

## IMPEDIMENTS TO IMPROVED MARKET ACCESS FOR LNG

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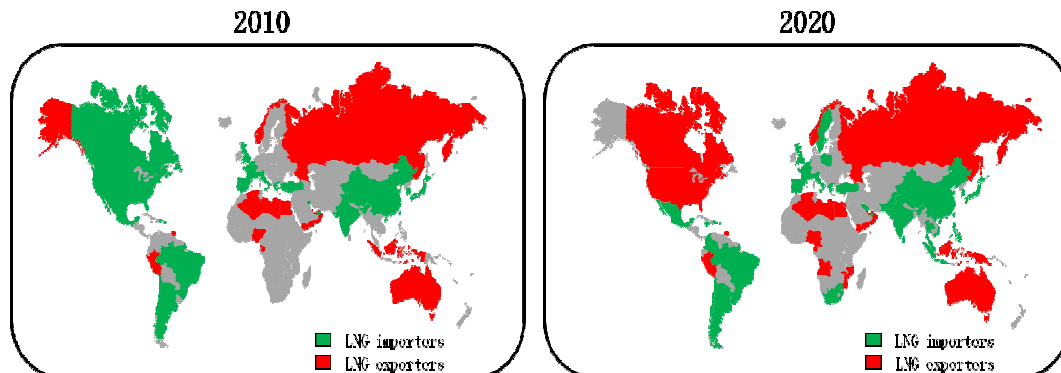
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### BACKGROUND

In this forum we can all agree that the importance of natural gas to meet the world's energy needs now and into the future is clear, and that the case for LNG is equally compelling. There are good reasons for LNG's rapid growth, and four advantages immediately stand out.

First, like other forms of natural gas, LNG offers cleaner energy than oil or coal, important in a carbon-constrained world. Second, in many situations (large distance from market, rugged terrain, etc.), LNG is cost competitive with other forms of gas delivery. The third advantage is a commendable track record in safety that spans more than 40 years (1) [1] and underpins the crucial role of LNG in ensuring security of supply in the future. The fourth advantage is the flexibility of LNG: unlike pipeline gas, buyers are able to source LNG from a number of supply points providing additional supply security. It is no wonder LNG demand has grown so rapidly. Figure 1 shows the growth in exporting and importing projects and illustrates the great job we have all done in the transformation of this industry.



# Countries	1990	2000	2010	2020 est
Exporters	8	12	18	~25
Importers	9	11	24	~40

Figure 1: Growth of Global LNG Markets [2]

There is a remarkable consistency of views that due to the price and difficulty of securing traditional liquid fuels and the unconventional gas developments in North America and elsewhere, gas will penetrate more deeply into many markets including non-traditional ones such as onshore and marine transportation. So, the use of gas will grow sharply in the coming years and LNG is expected to grow even faster within this mix (Figure 2).

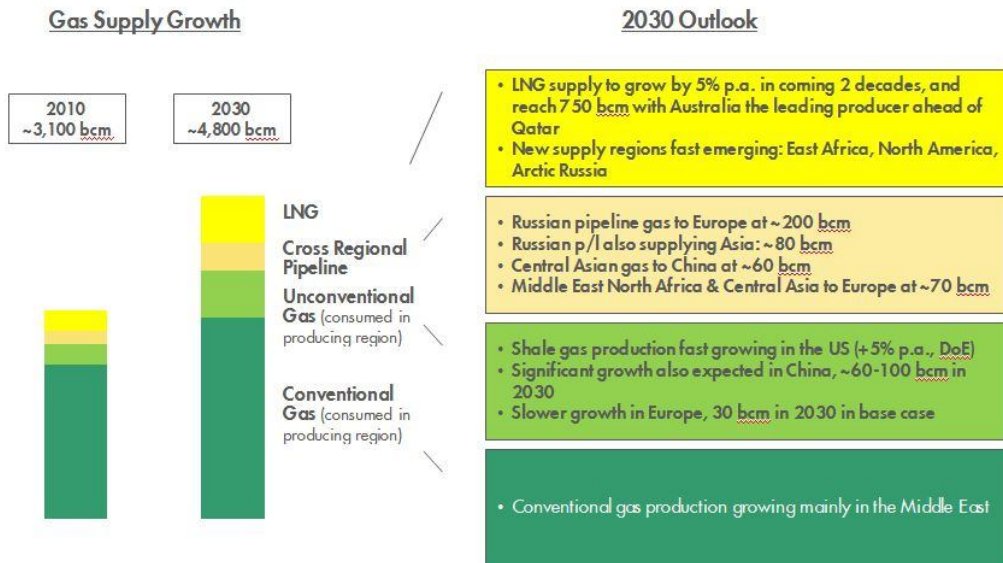


Figure 2: Gas Supply Growth 2010 - 2030 [2]

However, while the supply side of the industry has diversified with 38 supply projects now in existence in 20 countries, markets have exhibited a more “lumpy” distribution profile with Japan and South Korea alone accounting for the consumption of over 45% of all the LNG produced in 2010 [3]. We are all familiar with the role played by the Far East markets that are required to secure long term stable supplies of energy and the strength of their buyers to underwrite the accompanying long term take or pay obligations. However, this is only part of the story and neglects the role of new and emerging markets for LNG and their role in enabling new supply projects in the future.

Supply projects have traditionally required firm, long term contracts to fund the capital-intensive liquefaction trains and upstream developments. While this has evolved recently with more liquidity, in the coming years this will change further and help make the LNG market place more accommodating for new buyers and sellers. New markets represent potential to sharply increase the share of gas usage in their hydrocarbon mix with accompanying financial and environmental benefits. Some of these new markets and several of those “waiting in the wings” also represent a different credit and regulatory profile from the historical pioneering LNG markets requiring a new perspective on financing and development risks.

The responsiveness of LNG to flexibly meet the commercial and strategic demands of new customers has seen Shell recently supply the first LNG into Kuwait and Dubai. We believe there will be many more such new markets, not just in high profile markets in Europe, China and traditional Asia Pacific countries but in a host of new countries as well.

Despite these impressive growth rates there are still many markets where LNG has yet to penetrate or take up a market share commensurate with its attractive qualities. Our commitment to sustainable energy and efforts to meet the growing needs of the developing world means that we have to work even harder to grow the reach of gas in new markets. However, just as it has not been easy to secure the market growth so far, there remain challenges to overcome.

## AIMS

The paper will discuss several technical, economic, commercial, operational and political barriers to LNG market access with suggested solutions to resolve these, all of which are within our reach. The industry has made clear steps in resolving many of these but there remains an outstanding need for improved relationships with policy and decision makers to speed up execution and market entry.

## TECHNICAL ASPECTS

Unit cost, scale, permitting regimes and lead time are some of the challenges that industry leaders like Shell have addressed over the past forty years.

As with many products, the unit cost of handling LNG comes down dramatically with larger volumes. This has given large scale, base load markets such as power an advantage while small scale markets face disproportionate costs as they start up and grow. Scalability and the ability to remain economic at lower volumes are therefore important when developing new markets. In recent years solutions have been found in both these areas which can resolve and speed the adoption of LNG.

For example, floating storage and regasification unit (FSRU) technology is now widely accepted as an industry standard and makes use of existing marine facilities with minimal onshore impact. Our colleagues such as ExceleRate, Golar, Hoegh and others have done pioneering work in this area which has resulted in substantially shorter lead times for development and solutions that retain a degree of flexibility to cater to the uncertainties inherent in longer term developments. On account of lower capital cost, these solutions have the advantage of handling smaller volumes more economically and sustainably and can be scaled up as demand grows. There remains even more work to do in this area to continue to innovate and commercialize technical solutions.

At the same time small scale liquefaction – for instance, the Shell Movable Modular Liquefaction System (MMLS) - is designed to monetize smaller pockets of stranded gas by overcoming logistics constraints and making it available as LNG for transportation to traditional liquid fuels markets. Technological advancements, particularly in the area of storage and transfer systems are allowing LNG to penetrate the road and coastal marine transportation sectors. As an example, Shell has recently taken a positive investment decision on the Canadian Green Corridor project, where an MMLS unit will be installed at Shell's Jumping Pound gas plant near Calgary in Canada to supply LNG to fuel stations on a busy truck route. Initiatives are also underway to develop similar solutions for coastal marine vessels in North America, Asia and Europe, thereby allowing them to meet tightening emission norms.

The industry has also delivered improved LNG shipping performance, lowering costs through larger ships, improved efficiency, and optimized routes which has improved responsiveness and reach into new and existing markets.

Shell's commitment to innovation has led to a robust research and development budget to aggressively grow production, transport and downstream applications of LNG and has identified several potential opportunities in this space which it will progress in the coming months.

## PERMITTING ASPECTS

The permitting package and “license to operate” comprises several work streams. Notable are environmental impact studies (for instance coastal morphology when developing a greenfield port), public consultations, risk assessments and sustainable development programs. Some of these are sensitive from an environmental and security perspective and often require new legislation to be passed, while public consultation can be a time consuming process with considerable uncertainty on the outcome.

As examples, the Hazira terminal in India is located in the intertidal coastal regulation zone area which required detailed analysis to be conducted to understand the impact on morphology and bathymetry before being permitted. Many of us have worked on projects over the last 10 years across Europe and on both coasts of the Americas where the consultation and permitting for new LNG import terminals took longer than the anticipated construction time. This has slowed the capacity of the industry to respond quickly to new demand or place new production.

Nonetheless LNG is one of - if not the - safest energy products with an exemplary safety record [1]. However, it is clearly not as well understood as some of the other products nor is the relative risk in comparison to the current base load risk from existing products handling such as LPG, petrochemicals and other hydrocarbons. The multiplicity of stakeholders and approval agencies, especially in countries where LNG is only beginning to be adopted, can significantly add to the complexity of the development process. It is therefore fair to conclude that these aspects bring a degree of uncertainty and hence risk into the development process.

Although these aspects are highly site specific, the industry has developed a good understanding which we can build upon - we have extensive experience from Europe (Gate), Americas (Altamira, Cove Point, Elba, Baja), India (Hazira) and the Middle East (Dubai) – of things that worked well and did not. Whilst remaining dependent on regulatory and permitting agency intervention and support, with appropriate work scheduling and pre-investment where necessary, such work can be executed efficiently.

## ECONOMIC AND COMMERCIAL ASPECTS

The economic and commercial benefits of LNG in terms of the payback in comparison to liquid fuels are well evidenced in both mature and developing markets. As an example we found that in one market where the alternative was to burn imported diesel, the investment payback time on a new terminal was reported to be less than two years on a relatively modest volume. It is a commonplace observation that LNG generally sells at a discount to crude oil in the same market and timeframe, while most liquid fuels sell at a premium to crude. The difference between the two is generally sufficient incentive for new infrastructure and fuel switching. As a consequence, LNG is fast becoming a fuel of choice in massive, growing markets, again proof of its benefit and attractiveness.

Although still predominantly a base load industry, LNG has become more flexible. This has been observed over the last decade as suppliers have retained increasing amounts of divertible volumes to maximize netback. Buyers have responded by favouring flexible supply from different sources and keeping a proportion of open demand to opportunistically source such supply. Technology in the form of FSRU and similar solutions have abetted this flexibility by reducing the cost-related barrier



to entry and the inherent flexibility in charter terms which makes scalability or abandonment easier to contemplate. Both buyers and sellers have benefitted from this approach by remaining closer to their next best alternative of sourcing alternate fuels or markets.

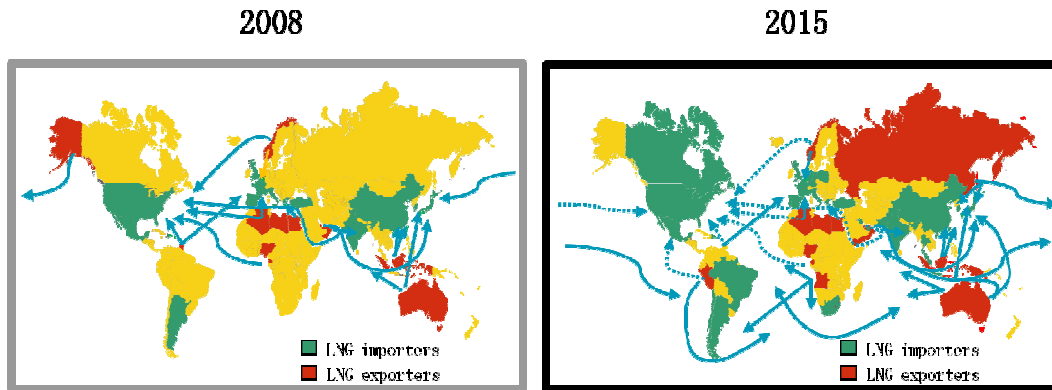


Figure 3: Global LNG Market Developments [2]

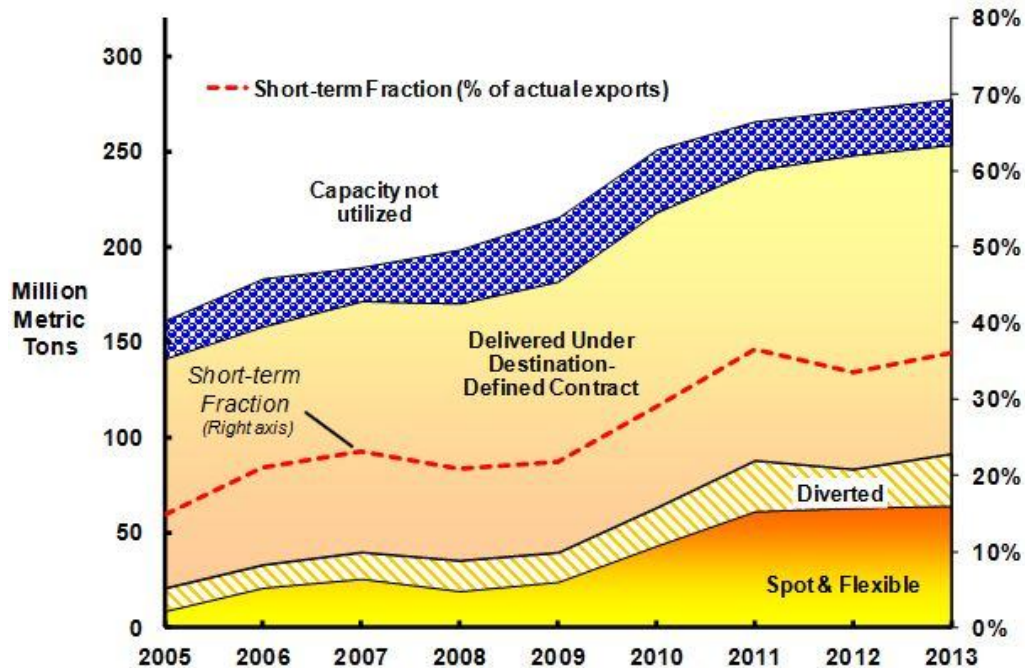


Figure 4: LNG Trade by Type<sup>1</sup> [4]

This is in marked contrast to the situation in the last century where flexible volumes accounted for much less than 10% of all shipped LNG; however, we remain some way from a fully liquid or a commoditized spot market.

So, we have a situation where there are increasing amounts of flexible volumes available to develop new markets without the often onerous requirement of helping finance a greenfield upstream project. Nonetheless, some of the markets may be

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required to procure additional credit support to underwrite long term obligations thereby adding to the deal complexity. The overall situation augurs well for market development; however, this pace of development has not been as fast as it could be for a number of reasons. First, LNG is still a highly capital-intensive business. Infrastructure costs can run into several hundred million dollars, and if project financed the level of lender due diligence for what is still a relatively bespoke value chain can be rigorous. Second, gas regulation in new markets has to adapt to receive an international energy source – with accompanying fiscal and pricing implications. Third, given the typical long term nature of contracts, governments and counterparties want to be assured of transparency and cost competitiveness in deals.

None of these aspects in themselves are reasons for the market failing to develop. For instance, the entry barrier does not seem to be related to costs alone as the existing global regasification capacity according to the IEA [5] reached 830 billion cubic metres (bcm) in 2010, more than twice the liquefaction capacity available (361 bcm) in that same year [6]. In many cases, developers have shown the ability to equity finance terminal projects, bypassing lender requirements. In other instances, governments have been remarkably resolute in ensuring that regulatory impediments are removed swiftly to accommodate LNG imports.

It is therefore our understanding that it is not one factor but a pancaking of some of these into a complex interlinked set of challenges that have often proved intractable in the recent past.

### **TRANSPARENCY ASPECTS**

Another factor retarding the growth of LNG market access and gas penetration in general is the discount at which gas is made available in some regions. Not only does this inhibit domestic gas exploration, it also makes LNG appear less affordable in comparison to albeit scarce local gas. This then necessitates complex, structural adjustments in the downstream market by penalizing industry that may be able to afford to pay more or artificially pooling LNG and domestic gas volumes – all of which can be inefficient and lead to further unintended consequences in terms of infrastructure creation and sourcing of LNG.

We are all aware of markets that have tried for the past many years to introduce LNG into their fuel mix and failed despite gas shortages and ongoing high liquid fuel bills. The constraints on government investment and the relatively high cost of infrastructure has required developers to look at project financing and seek multilateral agency support, which increases the time required to achieve financial close. Meanwhile, the gas and liquid fuels (which LNG is to substitute) enjoy pricing regimes which are often distorted or heavily subsidized. This makes the affordability factor difficult to assess, aggravates government finances and slows the shift to more affordable fuels.

Despite increased supply flexibility and a willingness to consider shorter term contracts, lenders and multilateral agencies prefer long term supply contracts to underpin infrastructure which can appear nationally significant and increase the perceived need to have multiple checks and balances before commitment. Given the individual nature of each LNG supply deal this has led to more than one process unraveling as supply or development proposals seldom present completely comparable terms or a consistent quality of reliability, etc. making comparisons difficult.

The response of new markets in particular to meet funding and transparency requirements has often been to float international tenders in the hope that this would yield a bankable, low cost project and value chain into their country. Whilst in itself a perfectly rational objective, there are significant challenges.

Recent experience suggests that the iterative nature of setting the right supply, market and local development criteria requires skill, experience and effort before appropriate technical solutions can be confirmed. This often means that a solution proposed at the early stage of a bid or permitting process and/or as a bid parameter may be inappropriate or sub-economic when it reaches the stage gate for financial approval. Consequently, host governments have in the past needed to encourage innovation and iteration by giving creative freedom to bidders to propose technical solutions and commercial structures, which in turn has resulted in the returning bids being difficult to compare against each other as the variables are simply too large to manage.

The foregoing is all on the infrastructure side but it needs to be coupled with evaluation of competing LNG supply proposals that can also be significantly at variance with each other (e.g. start date, LNG quality and ship sizes, to mention a few parameters). As a consequence the pancaking of issues referred to earlier makes decision making difficult. The admirable objectives of transparency and lower costs are in the end lost in the process of trying to find a workable way forward.

To illustrate the discussion above, one has to consider the many tenders for LNG import terminal development with commensurate supply that have been initiated during the past five years. Almost none have progressed per plan and most have simply been abandoned or remain stalled. Given the quality of the market, strength of the counterparty, availability of volume and infrastructure in some of these cases, the failure is not caused by the market but more from a process perspective. As a consequence, the customer benefits from LNG of improved air quality, short payback time, lower fuel costs and the reliability that comes from diversification of supply are lost or postponed.

## **OPERATIONAL AND REGULATORY ASPECTS**

The International Energy Agency (IEA) in the report "World Energy Outlook 2011: Are We Entering a Golden Age of Gas?" assumes that by 2035, the use of natural gas will rise by more than 50% and account for over 25% of world energy demand [6]. Reasons for this rapid growth are the environmental benefits of natural gas in comparison to other fossil fuels, the flexibility and suitability for power generation, the abundance and widespread distribution of gas resources, and the possibility to transport it not only via pipeline, but also as LNG which has strongly supported increased global trade.

Technologically, the LNG industry is operating on the cutting edge and has made rapid advances in recent years with implications for the market. The limited adoption of flexible hoses as a means of LNG transfer and floating technology has significantly increased the locations where operations are now possible making it easier for markets to be developed faster and more effectively. New applications of LNG in transport will also continue to push the operating envelope for LNG and as an industry with an impeccable safety record [1], the onus will remain high to ensure that safety risks are minimised.

New guidelines will continuously be required to allow LNG to grow and establish itself as a fuel of choice for providing safe, environmentally friendly and cost effective solutions. This is necessary to meet the challenge of growing energy whilst maintaining emissions at their current levels.

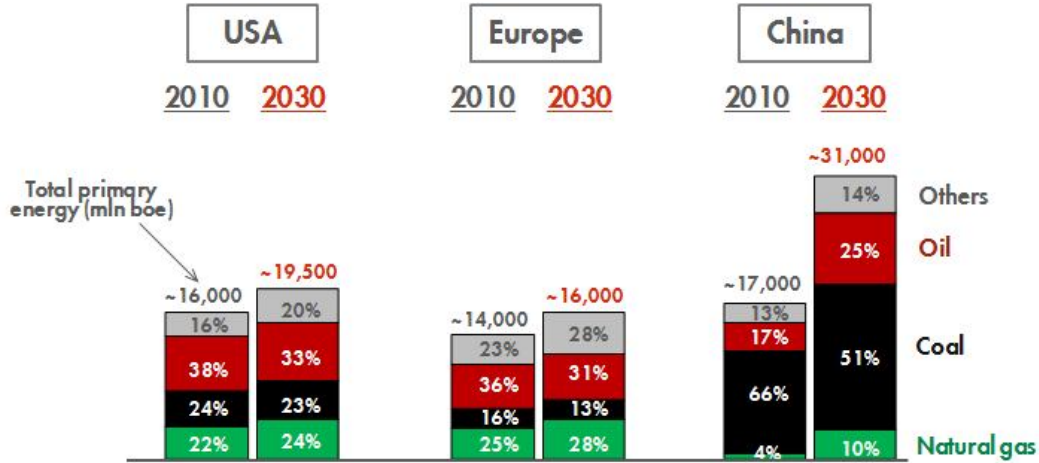


Figure 5: Fuel Mix in the Three Largest Markets [2]

Regulators therefore have a major role to play in proactively advocating for legislation that reflects the impending shift in energy usage with particular reference to LNG, thereby ensuring that there is a receptive consumer base, market forces are able to operate and LNG competes on a level playing field with other fuels.

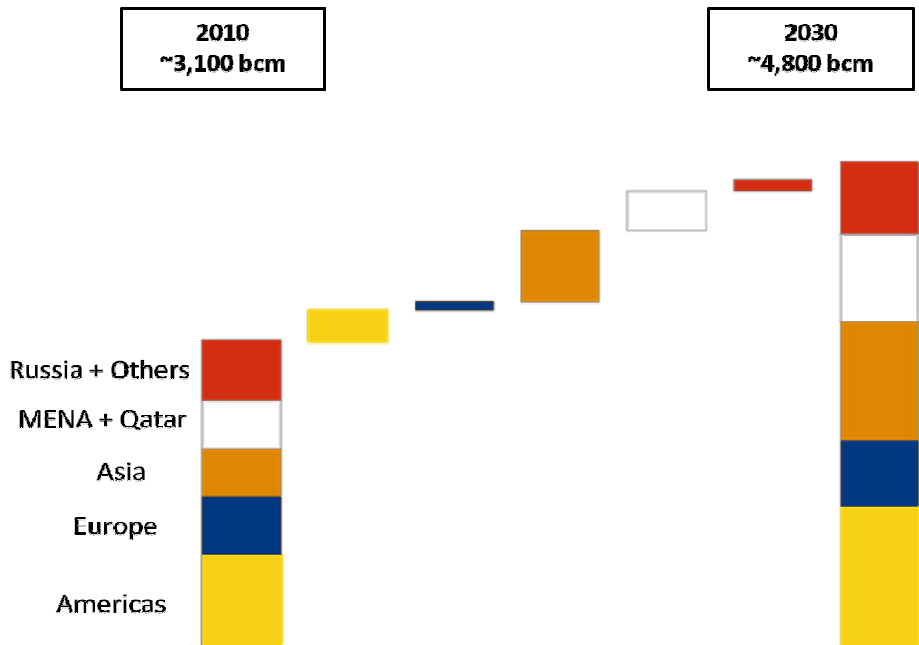


Figure 6: Gas Demand Growth

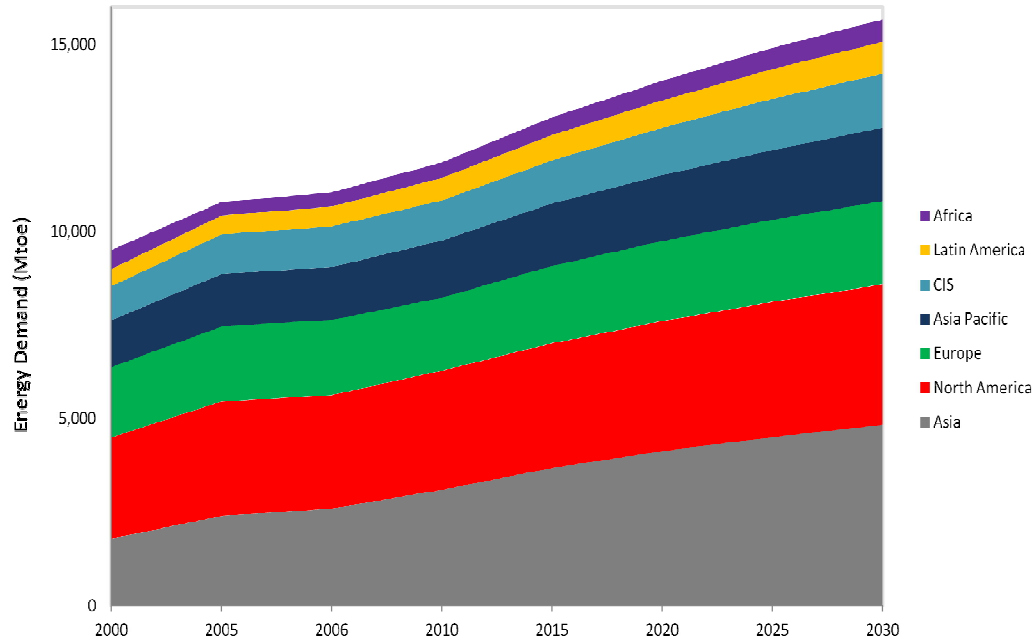


Figure 7: World Energy Demand Growth [7]

This is particularly important in the context of the fact that the strongest growth in energy (and LNG) consumption will come from countries where market protection in one form or the other is still quite strong. Aspects of domestic fuel subsidies need to be addressed urgently to create a conducive environment for increased investments in the upstream sectors and allow environmentally friendly and cost effective fuels like LNG to find their rightful place in the fuel mix.

It is recognized that this is a delicate balancing act for countries in their overall budget planning and necessitates a long term view but the time to initiate these structural reforms is upon us already!

## IMPLICATIONS

Despite the impressive growth record of LNG and industry innovation that has reduced the barriers to entry, a lot more can and should be done to grow the role of LNG in global energy. For instance, we believe that if the constraints discussed had been effectively addressed, an additional 25% LNG markets could have developed compared with those that exist at present.

First, we need to adopt commercial solutions which reduce the complexity of the supply chain and minimize utilisation risk. This requires an upfront understanding of the objectives and constraints of all stakeholders and appropriate commercial structuring of the value chain. As an example, Shell assisted the Dubai Government in realizing an effective LNG import solution over the longer term for that Emirate. The development process ran between 2006 and 2008 during which time all the tasks necessary to evolve an appropriate value chain model were undertaken. A clear understanding of the Emirate's energy strategy, customers, infrastructure availability at the port side (within the constraints of the port master plan) and off-taker requirements were prerequisites to enable this to happen. This understanding in turn helped the Dubai Government in taking decisions related to, amongst others,



terminal equity, FSRU ownership, ship-shore interfaces, pipeline routing, operational philosophy, capacity allocation, contracting strategy, supply construct and downstream gas pricing. The permutations possible in arriving at the appropriate set of decisions on the above factors are many and we believe that the project benefited from a dialogue between the host government and an experienced LNG player like Shell from the outset, through to the development phase and commissioning.

It seems that co-creation offers the most realizable route of forging and securing a successful LNG value chain.

The capital intensity and utilisation risks should not be downplayed especially as some of the new markets have limited appetite for investment or risk. Players with the ability to help via an appropriate allocation of risks and rewards can step into this area. Shell has for example taken merchant risk on terminal developments in the past and taken the lead in supporting markets to develop. However, these informed commercial decisions cannot be taken in the absence of a willing and supportive regulatory “host”.

The host governments not only play a role in facilitating permitting and sustainable development – they also need to be aligned with the developer in securing LNG procurement and regulating market entry. This is particularly the case where downstream gas, power or electricity markets have price setting and regulatory structures. In Shell we support clear and transparent decision making and are held to our business principles - you will see Shell participating in tenders worldwide for equipment, sites, products and of course LNG purchase and supply. However we are also one of the largest suppliers of LNG via bilateral negotiated contracts; in fact, such contracts are by far the most typical of the LNG world.

Our experience in recent years is that transparency and price setting in LNG has been pursued via tendered new entrance for regasification and supply. The evidence is out there that this has not been a highly effective route. At least three recent tenders remain unresolved more than a year from publicly opening, and in some cases many years from initial framing. Let us be clear that the most fundamental determinant of the price of LNG is the movement in worldwide energy prices – LNG has proven time and again to be a cost effective, reliable and sustainable solution and an attractive alternative to liquid fuels, coal and nuclear energy.

The technical, legal and commercial resources involved in running and participating in these tenders are significant, running into the millions of dollars and diverting resources within the host country. For participants the costs are equivalently high but multiplied by the number of bidders; in some cases, over a dozen bidders could be shortlisted. When weighted for the probability of success and the time taken to make decisions, this creates a burden on all participants, drives up industry costs and eventually will become difficult to justify or sustain.

Inadvertently cumbersome decision making processes put in place to protect environments or to ensure transparency of commercial decision making are either stalling or preventing the take up of LNG. This doesn't need to be so.

A base case solution is to have empowered local decision makers in a “trusted professional” working relationship with a key development partner. That development partner should be chosen in a clear and transparent process on the basis of their track record of business principles and performance, their pre-qualification and experience in LNG development and their willingness to share commercial risk in an equitable fashion.

Together they can make decisions on location, risk mitigation, local engagement, timetable and supply conditions – all of which are necessary for an informed and realistic LNG supply negotiation.

Those elements that can be tendered such as EPC elements, prime cost elements and equipment can be put to market with transparent and agreed processes, including provision for local content, knowledge and skills development where appropriate.

In complicated, integrated developments such as these we still see most of the LNG supply bilaterally negotiated with the key development partner, using best practice in Sales and Purchase Agreements to ensure complementary supply provisions that meet the needs of the customer, the downstream market, and the safe and efficient operation of the terminal. In time and with operational experience and market growth, additional tranches of LNG and greater demand will need to be accommodated. At that time the buyer will find a wider range of realistic supply opportunities are available than appeared to them when initially considering the terminal and market.

Of course it also has to be acknowledged that the solutions proposed above require an appetite for commercial risk, pre-investment and an expectation of return given the uncertainties involved.

We would argue that this construct, in many ways reflected in our engagement with the Dubai Government, enhances the probability of success and ensures transparency and competitive solutions.

## CONCLUSIONS

The preceding sections have discussed the role of LNG in the future energy mix, the progress made already and the impediments for future growth via additional market access. It is clear that the projected pace of global economic and energy growth make the role of gas and LNG in particular an important consideration.

As an industry we have addressed and overcome many of the technical and commercial obstacles such that flexible and deeper penetration of LNG into markets has become possible. The next steps will include new market entries, use of LNG in transport, and smaller scale use in comparison with large utility models. However, in order to progress we need to have empowered local decision makers in “trusted professional” working relationships with a key development partner.

Thank you and best wishes for a successful conference.

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