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**The Implications of Recent Developments in LNG  
Shipping on the Global LNG Trade**

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## Abbreviations

AIPN	Association of International Petroleum Negotiation
APEC	Asia Pacific Economic Cooperation
bcm	billion cubic meters
bcma	billion cubic meter per annum
BG	British Gas
BP	British Petroleum
Btu	British thermal unit
CCGT	Compressed Cycle Gas Turbine
CEPMLP	Center for Energy, Petroleum and Mineral Law and Policy
CIF	Cost Insurance and Freight
CSR	Corporate Social Responsibility
DES	Delivered Ex-Ship
EU	European Union
FERC	Federal Energy Regulatory Commission
et al	and other authors
FLNG	Floating Liquefied Natural Gas platform

FOB	Free On-Board
GTA	Gas Transportation Agreement
IEA	International Energy Agency
IEEJ	Institute of Energy Economics of Japan
IOC	International Oil Company
IPE	International Petroleum Exchange
IPP	Independent Power Project
IRR	Internal Rate of Return
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MWH	Megawatt Hours
NYMEX	New York Mercantile Exchange
OECD	Organisation of Economic Community and Development
OGEL	Oil, Gas & Energy Law Intelligence
OPEC	Organisation of Petroleum Exporting Countries
P.	Page
SPA	Sale and Purchase Agreement

Supra	cited
TEPCO	Tokyo Electric Power Company
TOP	Take or Pay
UK	United Kingdom
Vol.	Volume

## **Abstract**

Recent developments in LNG shipping have been a good sight for globalization of gas market in a competitive way with global oil market. Significant cost reduction, technological developments, expansion of LNG production capacities in excess of demand, liberalisation and increasing competition between players have changed the conventional game and forced LNG sellers to be more flexible. While long-term Sale and Purchase Agreements increase political risk and restrict diversification of energy sources which lead to more security of supply, short-term contracts increasingly improve more flexibility, liquidity in physical balancing and security of supply. Furthermore LNG vessels that can move LNG through oceans toward far distance markets, with increasing cost reduction in LNG shipping, expansion of vessels' capacity and invention of floating regasification ships all, are moving towards a new era of uncommitted LNG ships for LNG trading. This creates a significant potential to develop flexible contractual structures in the LNG market; Spot sales are to meet short term demands especially within changing seasonal weather. Swap arrangements are to optimize transportation costs and reduce interval between producing area and market, and arbitrage creates opportunity to enjoy from price differential between markets thus increasing competition in a global LNG market.

However, LNG to achieve a global spot market confronts with some shortcomings; the high capital expensive nature of LNG industry requires dependence on long-term contracts as the dominant relationship between sellers and buyers. Even the idea of covering long-term risk by financial derivatives has proved to be an incredible idea. Moreover LNG shipping cost although has decreased but still remains at least five times more than oil tankers shipping cost. This leads to several LNG prices in different destination markets, thereby limited achieving to a universal gas price. Furthermore price confidentiality in most Sale and Purchase Agreements and lack of transparent trade pressing on gas price in all regions as opposed to oil market has limited development of LNG spot market. Therefore long-term Sale and Purchase Agreements have remained as a mainstay in high capital extensive business of LNG; as no producer has yet embarked on LNG project solely to produce spot cargoes. This reality makes LNG spot trading an adhoc contractual environment not a regular spot market.

The main question is to consider how LNG spot trading compete in a predominantly long-term LNG market. The importance of this work highlights with regard to this fact that Iran is joining to LNG producer countries. This study is directed on interdisciplinary discussions and seeks to consider implications of recent developments in LNG shipping on flexibility of contractual arrangements for LNG trade and globalization of LNG spot market.

### **Key words:**

- 1) LNG
- 2) LNG shipping
- 3) LNG spot sales
- 4) LNG spot market
- 5) Arbitrage
- 6) Swap agreements

## Introduction

Natural gas has captured a particular growing importance in the overall energy mix worldwide. The two oil shocks of 1973 and 1979 that renewed prospects toward diversification of energy sources for more security of supply, pervasive growth of nationalization of concessions that were held by International Oil Companies especially within OPEC countries, restructuring and development of liberalised gas markets with third players access to terminals made it more attractive for potential investors and improved considering gas trade. This importance is mainly influenced by two reasons: first, natural gas is increasingly becoming the favoured fuel for electricity generation as Combined Cycle Gas Turbines that are gas fired power plants require lower investment cost that leads to a quick return on investment. Secondly, natural gas has lower greenhouse emission in comparison with oil and coal; these advantages attract policy makers' attentions in energy policies and influence industry decisions. This trend led to increasing demand and expanding gas trade beyond regional markets. Nevertheless natural gas as a low density fuel encounters with some physical constraints; most of the consuming markets particularly OECD countries are located in far distance from gas reserves and transportation by pipeline encounters with transit risk. The technology of Liquefied Natural Gas (LNG) seek to resolve this problem by turning gas(mainly ethane and methane) to liquid at -260 degrees Fahrenheit, this product is 1/1600<sup>th</sup> of the same amount of gas<sup>1</sup>, so transportation of gas becomes easier by LNG vessels which can carry great sums of LNG through oceans. This technology although is too costly but enjoys from the above mentioned advantages of gas; furthermore shipping LNG beyond regional commerce into far distant markets can, to some extent, give a

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<sup>1</sup> Jensen, J.T., The Development of a Global LNG Market, Is It likely? If so, When? , Oxford Institute for Energy Studies, 2004, P.5

competitive outlook for LNG alongside global oil market. It can play a key role in transportation of gas to markets when as a result of distance or natural limitations, transit risk and political obstacles, transportation by pipeline is not a suitable way. This is a significant advantage that transit risk in LNG transportation by sea is not materialised. Furthermore, recent developments in LNG industry that have led to lowering capital cost in liquefaction, shipping and regasification, increasing capacity of supply to enjoy from economies of scale, more flexibility in SPA provisions like take-or-pay and destination clause that inclined towards increasing use of LNG spot trading for meeting physical balancing give LNG more advantages over pipeline gas, given the fact that indigenous gas reserves in US, UK North Sea and Netherland are increasingly depleting.

Historically through 1970s and 1980s, LNG was an expensive and luxurious industry. Upstream and downstream players in LNG business were bound together by mutual dependency. The LNG chain has been an integrated process, comprising liquefaction, shipping and regasification infrastructures that require huge capital investment and specialized technology. Such huge investments necessitate proper mitigation of risks for return on investment or capital recovery on the basis of project internal rate of return (IRR). Conventionally, the return on investment was secured by long-term LNG Sale and Purchase Agreements (SPA) with rigid clauses on take or pay obligation thus formulating the pattern of risk sharing: "the buyer takes the volume risk and the seller takes the price risk". LNG was sold to a particular buyer and this monopoly was controlled by destination clause in the contract and a particular LNG ship was allocated to the project. Buyers have been usually states or regulated utilities that usually have substantial balance sheet to insure their creditworthiness and a continued market to guarantee their long-term purchase commitments; therefore predictability of cost and revenues of the project could be



assured. This arrangement facilitates project financing but limit both producer to extend its relation with other markets and buyer to be offered by competitive suppliers, it also left no room for spot trading. Liberalisation has brought a see of changes in market structures and contractual provisions; with the removal of dominant market players and introduction of third party access to terminals a regulatory regime for separation of ownership and use of these facilities developed. With the attendance of independent participants in downstream market and increasing competition between them, the pass through pricing mechanism has collapsed. In fact it can be regarded that the increasing number of players in LNG business is changing the conventional game; about last two decades, when there were very few players, buyers were essentially forced to assume the volume risk. If they sought flexibility, they would get it from somewhere else other than the LNG purchase contract, mainly by pass through pricing mechanism. But, increasingly with entrance of new sellers and availability of more production capacity than demand, the opportunity has arised for buyers to force sellers to be more flexible. So buyers in downstream market sought for more flexibility to mitigate price and volume risk in gas contracts. This led to reducing the length of conventional SPAs, review in some rigid clauses such as take-or-pay obligation in traditional SPAs and eliminating destination clause. On the other hand sellers tried to reduce their volume risk by downstream integration through self-contracting mechanism which developed opportunities for short-term contracts. These contractual flexibilities together with debottlenecking developments and disparity between ramp-up period of the contract and full production capacity in this phase released uncommitted volumes to the market that could be utilised in short-term trading.

On the other hand industrial developments have decreased LNG costs significantly thereby enabling LNG to enjoy from economies of scale following with capacity expansion in LNG

terminals and increasing global demand for natural gas as a favoured fuel for power generation. Increasing worldwide demand for LNG intensified by regard to significant advantage of LNG as a fuel which can assume some of the peaking role that is carrying out by oil. This enables LNG to satisfy physical balancing role by spot sales. Also the liquid nature of LNG offers greater flexibility in destination clause and makes it easier for cross-continent transportation.

In the meanwhile LNG shipping is a missed link between growing demand for gas and increasing LNG production capacities. In fact LNG shipping has a critical role in connecting a global LNG market.

Availability of extra production capacity and growing demand together with liberalisation and increasing third party access to terminals have come to pressure on transportation arrangements for more flexibility. Restructuring in LNG market prepared a competitive market for transportation that provides open and third party access for participants. New orders for shipbuilding have been placed that were not committed to specific project. This was in contrast with traditional form of dedicated ships to bilateral trades. This provides a scene for new group of uncommitted tankers operating by independent shipowners in favour of LNG spot market.

In fact it can be claimed that the overall implication of these developments in the global LNG trade is developing LNG spot market and more flexible contractual terms including swapping and arbitrage. However according to experts' view, it is not still comparable with oil spot market; it needs time to evolve and learn from the success of its sister product-oil.

Reliance on long-term SPAs is still inevitable in LNG industry; high capital intensive nature of LNG projects require security of revenue stream on the basis of long-term SPAs with take-or-pay

clause which help to mitigate volume risk, increasing reliance on oil as a dominant fuel in the industries, lack of sufficient infrastructures required for LNG facilities relating to deficiencies in capital or foreign investment and environmental resistance, lack of a central supply point for LNG and unified gas price, physical composition of gas, diverse requirements for gas quality in different markets and high expensive cost of storage which are potential impediments for utilisation of uncommitted gas volumes have restricted evolution of LNG spot market; moreover LNG shipping cost is significantly higher than oil tankers transportation cost. There are huge capital investments required for LNG transportation. Most of LNG ships are still employed in long-term charterparties. So transportation bottlenecks and lack of extra shipping capacity are also the potential impediments for the growth of LNG spot market.

In the context of this dissertation I am looking to answer “To what extent these changes within LNG chain has affected the dominant nature of long-term SPAs?”, “To what extent LNG trading with these modifications can be competitive with oil trading and lead to flexible contractual structures? ”, “To what extent regulations and contractual modifications can improve development of maturity in LNG short-term trading?” and “What are the potential benefits and impediments for development of LNG spot market?”

My hypothesis is that the ultimate shape of LNG market will be a synthesis of the traditional SPAs and the new short-term trading.

For a comprehensive study about developments of flexible structures within LNG shipping arrangements, in the first chapter after a review on vital role of shipping in LNG trade and recent technological evolutions in the LNG shipping industry that led to several cost reductions in LNG chain, contractual structure of LNG transportation agreements and its interference with SPA

terms will be examined. Then new trading arrangements for the emergence of non-contracted LNG ships as a main driving force of development of LNG spot market will be considered. In the further three chapters implications of LNG shipping developments has examined from three perspective; in chapter two, the main aspects of contractual flexibilities with development of LNG spot sales, arbitrage and swapping arrangements will be scrutinized. Chapter three regard to these implications from market perspective; development of LNG spot market, drivers and limitations will be examined in this chapter. Finally in the fourth chapter policy implications of these trading arrangements will be considered.

It should be noted that although the scope of a real spot contract is stricter than that of short-term contracts, in the context of this dissertation spot trading and short-term trading will be applied in the same meaning. Furthermore since developing LNG spot market has been originally derived from evolutions in restructuring of gas market, reference to the prospects in natural gas market is inevitable.

Direction of arguments is on the basis of interdisciplinary discussions on law, economics, management and policy which exactly represent underlying groundwork of my learning within Center for Energy, Petroleum & Mineral Law and Policy in University of Dundee.