OPPORTUNITIES AND CHALLENGES OF USING LNG AS FUEL IN SMALL-TO MEDIUM-SIZED POWER GENERATION

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1. ABSTRACT

In many power markets in South America, Central America, the Caribbean region and Southeast Asia, fuel oil is the primary fuel source for base-load or mid-merit power generation. As prices for fuel oil have steadily increased and environmental policies have evolved to promote cleaner power generation alternatives, power generators have sought to use natural gas as an alternative source of fuel. This has been met with limited success because of the disconnect between LNG market prices and the power generators’ pricing expectations for natural gas, and/or power market pricing dynamics, and/or cost of other alternative fuels.

More recently, expectations that the shale gas revolution and LNG exports from the United States will provide a “cheap” fuel alternative are reinvigorating efforts to substitute fuel oil with LNG. This paper will primarily focus on the commercial opportunities and challenges that both potential end-users and potential LNG suppliers face in emerging LNG markets. We will address the logistical, economic, and commercial factors that promote, or hinder, the growth of LNG in power generation in South America, Central America, the Caribbean region and Southeast Asia. The paper will also examine, conceptually, how recent advances in small/mid-scale LNG infrastructure technology can bridge price gaps and cater to small-volume power markets.

About Galway Group: Galway Group is the premier advisory firm specializing in oil and gas transactions that span the energy value chain, from concept development, through contract negotiations and commercialization. Headquartered in Houston, Texas, our company offers transactional, analytical and investment banking support to the energy sector. Our expertise is based on over four decades of industry experience in support of a wide array of clients, including global Fortune 500 companies, small and medium-size enterprises, and governments. With the opening of our Singapore office, our work has expanded to accommodate a growing base of Asian clients.

2. INTRODUCTION AND BACKGROUND:

LNG — a potentially cheaper, less polluting fuel — can possibly achieve great savings for small and medium-scale power generators who are struggling to provide uninterrupted, affordable electricity to their customers. However, despite the apparent benefits provided by LNG, power generators have been consistently reluctant to move forward with conversion. Their reluctance is rooted primarily in the prevailing mismatch in pricing expectations between LNG suppliers and the power generators.

Fuel cost-savings would greatly benefit small-scale power generators, but only once the LNG infrastructure connecting them to the global LNG markets is put into place. Unlike other existing large buyers of LNG, many small-scale power generators lack the know-how and capital needed to support the development of the LNG infrastructure required to meet their needs. Furthermore, the lack of economies of scale that prevails in small markets makes it impractical and uneconomic for the power generators to justify the large infrastructure investments required to serve these markets.
More recently, however, expectations that the shale gas revolution and LNG exports from the United States will provide a “cheap” fuel alternative have reinvigorated efforts to substitute fuel oil – encompassing heavy fuel oil and diesel - with LNG. In this section, we will explore the benefits provided by natural gas (Section 2.a.), the evolution of LNG markets (Section 2.b.), and the challenges faced by small-scale power generators (Section 2.c.).

a) The Value Proposition for LNG:

In many instances, the macroeconomic, environmental, commercial and geostrategic benefits of using LNG in small and medium-scale power generation may significantly outweigh the benefits derived from the use of fuel oil, diesel, or other petroleum derivatives.

i) Macroeconomic and environmental benefits:

Natural gas is an abundant global resource. In its 2012 World Energy Outlook, the International Energy Agency (IEA) estimated that natural gas reserves are sufficient for more than 230 years, at current rates of production. Furthermore, the environmental benefits of replacing petroleum-based fuels with natural gas are significant. Natural gas is the cleanest-burning fossil fuel. The US Energy Information Administration (EIA) estimates that carbon dioxide, nitrogen and sulphur oxides, and other particulates emissions are significantly lower for natural gas compared to petroleum alternatives. Low emissions, as well as the reduced opacity of natural gas, are particularly important in light of new global environmental regulations. Moreover, economies that are heavily reliant on tourism – as is the case with countries in the Caribbean – stand to benefit substantially from a reduction in pollution and smog, as a result of the switch to natural gas in power generation and industry.

ii) Commercial benefits:

Small-scale power generators have shown an interest in LNG primarily due to the expected cost-savings opportunities it provides. These savings are likely to be achieved as a result of the large price spread between fuel oil (both diesel and heavy fuel oil) and natural gas that is expected to remain a permanent fixture of the international energy markets moving forward, as seen in the Figure 1. By switching to natural gas, small-scale power generators hope to attain fuel cost savings of up to 15-35 per cent. Over the long term, small-scale power generators stand to achieve sustained savings from increased system efficiencies and low maintenance costs.

Figure 1: Price Spread: Natural Gas, Heavy Fuel Oil, Diesel

* Projections based on 11/9/2012 NYMEX forward curve for Henry Hub and Brent
In addition to cost-savings, switching to natural gas would help power generators avert the risks inherent in fuel oil markets. Over the coming years, the fuel mix strategies followed by refineries may change as a result of the implementation of environmental protocols such as the *International Convention for the Prevention of Pollution from Ships* (MARPOL). MARPOL imposes sulphur limitations on marine fuel within emission control areas. As a result, refineries might opt to alter their fuel mix to produce higher-value petroleum products such as diesel and distillates, and halt or reduce the production of heavy fuel oil. The ensuing decrease in global heavy fuel oil supplies would likely drive up prices, reduce the reliability of heavy fuel oil deliveries and, consequently, have a catastrophic impact on small-scale power generators who are dependent on this fuel.

iii) Geostrategic benefits - Small-scale power generators as anchor customers:

On a geostrategic level, with the addition of natural gas to their fuel mix, countries and companies can achieve a more diverse and, therefore, a more secure energy portfolio. Additionally, the development of LNG infrastructure provides numerous positive externalities. Natural gas in power generation can pave the way for this fuel to be adopted by industrial users and integrated into local transportation systems.

In the Caribbean, Central and South America, and Southeast Asia, the economy-wide transition from fuel oil to natural gas can be achieved most efficiently when small and mid-size power generators become the anchor customers. In these small individual markets, the power generators - supporting electricity loads of up to 500 megawatts (MW) - are best suited to facilitate the adoption of natural gas as the fuel of choice in other segments of the economy (e.g. transportation) by providing the base-load demand to justify and amortize the cost of the import infrastructure. Finally, as a bridging fuel, base-load natural gas is complementary to the use of intermittent renewable energy sources.

*b) LNG Markets in Perspective:*

Historically, the LNG market has been limited and regionally compartmentalized. LNG was sold based on stable, long-term contracts with point-to-point deliveries to larger, very creditworthy customers (usually gas and power utilities). Inter-regional trade was limited to cargos going primarily to demand centers in Europe and Asia. Additionally, the pricing regimes were highly segmented with LNG prices indexed to the Japan Customs-cleared (JCC) petroleum price in Asia and to a basket of petroleum products in Europe.

![Figure 2: LNG Trade, 1990s](image)

Today, global LNG markets display significant inter-regional activity and competition. The markets are more liquid and the supply sources and buyers more numerous. The LNG market is cyclical, with buyers and sellers negotiating and gaining leverage based on emerging expectations regarding global supply-demand.
dynamics. Furthermore, in recent years we have witnessed the emergence and growth of portfolio sellers that trade “flexible” volumes of LNG. These volumes are sold to the highest bidder on the spot and short-term markets. The emergence of a two-tier pricing system, with long- and shot-term rates, is a by-product of the globalization of LNG markets. Although a worldwide linkage for long-term prices has not yet emerged, price linkages are increasingly more common in the short-term and spot markets. Specifically, there is precedent for short-term rates to be tied to the Japan-Korea Marker (JKM) and to the United Kingdom’s National Balancing Point (NBP) index. Although the LNG market is more dynamic and flexible, new potential buyers, such as small- and medium-scale power generators, are competing for supplies with buyers in established and other larger emerging markets.

Figure 3: LNG Trade, 2012

c) Challenges to Conversion for Small- and Medium-Scale Power Generators:

For conversion to become a viable solution for small and medium-scale power generators, the challenges of procuring reliable, low-cost LNG supplies, and mitigating infrastructure development and shipping risks must be addressed. Moreover, the interests and risk profiles of all players across the LNG value chain – including LNG suppliers, shippers, infrastructure developers and buyers - must be managed in an integrated manner.

As detailed in the next section of this study, commercial tensions have emerged and persisted between the various players along the small/medium scale LNG value chain. These commercial tensions can be mitigated through the adoption of a set of coordination mechanisms. Solutions include the introduction of a commercial “integrator,” a player who has vested interest in the success of the project and is able to act as a coordinator and overseer of the process. The integrator would ensure that the substitution value derived from conversion to LNG is proportionately shared with the end-users, while creating sufficient equity returns for suppliers, shippers and infrastructure owners. Such conversion projects could be implemented either via direct supplies from a liquefaction facility, or through the development of a “hub and spoke” model that leverages the economies of scale needed for long-distance shipping and the logistical requirements of serving small customers/markets.

d) Disclaimer:

It is important to point out that, while each project faces unique circumstances, certain criteria are common across all regions and LNG conversion efforts. Common challenges include siting and marine access, load size and dispatch profiles for shippers, and the regulatory and political context of individual regions. The
examples and quantitative analysis provided in this study are drawn primarily from Galway Group’s first-hand experience working on LNG projects in South and Central America, and the Caribbean. These examples are representative of opportunities and challenges that are likely to arise and will need to be tackled by all small- and medium-scale power generators who are considering conversion to LNG, and the “integrators” who are aiming to promote LNG as a fuel oil alternative.

3. OPPORTUNITIES AND CHALLENGES OF CONVERSION:

Each player in the LNG value chain faces a unique set of opportunities and challenges. For LNG in small and medium-scale power generation to be viable, substitution incentives must be allocated amongst all key stakeholders. It is, therefore, important to understand the incentives and risks that these key players face. In this section, we will evaluate the benefits and challenges to small-scale LNG buyers (Section 3.a.), to LNG suppliers (3.b.), shippers (3.c.), and infrastructure owners/operators (3.d.).

a) Small-scale LNG Buyers – Opportunities & Challenges:

i) Benefits derived from fuel cost-savings:

The short- and long-term cost-savings provided by LNG represent the main incentive for small-scale power generators to convert to natural gas. As previously mentioned, significant fuel cost-savings can potentially be derived from switching to LNG, a cheaper and less-polluting fuel.

The natural gas renaissance unfolding in North America has revitalized the interest of small-scale power generators in LNG. The supplies originating from new US LNG export terminals are expected by many market participants to place downward pressure on global LNG prices by introducing additional supply competition on the international market. The expectations that US LNG will be low-cost, compared to alternative supply sources in Qatar and Australia, for example, is driven by the expectations of sustained large oil/Henry Hub spreads. Moreover, recent developments point to the fact that small-scale LNG plants are being proposed and developed specifically to target fuel oil substitution opportunities in the regions examined herein. When completed, these projects could provide dedicated production to power generators in the Caribbean, South and Central America.

Overall, it is likely that small- and medium-size LNG buyers will need to enter into long-term supply contracts to underwrite the development of the LNG production and delivery infrastructure. In the global LNG market, divertible and flexible LNG supplies have contributed to the growth of the spot and short-term markets ensuring a certain degree of supply security. This same supply security, however, might not necessarily apply to small/medium-size LNG customers. The liquidity of the market is evidenced by the events, which unfolded in the aftermath of the Fukushima disaster. At that critical juncture, Japanese power utilities were able to source LNG supplies on short notice from the spot/short-term market. This, however, is not the case for small/medium-scale buyers who are less likely to be able to benefit from similar high levels of supply liquidity until more flexible supply sources become available. In this context, early small/medium-scale LNG buyers may “benefit” from long-term contracts to provide the security of fuel supply they desire.

ii) Benefits derived from efficiency cost-savings:

Over the long term, significant cost benefits for small-scale power generators can be derived from generation efficiency gains. These gains can be achieved by using more efficient generation drivers that consume less fuel, and have generally lower maintenance costs. Plant repowering could, therefore, provide long-term sustained cost-savings. For existing heavy fuel oil (HFO) plants, the benefits of conversion are manifold. Many HFOs are quickly approaching retirement age. Retrofitting the engines of aging HFOs may either be technically unfeasible or not a strategically sound decision. This latter conclusion is based on the potential risks associated with the changing dynamics of the global refinery fuel mix, which could result in fuel supply reliability challenges and rising fuel oil prices.
iii) Supply-related challenges:

Buyers can source LNG from major suppliers, regional LNG providers, or from portfolio sellers on the short-term and spot markets. There are advantages and drawbacks to each sourcing option. In buying supplies from the global LNG market at short-term or spot rates, small-scale power generators compete directly with large international buyers. The intensity of competition drives bargaining leverage between buyers and sellers, with sellers benefiting from the heightened competition. As a result, buyers inadvertently become price-takers and are exposed to fuel price volatility.

Furthermore, small-scale customers face significant challenges in securing long-term supply contracts. To date, many existing and new full-scale LNG liquefaction plants have expressed reluctance to service smaller LNG ships directly due to berthing and loading capacity concerns. In addition, many established LNG producers/sellers tend to focus on developing large-scale projects and marketing to either larger existing or emerging markets. The size and remoteness of many small and medium-range markets have generally been disincentives for major international suppliers to incorporate small buyers into their marketing portfolios.

To address supply-related challenges, “hub and spoke” networks can be established to aggregate demand in the regions examined herein. Through economies of scale, small-scale LNG buyers can capture the attention and interest of large LNG suppliers, and potentially secure long-term contracts with these players. Alternatively, they can gain access to supplies in the more liquid short/medium-term market. Notable examples for this model are available at the Zeebrugge LNG terminal in Belgium and at the Gate terminal in the Netherlands.

iv) Infrastructure-related challenges:

The ability of small-scale power generators to justify conversion is predicated on their ability to integrate natural gas into the existing supply chain. Power generators need to ensure that natural gas conversion allows for multi-fuel capabilities to be retained in order to guarantee fuel security. Sourcing and managing the quality of a back-up supply of fuel oil may be costly, and result in economic challenges to maintaining parallel fuel supply chains. Additionally, as previously mentioned, small LNG buyers may lack the capital and technological know-how to develop and manage LNG supplies. For this reason, small power generators have tended to focus on procuring regasified LNG from the downstream in order to bypass their infrastructural challenges. Furthermore, small- and medium-size power generators may lack the capital to repower the plants where conversions prove to be technically and economically challenging. Finally, in some cases, plants may not be located in the proximity of ports that have the capacity to service smaller LNG ships. Pipelines or LNG trucking may, therefore, be required to supply the plants with natural gas.

b) LNG Suppliers – Opportunities & Challenges:

i) Opportunities to LNG suppliers:

To date, only a few major LNG suppliers have expressed an interest in servicing small-scale LNG markets. In some cases, large players have been motivated by the need to expand their marketing portfolios in anticipation of tighter global demand toward the end of the decade. For smaller, regional LNG suppliers, the ability to monetize reserves and to expand their operations into new markets represent the main motivators to servicing small-scale power generators. A closer look at market opportunities reveals that some national oil and gas companies are also becoming increasingly engaged in the small-scale LNG market segment, fulfilling governmental mandates to displace expensive fuel oil used in power generation (e.g. Indonesia). Repeatedly, as in the cases of Colombia and Trinidad & Tobago, we have observed the emergence of liquefaction projects that target small regional buyers in an effort to either monetize natural gas reserves that cannot be absorbed by the domestic market, or to satisfy the government’s geostrategic goals.
ii) Challenges to LNG suppliers:

LNG suppliers to smaller buyers are primarily concerned with securing pricing netbacks that are sufficient to either justify the development and liquefaction of their natural gas reserves, or the higher costs associated with developing and operating a “hub and spoke” network. In instances where suppliers develop liquefaction facilities, they are concerned with securing term agreements with creditworthy customers that are conducive to obtaining adequate financing. Suppliers need to, therefore, aggregate sufficient demand from smaller buyers to justify the development of their liquefaction or “hub and spoke” project. In sum, the main challenge for LNG suppliers seeking to serve the small/medium size LNG buyers is to find enough creditworthy customers to be able to finance the project, while optimizing their equity return. This latter goal can be achieved by marketing any remaining capacity at possibly higher prices to offset the incremental risk and boost overall returns.

c) LNG shippers – Opportunities and Challenges:

i) LNG shipping characteristics:

Traditionally, full-scale LNG ships have been used in the global LNG market. Full-scale LNG ship sizes range from 90,000 to 260,000 m³. Ships require deep-water access of 40-45 feet and relatively large port facilities with large LNG tanks and tugs at receiving terminals. In many smaller markets, marine and terminal infrastructures required by standard LNG ships may not be readily available or economic to develop.

A new class of small LNG ships, ranging from 7,500 – 20,000 m³, has been developed to address the marine infrastructure and logistical constrains prevalent in smaller markets. Small LNG ships have the capacity to service small ports with shallower drafts of 20 to 25 feet without requiring investments in dredging. In many cases, these ships can utilize existing berths that may be used to unload fuel oil and other petroleum products. They are more maneuverable and can be supported by smaller tugs. Although the CAPEX for small ships is approximately 20 percent of the CAPEX on standard LNG ships, small ships can only transport approximately five to 10 percent of the quantities delivered by large-scale ships. As a result, transporting LNG via small LNG ships remains more costly on a per unit basis.

ii) Challenges and opportunities in LNG shipping:

Shipping logistics and the economics of delivering small volumes of LNG are particularly challenging. Among the main challenges are the need to overcome concerns related to the impact of loading small ships on berth availability and schedule coordination, and the relatively higher costs of shipping LNG over long distances using small-scale ships. To address these challenges, small-scale LNG production facilities are being developed to load fleets of smaller vessels. The “hub and spoke” model, depicted in Figure 4, can also be employed to combine the benefits of standard shipping over long distances with the logistical benefits of small-scale ships. Under this model, traditional LNG carriers would unload in a regional hub that is equipped with the marine and storage infrastructures needed to accommodate large-scale ships. From there, small LNG ships transport the fuel to small-scale LNG terminals and power generators. In either scenario, the challenge of aggregating sufficient demand to optimize fleet utilization for small-scale ships, to minimize underutilization, and reduce overall shipping costs remains to be addressed.
d) Regasification Terminals – Opportunities & Challenges:

i) LNG regasification terminal characteristics:

LNG can be regasified at land-based or offshore floating regasification terminals. Storage can be located onshore or offshore as well. Several regasification options have emerged over time and are currently available to small-scale LNG buyers.

Traditionally, regasification terminals have been located onshore. The cost of land-based terminals ranges between $250 million and $1 billion. These terminals require three to four years to construct. Furthermore, they require sizeable land areas and deep-water ports, as well as the addition of three or four tugs to manoeuvre the LNG ships. These terminals are most suitable for servicing large power plants/markets that provide base-load capacity.

An alternative option for regasification is provided by Floating Regasification and Storage Units (FSRUs). This solution is becoming more prevalent worldwide. FSRU costs range between $100-$250 MM, in addition to associated infrastructure costs, an estimated $50-$200 MM. The FSRU construction period ranges between 12 and 30 months.

ii) Opportunities and challenges to LNG regasification terminals:

A viable option available to small-scale customers is to opt for small-scale LNG regasification that is less expensive than standard LNG regasification terminals. Smaller terminals have lower-cost cryogenic storage units that are suitable for servicing small LNG customers. The cost for smaller terminals can range between $50-$70 MM (depending on site characteristics), with a construction period of up to two years. Terminals can be located onshore or floating, depending on the specific characteristics of each project. The unit cost for the terminals is a function of throughput, and can, therefore, be a limiting factor. If serviced by small-scale ships, small terminals may not require deep-water ports. In the LNG regasification process, small-scale power generators’ main challenge is to reduce the CAPEX requirements for LNG terminals.

4. THE ROLE OF GOVERNMENTS:

In addition to logistical and supply considerations, the role of the government is integral to LNG conversion in small-scale power generation. Governments are predisposed to step in and support conversion to natural gas where countries possess large reserves of gas, and where entire communities are disconnected from the power grid or pipeline networks. In Ecuador and Columbia, for example, governments are providing incentives for natural gas to be deployed more broadly to satisfy domestic demand. Additionally, in some cases states have used their natural gas reserves, LNG supplies and the development of associated...
infrastructure as diplomatic tools to increase their regional leverage. Nonetheless, governments may also slow the development of LNG and natural gas infrastructures through extended environmental permitting processes and stringent import/export regulations with adverse implications for the timeline, cost and viability of projects. Where indigenous resources are absent, governments have been slow to incentivize conversion to LNG and to install regulatory frameworks that support the importation, transportation and adoption of natural gas. In all scenarios, the role of the government is key to financing LNG infrastructure projects and providing the policy and regulatory frameworks that support the successful conversion to LNG.

5. CONCLUDING REMARKS:

In the aftermath of the natural gas renaissance in North America, and the active development of new LNG export projects, there has been renewed interest in conversion to LNG for small- and medium-scale power generation in the Caribbean and Central America, among other regions. Nonetheless, despite the potential environmental and economic benefits derived from substituting fuel oil for LNG, small and medium-scale power generators face significant commercial challenges. These challenges include the ability to effectively address the mismatch between their and the LNG suppliers’ pricing expectations, as well as the ability to secure the commitment of international players to participate in the LNG infrastructure needed to service small-scale markets.

Conversion to natural gas for small and medium-scale power generators is predicated on the ability to take a holistic approach to the LNG value chain. High levels of adoption and conversion can only be achieved when all stakeholders’ requirements are addressed. The technology solutions needed to ensure the viability of small-scale LNG projects are currently available. An optimized commercial model is now needed to bring together and coordinate the interests of the stakeholders. This model can be implemented most effectively by an “integrator,” a large player with a vested interest in the region and its small-scale LNG customers.

Furthermore, LNG “hub and spoke” networks are needed to aggregate the demand of multiple small-scale LNG buyers in a given region. The development and timing risks associated with this model have slowed down its rate of adoption. For example, “hubs” have previously been built with the expectation that buyers and sellers would come together once the infrastructure is built. This, however, has not always been the case. Procuring LNG supplies has proven to be a real obstacle in many instances. The role of the integrator is, therefore, key to ensuring the development of the “hub and spoke” networks and the alignment of interests for LNG buyers, suppliers, infrastructure owners and operators, and shippers.
APPENDIX

Representative Case Study

Included below, we have provided a representative case study to illustrate our analysis. The location for the hypothetical case study is the Caribbean, where most power clusters are relatively small, as seen in Figure 5. The Caribbean is ideally positioned to access large LNG exports from the United States over the coming years.

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Figure 5: Power Generation Capacity for Caribbean Power Clusters

A “hub and spoke” network would be established within a 1,500-2,000 nautical mile (nm) distance from the hypothetical US small/mid-scale LNG export project. LNG would be shipped on standard LNG ships from the US Gulf Coast (USGC) to the hypothetical regional transshipment terminal located in the Dominican Republic, as seen in Figure 6.

Once received, LNG would be unloaded and stored at the transshipment terminal equipped with a traditional storage tank or with a Floating Storage Unit (FSU).

Smaller LNG ships, in the 10,000 - 12,000 m3 range, would provide shipping between the transshipment terminal and regional small-scale LNG customers. Shipping from the regional “hub” reduces shipping fleet requirements compared to shipping directly from a liquefaction facility in USGC, as seen in Figure 7.
Despite the more optimal shipping requirements achieved, shipping costs do not necessarily scale linearly, and will be determined by shipping fleet utilization. As the size of the load and the shipping distance from the hub increase, using a “hub” facility will help reduce costs. However, shipping costs from the supply source – in this case the USGC – will also need to be included in the final cost of fuel. Additionally, the hub service cost will need to be included in the final calculations for shipping costs.

*Figure 8* provides estimates for shipping costs from the USGC supply source to the Caribbean regional hub. From the hub, LNG is distributed to the Dominican Republic, where the hypothetical small/medium-scale power generators are located. Where “spare” shipping capacity is available, the unit cost for shipping LNG to the demand centres is significantly lower compared to the alternative option of securing a dedicated ship.

The main advantage of the “hub and spoke” model is the ability to leverage the benefits derived from economies of scale by aggregating multiple smaller customers within a region. Within the framework of the case study, LNG would initially be distributed through a “simple” hub solution directly from the USGC to the small/medium-scale customers in the Caribbean. As volumes build up, the transition to the “hub and spoke” model would become more economical, as seen in *Figure 9*. The challenge is to determine how to price the LNG and share the value derived from the optimized logistics process with the customers.
Figure 9: Economies of Scale, Simple vs. Complex Hub Model

* Note: Simple Hub CAPEX $250 MM, Complex Hub CAPEX $500 MM $/MMBtu, fee is pre-tax, assume D/E 70%/30%, 15% ROE, 8.5% interest rate

Figure 10 summarizes the cost-savings gained along the LNG value chain, from the USGC supplier to the end user in the Caribbean. In addition to the cost-savings obtained as a result of optimized logistical processes, in our hypothetical case study the bulk of cost-savings is derived from the price spread between natural gas – priced at the Henry Hub index - and petroleum products. Based on our analysis in Figure 10, higher priced No.2 fuel yields significant potential savings to be shared, whereas the substitution value for No.6 fuel may be more challenging under the pricing scenarios shown. Upward pressure on No.6 prices - potentially resulting from the refinery mix changes discussed in the body of this paper - would only increase the potential substitution value. While the fuel price spread provides significant substitution value in the hypothetical scenario, it is important to consider the risk inherent in the volatility of the oil/natural gas price spread over time and its impact on substitution economics.

Figure 10: Substitution Value Attained by Small/Medium-Scale Power Generators

In sum, the “hub and spoke” network provides a potential model to serve small-scale customers and LNG suppliers in the Caribbean region, and to offer potentially significant fuel cost-savings to power generators in the region. However, the savings potential is largely driven by the price spread between the existing fuel price and the “cost” of the LNG. Although important and relevant, optimizing the logistics and infrastructure costs only contribute to the substitution value at the margin. The determining factors remain the cost of fuel being replaced and the price of the LNG. Ultimately, the “hub and spoke” model provides the opportunity to aggregate demand on a regional level, which may provide the “integrator” with more supply options to serve small emerging markets.
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