CHANGING CONTRACT STRUCTURES IN THE LIQUEFIED NATURAL GAS MARKET: AN EMPIRICAL ANALYSIS OF SELLERS AND BUYERS RELATIONS IN THE NATURAL GAS INDUSTRY

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Abstract

LNG contract is characterized by: A sizeable contract volume, a long contract term, Take-or-pay (TOP), Bilateral contracts between specified sellers and buyers uniform/fixed-rate deliveries. In this paper, we analyze the determinants of contract duration in a large number of natural gas contracts and provides an empirical assessment of long-term liquefied natural gas (LNG) supply contracts to determine optimal contract duration. also be investigated the trade-off between contracting costs due to repeated bilateral bargaining and the risk of being bound in an inflexible agreement in uncertain environment. we find that in general, contract duration decreases as the market structure of the industry develops from monopolistic to more competitive regimes. our main finding is that contracts that are linked to an asset-specific investment are on average six years longer than the others; however, their duration decreases with liberalization as well. with increasing bilateral trading experience between the same trading partners, contract duration decreases we additionally observe that countries heavily reliant on natural gas imports via LNG are willing to forgo some flexibility in favor of supply security. contracts dedicated to competitive downstream markets on average are shorter than those concluded with customers in non liberalized import markets.The discussion is fostered by the ongoing liberalization process in continental Europe's natural gas and electricity markets in a period when import countries have encountered record-high prices, example , crude oil has been traded in the US$ 140/bbl range in summer 2008 and liquefied natural gas (LNG) spot cargoes delivered to Japan were above US$ 19/MBTU in January.to conclude, we note a significant and widening gap between European production and demand, growing faster after 2012. from the analysis of production prospects, export infrastructure projects in producer countries and long-term contracts, the structure of European gas supply in 2020 is expected to evolve as follows: Norway will become the key indigenous supply source, with a market share of around 20%, Subject to investment conditions and import capacity from central Asia, Russia will maintain its dominant share of European gas supply, estimated at more than 28% by 2020, relying on its large reserves, LNG is forecast to account for 20% of European gas supply in 2020, coming from a variety of sources, Africa and the Middle East will powerfully consolidate their role in European gas supply, accounting for estimated respective shares of 22%-23% and 10% by 2020, compared to 15% and 2.5% in 2008.similar to these events, European markets are today, undergoing significant changes. Breaking up of monopolistic market structures, introduction of regulated third party access to infrastructure, decreasing indigenous production and the growing importance of LNG in the supply mix cause increasing spot activities, entrance of new market participants, and multi-sourcing of supplies. Result: today, most of the natural gas on the US-American and British markets is sold under short and medium-term contracts, spot trade at a diversity of market places has reached a mature level, spot markets are liquid and financial instruments with some forward depth have evolved. contracts that have been signed in combination with exploration of new resources or building of new infrastructure are on average five years longer in duration in Europe and almost three years for all contracts. removal of destination restrictions in European contracts replaced by shift from FOB to DES contracting. Finally: consideration of future LNG contracts, many options of pricing formula will be available in the future.

Moreover, a wide variety of LNG contracts can be arranged by pairing different pricing formulas with various trading patterns, each having flexibility of its own.

Introduction

The issue of long-term contracts as an intermediate organizational form somewhere in between vertical integration and short-term, market based trading in itself is a regular topic in institutional economics and contract theory. This debate, which had somewhat abated in the 1990s, is now back in ful swing, driven by theoretical developments in institutional and contract theory, but also by increasing concerns about reduced security of supply and skyrocketing short term prices of these commodities the most drastic being the unexpected surge in oil prices. our hypothesis, derived from theoretical work and more recent empirical analysis, is that the move from a monopoly industry to more competitive market structures implies that long-term contracts loose some of their importance, and that they are likely to play a considerable role (only) when large scale, asset specific investment decisions are at stake. amongst other things, we find that the contracts duration decreases significantly as natural gas markets become more competitive, and that the volume of yearly contracted gas is positively correlated with the contract length.as transportation technology improves and economies of scale are reaped upstream, midstream and downstream, the capital intensity of the natural gas value added chain diminishes. this is particularly the case for LNG, but it also holds for traditional pipeline technology. In the LNG chain, investment costs per unit of output (here: million British thermal units,), has decreased from well above$ 4.5 MBtu in the early 1990s, to about $3.5/MBtu in the year 1996,to abouat ,$3.5/MBtu in the year 2003. Figure 1 shows the composition of these costs, the reduction of which has different sources - Liquefaction is carried out in larger units than before. Standard size of a train was about 1 mtpa per year at the upsurge of LNG business and has now reached a capacity of 3.5 to 4 mtpa; plans for 7.8 mtpa trains exist in Qatar (ConocoPhillips and Bechtel, 2004) - Likewise, shipping is carried out in larger LNG-vessels (140.000 to 145.000 cm today, 40.000 cm15 years ago, 25.000 cm 40 years ago) that use more efficient motors; costs for construction tankers in Asia have dropped from $250 million to $170 million for a standard 135.000 cm ship since some ten years ago (IEA, 2004) - Downstream, regasification also benefits from scale economies mainly for storage (according to IEA (2004) tanks with storage capacity of 200.000 cm are the current optimal size) and using different technologies Decreasing investment intensity leads to lower risks in the industry, and should thus have a negative effect on contract duration. also Figure 1 is an effort to trace what has happened to LNG transportation costs over time .It uses the cost assumptions of the day to provide an illustration of what the transportation costs (excluding the cost of the feedstock) might be of delivering LNG to the North American Pacific coast from a new six million ton greenfield plant in Australia . In 1996, the plant might have consisted of three 2 million ton trains. In 2000 and 2003 two 3 million ton trains would have provided the same output. currently the plant might be designed for one 6 million ton train. As Figure 6 illustrates, the declining cost trend of the late 1990s and early 2000s has been sharply reversed, overriding the scale economy effect operating earlier.

Major themes

Global LNG Supply / Demand Outlook consist :Near-term(next 5 years) and Long-term: 2013-2030,Developments in LNG Markets and Trade consist:c hanges in business models,optimal contract duration,spot trade, flexible LNG and arbitrage and pricing: is convergence likely? Structural changes in the LNG industry and underlying reasons : traditional model:“tramline projects” with long-term dedicated contracts and bi-lateral trade consist: major expansion expected in US was catalyst for change in Atlantic Basin,transition in Europe further induced by early cargoes or additional volumes associated with long term contracted production without contractual destination ,growing trend towards portfolio play with shorter term contracts, cargo deviations, spot trade and arbitrage play.changes in

contracting strategies for LNG supply consist: destination flexibility is key, but who controls? removal of destination restrictions in European contracts replaced by shift from FOB to DES contracting ,p rofit-sharing mechanisms for cargo deviations under scrutiny by competition authorities ,a cceptable compromise are “push-button” diversion clauses, master sales agreements and confirmation notices per transaction allows rapid execution of spot trade.commercial strategies consist:resource holder/producer strategies, shorter contracts , not contracting entire capacity,self-contracting, marketers and gas merchants pursue LNG trading for arbitrage gains and to mitigate volume risk,aggregators assume volume risk under long-term FOB contracts in return for destination flexibility of LNG.Source and development of LNG Spot Market :annual growth rate past 10 years, spot/short-term LNG Trade = 15%(currently 20% of total),all LNG trade = 7.5 %,source of spot/short-term trade ,“true spot”,“ flexible LNG”,50% of capacity added in 2008-2010 is flexible ,By 2010 25% of total capacity is flexible LNG, major growth of flexible production in Middle East.Impact on security of supply and prices: flexible LNG supply suitable for demand peaks and supply disruptions,[Figure2]less for base load needs (unless reliable access to alternative supplies), Need to outbid competition on global basis to attract cargoes, leading to increased volatility of wholesale prices, critical will be the timing of transition of US market from current “sink” to base load buyer (unconventional resources are key).Implications for pricing: is convergence likely? Price Setting mechanisms: concepts for gas pricing can be based on: traded markets, bi-lateral contract markets or government determination ,Europe has different price setting for spot and for long term transactions, Europe and US have different supply/ demand drivers and have different short-term clearing price mechanisms, can physical trading link between both markets lead to price convergence in traded markets? conditions for price convergence consist: convergence understood as: operation of single price mechanism between two traded markets, requirements for LNG trade to establish convergence between US and Europe (and eventually Asia),sufficient discretionary supplies which respond to price signals, surplus shipping capacity, accessible surplus regasification capacity ,s upply and demand in balance in respective markets[Figure 3]. Outlook on convergence or divergence p ast: occasional influences between HH and NBP but no convergence, outlook: convergence in Atlantic Basin only if USA needs more LNG and ample supply of flexible LNG available, critical developments c an recent increase US gas production be sustained, new LNG will projects continue to feed sufficient flexible LNG into Atlantic Basin. LNG buyers will secure long term regas capacity without contracting LNG supply, to take advantage of the differences in the profitability and competitivness of different regasification terminals at both regional and national level (especially in the liquid markets in Northwest Europe), in line with the emergence and development of a market for LNG regas capacity. The gap between European LNG long-term contracted volumes and actual imports is estimated at 30 bcm in2015 and approximately 56 bcm in 2020 (assuming extension of Algerian contracts with Spain and France and Nigerian contracts with Italy). In the short and medium-term, a large majority of this gap is expected to be met by the flexible long-term LNG portfolio, which is gaining large importance in the Atlantic Basin and can be dedicated to multiple destinations (US, Europe). This will entail re-orientations of LNG cargoes from the US to Europe .Indeed ,the recent growing role of unconventional gas in the US has altered previously forecast US LNG requirements. The Atlantic Basin’s long-term LNG portfolio is a main source of short-term deliveries. Adding direct spot purchases between the two continents particularly related to different seasonal national demand profiles, short-term LNG trading in the Atlantic Basin is expected to increase almost fourfold to 55 – 60 bcm by 2015,representing around half of global short-term LNG trade by this horizon, compared to 35% in 2007.[Figure 5], Qatar is set to gradually emerge as a key European LNG supplier, accounting for almost 8% of European gas supply in 2020, compared to only 1% in 2007. Among the other main suppliers, LNG deliveries from Algeria, Egypt and Nigeria are predicted to grow 35%, 200% and 67% respectively over the 2008-2020 period. In Egypt and Nigeria, marketable production has increased by more than 60% in the last five years and proven reserves by 10%.[Figure 6] This paper analyzes the impact of long-term contracts on the ability to sustain

collusive outcomes. I consider a simple model where firms have signed index contracts and repeatedly interact on the spot market. the contracts specify a quantity and a price indexed to the spot price where the indexation can take different forms. It is shown that these contracts facilitate collusion on the spot market provided that the indexation to the spot price is sufficiently strong .It is the flexible portion of LNG that may drive price alignment ,also

figure 4 illustrates that is the portion not tied into long term point-to-point contracts, flexible

LNG flows to the buyers that offer the highest netbacks,flexible LNG consists of: uncommitted LNG ,contracted LNG where the buyer is not an end user but an aggregator /trader.

Data

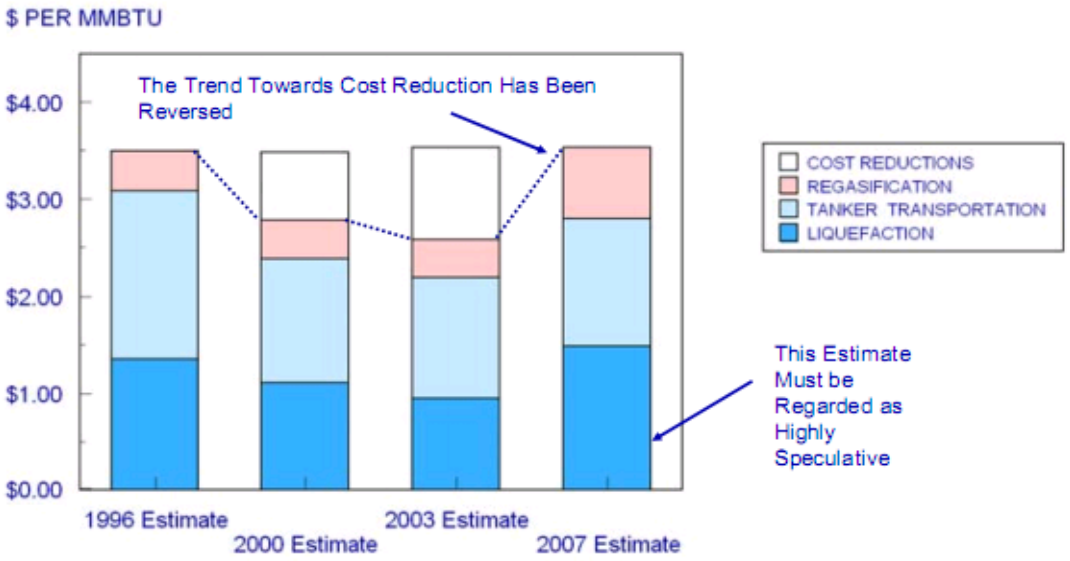
Empirical research in international natural gas trade is heavily restricted due to data availability. Different to the US, where a list of signed contracts and respective information on price provisions, take obligations and several adjustment parameters as of 1985 is available, there seems to be no better secret kept in European trade than which company is supplying natural gas under which conditions. Therefore ,the data used is in this analysis has been collected from several public available sources and partly verified through expert interviews. detailed information is available on the date of contract signature, and for a large part on the starting and ending date of deliveries and contracted volumes (annual or total).Recently signed contracts linking the price for natural gas in these contracts to power pool prices, natural gas spot market prices or mixtures of these have been extensively exploited by trading press as if to document the dawn of a new era. The same applies to LNG contracts where segmented evidence on negotiated fob-pricing is available. Overall, we have identified 300 contracts with a duration exceeding one year signed between 1968 and 2010. [6],The contracts with the longest duration originate in deals between traditional monopolistic importing and exporting companies. a large share of the sample set including all contracts is represented by trade in the Asian-Pacific region. The dependency on LNG imports mainly from Malaysia, Indonesia and Australia has been neatly documented. Prices for natural gas imports in Asia are known to be linked to the JCC (Japanese Crude Cocktail, the average of Japanese crude import prices) and signed for long time periods. Recent developments indicate the willingness to introduce more competitive trading. However, this will only be implemented when the Asian electricity sectors have been liberalized.[Figure 8]

Conclusion

We study the trade-off between contracting costs due to repeated bilateral bargaining versus flexibility. estimation results of a simultaneous equation model show that the presence of high dedicated asset specificity results in longer contracts thus confirming the predictions of transaction cost economics, whereas the need for flexibility reduces contract duration. with increasing bilateral trading experience contract duration decreases. we furthermore observe that countries heavily reliant on natural gas imports via LNG are willing to forgo some flexibility in favor of supply security. estimation results of a model of simultaneous equations show that the presence of high dedicated asset specificity in LNG contracts results in a longer contract duration, which confirms the predictions of transaction cost economics. We observe, however, that the increasing need for flexibility in today's "second generation" LNG industry reduces contract duration. Firms experienced in bilateral trading generally are able to negotiate shorter contracts. We also find that countries that rely heavily on LNG imports are often willing to forgo some flexibility in favor of supply security. our main result is that contracts related to a significant asset specific investment are on average several years longer than those where less significant investment issues are at stake. the structure of international LNG trade is changing both in quantity and quality: natural gas hubs gain

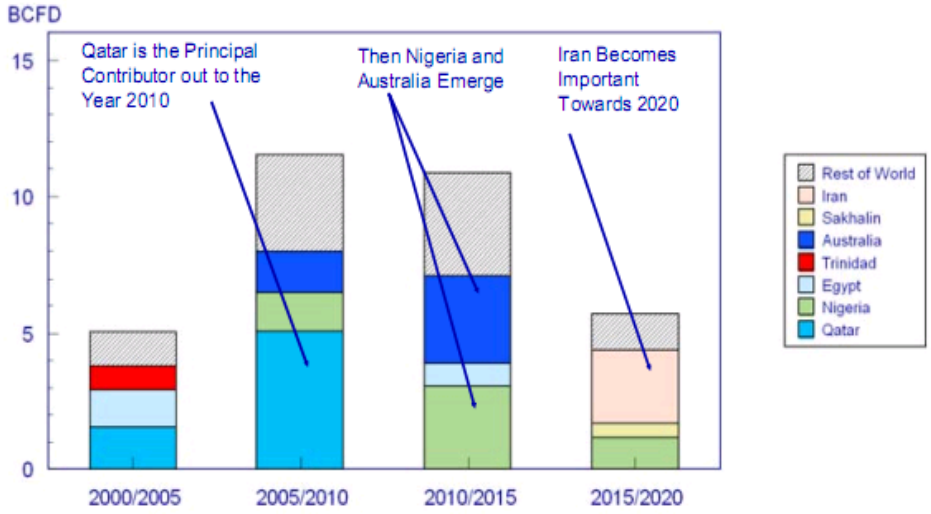
liquidity, long-term contracts and short-term agreements co-exist, and the duration of shipping charter contracts is falling significantly, too. If the "first generation" LNG market companies tended to develop bilateral trading relationships within one of the major regions (North America, Europe-Eurasia, or Asia-Pacific), the "second generation" LNG market motivates market entry along the entire value chain. The analysis of disparities in the balance between contracted imports and projected LNG demand in the Atlantic and Pacific Basins reveals that the Atlantic Basin is oversupplied over the 2008 – 2015 period, while the gap between the contracted imports and actual LNG demand in the Pacific Basin is progressively growing after 2010,to reach approximately 70 bcm by 2015. Around half of this volume is expected to be provided by the Atlantic Basin's long-term LNG portfolio initially dedicated to the US. Increasing spot trade from re-divertible long term LNG contracts is thus expected to grow sharply to allow arbitrages in the Atlantic Basin and the reorientation of LNG flows from the Atlantic Basin toward the under-supplied Pacific Basin in the medium-term.

Figure 1: An illustration of LNG transportation costs over time for a hypothetical LNG trade from Australia to the North American pacific coast :four recent cost estimates



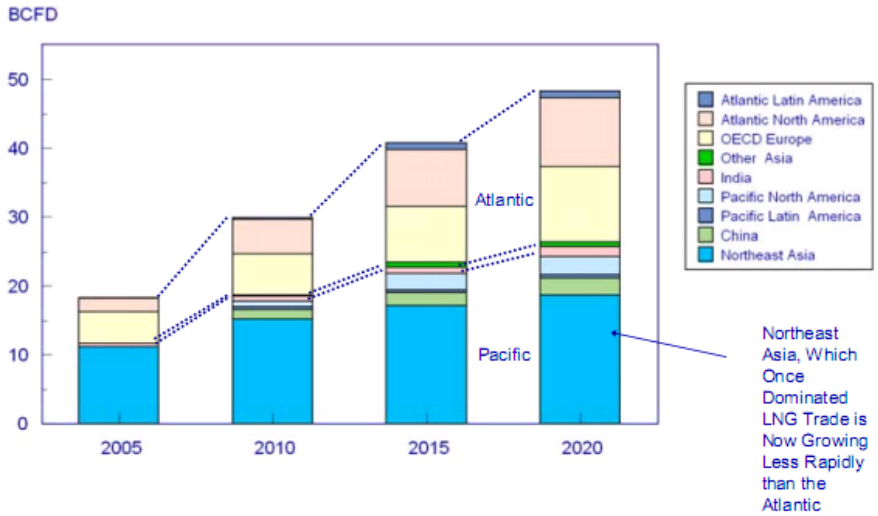
Data Source: U.S. Energy Information Agency (2010); Jensen Associates (2004)

Figure 2: The three largest contributors to incremental natural gas supply over five year periods – BCFD



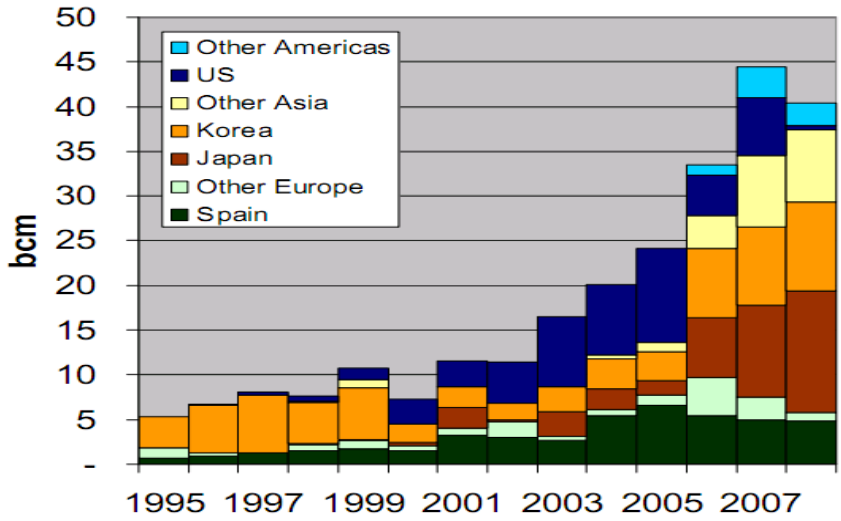
Data Source: U.S. Energy Information Agency (2010); Jensen Associates (2004)

Figure 3: Projections of World LNG Demand by Region BCFD



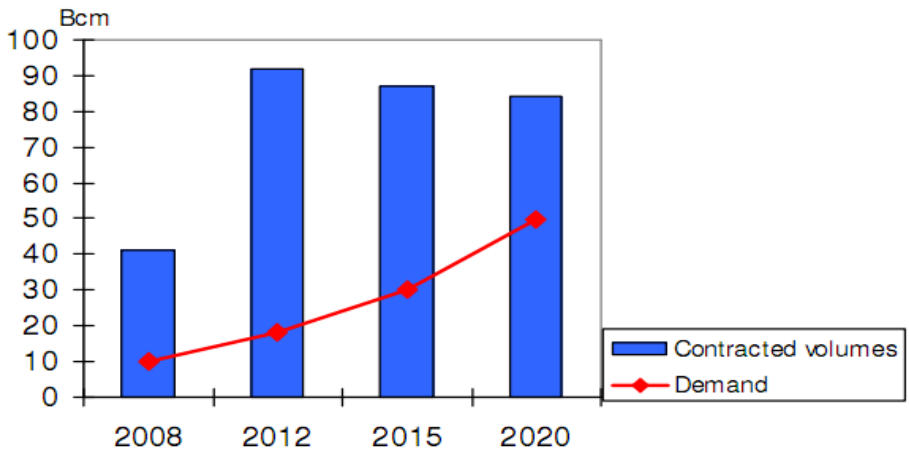
Data Source: U.S. Energy Information Agency (2010); Jensen Associates (2004)

Figure 4**:** Spot LNG trade by importing region, 1995-2008



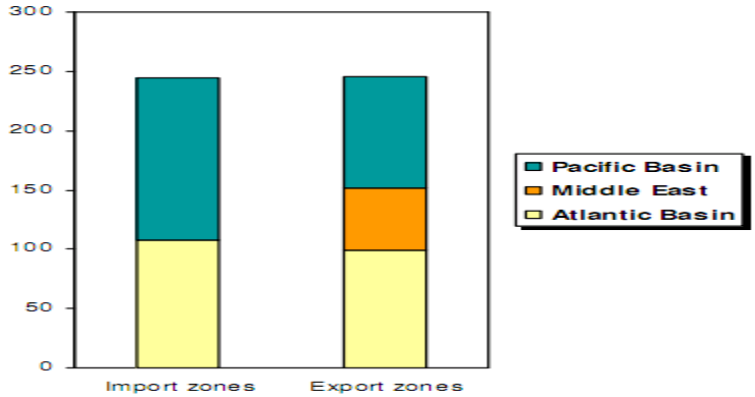
Data Source: Annual Energy Outlook 2011; [1]

Figure 5:US LNG demand and long-term LNG contracted imports (including flexible portfolio) 2008 - 2020



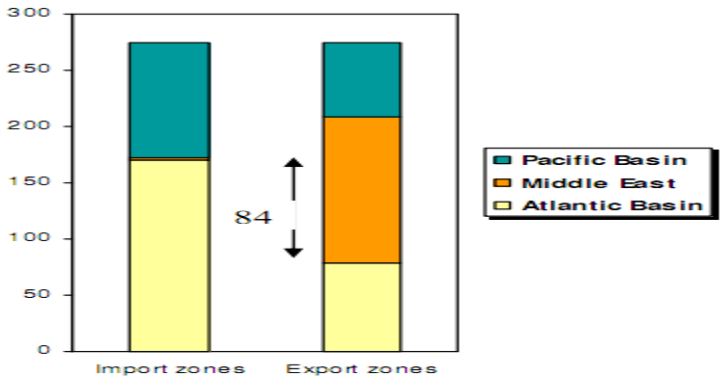
Data Source: CEDIGAZ; [3]

Figure 6: Total contracted volume in 2008, Total = 245 bcm



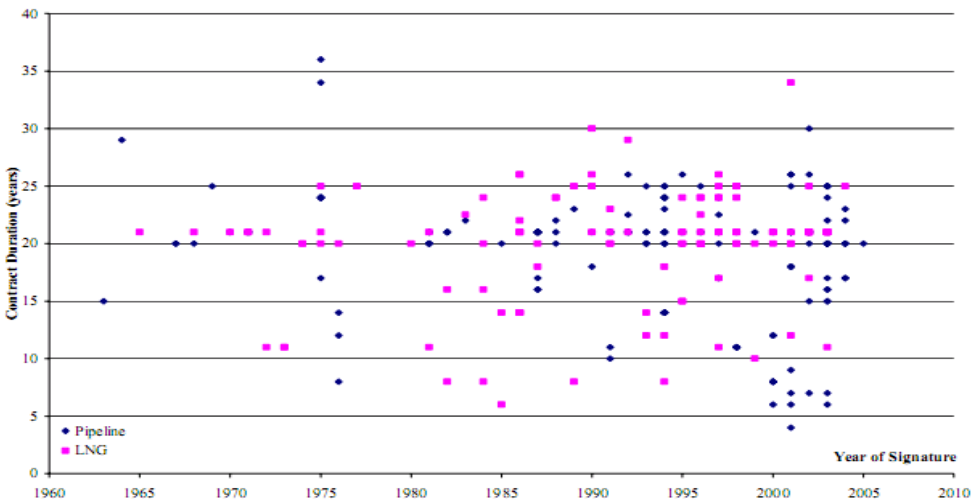
Data Source: CEDIGAZ; [4]

Figure 7: Total contracted volume in 2015 Total = 321 bcm



Data Source: CEDIGAZ; [4]

Figure 8: **European pipeline and LNG contracts**



Data Source: [2] ; [6]

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