

NATURAL GAS SUPPLY AND DEMAND, AND PROSPECTS FOR THE LNG TRADE IN THE AMERICAS

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ABSTRACT

North America has a natural gas-hungry market, which is forecasted to demand approximately 42 Trillion Cubic Feet (TCF) in the year 2020, while consumption in the USA alone is expected to reach 33 TCF. Although Central/South America and the Caribbean consumed 3.5 TCF in 2001, that figure is expected to rise to 8.8 TCF in 2020. South America and the Caribbean (with over 5% of the world's reserves) could play an important role by supplying neighboring nations with much needed natural gas.

Although the pressing need for LNG is expected to be felt after 2007, inklings of what is to come are already being seen. As an example, the USA has imported over twice as much during the first half of 2003 if compared with 2002 (201.5 and 96.9 BCF, respectively). Mexico alone has consumed 1.3 TCF in 2001 but that figure is expected to skyrocket to approximately 4 TCF by 2020, increasing its gas imports. The North American gas demand deficit could grow 15 TCF by 2020 (assuming a price of US\$5 MBTU).

Supplying LNG from South America and the Caribbean to North America faces several challenges. From global competition from giant projects in Asia, Africa, Australia, the Middle East and Russia, to pricing, markets, financial, and social, environmental, political and social situations, LNG exports are a challenging endeavor that could render excellent benefits but face considerable risks.

INTRODUCTION

Natural gas is quickly becoming the world's preferred fuel in the 21st century. In 2001, the world's demand for natural gas was about 90.3 Trillion Cubic Feet (TCF) of which 26.9 TCF (about 30%) corresponded to North America alone¹. By 2020, North America is expected to demand approximately 42 TCF, and consumption in the USA is expected to reach 33 TCF, (with power generation using up about 30% of it). Like many other areas in the developing world, gas consumption is expected to skyrocket in Latin America as well. Although Central/South America and Caribbean consumed 3.5 TCF in 2001, that figure will likely rise to 8.8 TCF in 2020.

When it comes to supply, the Americas have only a fraction of the world's gas reserves (about 10%). Still, in South America only a portion of these reserves are being tapped to meet the increase in demand, and more and more countries in the region (including the Caribbean) have begun LNG initiatives to monetize their surplus reserves² in order to meet the demands of the vast North American market. Although LNG imports to the USA are currently very small, governments and industry are actively supporting LNG initiatives in order to fulfill the increasing natural gas needs in the decades to come.

¹ The United States alone demanded 22.6 TCF in 2001.

² In 2001 the US imported 0.238 TCF of LNG, a small amount compared to Japan's 2.8 TCF.

LNG is becoming an economically viable alternative that can be traded globally. Although South America is relatively closer to the USA and has the competitive advantage when it comes to transportation, large exploration and production (E&P) companies are also immersed in the marketing of LNG, and are making it economically feasible for it to be brought from remote areas in Asia, Africa, Russia or the Middle East. In addition to global competition, the South America and Caribbean regions face social, environmental and political challenges before implementing LNG facilities in the short term.

The background and issues mentioned above create a new environment for natural gas and LNG in the Americas, and make it vital for trade and development. This paper compiles a variety of information, and performs an analysis of the supply and demand of natural gas and LNG trade in the Americas.

NATURAL GAS SUPPLY AND DEMAND, AND PRICES

The Americas³ (the Region) have approximately ten percent of the world's gas reserves, with the United States (USA) and Venezuela holding approximately sixty percent of the total (Table 1).

Region or Country	Reserves		
	Trillion Cubic Feet	Trillion Cubic Meters	World's Percentage
<u>North America</u>			
United States	183.5	5.2	3.3
Canada	60.1	1.7	1.1
Mexico	8.8	0.2	0.2
Total North America	252.4	7.1	4.6
<u>Central and South America, and Caribbean</u>			
Venezuela	148.0	4.2	2.7
Bolivia	54.9	1.6	1.0
Argentina	26.9	0.8	0.5
Trinidad and Tobago	23.5	0.7	0.4
Brazil	8.1	0.2	0.1
Peru	13.3	0.4	0.2
Colombia	4.5	0.1	0.1
Others	6.4	0.2	0.1
Total Central & South America, and Caribbean	285.6	8.1	5.2
Total Americas	537.9	15.2	9.7
Total World	5536.9	156.7	100.0

³ For the purposes of this paper, the Americas include North, Central and South America, and the Caribbean.

Table 1: Natural gas reserves in the Americas.

Source: USA Energy Information Administration and the author's estimates.

However, countries in South America have recently reported new discoveries. For instance, Brazil has announced in 2003 that it has tripled its reserves to a total of 22.97 TCF due to a large discovery in the Santos Basin. By the same token, Peru is about to confirm that natural gas reserves have reached 35.3 TCF (Peru and Brazil's data not included in Table 1).

The Region is characterized by large supply and demand in the North, while the rest of the continent has relatively more modest values (Figure 1). The average North American supply for 1991-2001 was approximately 25 TCF (27 TCF for year 2001) with an increase of about 20% in that period. Although the Central and South America supply had an increase of about 70% in the 1991-2001 period, it had an average production of 3 TCF (3.6 TCF in 2001).

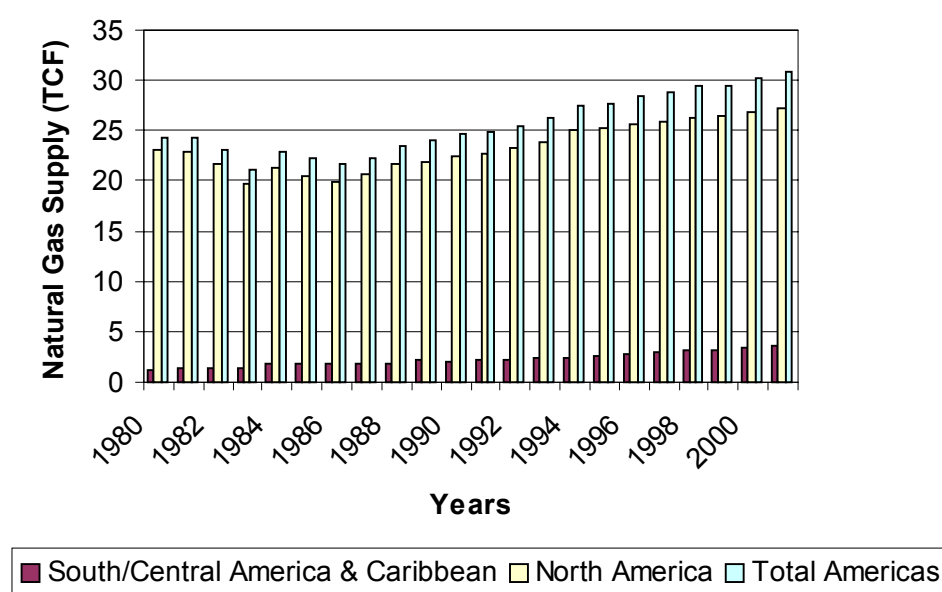


Figure 1: Natural gas supply for the Americas.

Source: USA Energy Information Administration.

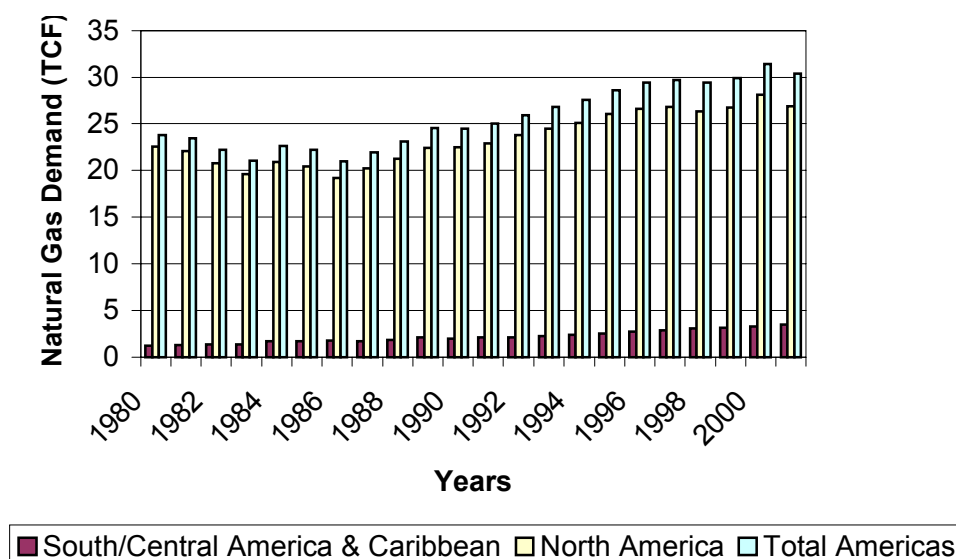


Figure 2: Natural gas demand for the Americas.
Source: USA Energy Information Administration.

Natural gas demand (considering exports and imports) is shown in Figure 2. During the period 1991-2001, the average North American consumption was about 23 TCF (27 TCF for year 2001) with an increase of about 17% in that period. Similar demand patterns (with respect to the supply) were seen in South/Central America and Caribbean: an average of 3 TCF annually with an increase of about 63% between 1991-2001.

Prices of gas in the Americas follow different patterns and rules. In the USA, gas prices (as seen in Figure 3, period January 2001 to June 2003) have shown an impressive volatility due to supply and demand of this commodity in time and space. Aside from the USA and Canada, gas prices for the rest of the Americas are set either by markets and/or governments. For instance, in Brazil gas purchased from Bolivia is over 20% more expensive than Brazilian gas. This is due to large transportation costs (approximately 40% of total costs).

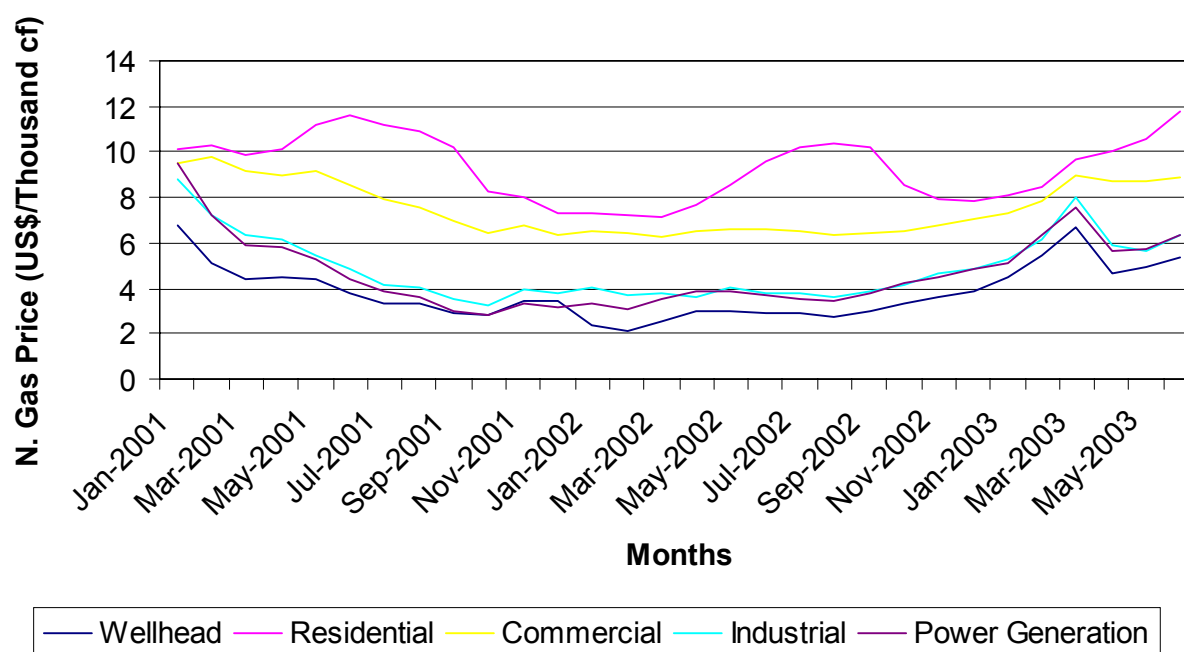


Figure 3: Historical USA natural gas prices.
Source: USA Energy Information Administration.

FORECASTED SUPPLY AND DEMAND

The ideal gas market of the Region is, undoubtedly, North America, where gas supply and demand forecasts (based on IHS' North American Gas Business Model) show supply-demand equilibrium up to year 2007 for a price of US\$5 MBTU. Starting in 2008 there is a forecasted deficit of 0.11 TCF that increases to 15.03 TCF in 2020 (Figures 4 and 5).

Although the model mentioned above includes LNG supplies from the East and West Coasts, as well as the Gulf of Mexico (shown in Figure 5)⁴, it is quite obvious that for the US\$5 MBTU price there would be a gap that needs to be covered with either more LNG imports or by amount produced by the incentive of a price increase. The forecasted demand for South and Central

⁴ These values include production and expansions of current facilities plus new regasification plants.

America, and the Caribbean (see Figure 6) shows an increase from 3.9 TCF to 8.8 TCF in 2020 (a 125% increase in 15 years), with Brazil being the most rapidly growing market (from 0.6 to 2.6 TCF, a 330% increase). The gas supply in South and Central America, and Caribbean (as is shown in Table 1) far exceeds the domestic demand and there is a large LNG export potential.

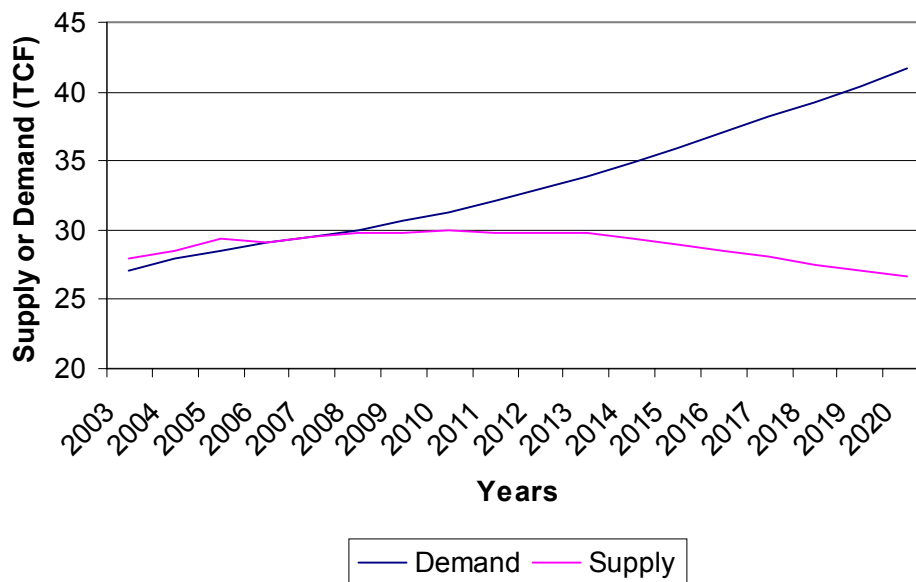


Figure 4: Forecasted gas supply and demand for North America at a US\$5 MBTU.
Source: IHS' North American Gas Business Model.

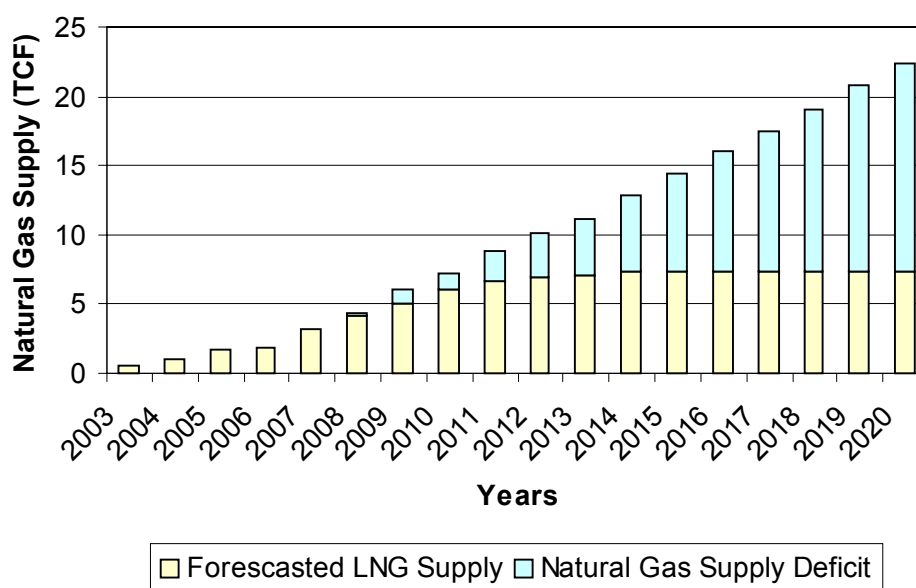


Figure 5: Forecasted LNG supply and gas deficit demand for North America at a US\$5 MBTU.
Source: IHS' North American Gas Business Model.

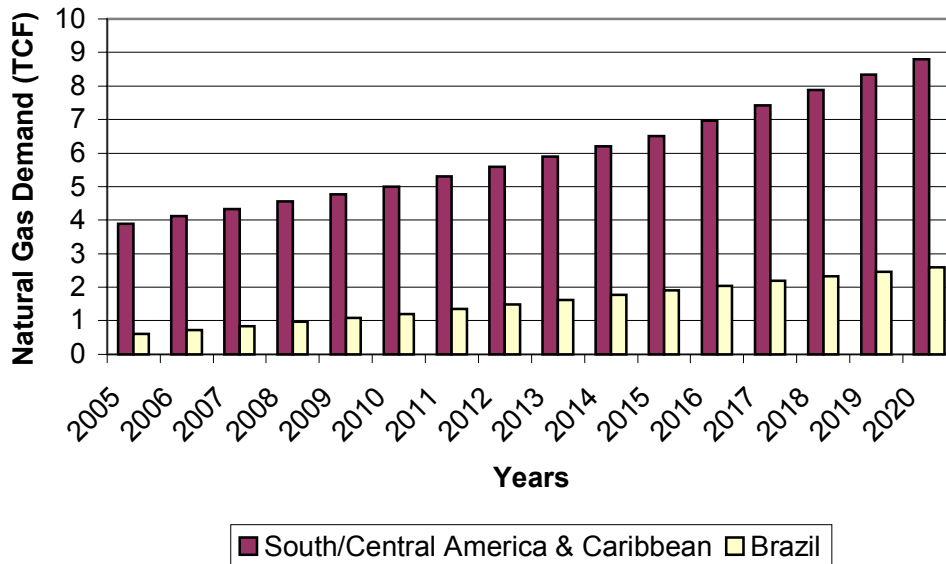


Figure 6: Forecasted natural gas demand for South and Central America, and Caribbean.
Source: USA Energy Information Administration and the author's estimates.

AMERICAS' LNG DEVELOPMENTS

There are currently only two operating LNG liquefaction facilities in the Americas. The oldest is Kenai in Alaska, which started its operations in 1969. All its LNG production is exported to Japan. The second one is Atlantic LNG in Trinidad and Tobago. It started its operations in 1999 and currently has 3 trains (one more is under construction). There are several other liquefaction projects, which are detailed in Table 2.

There are six LNG regasification import facilities in the Americas, five in the USA (including one in Puerto Rico) and a new one in the Dominican Republic. There are, however, a handful of new planned facilities, which are shown in Table 3.

Country	Facility	Status	No. Trains	Capacity (BCFY) ⁵
Bolivia	Pacific LNG	Planned	2	292
Peru	Camisea	Engineering	1	220
Trinidad & Tobago	Atlantic LNG	Operating	3	467
Trinidad & Tobago	Atlantic LNG	In construction	1	253
Venezuela	Mariscal Sucre	Planned	1	229
US-Alaska	Kenai	Operating	1	63

Table 2: Natural gas liquefaction facilities in the Americas.
Source: IHS' Midstream database.

Country	Project	Status	Capacity (BCFY)
USA	Everett	Operating	164
USA	Cove Point	Operating	365
USA	Elba Island	Operating	161
USA	Lake Charles	Operating	256
Mexico	Altamira	Engineering	409
Mexico	Costa Azul	Planned	475
Mexico	Ensenada	Planned	475
Mexico	Lázaro Cárdenas	Planned	164
Mexico	Tijuana	Planned	365
USA-Puerto Rico	Ecoeléctrica	Operating	23
Dominican Republic	Andres	Operating	37

Table 3: Natural gas regasification facilities in the Americas.
Source: IHS' Midstream database.

CONCLUSIONS

The gas situation in the Americas poses some very real challenges for LNG project implementation. North America faces a considerable natural gas shortage in the not too distant future and in fact, the USA and Mexico are already in the midst of a serious predicament by importing natural gas and LNG. Undoubtedly, South America and the Caribbean could meet the demand of the North if its considerable untapped gas reserves are developed appropriately. However, supplying LNG to North America raises some important issues that need to be considered:

- a. **Prices.** The cost of export and import of LNG varies greatly with supply and demand of natural gas. In the last few years higher than expected demands in North America, and stagnant domestic supplies of natural gas have created price conditions that have made export to the north quite profitable, especially when prices in most US hubs are above US\$4 MBTU. As a reference, total

⁵ LNG is also expressed in metric Tons (1 ton LNG = 48.69 thousand cubic feet of gas)

average costs (which include wellhead price and transportation, liquefaction, maritime transportation and regasification) are about US\$2.70 to 4.00 MBTU.⁶

b. **Facilities.** Even the most optimistic forecasts predict volumes of gas deficit that need to be covered by importing the commodity. Although there are many projects pending, there are currently only four regasification facilities in North America, each of them having their own LNG quality specifications for processing. Permitting and construction processes can take years, postponing the implementation of new and upgraded regasification plants even further. LNG facilities also require substantial financial resources. For instance, an LNG system composed of upstream and midstream facilities (train, storage tanks and export terminals), shipping and regasification terminals can cost between US\$3 to 4 Billion.

c. **Technology.** Although LNG technology has been around since the early 1900s, there are many improvements that are important to consider. For instance, transportation can be more cost effective with new vessels and terminals. Energy bridge ships (regasification vessels and buoy system that can deliver gas into offshore facilities) are also cost effective and mitigate environmental and safety concerns. By the same token, more permanent offshore regasification facilities can play the same role if used adequately. Marketing savings can also be achieved since new research is indicating that LNG can also be stored in salt caverns if temperatures are kept at appropriate levels.

d. **Global competition.** LNG from South America and the Caribbean is in direct competition with vast amounts of potential LNG volumes from Russia (Sakhalin), the Middle East (Qatar, Yemen, Oman, Iran), Australia, Asia (Indonesia and Malaysia) and Africa. Several mega producers have recently announced major plans for massive LNG shipments⁷. This will undoubtedly have price, supply and demand effects in North America. Latin American exports are also competing with massive Alaska reserves than are planned to be piped to the continental USA in a mid term horizon. South American producing countries also compete with each other. Venezuela is in the midst of developing large LNG facilities, Peru is already developing its Camisea LNG project and Trinidad and Tobago is constructing its fourth train and storage tanks.

e. **Quality.** LNG contains not only methane. Ethane, propane and butane are common components of gas that get liquefied in LNG as well. These extra liquids change the energy content of the regasified LNG. Terminals and purchasers have different standards for acquiring these qualities of LNG, which could be a constraint for future suppliers.

f. **Safety, environmental, political and social Issues.** LNG is a nontoxic component that is flammable if vaporized (concentrations of 5 to 15% if mixed with air) causing asphyxiation and burning. In the USA there have been three accidents related to LNG, the worst one occurring in Cleveland in 1944 killing 120 workers. The other two were of minor scale, related to the LNG facilities but not to LNG *per se*. Since then safety procedures have made tremendous progress and, for example, there have not been any reports of a single major accident with LNG transportation⁸, or in liquefaction and regasification facilities. However, there is always the issue of safety risk that developers have to face and in turn educate the stakeholders.

Even though the burning of natural gas is environmentally sound, the implementation of liquefaction and regasification facilities would require major midstream infrastructure civil works,

⁶ As an example, Atlantic LNG (Trinidad and Tobago) faces total costs of about US\$3 MBTU.

⁷ In November 2003, ExxonMobil sought FERC approval to build a large LNG regasification terminal near Sabine Pass, Texas (border with Louisiana). Under a pact with Qatar, ExxonMobil plans to ship 15.6 million tons of LNG annually.

⁸ Shell reports that vessels have made more than 35,000 ocean voyages covering more than 60 million miles with no record of fatalities, loss of cargo containment, or serious safety incidents on any LNG ship.

which would create environmental, social and political challenges. Just recently, social and political problems in Bolivia caused the delay of important LNG exports (Floris, 2003). In Maine, a proposed LNG regasification facility is facing severe opposition from the community and could prevent its construction. These are important issues that project developers have to handle appropriately.

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ACRONYMS AND ABBREVIATIONS

BCF: Billion cubic feet.

FERC: Federal Energy Regulatory Commission.

MBTU: million BTU (British Thermal Unit). 1 BTU=1.055 kJ=0.293 W (SI units).

LNG: liquefied natural gas.

TCF: Trillion cubic feet. 1 TCF = 2.832 E-02 TCM.

TCM: Trillion cubic meter.

USA: United States of America

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