LNG in Brazil and beyond

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INTERNATIONAL TRADE in liquefied natural gas (LNG) grew 1.8% in 2014, reaching 241 metric tons per annum (mtpa)—about 33% of world trade in gas. In 2014 exports by pipeline totaled 1.82 billion cubic meters a day and traversed 39 countries.

Currently, 19 countries produce LNG and 29 import it. The increase in the number of producers in all geographic areas ensures greater security of supply. Qatar is the largest producer of LNG (76.8 mtpa), followed by Malaysia (25.1 mtpa) and Australia (23.3 mtpa). In 2018, Australia will become the world's largest producer, with over 80 mtpa. In the United States 50 projects for exporting LNG have been approved, though only 4 are under construction.

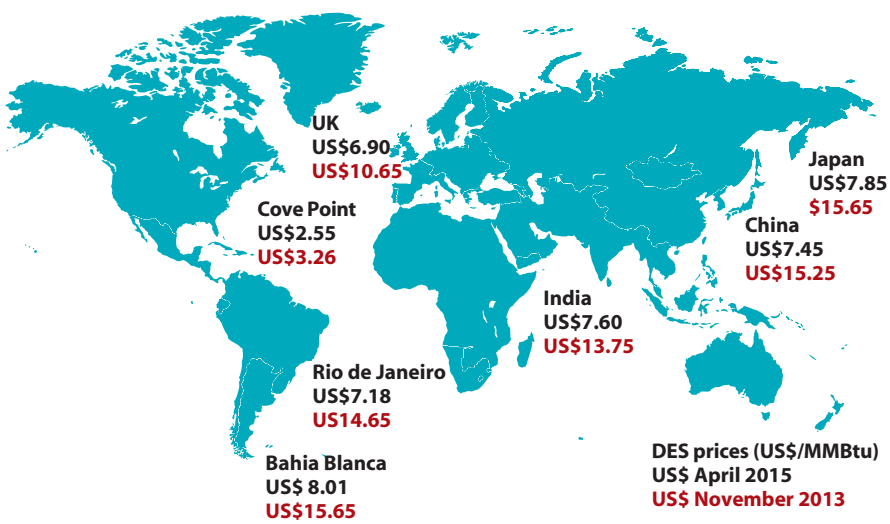
The Asia Pacific region is the largest import market, accounting for 75% of the total. In 2014 Japan consumed 88.9 mtpa. Consumption in the Americas reached 23.6 mtpa, with Brazil, Argentina, the Dominican Republic, Puerto Rico, and Chile consuming 15.2 mtpa—about 6% of world consumption.

By the end of 2014, when oil prices were above US$100 a barrel, new LNG projects planned in the US, Canada, Mozambique, Russia, and Australia totaled almost 900 mtpa. Given the limited number of companies qualified to build LNG plants and the cost inflation of materials and labor, investment in gas liquefaction reached US$1,400 per ton, equivalent to US$5-6 per MMBtu (million British thermal units). To these add production and transportation costs to the liquefaction plant, plus transportation costs by ship to the destination. LNG suppliers are seeking to obtain long-term prices ("delivered ex-ship," DES) of 14% to 15% of the Brent oil price to make their projects viable.

With a Brent oil price of US$100 per barrel, the price of LNG DES would be US$14-15 per MMBtu. Adding US$0.5-1.5 /per MMBtu for regasification, the LNG at the city gate would reach US$14.5-16.5 per MMBtu, which is not competitive in emerging markets, where the price of domestic natural gas and alternative fuels is often subsidized, as in Argentina and the Middle East. In such cases, the Treasury or the national oil company picks up the losses.

The price of LNG on the spot market tracked the decline in oil prices: Between 2013 and 2015 spot prices fell by 50%. North American, European, and Asian markets have different reference prices. In the United States prices are referred to the Henry Hub spot price (HH), which fell substantially as shale gas supply went up. In northern Europe, LNG prices are referenced to prices

DES LNG spot prices in regional markets
(US$/MMBtu)



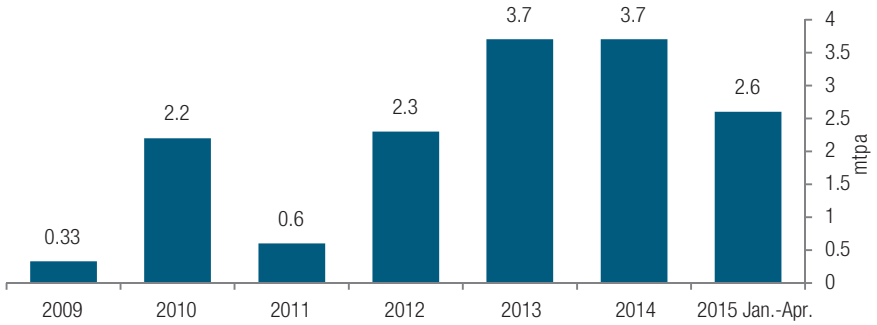
Souce: Federal Energy Regulatory Commission, Market Oversight, 2013 and 2015.

of contracts of gas imported through pipelines from Norway and Russia, which are tied to a price basket of oil and fuel. Spot prices in Asia are pegged to oil prices. When demand for LNG is high, suppliers arbitrate prices according to Asian demand, moving LNG volumes from the Atlantic Basin to Asia when transportation costs by ship are lower than the price differences between the two regions.

LNG spot prices for delivery in April 2015 converged in all markets, including Brazil; they fell between November 2013 and April 2015, reflecting much higher supply than demand and low oil prices.

Currently, in Brazil only state-owned oil company Petrobras imports LNG, which it uses mainly to supply thermal power plants. Brazil's LNG imports have increased significantly because prolonged drought has reduced hydropower generation, which has been replaced by thermal.

Brazil's imports of LNG



Source: Ministry of Mining and Energy, Monthly Buletin of Natural Gas Industry, May 2015.

Comparing DES LNG prices

Brent *vs.* Henry Hub

Henry Hub (US$/MMBtu)	Brazil DES price (US$/MMBtu)	Brent (US$/barrel)	DES price (15% of Brent) (US$/MMBtu)
3	7.9	30	4.5
4	9.0	40	6.0
5	10.2	50	7.5
6	11.3	60	9.0
7	12.5	70	10.5
8	13.6	80	12.0
10	15.9	100	15.0

Source: Author's estimates based on published projects.

According to the Ministry of Mines and Energy, since 2009 Petrobras has spent more than US$10 billion on LNG imports and at least US$1 billion in additional transportation costs. It has imported LNG from Qatar, the United Arab Emirates, Nigeria, Norway, Trinidad and Tobago, Spain, and the United States.

The supply of LNG is equivalent to 20% of the gas supply to the Brazilian market. Petrobras import capacity is 41 million cubic meters per day (mmcmd) in port terminals in Ceará, Rio de Janeiro, and Bahia states. There seems to be spare capacity because the maximum volume of regasification was 24.5 mmcmd in May 2014.

Brazil's demand for LNG is expected to increase. The 2014 energy auction offered two thermal power plants of 1,230 MW each fueled by imported LNG, and the 2015 auction offered another thermal power plant of similar capacity. Brazilian energy planning should encourage a greater share of LNG in Brazil's gas market because Petrobras has drastically reduced investments in exploration and gas, which in the long run will reduce the domestic supply. Bolivia, which accounts for 30% of Brazil's gas market, needs US$12 billion to maintain gas supply to its domestic market and to Brazil and Argentina.

Using a cost-plus pricing formula based on HH gas spot prices and assuming a cost of liquefaction US$3 per MMBtu, LNG DES cost of 15% of the Brent oil price and US$1.40 per MMBtu for transport to Brazil, U.S. LNG would be competitive when the Brent oil price is above US$60 a barrel and the HH gas spot price is below US$7 per MMBtu. If oil prices again go up to US$100 per barrel, LNG prices are expected to increase to US$14-15 per MMBtu.