Can Natural Gas be a catalyst to build a Lower-Carbon world?

By **Swati Dsouza**

The author currently manages a project at Brookings Institution India Center focussing on framing a long-term policy for natural gas in India. Her research focuses on energy security.

The short answer to the question is yes; natural gas can be and has already become a catalyst in some countries, which are transitioning to a low-carbon economy. The more important question though is can this model be replicated in other countries with gas as a catalyst? Several factors have been responsible in countries where natural gas has acted as a catalyst or 'bridge' fuel. Unlocking cheap gas supplies and new producers (conventional and unconventional), falling costs of Renewable Energy (RE), increasingly vocal concerns on climate change and dangers of exceeding the 20 C target, deteriorating air quality leading to a policy push are just some of the factors that have aided the shift. This, in essence, provides the short answer, and now let us dive a bit deeper.

Emergence of the term 'Bridge' Fuel

The term 'bridge' fuel came into vogue when the International Energy Agency (IEA) released its report on the 'Golden Age of Gas' in 2011. At the time of the release of this report, RE costs were still sufficiently high to make gas look like the best option to switch away from coal. Thus, a number of oil and gas companies and political administrations backed the idea of gas as a transition fuel in the move towards a low-carbon economy.

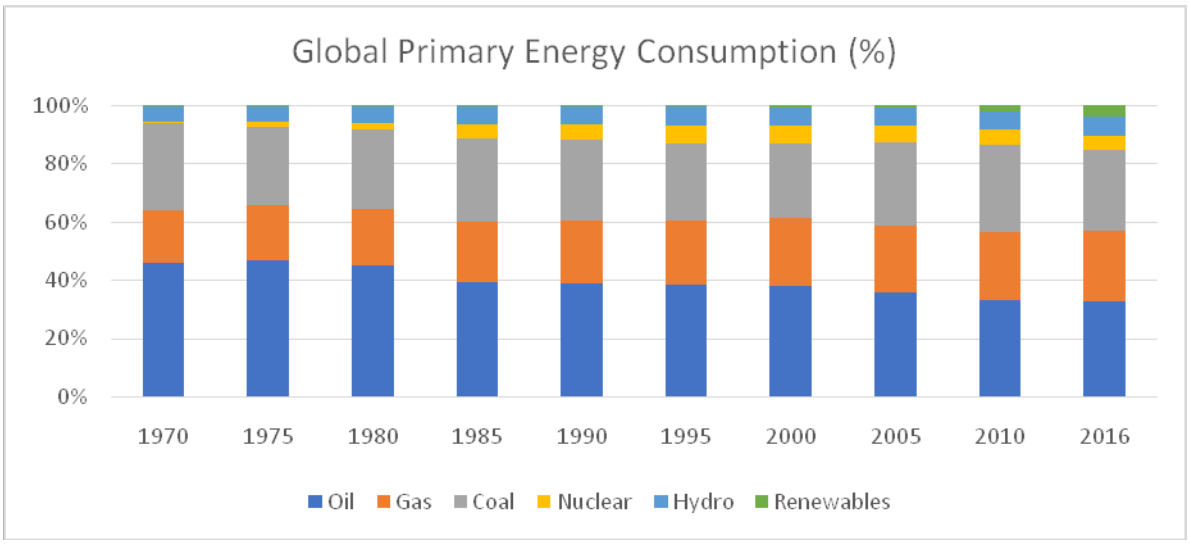
In 2018, the nature of this conversation has changed given that in some cases RE is cheaper than natural gas. Today, RE costs sans storage are competitive with both coal and gas. At the same time, natural gas has cemented its place as a part of the global energy mix and if one is to go by projections such as Sustainable Development Scenario of the IEA, it is the only fossil fuel to maintain its share in the energy mix for the next few decades. The share of natural gas in the global energy mix has increased from 18 per cent in 1970 to ~24 per cent in 2016 (BP, 2018). In countries like the United States of America, the share of natural gas in the energy mix (29 per cent) is higher than the share of coal (14 per cent) in 2017 and while absolute consumption in the 28 member countries of the European Union has decreased from 25 per cent in 2005 to 22 per cent in 2014, it still remains higher than the share of coal (18 per cent).

Further, investments too are moving away from coal (mining, infrastructure and power plants) into oil, gas and renewables. As per the IEA, in 2016, global investments in coal continued to decline to ~USD 125 bn (its lowest level in ten years) in comparison to ~USD 700 bn in oil and gas sector suggesting that investment in coal had peaked in 2015 and signalling the beginning of the end of coal.

Shifting Global Energy Systems

A number of factors occurring simultaneously aided natural gas consumption across the world. In the US, the shale gas revolution and the ability to unlock cheaper resources made natural gas attractive across different sectors. Traditionally, gas has been extensively used in the residential and industrial sectors. Unlocking cheap gas made it competitive to be used for electricity generation. Since 2009, the Henry Hub spot prices have averaged at $3.48/mmbtu in comparison to $6/mmbtu in the years between 2000-2008 (Figure 2). This in effect aided the transition in the US electricity sector away from coal. Between 2007 and 2017, the share of gas-based generation in the US increased from 22 per cent to 32 per

Figure 1: Shares of global primary energy consumption by fuel



Source: (BP, 2018)

> *Natural gas has cemented its place as a part of the global energy mix and if one is to go by projections such as Sustainable Development Scenario of the IEA, it is the only fossil fuel to maintain its share in the energy mix for the next few decades*

cent, while that of coal dropped from 49% to 30%.

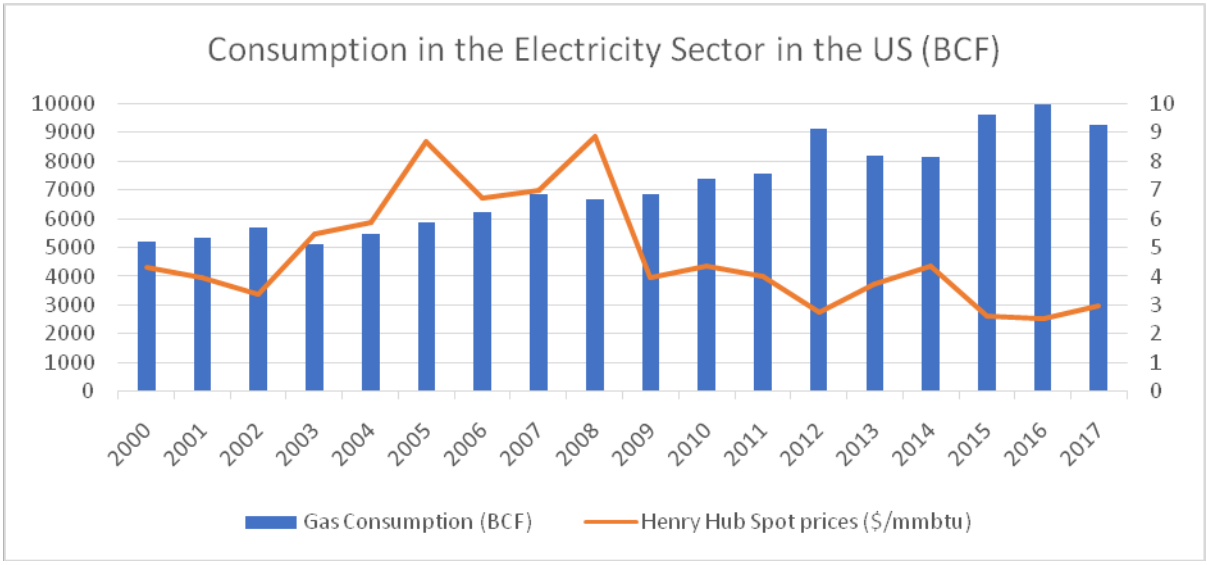
Abundant cheap supplies also helped in the decision-making of shifting towards cleaner energy sources such as President Obama's Clean Power Plan. And with increasing RE penetration and the ability of gas-based plants to function as a peaking plant, gave further impetus for the US electricity markets to switch to gas. Despite the current US administration's push on coal, it has become unlikely that the US electricity markets will veer away from gas and move back to coal. Unlocking cheap gas also made the US an active player in the Liquified Natural Gas (LNG) market. While the US accounted for only 4.5 per cent of the global LNG trade in 2017, it has become a major driver of capacity growth. While the US and Australia account for more than 70 per cent of the under-construction liquefaction capacity, more than two-thirds of proposed capacity (591 MTPA) is expected to come up in the US (and Canada) in 2020s.

The increase in Australian and the US production (which aided global supply) coincided with the Fukushima disaster in Japan in 2011 which led to the shutdown of nuclear plants in the country to avoid radiation leaks. Japan resorted to LNG over coal to meet its power generation, and thereby becoming the world's largest importer. The share of gas in Japan's electricity mix increased from 28 per cent in 2010 to 42 per cent in 2014 and remains elevated at 39 per cent even in 2017, although high fiscal deficit is making Japan move away from LNG to RE. Going forward, as per the National Energy Plan, released in 2015 by the Ministry of Economy Trade and Industry (METI), the reliance on LNG is expected to continue despite a reduction in the share of gas in the electricity mix to 27 per cent, given that Japan wants to increase its share of RE to 24 per cent.

In South Korea, the increased role of gas in the energy mix was prompted by environmental concerns on air quality and safety concerns, given its reliance on coal and nuclear for power generation. South Korea which consumes gas mainly for heating and cooking, and which until recently was the second-largest importer, is expected to increase LNG-based installed capacity to 47 GW and RE installed capacity to 58.5 GW from the present 37.4 GW and 11.3 GW, respectively by 2030 (in line with its NDC commitments). This translates to a gas consumption of 40.5 MT in 2030 (17.09 MT consumption in the power sector and the rest for city gas). Further, the government is also considering raising consumption tax on thermal coal to help power generators to switch to gas.

China is one of the biggest examples of how policy can drive transition and the

Figure 2: Impact of prices on natural Gas consumption in the electricity sector in the US



Source: US EIA

> *While the US and Australia account for more than 70 per cent of the under-construction liquefaction capacity, more than two-thirds of proposed capacity (591 MTPA) is expected to come up in the US (and Canada) in 2020s*

role of natural gas. After going through some of the worst air pollution crisis, China initiated a national action plan to clean its air (BlueSky Strategy) in September 2016, which mandated a switch from coal heating to gas or electricity in Beijing and Tianjin. In March 2017, this plan was expanded to include 26 more cities where the mandate was to replace coal stoves with gas/electric boilers. This policy had a major impact on global LNG market. Between 2015 and 2017, China's LNG imports almost doubled from 19.7 MT to 38.3 MT, while pipeline imports increased from 12.5 MT in 2015 to 28 MT in 2017. It also led to a sharp spike in prices last winter as supply fell short of demand (for a brief time). While the major focus in recent years has been switching from coal to gas for heating purpose (which is also responsible for 50 per cent of natural gas consumption), China is aiming to expand the share of gas in its energy mix to more than 10 per cent, increase its share of gas-based power plant from 67.5 GW in 2016 to 110 GW by 2020, while also limiting coal consumption to 62 per cent. All these measures (including targets on RE) suggest that China energy policy is transitioning with natural gas and RE as its central focus.

From the factors above, a few things stand out. One, natural gas did indeed become a catalyst for transition to a low-carbon economy in countries with cheaper and increasing domestic production and while policies in these countries acted as a supporting mechanism, the economics was the driving factor. In countries with no domestic production and with semi-regulated markets, unforeseen circumstances forced economics to switch to gas and further developments in the global energy space aided the role of gas as a transition fuel. In economies with abundant reserves of other fuels (such as coal/crude oil) and with regulated pricing/markets, natural gas on its own was not a catalyst for change, but was rather introduced into the system via concerted effort by different administrations. Moreover, the signing and ratification of the Paris Agreement in 2015, whereby the mandate to keep global temperatures well below 20C played in the favour of gas as a catalyst for change.

Challenges to Natural Gas as a Catalyst for India

For India, the role of natural gas as a catalyst to transition to a low carbon economy is debatable for multiple reasons. Gas usage in the power sector (which was the primary sector for change in other countries) has been declining over the past eight years, since low price domestic production has fallen and at the margin LNG is not competitive against coal-based

> *After going through some of the worst air pollution crisis, China initiated a national action plan to clean its air (BlueSky Strategy) in September 2016, which mandated a switch from coal heating to gas or electricity in Beijing and Tianjin*

generation (landed price of coal and gas are still regulated in addition to electricity tariffs for residential and agriculture end-consumers). The share of gas-based generation has fallen from 13 per cent in 2010 to 4 per cent in 2018. Moreover, the sector is already in process of decarbonising, with increasing penetration of renewable energy (175 GW by 2022 and 275 GW by 2027), and the Central Electricity Authority (CEA), India's electricity regulator and planning authority in its National Electricity Plan, 2018, expects natural gas to have a limited role in the power sector by 2030.

Secondly, unlike other economies, India does not have as much heating requirements where a fuel switch is necessary. In India, the highest consumer is the fertilizer sector (non-energy) where gas is used as feedstock. Considering the efficiency of natural gas-based urea production over naphtha/fuel oil, the Government of India has put in place mechanisms such as price pooling which can increase natural gas in the short run.

On the supply side, the existing structure of price setting does not incentivise domestic production as companies are unable to recover the cost of production. Further, the taxation structure of natural gas (the fuel is not under the Goods and Services Tax) makes it uncompetitive against coal, naphtha and fuel oil for end-consumers since they are unable to take advantage of the input tax credit mechanism and have to pay multiple taxes at the state and central level. The lack of gas market on the supply side, lack of infrastructure, regulations on pipeline tariffs and issues with open access, taxation structure and regulated tariffs on the demand side have so far impeded higher gas consumption in the economy. The share of natural gas in the energy mix has decreased from 10 per cent in FY11 to ~6.5 per cent in FY18. Therefore, under existing conditions, it therefore becomes very difficult to envision the role of gas in India's energy mix let alone its position as a catalyst that will drive the transition to a low carbon economy.

Agent of Change

Despite these factors, natural gas can be the agent of change in India under certain conditions, since one cannot escape the fact that gas is cleaner than coal/refined petroleum products. Burning gas emits 50-60 per cent less CO2 as compared to burning coal in an equally efficient power plant, while its emission intensity is ~28 per cent lower than diesel. Moreover, decarbonising the power sector was just the first step and a low-hanging fruit in moving towards a low-carbon economy for India. The country is yet to tackle the challenge of reducing petrol and diesel consumption in the transport sector (which contributes ~20 per cent to GHG emissions); diesel/fuel oil/naphtha consumption in industry (which contributes ~30 per cent GHG emissions) and reducing the share of biomass and encouraging cleaner fuels for residential cooking (especially in urban and peri-urban India). Some of the enabling conditions which we witnessed in other countries exist in India too. For example, the northern region has some of the worst air quality in the world rivalling what used to be in China. From an energy security point of view, the countries India sources natural gas from are far more stable as compared to those from where crude oil is sourced. Further, global price volatility in the gas market is far more contained and is seasonal as compared to global crude oil markets thus reducing current account deficit and

> *The taxation structure of natural gas (the fuel is not under the Goods and Services Tax) makes it uncompetitive against coal, naphtha and fuel oil for end-consumers since they are unable to take advantage of the input tax credit mechanism and have to pay multiple taxes at the state and central level*

making compelling case for increased gas consumption.

Certain sectors are already witnessing increased use of gas due to certain conditions. For example, total consumption in city gas networks has increased at an average of ~7 per cent since 2012. Some factors responsible for this transition were environmental concerns on air quality which made it mandatory for public transport vehicles to shift to CNG (in Delhi and Mumbai); a policy push on priority allocation of domestic gas for CGD; and competitive pricing vis-à-vis alternate fuels. One can expect this growth to continue given the ongoing CGD auctions where after the 9th round of bidding, India is expected to have coverage in nearly 50 per cent of its districts and service 50 per cent of the total population. Other schemes which have encouraged transition include the Smart Cities Programme where State and urban Local bodies have been asked to make provisions for PNG supply and CNG stations. These factors coupled with projections on India's urban population (~550 million by 2030 as per the India Habitat III National Report, 2016) mean that demand from CGD could increase from ~8 BCM in 2017 to more than 50 BCM in 2030, which is more than the current combined consumption from fertilizer and power sectors. Another sector where consumption has increased has been the petrochemical industry, which has seen an average growth of ~9 per cent between 2012 and 2018. Here too, concerns on air quality and strict monitoring by the Central Pollution Board Official (CPCB) have aided the transition.

Looking Ahead

Globally, natural gas has been an agent of change in different countries due to multiple reasons. In India though, the potential for gas to become a catalyst is still in its early stages. Apart from existing sectors, new areas of demand include transport (particularly long-distance road, rail and shipping), fuel switch in captive uses across different industries, CHP. However, more needs to be done for gas to become a catalyst across different sectors. Plans to use natural gas as a catalyst should consider trade-offs of using gas vis-à-vis other fuels at the regional level and impact of macro-level policies (such as air pollution or creation of carbon markets) as pressure points for change. A coordinated effort has to be made with stakeholders from the supply and demand sectors along with change in existing regulations if natural gas has to enlarge its role as a catalyst of low-carbon transition in India.

The views in the article of the author are personal .

For suggestions, email at:
feedback.infralineplus@infraline.com