member of the
**TSAKOS GROUP**
of companies
The Tsakos Group traces its origins deep in the passage of time, well beyond its almost half a century continuous activity and growth. It’s roots can be found at the heart of the maritime tradition of Greece, in the metropolis of Greek shipping, the Aegean archipelago island of Chios.

Tsakos Shipping and Trading S.A. was the first of the companies to comprise what now is known as the “Tsakos Group of Companies”. Over the ensuing years, the Group established a number of affiliated and associated companies around the globe significantly expanding its shipping activities and world-wide operational capability while building a reputation of solid performance in reliable maritime transport services, thereby acquiring a strong reputation within the shipping industry as the preferred partner of choice for a wide range of entrepreneurs.

As the maritime transportation industry was developing into the modern age, the Group gradually adjusting to technologies of the most advanced kind lead the way into the 21st century by broadly expanding its investment base with the addition of thousands of institutional and individual investors through the listing of one of its affiliated Companies, Tsakos Energy Navigation Ltd, steered by the astute and competent management of Nicholas Tsakos who successfully led the company at the world’s leading stock exchange in New York and thereby embarking upon a massive newbuilding program.
Global Presence

Our Office Locations
### Our Fleet Profile

<table>
<thead>
<tr>
<th>Type of Vessel</th>
<th>Number of Vessels</th>
<th>Total Deadweight Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tankers</td>
<td>74</td>
<td>8,127,467</td>
</tr>
<tr>
<td>LNG Vessels</td>
<td>2</td>
<td>170,365</td>
</tr>
<tr>
<td>Container ships</td>
<td>7</td>
<td>282,595</td>
</tr>
<tr>
<td>Dry Cargo ships</td>
<td>7</td>
<td>869,874</td>
</tr>
<tr>
<td>Tug Vessel</td>
<td>1</td>
<td>350</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>91</strong></td>
<td><strong>9,450,651</strong></td>
</tr>
</tbody>
</table>

**Fleet composition by deadweight**

- **Tankers:** 8,127,467
- **Dry Cargo Vessels:** 869,874
- **LNG Vessels:** 170,365
- **Container Vessels:** 282,595
CYnergy Action

Connecting Europe Facility
2014 – 2020
SYNERGY CALL FOR PROPOSALS
2016-1
Description of the proposed action

Co-financed by the European Union
Connecting Europe Facility
CYnergy Action

One Central LNG Storage Facility

Co-financed by the European Union
Connecting Europe Facility
CYnergy Action

The FSRU solution

Large LNG carriers
On-shore Storage Facility
Bunkering Barge
LNG / TEUs Truck Loading Facilities
FSRU – Floating Storage and Regasification Unit

FSRUs are based on LNG tankers and use essentially the same technology as onshore terminals. The difference is that the regasification equipment is either constructed with the ship or retrofitted onboard, and that it is specifically designed to be suitable for shipyard construction and marine operations.

The Floating Storage and Regasification (FSRU) business started just 16 years ago in 2001 when El Paso contracted with Excelerate Energy to build the first FSRU vessel for the Gulf Gateway project. The first FSRU went into service in 2005. Today there are 26 FSRU vessels of which 23 are operating as floating terminals and 3 as LNG tankers. Another 10 are currently in construction with options placed with shipyards for another 10.

In 2015, out of the seven new terminals, four were FSRUs, and six of the 19 currently under-construction projects are floating concepts, indicating that the ratio of onshore to offshore terminals will continue to shift.

At the end of January 2017, total active floating import capacity stood at 83 mtpa.

FSRUs have enabled far more countries to become LNG importers and enabled them to enter the market far faster and at a substantially lower cost compared with building a conventional onshore receiving terminal.

A total of 109 LNG terminals have been proposed for start-up between now and 2020. If all 109 terminals go ahead and materialize they will add 305 million tonnes of regasification capacity, most if it in Asia.

Industry reports estimate another 58 FSRUs at various stage of development, from early concept to implementation, and could be in operation by 2025 with the capacity to import close to 200 mtpa i.e. 60% of the world’s LNG production in 2016.
Why FSRU?

- Lower cost, faster schedule, commercial flexibility and reusable asset feature of FSRUs when compared to land based (onshore) terminals which cannot be relocated and must be accounted as unrecoverable cost, i.e. sunk cost.
- A typical new-build 174,000 m³ FSRU typically cost $240 – 300 m compared with US$1 billion+ for a similar sized conventional onshore terminal.
- The recent trend has been to construct new build vessels with typically 170,000 m³ storage and a 600-750 mmscfd send out rate.
- An FSRU takes 2-3 years to build compared with 3-5 years for the onshore terminal.
- Consequently, the shorter schedule to deliver first gas will improve the cash flow and the project economics.
- Most FSRUs are classified as ships to provide the flexibility to operate either as an FSRU or LNG tanker.
- FSRUs currently in construction offer the same full processing capability as land based terminals including full boil-off gas management facilities using recondensers.
- Permitting issues for onshore terminals are common due to the NIMBY (Not In My Back Yard) effect.
- Construction of FSRUs in a shipyard minimizes the impact of local construction activities such as large movements of civil engineering materials, large equipment, steel works etc. Such disruptions frequently create major issues in securing planning permissions for onshore terminals, especially in environmentally sensitive/protected areas.
<table>
<thead>
<tr>
<th>Feature</th>
<th>FSRU</th>
<th>Onshore</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send-out &lt; 6 mtpa</td>
<td>X</td>
<td></td>
<td>Allows for quicker fuel switching</td>
</tr>
<tr>
<td>Additional capacity required in future</td>
<td></td>
<td>X</td>
<td>Space on onshore site allows additional vaporizers to be added. Additional FSRU can be added.</td>
</tr>
<tr>
<td>Storage &gt; 170,000 m³</td>
<td>X</td>
<td></td>
<td>If conversion, Max vessel size ~ 170,000 m³. New-build can be custom designed. However, could add FSU.</td>
</tr>
<tr>
<td>Additional storage required in future</td>
<td></td>
<td>X</td>
<td>Space on onshore site allows for further tanks. Could consider adding FSU.</td>
</tr>
<tr>
<td>Strategic storage required</td>
<td></td>
<td>X</td>
<td>FSRU is a flexible option. Multiple FSUs can be leased.</td>
</tr>
<tr>
<td>No existing harbour available</td>
<td></td>
<td></td>
<td>Offshore FSRU with pipeline to shore provides the best option as harbour/breakwater construction can be very expensive.</td>
</tr>
<tr>
<td>Water depth &lt; 14 m at harbour entrance</td>
<td></td>
<td>X</td>
<td>Dredging expensive and ongoing OPEX. Offshore FSRU with pipeline to shore provides the best low cost option.</td>
</tr>
<tr>
<td>Required Onshore permits difficult to issue - NIMBY</td>
<td></td>
<td>X</td>
<td>Onshore terminals are major construction projects involving major earth moving and heavy construction materials creating major disruptions and delays.</td>
</tr>
<tr>
<td>Fast track need for gas market</td>
<td></td>
<td>X</td>
<td>Onshore terminals typically take up to 5 years to construct.</td>
</tr>
<tr>
<td>Financing / lack of capital restrictions</td>
<td></td>
<td></td>
<td>FSRU can be leased. Still need to finance harbour works if needed, and pipeline connection to customers/grid etc.</td>
</tr>
<tr>
<td>Lower CAPEX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of land for onshore terminal</td>
<td></td>
<td>X</td>
<td>Land reclamation can be an expensive option.</td>
</tr>
</tbody>
</table>
The capital cost of a new FSRU-based terminal can typically represent just 60% of an onshore terminal and can be delivered in a shorter time. An onshore 3 mtpa terminal with one 180,000 m³ storage tank is likely to cost $800-900m, depending on local construction labour costs, compared to $400-500m for a similar capacity FSRU. Project schedule, the time taken to construct an onshore terminal is driven by the construction of the tanks which is typically 36-40 months. New build FSRUs typically take 27-36 months but a conversion could be less at typically 18-24 months.

The capital cost of an FSRU terminal comprises of three major components:

- **The FSRU vessel:**
  - New Build or conversion
- **The infrastructure**
  - **Inshore** (jetty structure for mooring the vessel, the transfer of LNG from the supply tanker and the piping systems necessary to connect the regasified LNG to the gas network)
  - **Offshore** (either a submerged turret buoy system or a single point mooring surface system)
- **Owner’s costs:**
  - Owner’s project team that oversees all technical and commercial aspects that include the cost of all specialist contractors and consultants used during the period prior to the Final Investment Decision (FID) e.g. feasibility studies, design, and environmental impact assessment.
FSRU – Project Schedules

Project Schedules
FSRU project schedules are driven primarily by 3 key activities:
  Preliminary discussions & feasibility studies
  Permitting & pre-engineering to achieve project approval
  Construction

Preliminary Discussions & Feasibility Studies
These cover the initial discussions and negotiations between the various stakeholders – the gas customer, the LNG supplier(s), the possible FSRU provider, the local authorities including the harbour authority and project financing. The purpose of these discussions is to determine if the project is feasible and usually concludes with the issue of a feasibility report with next stage actions. This stage will include preliminary conceptual design work to ensure the technical feasibility.

Permitting & Pre-Engineering to Achieve Project Approval (FID)
This stage covers the preparation of the contracts between the stakeholders, the development of the concept, specifying the precise project location, obtaining the necessary permits and determining the project budget and schedules as the basis for project approval (Final Investment Decision). It will include discussions with the necessary permitting authorities to ensure all the required permits can be issued for construction and subsequent operation. This is critical for making the final investment decision.

Construction
This covers the time taken to obtain the FSRU vessel and construct the infrastructure e.g. jetty and interconnecting gas pipeline. The two activities are independent and can run in parallel.
member of the TSAKOS GROUP of companies

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