court Analysis. See main report attachment 2 for data.

The challenge is to ensure balanced gas supply during El Niño

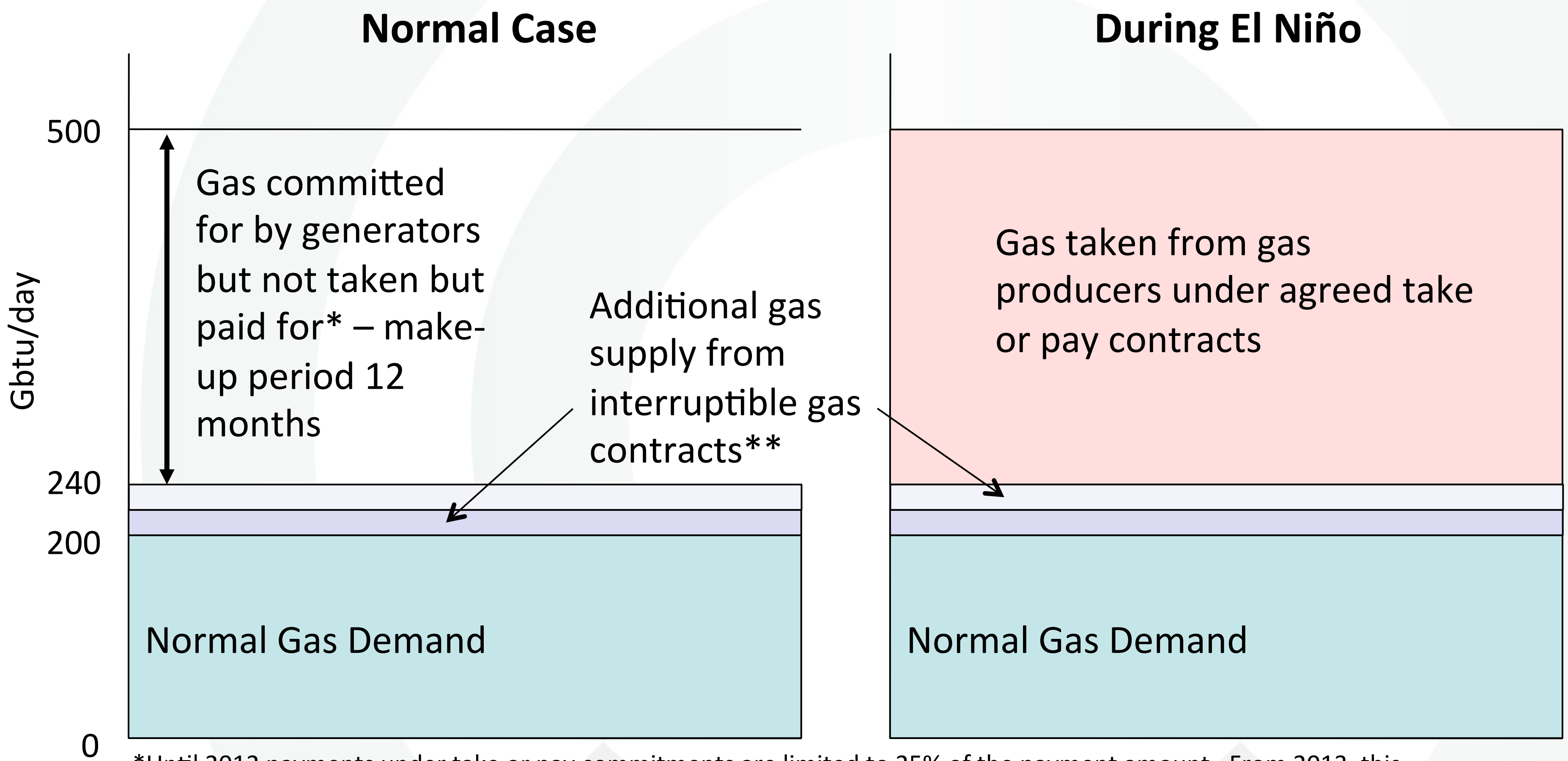


- Gas supply to power increases from ~ 170 million to ~ 460 million Scf/day during El Niño
- Gas for power rises from 22% to 46%



Source: Data from CNO Gas, CREG, South-Court Analysis. See main report attachment 2 for data.

Power producers manage El Niño gas supply through committing to domestic gas



*Until 2012 payments under take or pay commitments are limited to 25% of the payment amount. From 2013, this percentage may increase to 80-90% thus increasing liability to the power producers

** Interruptible contracts are for 20-40 Gbtu/day

Source: South-Court Ltd research

El Niño occurs on a regular and reasonably predictable basis 1/2

- By August/September each year its should be possible to predict that El Niño (and therefore lower rainfall) will occur from December that year
- The period of El Niño varies 11-19 months
- The potential volume of 250-350 million Scf/day of gas imports from LNG represents 32-46 LNG cargoes per annum (i.e. one cargo every 8-11 days)

El Niño occurs on a regular and reasonably predictable basis 2/2

- During period of low rainfall power producers still need to produce power under the terms of the Firm Obligation Reliability Payment.
- If, during periods of El Niño, power producers cannot produce power, then they would cover the shortfall by:
  - buying power from other power producers (gas, oil or coal)
  - buy gas from domestic supply
  - buys gas from LNG at a higher feedgas cost and charge a spot market price for power (it should be able to recover all or part of its additional energy feedstock costs)

LNG as a gas supply source for Colombia

- Colombia could meet gas shortfall through LNG imports
- The issue is that:
  - the volume of LNG required on an annual basis is uncertain, as it will not be known in advance how severe El Niño is going to be
  - to import LNG on a short-term basis, the necessary facilities need to be in place
- The LNG requirement, therefore, has two elements:
  Facilities – An LNG regasification facility – either permanently in place or available on 3-4 months notice
  LNG Supply – To be sourced on a requirement basis, volume and delivery dates to be advised at the time (could be 1-2 months ahead of delivery)

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LNG Chain – Gas Use, Capex and Unit Costs

	Upstream	Liquefaction	Shipping	Regasification	Total
					
Gas Use		**10-14%**	**1.5-3.5%**	**1-2%**	**12.5-19.5%**
Capex	**$2–6bn**	**$6-10bn**	**$1-2.5bn**	**$1-1.5bn**	**$10-20bn**
Unit Cost In $/MMBtu	**$1-3**	**$3-4.5**	**$0.8-1.5**	**$0.4-0.8**	**$5.2-$9.8**

Capex estimates based on an 8mtpa project

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Why Floating regasification

- Land based systems are expensive
- Floating regasification facilities can be developed faster than land based alternatives (1-2 years vs. 4 years)
  - Easier to secure permits
- Can locate floating regasification units close to market (more difficult with onshore facilities)
  - Close to gas infrastructure and major gas consumers
  - Close proximity to onshore support services
- Minimise environmental impact due to offshore location
  - No visual impact on and from the coastline
- Lower cost and flexibility enables intermittent LNG supply

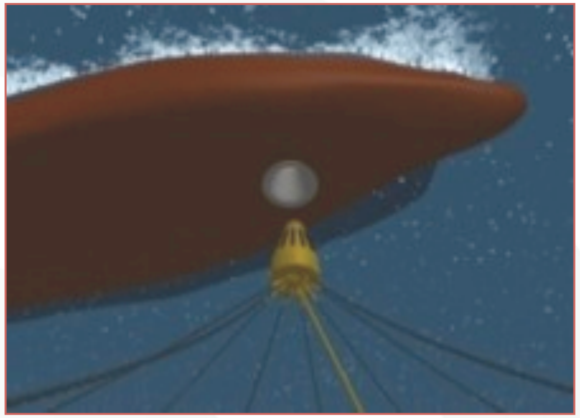
Use of Ships as FSRUs (1/2)

- Regasifiers are installed on a conventional LNG ship
- Regasification and ancillary equipment can be designed and built into a new ship or installed as a conversion of an existing vessel
  - New build 24-30 months
  - Conversion ~ 12 months
  - Times vary depending on shipyard
- Not usually possible to use a converted vessel for standard trade. FSRU conversions normally operate as static regasification terminals when no cargoes are being received

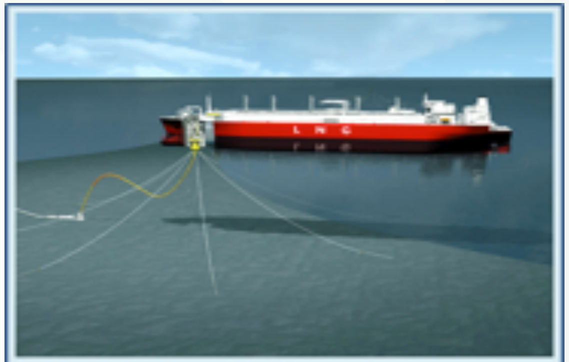
Use of Ships as FSRUs (2/2)

- Typical base load capacity 300 to 500MMscf/d (2.3 to 3.8mtpa) with peak throughput of 700MMScf/d (5.4mtpa)
- Ship is moored at an offshore location or in a port and connected to the gas grid by pipeline
- When vessel empty it:
  - either returns to the liquefaction plant to reload, or
  - a second LNG ship comes alongside the moored ship and trans-ships its cargo
- The moored ship regasifies the LNG as required by the market

FSRU discharge systems



Source: Excelerate



Turret gas discharge system

Loading systems are effectively the same as standard vessels, the difference is how gas is sent to to market

<u>Submerged turret unloading system -</u> Offshore discharging system using a turret and flexible riser pipeline.

- Vessel has a purpose built turret reception system
- The gas is piped to shore using new or existing gas pipelines.
- The system ideally needs water depths of 100+ metres

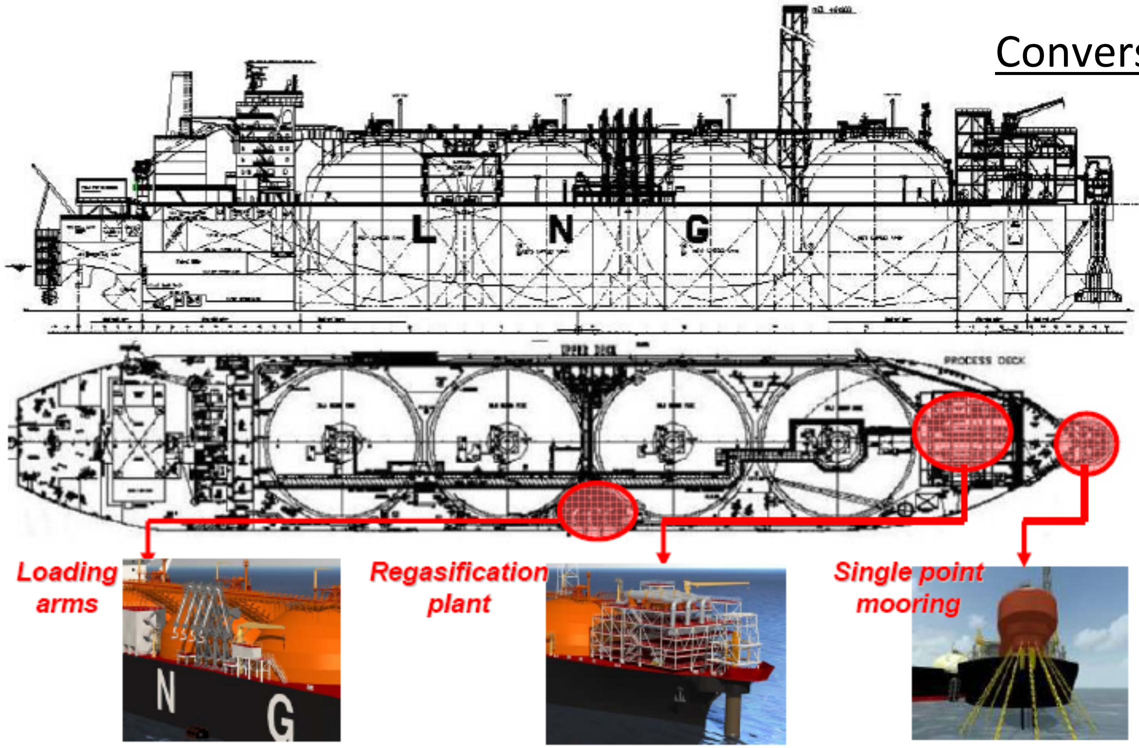
Source: Excelerate

<u>Gas jetty system</u> – Gas is discharged via a simple gas connection in its deck

- FSRU moors alongside the jetty
- Vessel connects to high pressure arm on a jetty
- No LNG discharged, so no need for any onshore cryogenic pipelines or equipment

Main features of an FSRU

Conversion



Source: Eon Ruhrgas OLT Conference Presentation

New-Build

Source: Excelerate

Excelerate Energy (USA) - 8 FSRUs in operation
(138,000m^3 to 151,000m^3 in size)
Golar LNG (Norway) - 4 FSRUs in operation
(125,000m^3 to 137,000m^3 in size) and one in conversion
GdFSuez (France) - 2 FSRUs and one FSU in operation
(145,000m^3 in size).
Other players are planning to enter the market

FSRU vaporisation systems

- Regasification process requires the addition of heat. Two systems:

1. Closed loop
   - Uses a portion of the gas (LNG) on board as fuel gas which heats the LNG. For FSRUs the fuel gas used is 2% or higher of the gas send out
   - Could be additional planning and environmental considerations (for example NOx and SOx emission)
2. Open loop
   - Uses sea water so use very little gas as fuel for vaporisation, typically 0.5% or less (for power generation/pumping)
   - Open loop vaporisation may not be allowable in some locations due to concerns about the effects of water cooling in the vicinity of the FSRU and its effects on marine life

New Build or Conversion?

- Environmental performance depends on:
  - Fuel consumption
  - Boil-off rate
    - New-build: 0.10-0.15% per day
    - Conversion: 0.20-0.25% per day
    - Larger vessel
    - Increased emissions CO_2, NOx, VOC (volatile organic compound)
- Fuel consumption
- Guaranteed life of FSRU
- Dry dock and maintenance cost
- Refurbishment cost
- Increased risk on old vessels
- Commercial attractiveness in the market

Costs of New Build or Conversion

- Look at the full costs not just the charter hire.
- Time to develop
  - conversion 2 years
  - new-build ~ 3 years
- Yards empty, may get a good deal
- Charter vs. capex cost
- Environmental liability

Source: Hoegh conference presentations

Commercial considerations 1/2

Two different commercial models for FSRU operations
- empty and leave & stay on station.

1. <u>Empty and Leave</u>

Vessel departs when empty to sail to an LNG export plant to load an additional cargo

- During the period that the vessel is off jetty no gas is supplied to market – may not be acceptable is some market circumstances
- Period of non-supply can be mitigated through having a second vessel ready to discharge immediately
- Line-pack may reduce the impact of non-supply

If interruption of gas supply is not acceptable then can have a two FSRU discharge system

- both vessels must be FSRUs

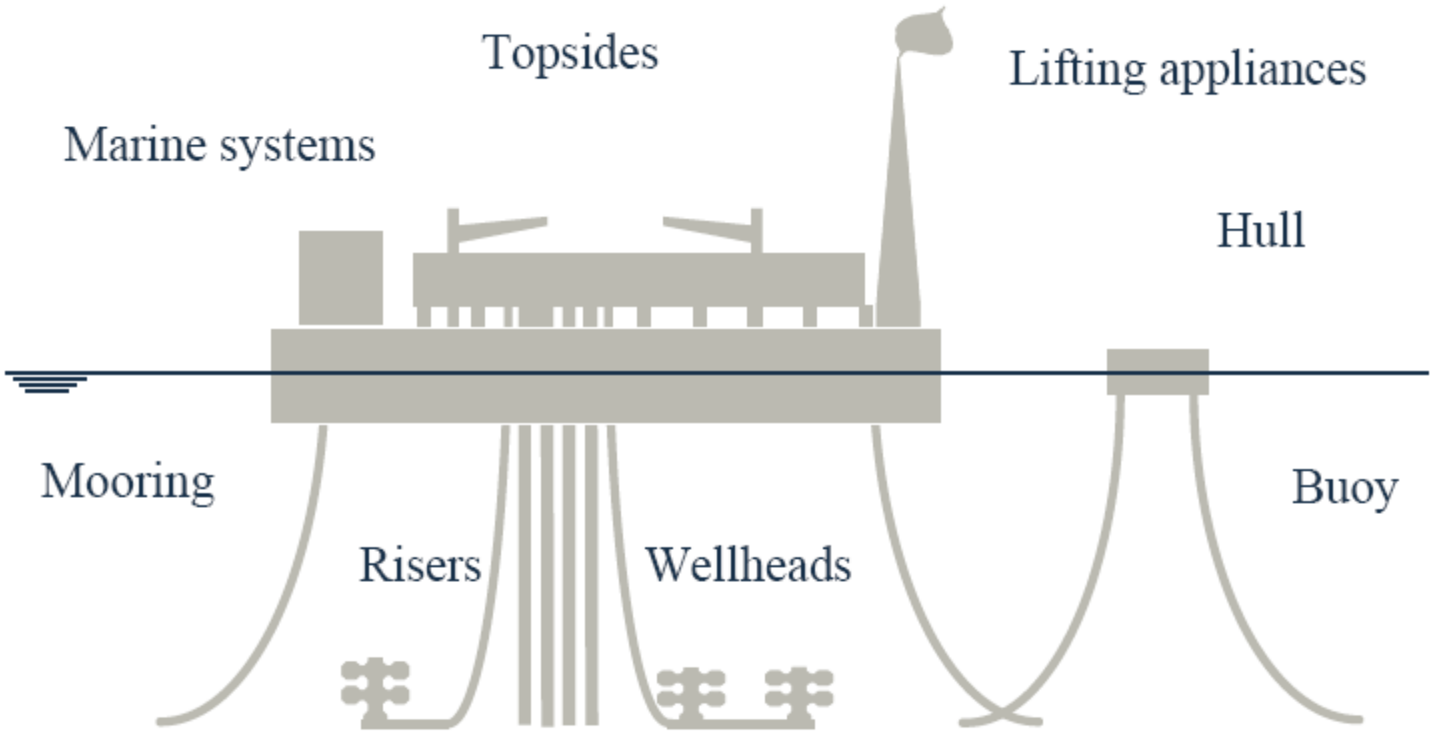
Commercial considerations 2/2

2. <u>Stay on Station</u>
   The vessel does not leave the import location and takes the additional LNG from another LNG vessel which delivers to the FSRU (through a ship-to-ship transfer)
   - Use a single FSRU in a semi-permanent configuration where the FSRU is permanently connected to the gas discharge location
   - When empty the FSRU is refilled from another vessel (can be a standard vessel not an FSRU)
   - Most FSRU schemes are at a jetty. The scheme under construction in Italy is an offshore turret system
   - Offshore ship to ship transfer is more complex than at a jetty

Other considerations

- FSRU schemes have a lower capital cost than land based terminals and are generally faster to develop
- Use of only FSRUs in an LNG delivery scheme (as is required by all turret and gas jetty schemes) limits the number of vessels that can deliver LNG
  - Most LNG is sold ex-ship so would reduced LNG supply options
- Stay on station schemes have therefore been preferred
- No set rules on commercial and technical configuration
  - Schemes are designed for the location – no one model
- Must get the necessary technical design and advice applicable to the project and location

Applicable Rules & Regulations cover all aspects of the floating unit



Source: Det Bureau Veritas (DNV) conference presentations

Applicable Rules & Regulations

- Coastal State Regulations
  - From boundary of state to international waters
- Flag State Regulations
  - Vessels must comply with safety regulations of the maritime authority of the Flag State
  - FSRU do not need to carry a flag unless required by coastal state or when in international waters
- Class Rules
  - Flag state requires classification
- IMO (International Maritime Organisation) Conventions
  - Several IMO documents that are applicable to offshore LNG terminals
- Owner/Operator Specifications
  - SIGGTO, Oil Companies International Marine Forum etc.

DNV* Key Safety Aspects and Issues

- Location & Sea Condition
- Type of Vessel & Containment System
- Mooring of the Facility
- Access for Export / Import Vessels (tugs & pilotage)
- Method of Transfer of Cargo (Offshore LNG offloading)
- Type of Plant, Liquefaction / Regasification
- Topsides & Deck Congestion
- Safety Issues
- What if the LNG supply vessel must leave partially loaded?

→ Proper design and safety, no "one size fits all" approach

* Det Norske Veritas or DNV is a classification society organized as a foundation, with the objective of "Safeguarding life, property, and the environment"

Non-FSRU and other technologies

- FSU – Floating Storage Unit is a standard vessel with no regasification facilities on board, used for LNG storage
  - Minimum modifications required
  - Can use more than one FSU for additional LNG storage
- LNG is delivered from a standard vessel to the FSU and stored in the FSU
- Regasification is carried out onshore or on the jetty
  - LNG is pumped from the FSU to the regas facilitiies
  - Increase in complexity as cryogenics on the jetty
  - Gas is pumped to the pipeline grid when required
- One scheme is operational (GDFSuez Mejillones, Chile) and a second under consideration (Petronas Malacca, Malaysia)

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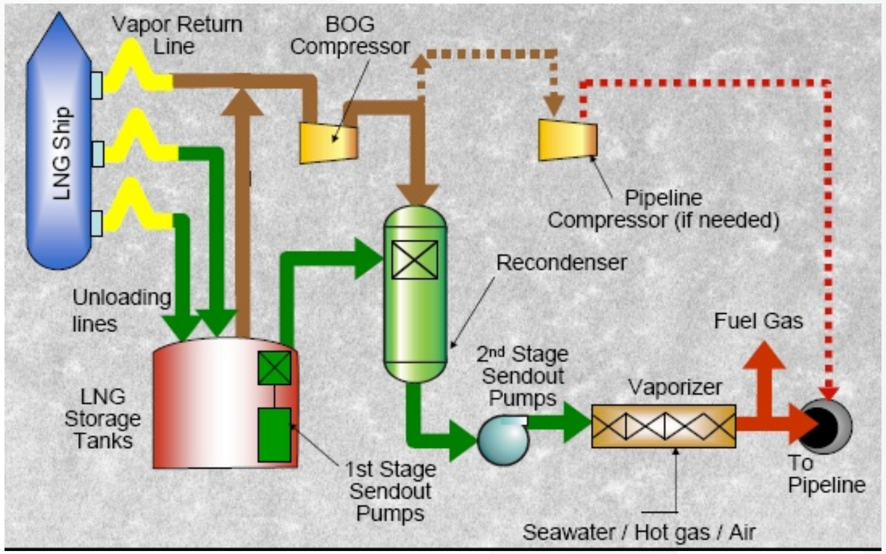
PLEASE NOTE: Site selection, zoning and permitting are highly specialized areas and are not within the scope of this report. A detailed site selection study must be undertaken with an expert in order to identify suitable ports and the necessary technical requirements for an LNG import project. This presentation, and the report on which it is based, only gives rough indications of costs for typical LNG import schemes. Each LNG import scheme is specifically designed for the location and to meet market requirements.

Regasification options for Colombia

1. Land based facility

- Construction of land based terminal
- No FSRU ship charter cost
- Typical cost $1 billion for 7 mtpa facility



Advantages	Disadvantages
• Long term flexibility and expansion options • Continuous and flexible gas send out, Uses standard ships only • Variety of regas options (waste heat, air vaporisation, open or closed loop)	• Very expensive • Large land requirement • Local permits could be difficult • Four year built time after permits obtained. • Environmental impact of on land facility.

Regasification options for Colombia

2. FSRU with offshore single turret

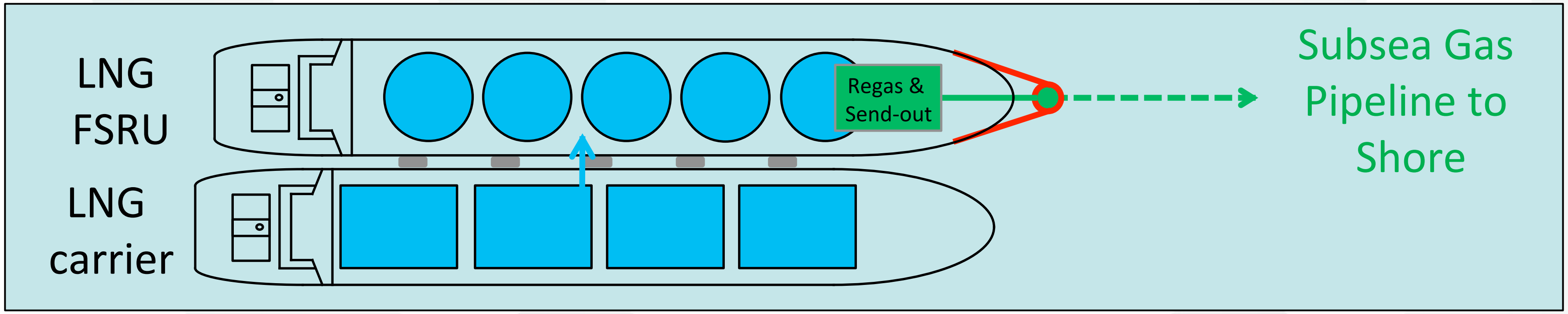
- Single offshore buoy
- Similar system to Excelerate's Gulf Gateway
- LNG is stored and regasified on the vessel and supplied to market via the single turret
- Need to pay FSRU vessel charter and option cost
- Cost
  - $ 100 million+ capex depending on length of sub-sea line
  - FSRU charter = $ 55 – 75 million per annum

Advantages	Disadvantages
• Low construction cost • No or few onshore facilities • Local permits much easier • Shorter build time (2 years or less) • No tug requirement	• Gas supply interrupted • Can only use FSRU turret ships only (standard ships cannot connect) – higher charter cost • Turret ships will limit the supply options

Regasification options for Colombia

3. FSRU with offshore single turret and ship-to-ship LNG transfer from the "delivery" vessel to the FSRU

- Single offshore buoy with standard LNG ships delivering to the FSRU ship-to-ship (STS)
- The FSRU stores the LNG and regasifies the LNG and sends gas to market via the single turret
- Similar to Golar LNG, Livorno OLT Offshore, Italy



Source: Marine Service GMBH

Livorno OLT Offshore, Italy (Eon/Golar)

- Golar Frost is currently undergoing conversion to FSRU service.
- 5 bcma open loop regasification
- Incorporate a new fixed* turret gas discharge system and is also equipped with LNG loading arms on-board (first vessel of this design)
- The FSRU, once in service, will be moored to the seabed via the turret discharge system through which gas from the FSRU will be discharged
- LNG will be delivered to the FSRU via the on-board LNG loading arms from the delivering ship which will moor directly to the FSRU

Source: OLT Toscana

* i.e. turret cannot disconnect and stays permanently fixed

Regasification options for Colombia

3. FSRU with offshore single turret and ship-to-ship LNG transfer from the “delivery” vessel to the FSRU

- Cost
  - $ 100 million+ capex depending on length of sub-sea line
  - Higher operating costs costs to monitor FSRU location
  - FSRU charter = $ 55 – 75 million per annum

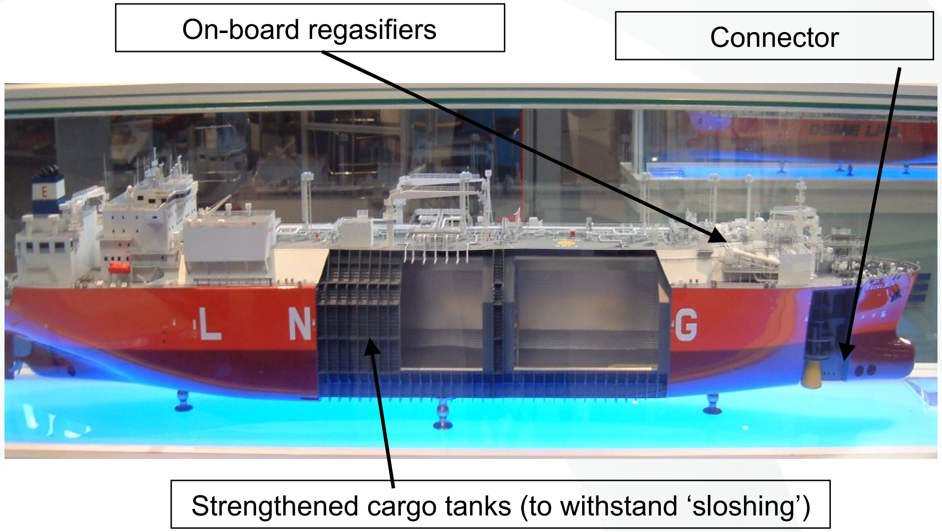
Advantages	Disadvantages
• Low cost • No or few onshore facilities • Local permits much easier • Shorter build time (2 years or less) • LNG delivery using standard ships	• Not all ship operators will be willing to deliver to STS • STS could limit supply options • Requires very benign marine environment

Regasification options for Colombia
4. FSRU with twin offshore turret

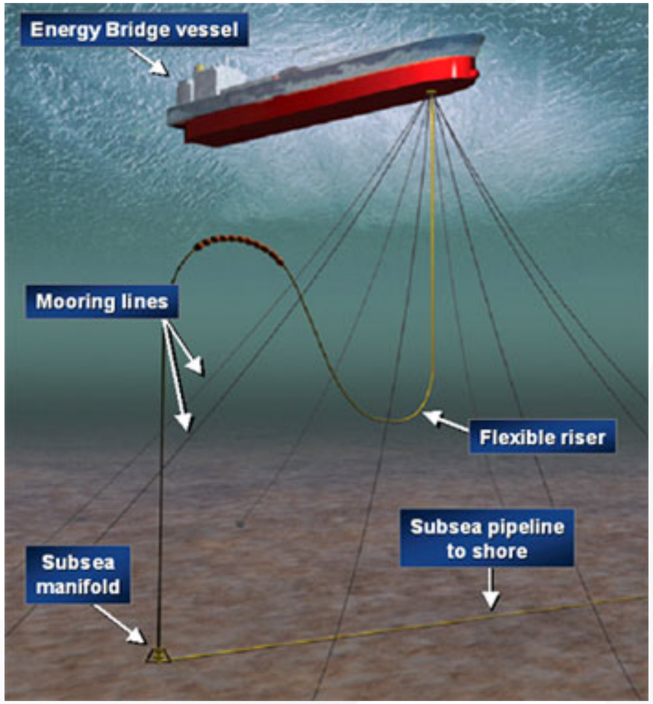
- Twin offshore buoys
- Similar system to Excelerate's North-East Gateway and GDFSuez/Hoegh LNG Neptune (both offshore N.E. USA)
- LNG is stored and regasified on the vessel and supplied to market via the single turret
- Two turrets ensure consistent supply of gas to market
- Need to pay two FSRU vessel charter and option costs

NorthEast Gateway, offshore Boston, USA (Excelerate)

- Twin APL turret arrangement
- Located 20 km offshore Boston (USA)
- The twin turret arrangement allows a continuous send out of gas into the terminals sub-sea pipelines when used with two FSRUs in rotation
- The terminal is permitted for closed loop regasification only
- Came into service in 2007



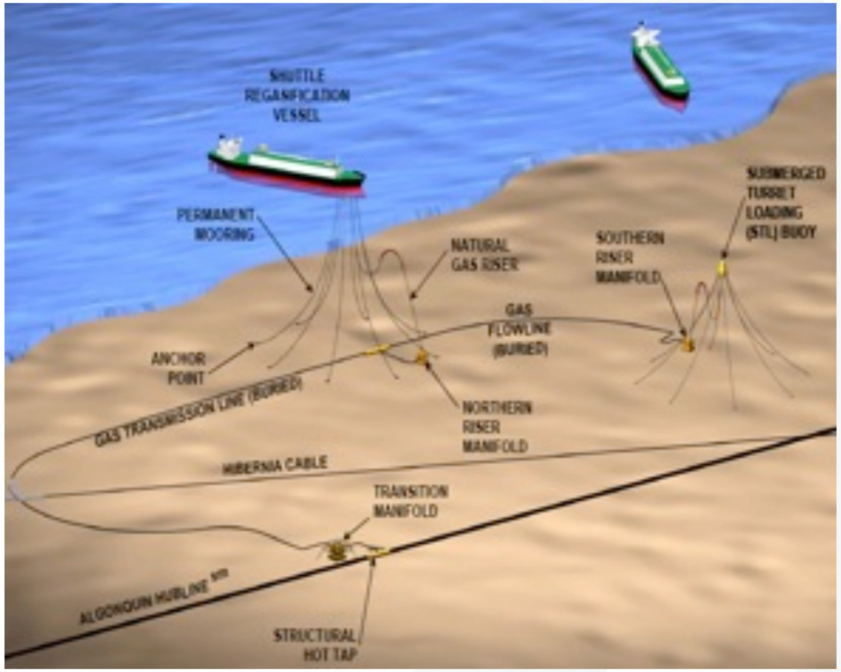
Source: Excelerate



Source: Excelerate

Neptune, offshore Boston, USA (GDFSuez)

- GdFSuez first entry into the FSRU markets with the construction of the Neptune project, offshore Boston (USA)
- Same method as NorthEast Gateway i.e. a twin APL turret arrangement offshore.
- To service the Neptune project GdFSuez also ordered two new FSRU ships, the Neptune and the Cape Ann, which came into service in 2009 & 2010.



Source: GDFSuez

Regasification options for Colombia

4. FSRU with twin offshore turret

- Cost
  - $ 150 million+ capex depending on length of sub-sea line
  - Higher operating costs costs to monitor FSRU location
  - FSRU charter = $ 110 – 150 million per annum

Advantages	Disadvantages
• Low construction cost • No or few onshore facilities • Local permits much easier • Shorter build time (2 years or less) • No tug requirement	• Have to pay option/charter for two vessels • Can only use FSRU turret ships only (standard ships cannot connect) – higher charter cost • Turret ships will limit the supply options

Regasification options for Colombia

5. FSRU on Jetty

- Single jetty head with gas discharge
- Teeside terminal (UK) is the world's first use of an FSRU in a jetty type discharge arrangement
- FSRU brings the LNG to the jetty and LNG is stored and regasified on the FSRU
- Gas is supplied to market via high-pressure pipe
- Shore based facilities can incorporate nitrogen injection or liquids extraction

Teesside Jetty Terminal, UK (Excelerate)

- The Teesside terminal was built in the river Tees (North East England) via the conversion of an existing jetty to FSRU use
- The FSRU moors at the jetty and discharges its cargo as gas via gas discharge arms mounted on the jetty in closed loop mode

Source: Excelerate

- Once empty the FSRU leaves the location to allow the next FSRU to deliver
- The terminal (shore side) also features nitrogen injection equipment in order to adjust gas quality to match UK specifications (UK gas specification ranges are relatively narrow)

Regasification options for Colombia

5. FSRU on jetty

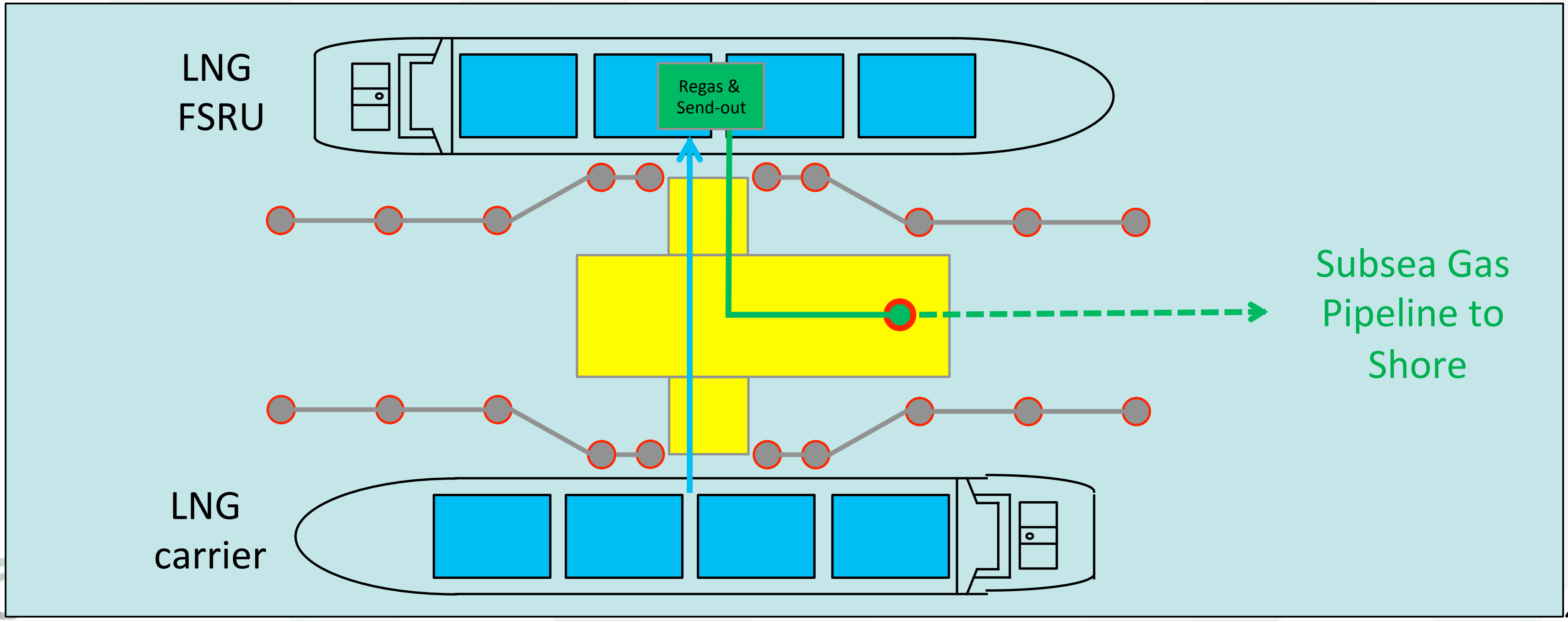
- Cost
  - $ 50-100 million+ capex depending on whether an existing jetty can be used
  - Higher operating costs costs to monitor FSRU location
  - FSRU charter = $ 55-75 million per annum

Advantages	Disadvantages
• Low cost (can use existing jetty) • Short build time (18 months possible)	• Gas supply interrupted • Requires FSRU ship only (standard LNG ship cannot connect) • Use of FSRU vessel will limit the supply options

Regasification options for Colombia

6. FSRU Jetty with FSRU on station

- Single jetty head with gas discharge and LNG transfer lines
- Standard LNG vessel brings the LNG to the jetty
- LNG is transferred to an FSRU
- LNG is stored and regasified on the FSRU
- Gas is supplied to market via high-pressure pipe



Source: Marine Service GMBH

Pecem, Brasil (Golar Spirit)

- Petrobras, terminal sponsor, commissioned Pecem (NE Brasil) terminal in 2008
- Uses an existing jetty that has been modified to accept an FSRU and delivering ship in a side-by-side across the jetty type arrangement
- FSRU Golar Spirit is moored semi-permanently and discharges gas via two gas discharge arms mounted on the jetty head
- FSRU is connected via 3 LNG loading lines that in a standard configuration

Source: Petrobras

Guanabara Bay, Rio de Janeiro, Brasil (Golar Winter)

- Petrobras, terminal sponsor, commissioned 5.1 Bcma terminal in 2009
- Uses a purpose built near-shore (island type) jetty head arrangement
- Jetty head is offshore and subject to maritime regulations
- Gas from the FSRU discharges via the gas discharge arms on the jetty head and is sent to the gas grid via the connecting subsea pipeline

The Excellence Transferring Its Cargo to the Golar Spirit in Guanabara Bay, Rio de Janeiro, Brazil

Source: Petrobras

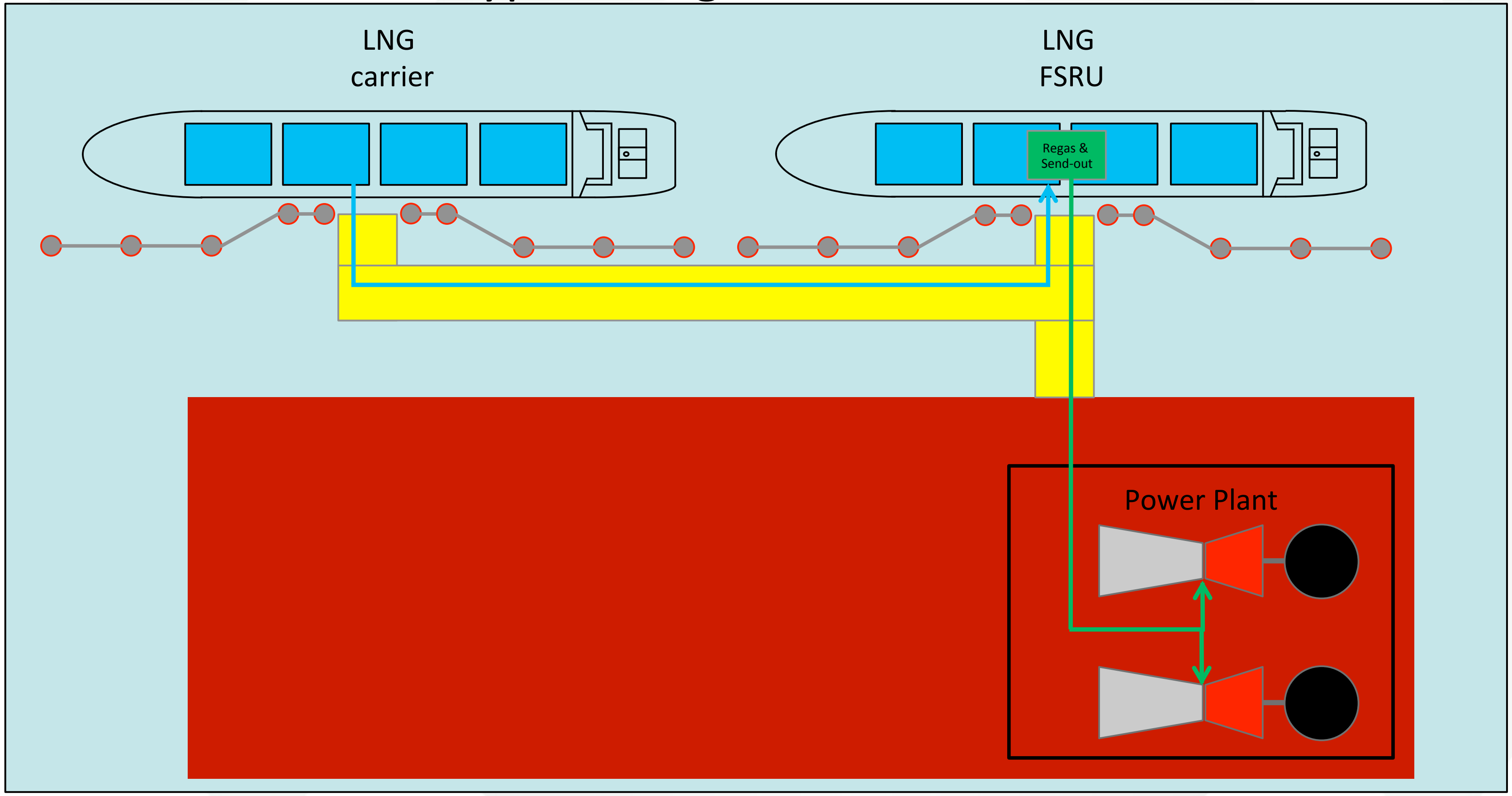
Mina Al Ahmadi, Kuwait (Excelerate) 1/2

Source: Excelerate

- The Mina Al Ahmadi terminal, originated by Kuwait Petroleum Company, uses an existing jetty modified to accept FSRUs
- LNG is then discharged from the delivering ship to the FSRU via a separate bank of LNG discharge arms and cryogenic pipelines to the FSRU
- Gas is delivered to market via high pressure gas line

Mina Al Ahmadi, Kuwait (Excelerate) 2/2

- The FSRU moors to the jetty and connects as usual via gas discharge and LNG loading arms
- The delivering LNG ship moors to the same jetty via a separate jetty head in an end-to-end type configuration



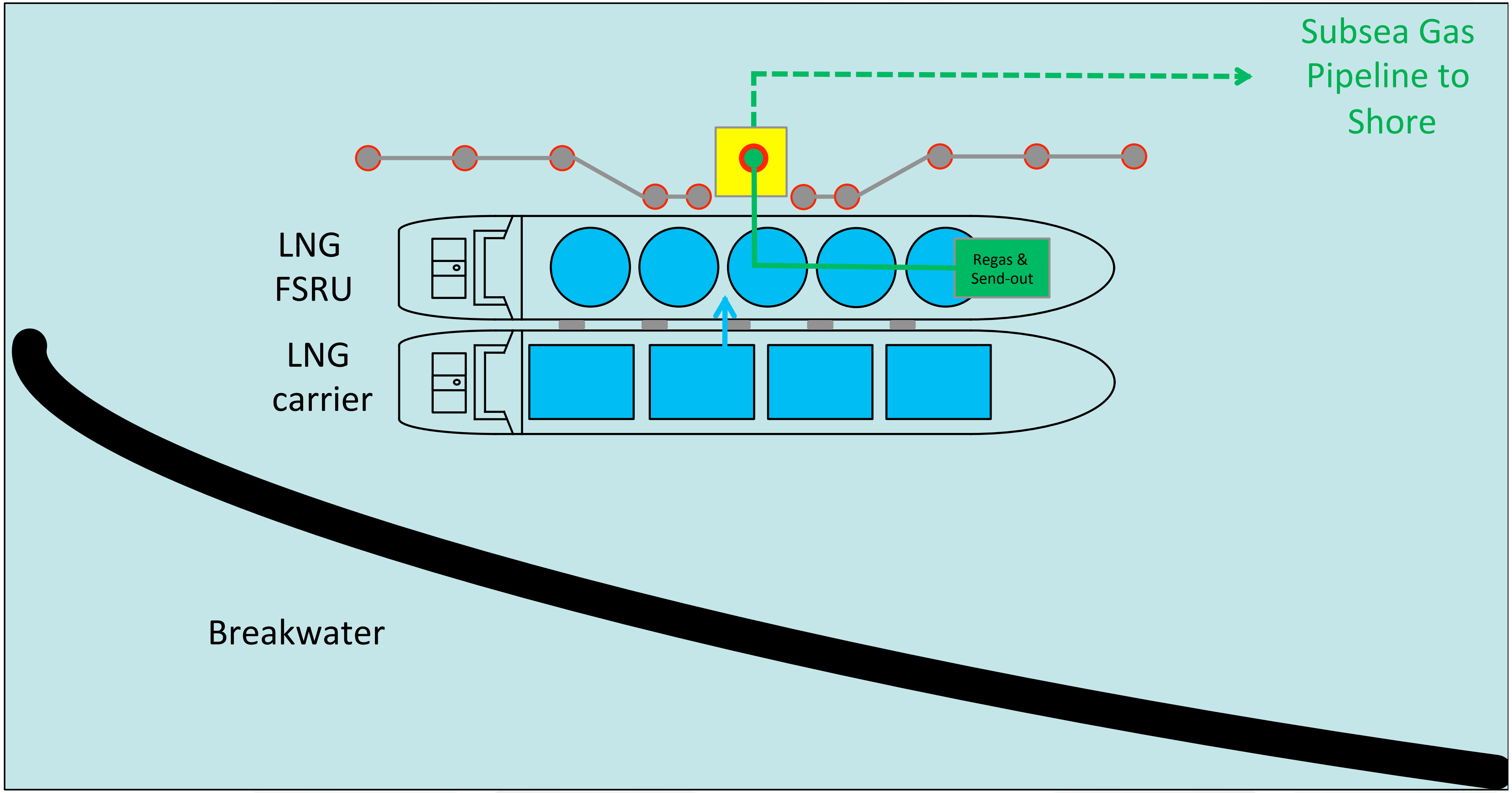
Source: Marine Service GMBH

Jebel Ali, Dubai (Golar Freeze)

Source: Golar LNG

- Sponsored by Dubai Supply Authority (DUSUP), 4.0 Bcma open loop, started operation in 2010
- New jetty and breakwater to allow the FSRU to moor semi- permanently to the jetty head
- The delivering ships moor directly alongside the FSRU (i.e. delivering ship is not moored directly to the jetty)
- LNG transfer is effected ship-to-ship by connection to the FSRU via flexible cryogenic hoses
- FSRU Golar Freeze is connected semi-permanently via gas discharge arms to the jetty head
- Discharges gas via gas discharge lines to market

Jebel Ali, Dubai (Golar Freeze)



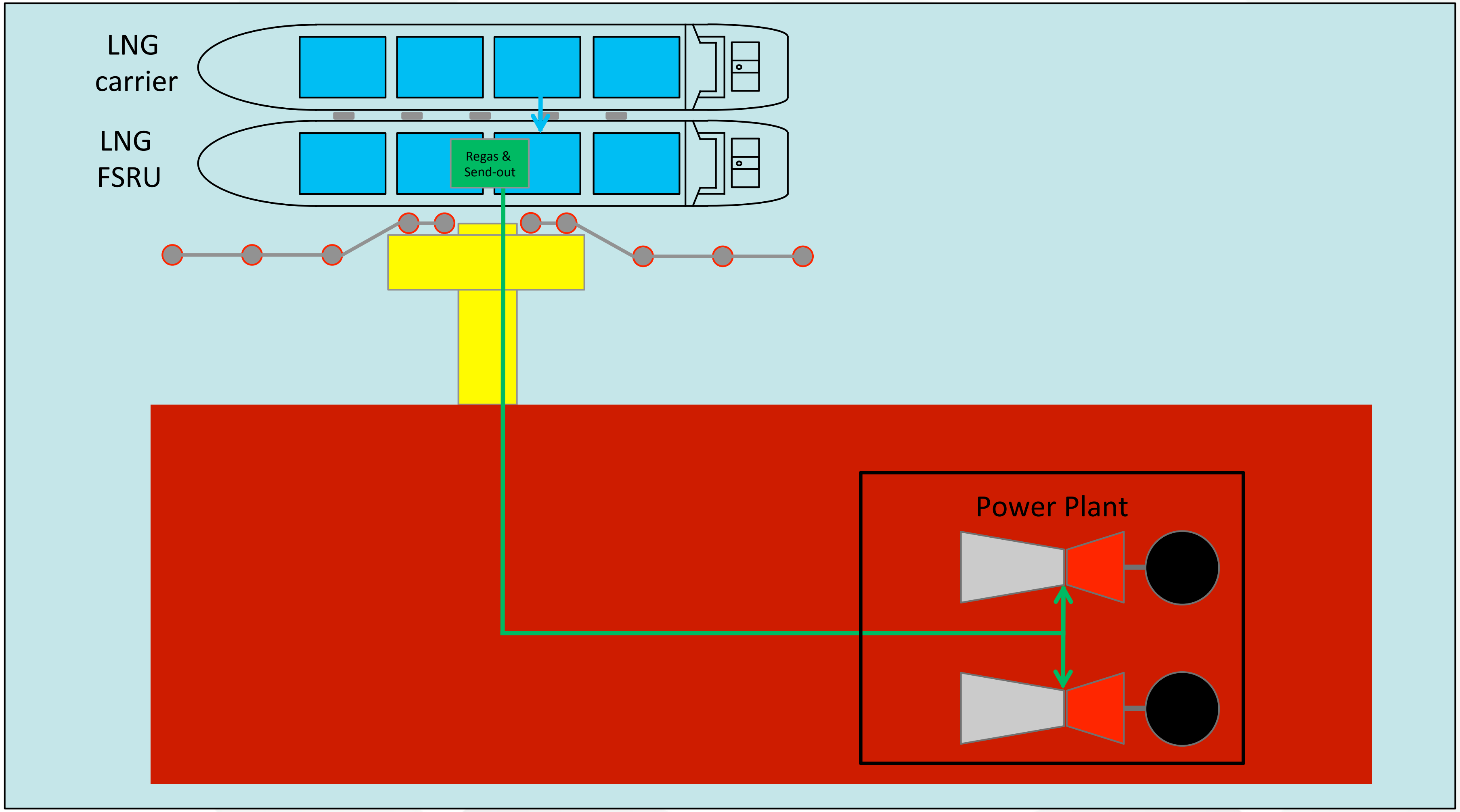
Source: Marine Service GMBH

Bahía Blanca GasPort, Bahía Blanca, Argentina (Excelerate) 1/2

Source: Excelerate

- Sponsored by Excelerate Energy, YPF and Repsol, located 400 km south of Buenos Aires
- Jetty type arrangement
- The FSRU connects to the jetty head via gas discharge arms and regasifies in closed loop mode
- Can accept delivering standard ships which moor directly alongside the FSRU (i.e. the delivering ship is not connected directly to the jetty)
- LNG transfer is effected ship-to-ship by connection of the delivering ship directly to the FSRU via flexible cryogenic hoses

Bahía Blanca GasPort, Bahía Blanca, Argentina (Excelerate) 2/2



Source: Marine Service GMBH

Regasification options for Colombia

6. FSRU Jetty with FSRU on station

- Cost
  - $ 100-150 million+ capex depending on whether an existing jetty can be used
  - Higher operating costs costs to monitor FSRU location
  - FSRU charter = $ 55-75 million per annum

Advantages	Disadvantages
• Low cost (can use existing jetty), • Short build time (18-24 months possible) • Can take delivery from standard LNG ships • Continuous gas discharge	• LNG transfer lines add cost

Regasification options for Colombia

7. FSU jetty with FSU on station

- Single jetty head with onshore regas and LNG transfer lines
- Mejillones, Chile (GDFSuez) started operations in 2009
- Standard LNG vessel brings the LNG to the jetty that is transferred to an FSU
- LNG is stored on the FSU
- Regasified using onshore regasification facilities (could be regasified on jetty based facilities)
- Supplied to market via high-pressure pipe

Mejillones, Chile (GDFSuez)

- Sponsored by GdFSuez the terminal uses a modified standard LNG ship to receive LNG
- LNG is then sent to a shore based regasification system
- Avoids the need for on shore tanks (which in the particular example were planned for construction at a later time)
- LNG transfer is effected across the jetty (i.e. similar to the Brasil terminals

Source: GDFSuez

Regasification options for Colombia
7. FSU jetty with FSU on station

- Cost
  - $ 150-200 million+ capex depending on whether an existing jetty can be used
  - Higher operating costs costs to monitor FSU location
  - FSRU charter = $ 22-29 million per annum

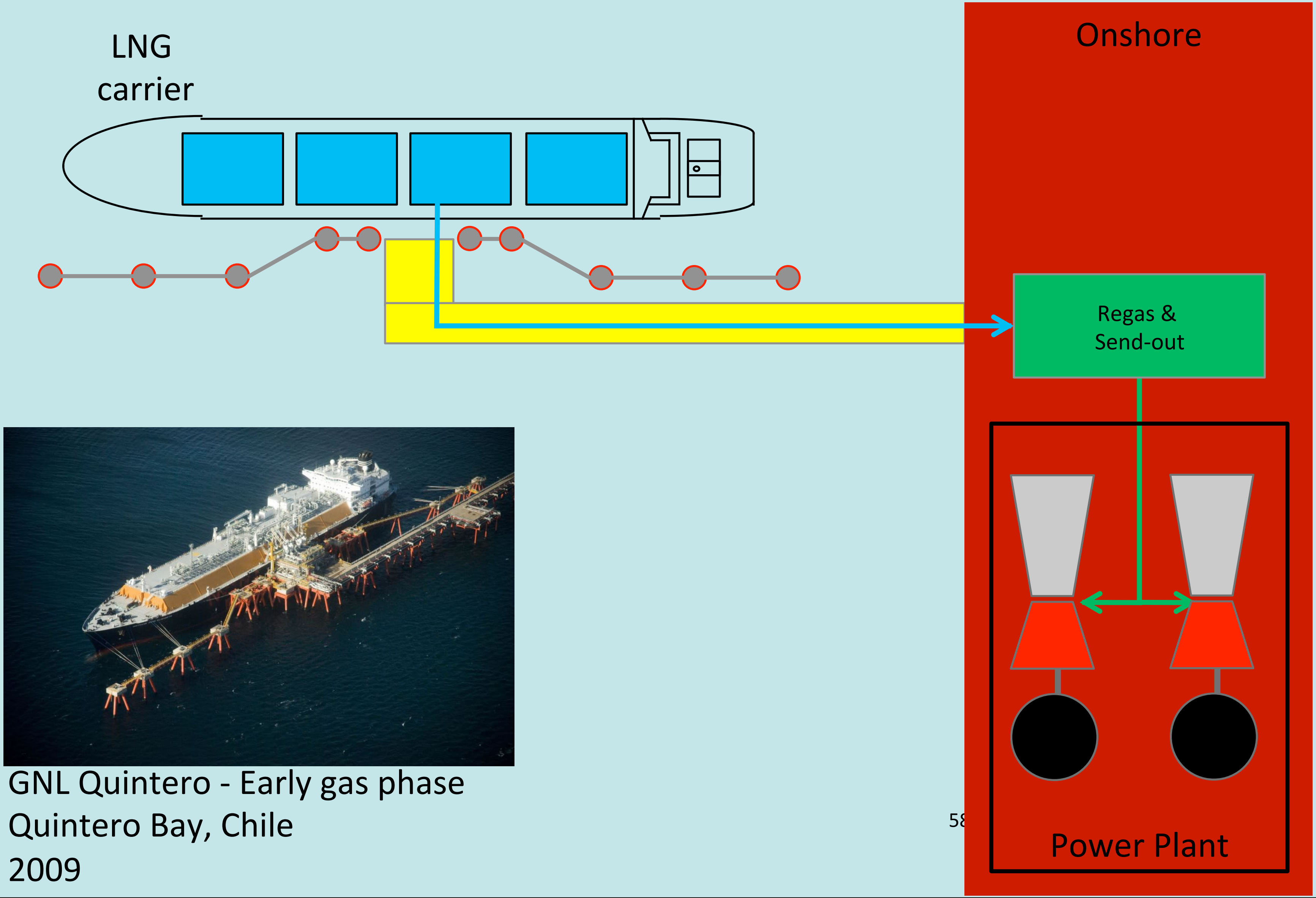
Advantages	Disadvantages
• Low cost (can use existing jetty) • Shorter build time than land based (2 years) • Takes delivery from standard LNG ships (no need for an FSRU • Continuous gas discharge	• Onshore regas and LNG transfer lines add capital cost • Such a facility would need maintenance during periods of non-use.

Regasification options for Colombia

8. Regas Jetty with no FSU

- Single jetty head with onshore regas (could be on jetty)
- LNG transfer lines
- Standard LNG vessel brings the LNG to the jetty and is slowly discharged to the regas system
- Delivering ship stays on jetty throughout (7 days+)

Quintero, Chile (GDFSuez)



GNL Quintero - Early gas phase
Quintero Bay, Chile
2009

Source: Marine Service GMBH

Regasification options for Colombia

8. Regas Jetty with no FSU

- Cost
  - $ 125-175 million+ capex depending on whether an existing jetty can be used
  - LNG ex-ship may be marginally more expensive as vessel will have to stay on station for 7+ days (rather than 1 day)

Advantages	Disadvantages
• Low cost (can use existing jetty), • Shorter build time than land based (2 years) – can build tank later • Takes delivery from standard LNG ships. Does not use an FSRU or an FSU • No need for a charter agreement – pay for ships via amended ex-ship price • Gives flexibility for supply outside El Niño	• Onshore regas and LNG transfer lines add capital cost but only requires one set of LNG arms • Gas supply interrupted when ship leaves • Suppliers would need to agree a long discharge time – some ships may not be able to slow unload (this would need to be checked)

Application of FSRU schemes to Colombia

- Colombia's need
  - If El Niño occurs 300-400 million scfd gas is required to support shortages of power from hydro
  - Colombia will know 3-4 months before El Niño occurs that it will require the gas
- LNG imports will require import infrastructure and LNG supply

Provision of LNG importation infrastructure

- LNG import capacity required once every 4-5 years for a period of 6-11 months
- To be able to remain idle for potentially long periods
- To supply gas to high pressure grid (up to 100bar)
- To have wide range of gas send out rates – zero to full flow (400 million scfd) depending on severity of gas shortage
- Ideally no requirement for quality adaptation (nitrogen injection) – reduces costs
- Minimal capital cost or minimal charter/option when the terminal is not in use

Provision of LNG importation infrastructure But…………

- Most LNG import schemes are designed for base-load not intermittent supply
  - Seasonal import projects in South America and Middle East have higher unit energy costs
- Colombia will use the facility once every 5 years, but must pay to ensure that LNG can be imported at any time
- Number of FSRUs that are available are limited, companies with vessels would rather charter long-term (e.g. 10 years with a 5 year option)
  - Unlikely that FSRU providers would accept off-hire at no cost – Colombia will have to pay for the FSRU capacity regardless of use
  - FSRU operators may accept an "option payment" but this may not be cheap (assumed at full cost)
- Some options would allow Colombia to import LNG during non El Niño periods if required

LNG Supply

- Colombia must have LNG when required - an option to take delivery of LNG is needed
  - Option to take LNG to be exercised with approximately three months notice
  - Likely time for deliveries December to April with flexibility to shorten, extend or move
- Gas flow rate up to 400 million scfd which equates to approximately one cargo every 8-11 days (standard sized LNG ship 125,000 – 145,000cm)
- No requirement for a minimum volume (since there could be years where LNG is not required)
- Gas send out to match grid quality specifications

LNG Supply
But……….

- LNG suppliers prefer long-term, offtake contracts (5+ years)
- For an LNG supplier to give an option to supply it would require compensation for the opportunity cost of not taking a cargo to a firm buyer
- Seller would be unlikely to agree a price* today for optional supply – so price would have to be agreed at the time the option is declared (what would Colombia do if the price was not agreed??)
- Likely that Colombia will have to rely on the LNG "spot/ short-term" market
    - LNG will be secured if Colombia offers a higher price than the alternative market price or buyer
    - Other South American countries currently source LNG this way

* By price one means a relationship to a market index not a fixed price

Comparison of LNG supply options - Methodology

<u>Cost</u>

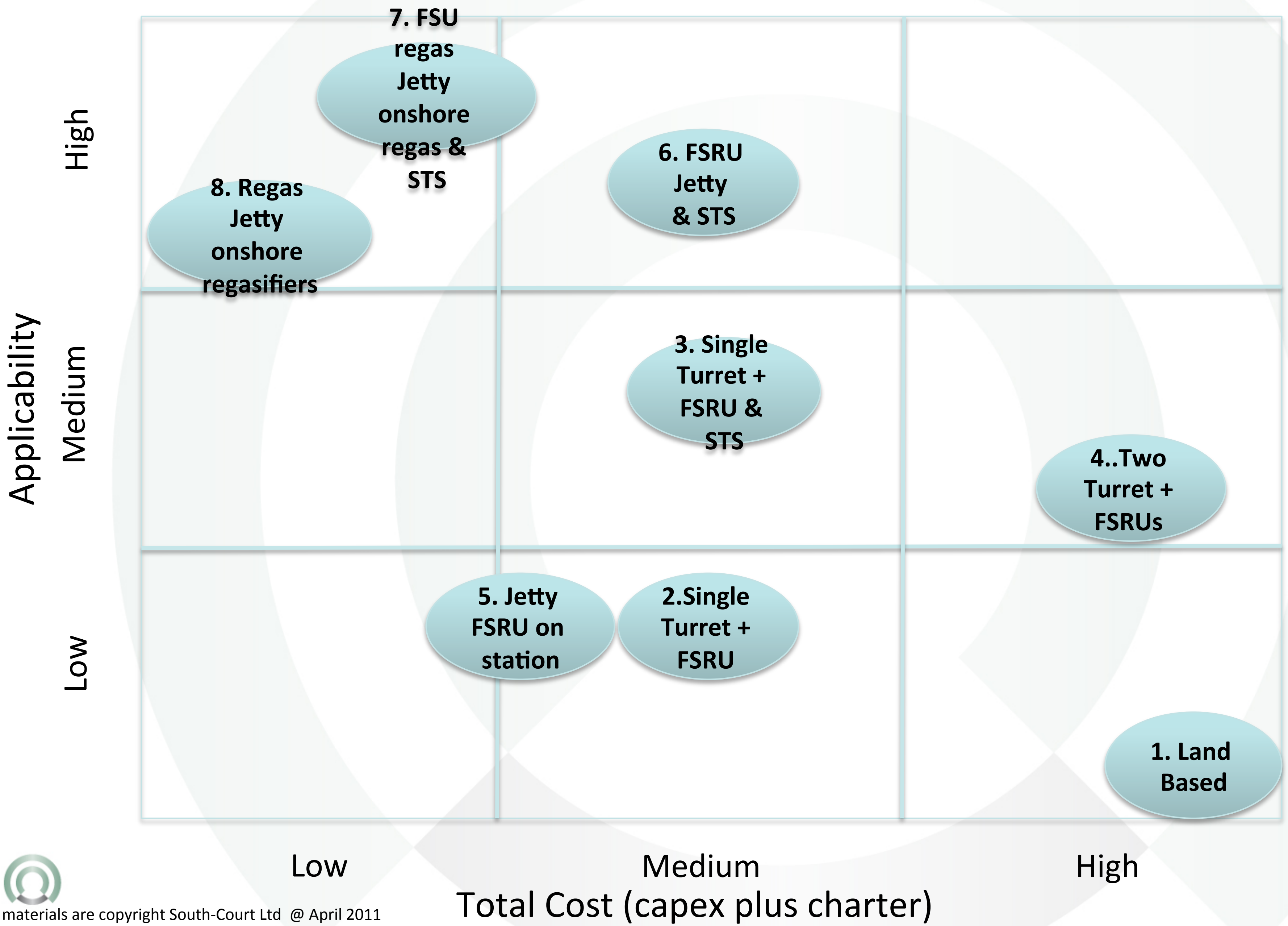
- A full technical feasibility study is required to evaluate costs but approximate infrastructure and option costs* over 10 years would be in the range:
  - Low: US$ 0-250 million
  - Medium: US$ 250-750 million
  - High: US$ 750-1000 million
- The cost of sourcing LNG and operating costs must be added

<u>Applicability</u>

- A subjective view of which schemes would be more suitable for Colombia

* In Money of the day (MOD)

Comparison of LNG supply options



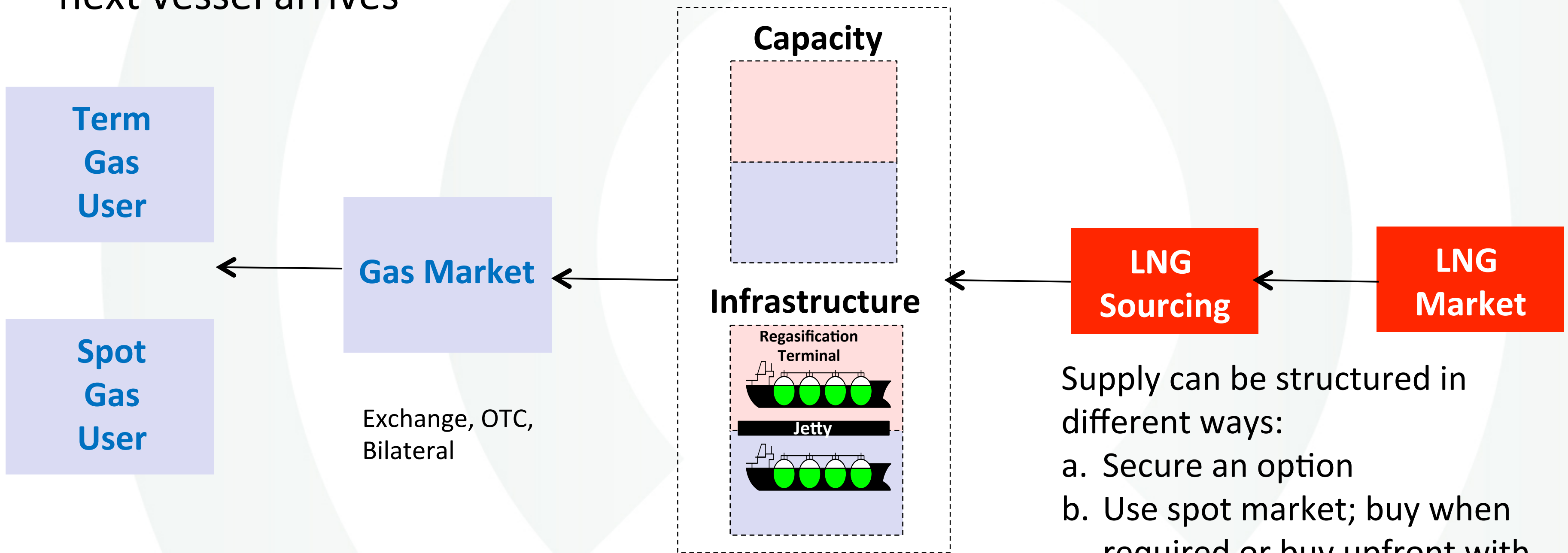
- Introduction
- Why does Colombia need LNG
- Overview of the LNG value chain
- Overview of floating regasification
- Potential application of FSRU schemes in Colombia
- Commercial structures for Colombia

Components of a commercial structure

- Structure to include:
  - Buyer for the LNG (the "Buyer")
  - Owner/financier of the import terminal ("Terminal Owner")
  - A party to own the terminal capacity rights ("Capacity Holder")
- Regasification terminal paid for by the party who owns the rights to the capacity, cost depends on capex but normally structured:
  - Capacity payment – to cover the capital cost of the facility.
    In the case of Colombia, this would include any option payments for a regasification vessel that may be agreed
  - Throughput fees – to cover operational costs in the regasification facility
    In the case of Colombia, there may be different fees depending on whether the facility is being used or is not (as there could be long periods when the facility remains unused)

The LNG Chain has different parts, who owns and operates which parts?

- The fewer segments of the chain the better – less companies the better
- Bankable credit rating required for the buyer of the LNG
- Operational necessity to move gas out of the regasification terminal before the next vessel arrives



Supply can be structured in different ways:

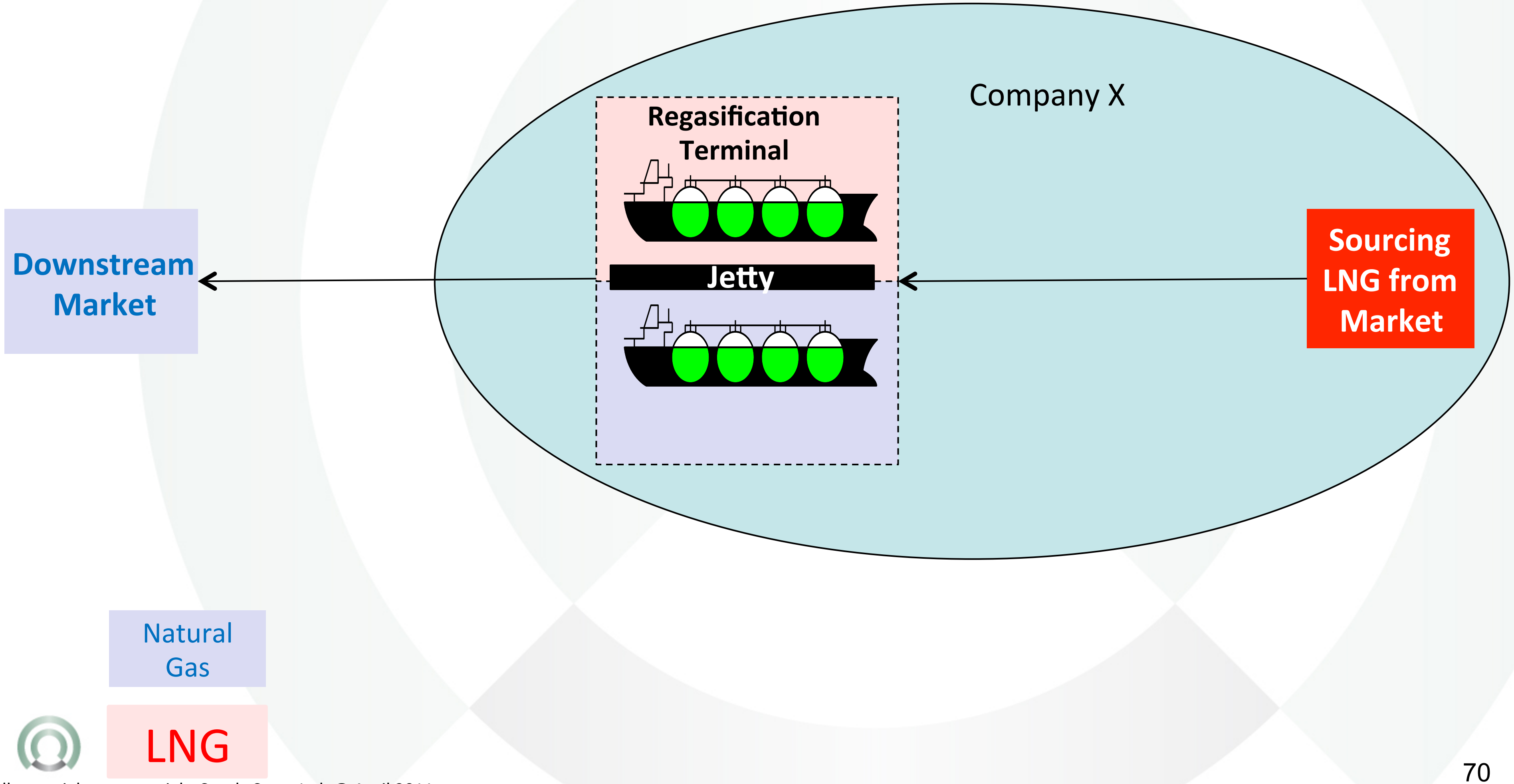
a. Secure an option
b. Use spot market; buy when required or buy upfront with cancellation option

- The owner of the infrastructure can be different to the capacity rights
- Delivery of the infrastructure is key
- Issue – Third Party Access vs. sole capacity ownership ("use it or lose it")

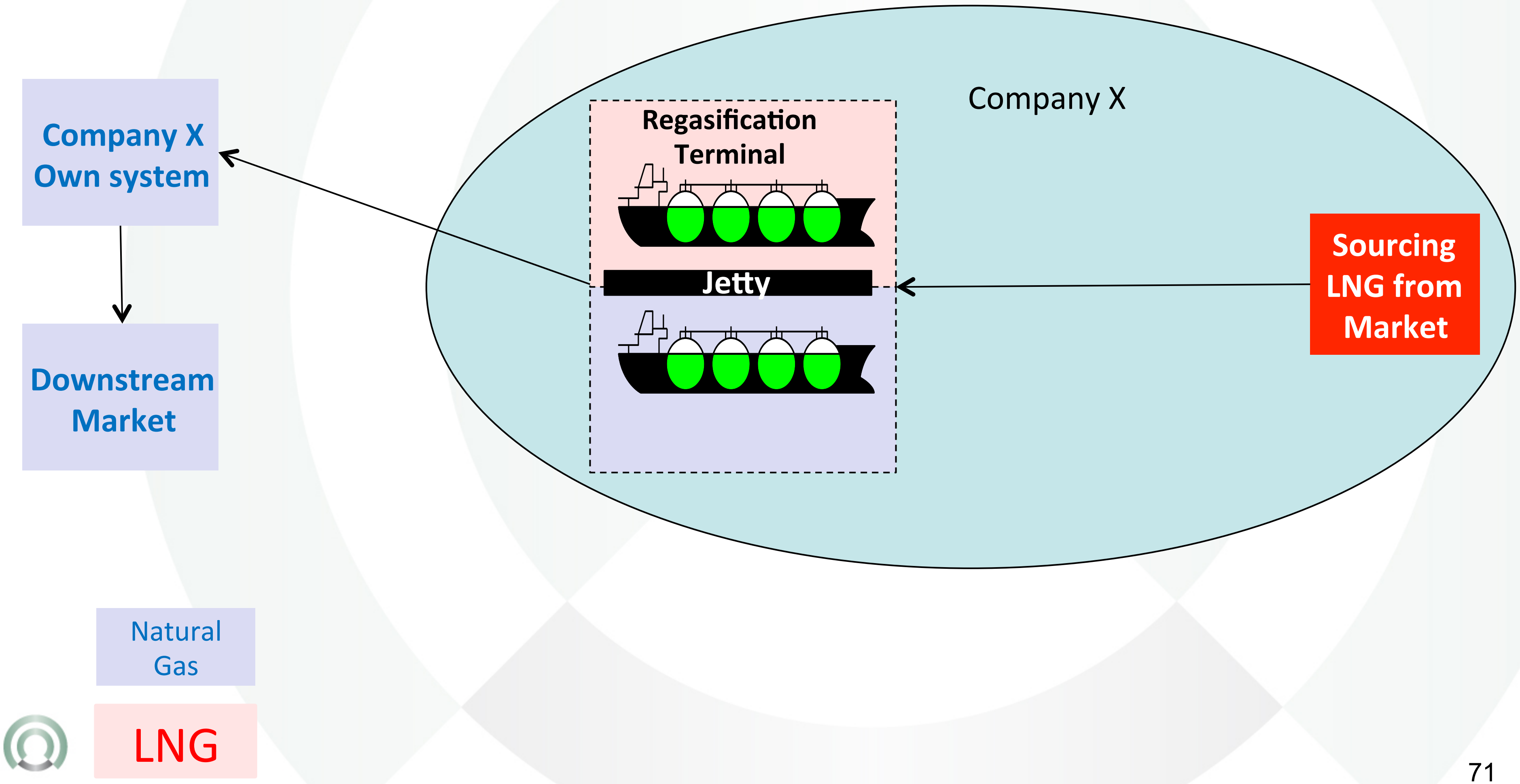
Natural Gas

LNG

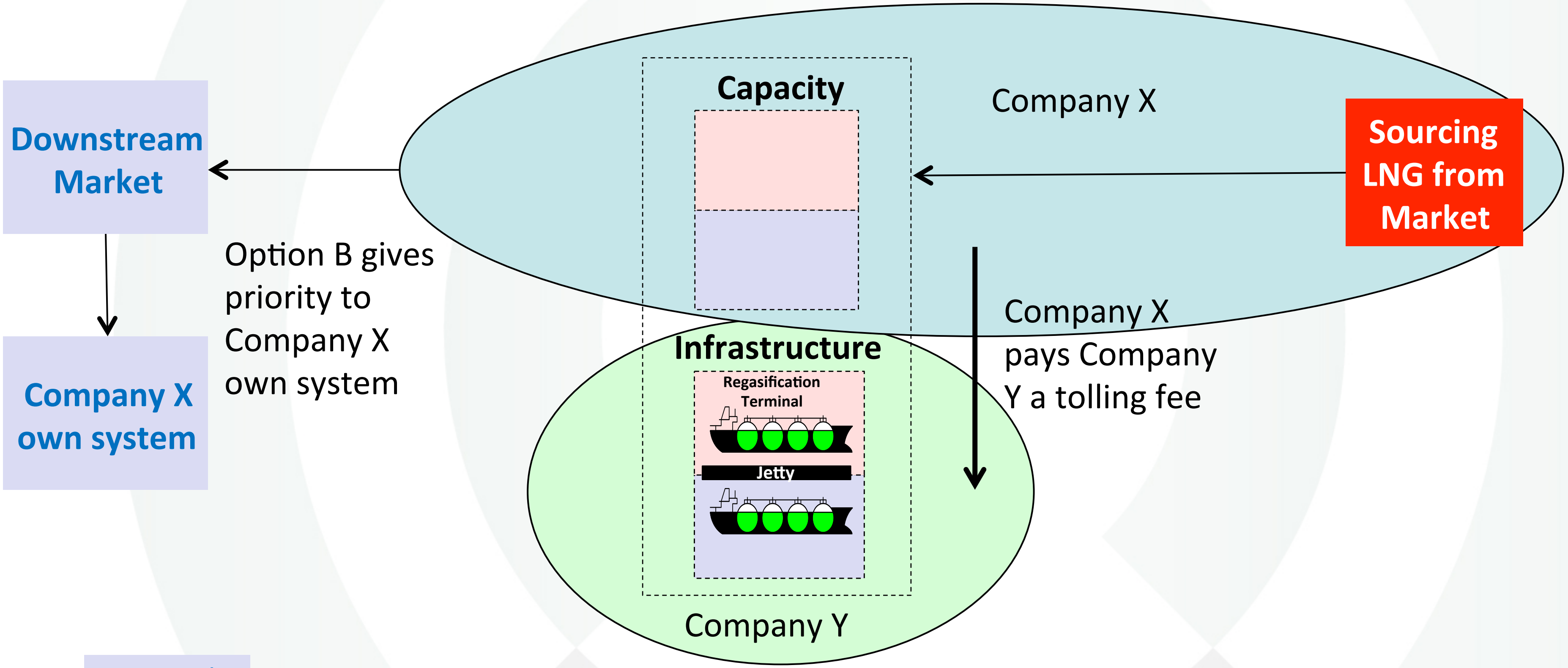
1a. Company X buys LNG, owns regasification facilities & capacity and sells to the market



1b. Company X buys LNG, owns regasification facilities & capacity and sells to its own system with any surplus to the market



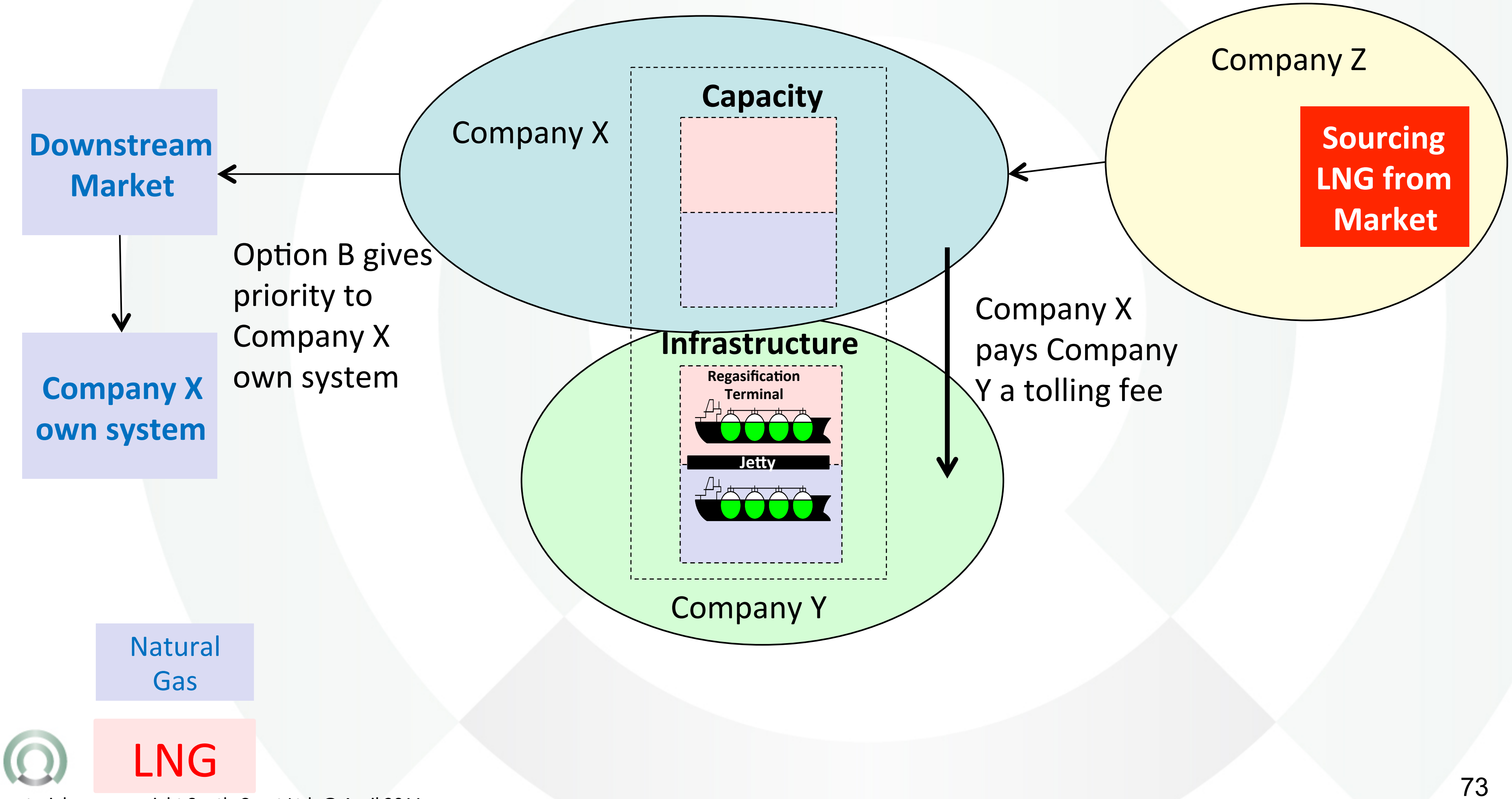
2 a & b. Company Y owns regasification facility. Company X buys LNG and pays a fee to toll through the regasification facility



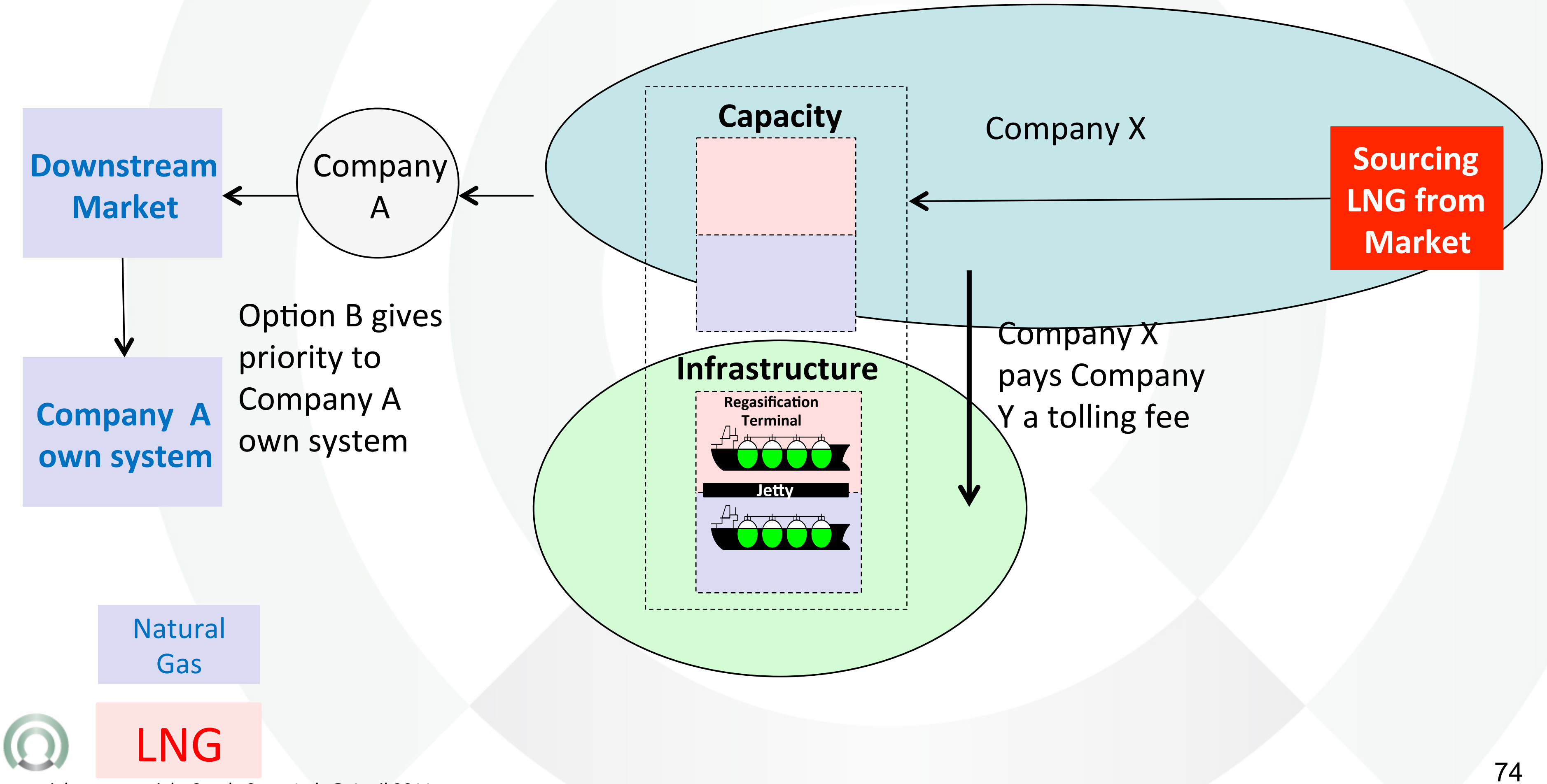
Natural Gas

LNG

3 a & b. Company Y owns regasification facility. Company Z buys LNG and sells to Company Z who and tolls through the regasification facility



4 a & b. Company Y owns regasification facility. Company X buys LNG and pays a fee to toll through the regasification facility and sells to company A who sells to the market



Commercial structure – Summary thoughts

- There is no one structure that can be clearly identified as the best one for Colombia
- The final structure will depend on local requirements and company interests
- Two key drivers that must be taken into consideration:
  - The simpler the better
    - developing infrastructure projects is a costly and complex undertaking
    - The more companies involved the longer it takes to develop such projects
  - Selection of companies and partners for political means can often result in the wrong companies (with the wrong skills) being involved which results in the slowing down of a project
    - The structure must be credible to LNG infrastructure providers and LNG sellers. If not, then it may be difficult to secure the necessary LNG supply

Points Covered

- Why does Colombia need LNG
- Overview of the LNG value chain
- Overview of floating regasification
- Potential application of FSRU schemes in Colombia
- Commercial structures for Colombia

Thank you

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