The renewable energy revolution: how could it affect growth opportunities for the global LNG business?

Essay for Mini MBA New Energy Realities, Energy Delta Institute | Energy Business School

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1. Introduction

It appears that a new era approaches for natural gas and specifically the liquefied natural gas (LNG) market. At an energy summit in Paris in October 2015, industry leaders gave their insights into the future of natural gas in general and LNG in particular, as the industry once again faces a period of upheaval. Among the questions they addressed were: What should be the role of natural gas in the accelerating "energy transition"? What should the gas industry be doing to ensure its future? And what will be the impact on LNG trade of the new waves of supply coming from Australia and the US?[1] These may be very relevant questions indeed, considering the increasing momentum and recent revolutionary growth for renewables in the energy mix for power generation.

The development of the global LNG business in the last 50 years, from zero to about 240 mtpa today, as illustrated by figure 1.1 below, has resulted from the increasing role of gas as fuel for power generation at the expense of oil, coal and nuclear fuels.

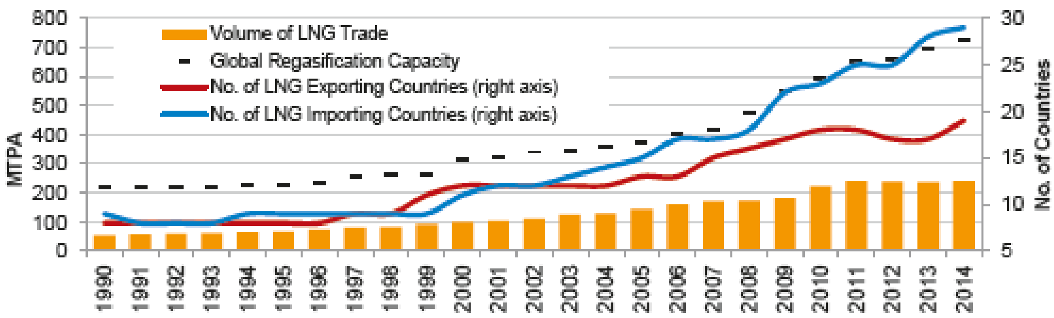

Figure 1.1 – LNG trade volumes and number of countries involved, 1990-2014 [2]

It is now anticipated that it will take only 25 years for renewable energy sources to represent the same amount of installed generation capacity as gas-fired power today. By 2025 there could be as much as 1,400 GW of installed solar plus wind capacity worldwide, which would displace 400-700 Bcm (15-25 Tcf) of gas or as much as Europe's total gas demand today.[3] This is equivalent to 315-525 mtpa of LNG, or 150-200% of today's global LNG production capacity.[4]

Global power generation capacity is concentrated in the developed world. Some 20 countries represent as much as 80% of global installed generation capacity. For now, it is expected that global demand for LNG will grow significantly to meet the increasing demand for power in developing countries like India and China, and from replacing coal (and oil) for power generation in more developed countries. According to several studies, by 2025 both gas and renewables (solar, wind and hydro) will represent about 20-25% in the energy mix for power generation globally.

For Europe, Asia-Pacific and North America, the most optimistic forecasts predict that renewables could constitute as much as 50-60% of the energy mix by 2040. The speed at which developments are taking place in renewable energy technologies, cost declines and global alignment on climate change policies and regulations, may present a serious threat of long-term oversupply, suppressed prices and a lack of growth or even gradual decline of traditional LNG markets in the next 25 years.

The essay will explore how the revolutionary increase in the dispatching of renewables in the power generation mix may affect opportunities for the global LNG business to grow between now and 2040.

[1] Gas Strategies, 30 November 2015
[2] IGU, World LNG Report - 2015 Edition
[3] IEA, World Energy Outlook 2015
[4] GW = gigawatts, Bcm = billion cubic metres, Tcf = trillion cubic feet, mtpa = million tonnes per annum

2. Aims and conceptual framework

The underlying premise for this essay is that markets for LNG are predominantly driven by demand for gas-fired power in places where (pipeline) gas is insufficiently available. It is foreseen that development of new gas-fired power generation capacity will increasingly be competing with renewables like solar and wind, rather than with oil, coal and nuclear power. The essay has the following aims:

- To analyse power demand growth between now and 2040 for different scenarios and market archetypes (mature, emerging, closed)
- To discuss latest developments and outlook for renewable energy on the power supply side from the perspective of technologies, investment and cost, policy and regulatory.
- To evaluate the effect of these developments on the energy mix for power generation for different demand growth scenarios and market archetypes
- To assess the impact of the different outcomes of the energy mix on growth opportunities for the global LNG business between now and 2040

To assess the likelihood of such a scenario, the essay will explore the current driving factors in and around the power sector that will affect the opportunity landscape for LNG. The discussion in the essay will be structured applying a conceptual framework as shown below.

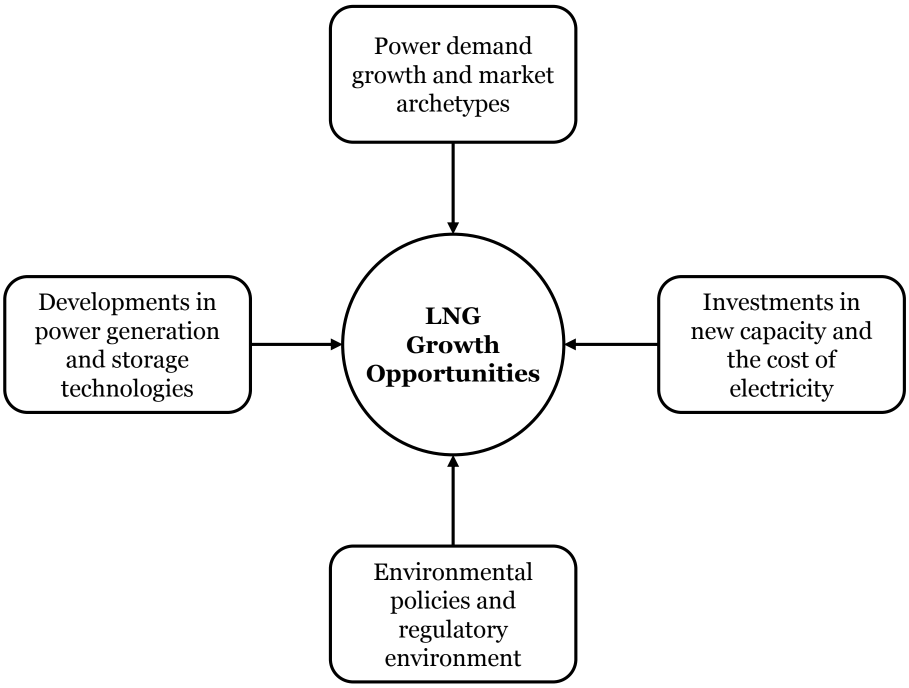

Figure 2.1 – Factors in and around the power sector affecting the opportunity landscape for LNG

Key questions that will be addressed are:

- Power demand growth and market archetypes
  - What are the scenarios for power demand growth in different market types ("mature" e.g. Europe, "emerging" e.g. China/India, "closed" e.g. Middle East)?
- Developments in power generation and storage technologies
  - What are the key technological developments that drive the competiveness of renewables vs. gas for power generation?
- Investment in new capacity and the marginal cost of electricity
  - What drives investments in renewable power generation capacity and how will it affect the long-run and short-run marginal cost of different technologies vs. gas-fired power?
- Environmental policies and regulatory environment
  - Which global policies and regulations (e.g. carbon pricing, ban on coal) are likely to be implemented and what could it imply for the use of gas in power generation?

3. Power demand growth and market archetypes

Electricity is the fastest-growing final form of energy. It is projected that some 4,400 GW of capacity needs to be built by 2040 to keep pace with increasing electricity demand while also replacing existing power plants due to retire. Electricity demand is strongly correlated to economic growth, although the extent of the linkage depends on the level of economic development of each country, the structure of the economy and the accessibility of electricity. In this section, the outlook for power demand and the dependencies will be discussed for three distinctly different power market archetypes.

Mature power markets

These markets are characterized by:

- Policy focus to move away from fossil fuels to cleaner and more efficient technologies
- Deregulated, unbundled and competitive markets for electricity
- Proactive retail consumers aware of cost, efficiency and environment

Emerging power markets

These markets are characterized by:

- Power sector partly regulated (reforms underway) with no strict policies for carbon emissions
- Focus on cheap power solutions driven by strong economic growth and increasing urbanization
- Opportunities for full electric-to-electric supply chains, leap-frogging technological developments

Closed power markets

These markets are characterized by:

- Power sector regulated and subsidized
- Heavy use of (indigenous) oil and gas in power generation
- Growing government support to expand renewables and nuclear generation capacity

In typical *mature markets* like Europe, North America and Japan, energy and power demand is projected to decrease in the next 25 years, as shown in figures 3.1, mainly due to demographics and energy efficiency measures. Power demand in these markets is expected to remain flat as the share of electricity in energy consumption will grow towards 30%, as illustrated in figure 3.3, due to increasing electrification and policies to stimulate deployment of renewables. In *emerging markets* like China and India, energy as well as power demand will grow strongly. In these markets electricity generation accounts for about 60% of energy demand growth until 2035, driven by urbanization and new infrastructure.[5] In *closed markets*, demand for electricity will be driven by population growth and increasing grid connectivity, but growth will be more moderate than in the past due to an increasing focus on energy efficiency, subsidies and cost.

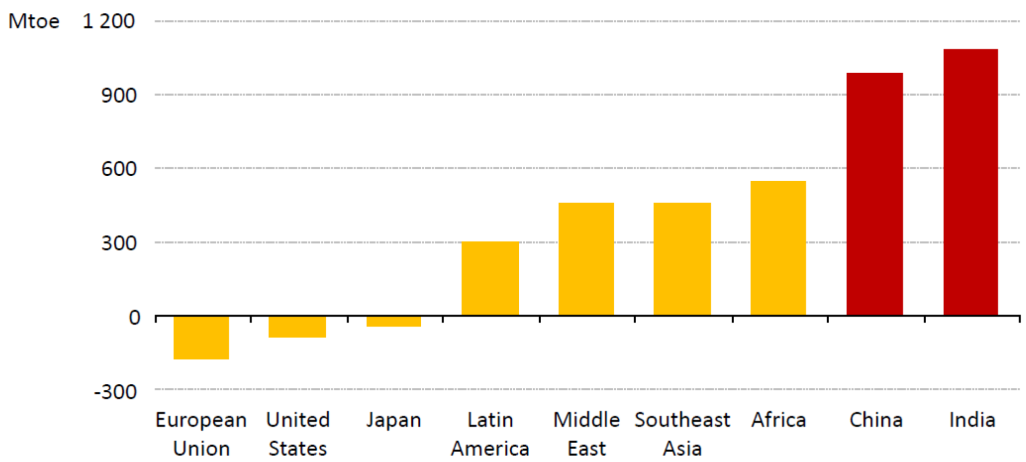

Figure 3.1 – Change in energy demand for selected regions 2014-2040 [6]

[5] BP, BP Energy Outlook 2035
[6] IEA, World Energy Outlook 2015

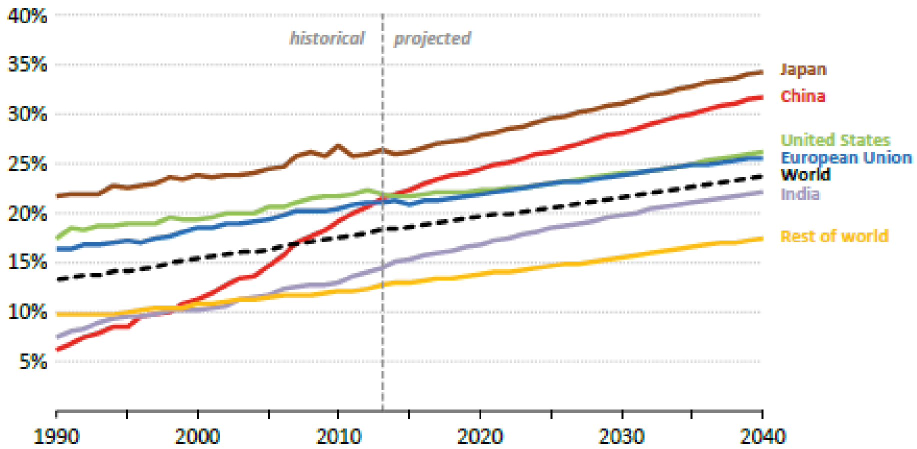

Figure 3.2 – Share of electricity in total energy consumption by region [4]

Overall, electricity demand is likely to continue a growth path on a global scale over the next 25 year. However, growth will vary widely on a scale from negative to multiple percents of growth, dependent on the power market type and level of maturity as pictured in figure 3.3 below.

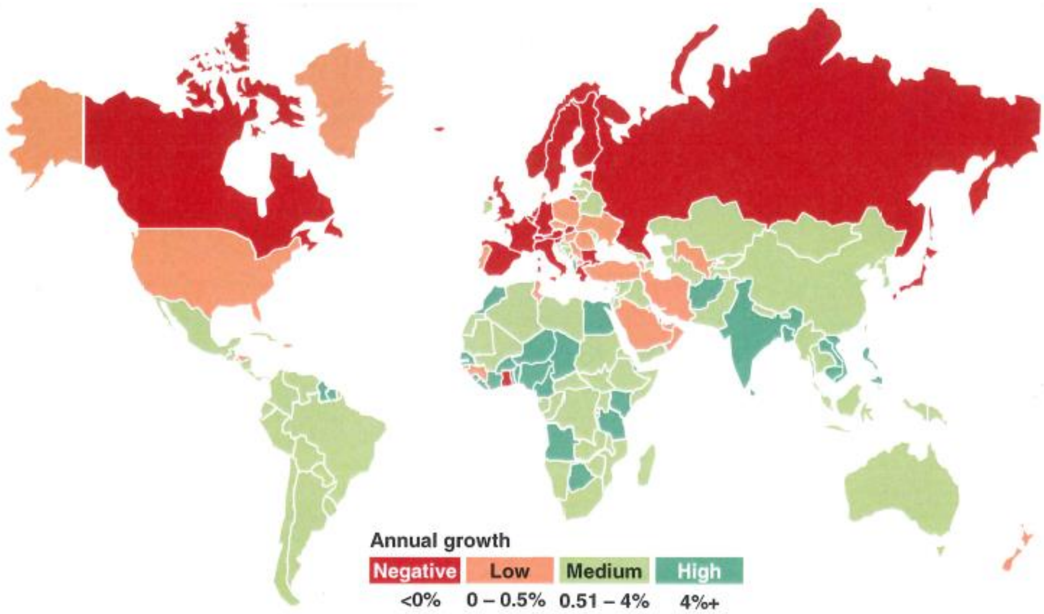

Figure 3.3 - Global power demand growth by country 2015-2040 [7]

In different scenarios from the IEA and others, it is forecasted that global demand for electricity will increase by more than 50% between now and 2040. Out of this growth, non-OECD countries or emerging power markets will be responsible for 7 out of every 8 additional units of global electricity demand. Most OECD countries will show zero or even negative power demand growth, even when offset by an increasing level of electrification in the overall energy consumption of these countries.

Based on the outlook for electricity demand alone, all market types appear to offer scope for growth of LNG supply to fuel the additional power generation supply capacity required to balance future demand. However, it is not only the growing electricity consumption that will drive an uptake of gas, either imported by pipeline or shipped from overseas, in the power generation mix. In addition to the traditional competition of gas with coal, emerging driving factors are rapid developments in renewable generation technologies in combination with storage and off grid solutions, resulting declines in the cost of electricity from renewables, and increasingly stringent CO_2 emission reduction policies and regulatory environments favouring non-hydrocarbon sources of energy. These factors and their interplay in the opportunity landscape for LNG will be discussed in the following sections.

[7] Bloomberg New Energy Finance, November 2015

4. Developments in generation and storage technologies

In the power systems technology domain there are two outstanding developments, which in tandem are likely to have a disruptive effect on the use of gas for power generation. These are photovoltaic solar panels (solar PV) and large scale electricity storage. The technology to generate electricity with photovoltaic cells exists for about 40 years, within which the production costs of crystalline silicon panels have fallen by more than 99%. Large scale, efficient and cost-effective storage has until now been the missing link between the intermittency of electricity supply from renewables and end-user demand profiles. Resolution of this issue is underway at a rapid pace, paving the way for the deployment of more decentral power solutions as well as utility scale deployment of renewables without back-up. During the same time, improvements in the efficiency and CO2 emissions of gas-fired turbines and in the cost of building and operating thermal power plants have been marginal and appear to have reached their limits going forward.

Solar PV

According to Swanson's Law, the price of solar panels tends to drop 20% for every doubling of cumulative shipped volume, which is illustrated in figure 4.1 below.

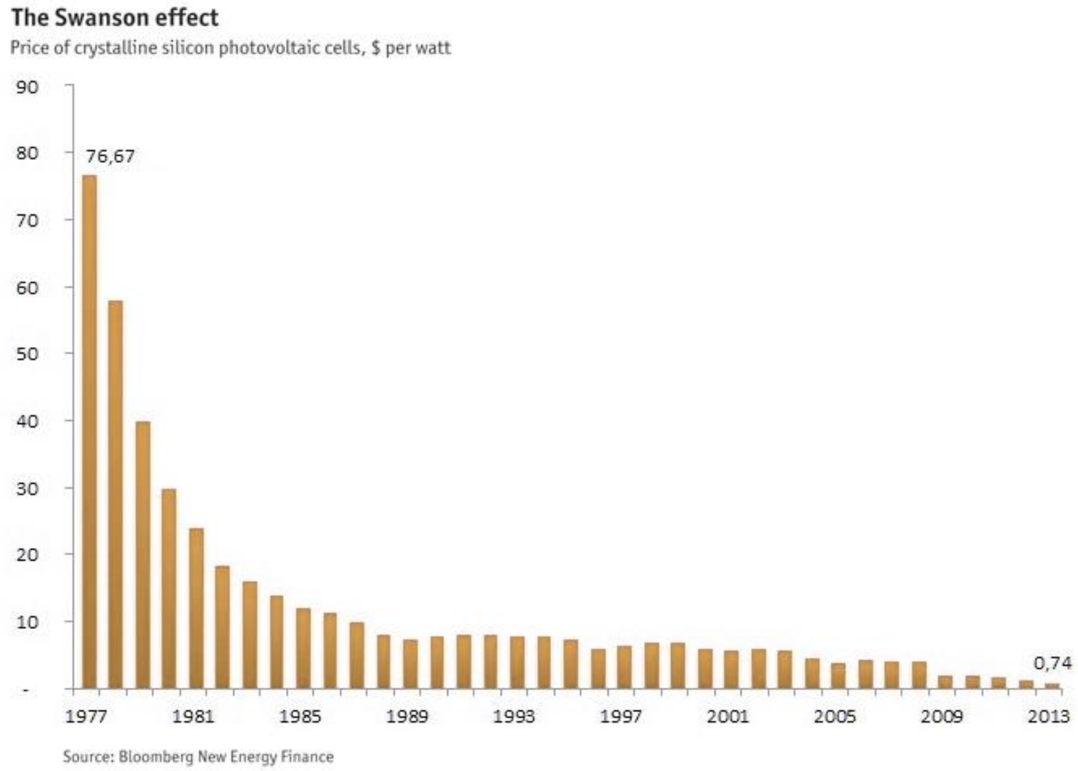

Figure 4.1 – Swanson effect on the price of for crystalline silicon photovoltaic cells

The effect of this ongoing increase in efficiency and decrease in cost, driven by economies of scale and shipped volume of panels, has recently triggered a rapid and large-scale uptake of solar PV in the energy mix for power generation. Since 2010, the world has added more solar photovoltaic (PV) capacity than in the previous four decades. Total global installed solar capacity overtook 150 GW in early 2014.[8]

From a technology standpoint, solar PV is arriving at a level where it is more efficient, less complex and cheaper than any other means of power generation. Different sources even predict that in future solar PV will be the backbone of the world's electricity supply system[9]. Although for now solar power will continue to require a level of back-up from thermal power plants to resolve intermittency and balance peak demand, it is likely to displace or even avoid large volumes of gas (and other fuels) being used as fuel for base-load or mid-merit power generation in mature as well as emerging power markets.

[8] IEA, Technology Roadmap - Solar Photovoltaic Energy, 2014
[9] NRC Handelsblad, 25 November 2015

Electricity Storage

The beneficial applications of electricity storage in the power sector are abundant, as illustrated by picture 4.2 below. In the context of this essay, the areas of resolving intermittency issues of renewables and enabling consumers to develop distributed, off-grid energy management solutions are of most interest.

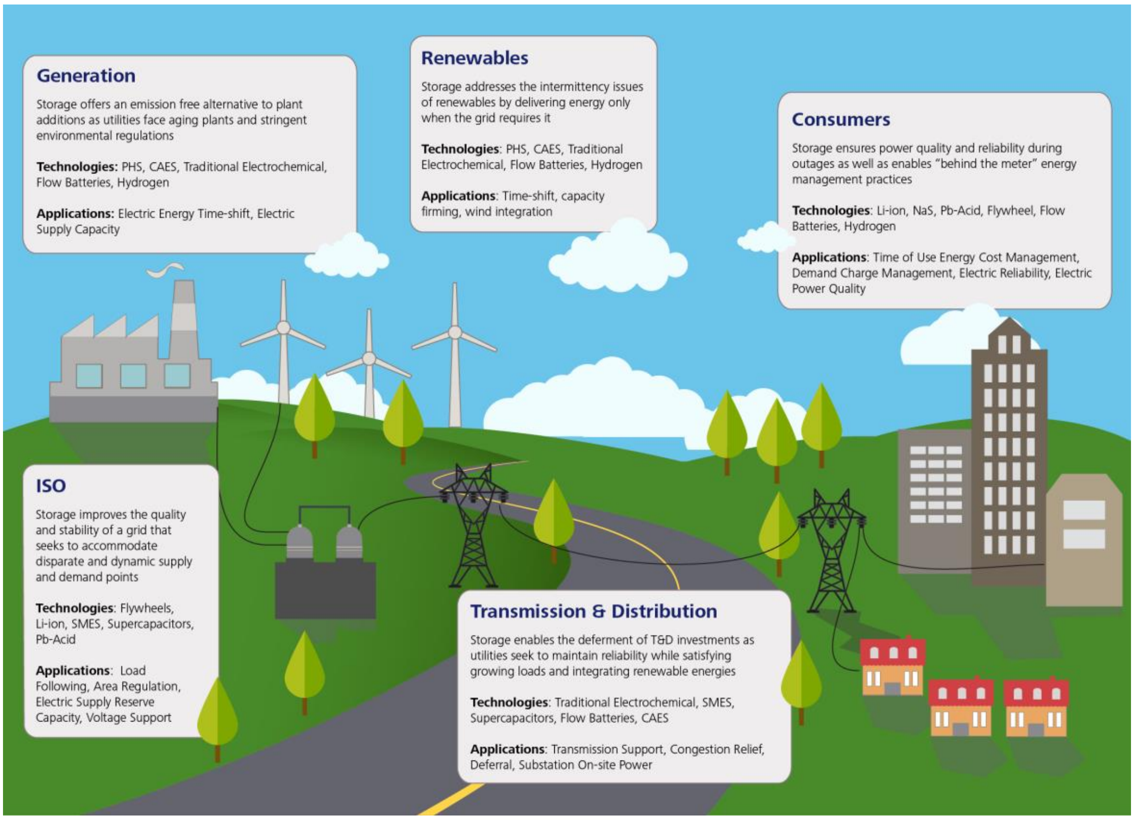

Figure 4.2 – Electricity storage applications across the power sector [10]

In recent years, both the need and the technological solutions for electricity storage have been growing rapidly, driven by the proliferation of intermittent renewable electricity generation, particularly solar PV and onshore wind, both at grid scale and distributed at building or local scale. In particular development of battery storage technologies targeted at distributed applications has been facilitated by the rise of hybrid and all-electric vehicles in recent years.[11] Today, batteries are cost competitive or near-competitive for many off-grid and remote community applications. However, today's battery systems struggle to realise widespread deployment for on-grid applications due to relatively high costs and performance issues.[12] While battery technologies could be candidates to fill this role as prices decline and they continue to reach scale, balancing generation systems with higher renewable generation intensity will likely continue to require use of other options in the next 25 years, which includes using existing and additional gas-fired peaker plants.

The biggest threat for utility scale gas-fired power generation may however come from the consumer side. For example, when cost reductions in batteries for home use down to USD 1,000 per kilowatt (kW) would be reached, a breakthrough in off-grid power solutions is likely to emerge. In particular the tandem of rooftop solar PV panels with affordable distributed batteries could then rapidly become the cheapest and most flexible electricity solution for many consumers in mature, emerging and even closed power markets. This could leave centralized, thermal power plant systems with idle overcapacity and prevent new capacity from being built. At least, it could allow the rise of off-grid solutions to capture a significant share of residential and commercial electricity market and fill in the demand growth from increasing electrification in transportation, i.e. electric vehicles.

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[10] SANDIA, December 2010
[11] Deloitte, Electricity Storage - Technologies, Impacts, and Prospects, September 2015
[12] IEA, Technology Roadmap - Energy Storage, 2014

5. Investments in new capacity and the cost of electricity

As described in the previous section of this essay, the cost of power generation from renewables and particularly solar PV continues to decline, while mature technologies like gas-fired thermal power plants are expected to stay at similar price levels. By 2030, the costs of solar PV and onshore wind may go down up to half of current levels, making them cheaper than even the marginal costs (fuel costs) of gas-fired plants, driven primarily by a fall in capital costs. Offshore wind, though moving in the same direction, will remain relatively expensive. For combined cycle gas-fired power plants (CCGT) in China a decline in capital costs is only expected for an increasing uptake (i.e. when replacing new coal-fired capacity) and growing domestic manufacturing capabilities.[13] The factors affecting investment in power generation capacity, the cost of electricity and the role of gas in the energy mix will be discussed below for two contrasting power market types, Europe and China.

Europe

For Europe, a typical mature power market an perceived to be an opportunity for more LNG sales, it can be seen from picture 5.1 below that electricity from onshore wind is already cheaper than from gas, while solar is reaching parity with gas by 2020.

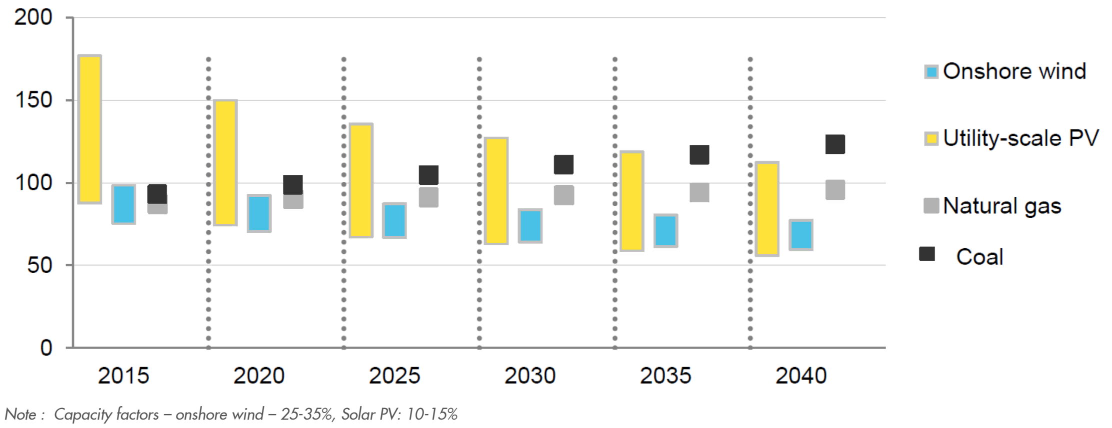

Figure 5.1 – Levelised cost of electricity in Europe in USD/MWh [14]

For solar PV to reach grid parity in Europe could signify a marked shift in customer behavior, whereby individuals or communities are incentivised to install solar PV panels on their rooftops in order to receive cheaper electricity as well as attractive feed-in tariffs. In a mature market with zero to negative power demand growth, the consequence will be that thermal capacity is underutilised or even idle and therefore loss-making to operate for peak demand and balancing of the grid. In such a scenario, replacing retired gas-fired thermal power plants as well as switching from coal to gas will be unaffordable for utilities companies. Germany is an example of a liberalised power market where this scenario has become a reality.

In Europe and similar mature power markets, actively promoting solar PV and wind power, opportunities for gas in the power generation mix will rely on the penetration rate of renewables. The biggest challenge for a rapid uptake of solar power at the expense of thermal power remains intermittency. For now, back-up capacity from existing thermal generators is the only available solution. If investments in additional thermal back-up capacity stall for a lack of financial attractiveness, the penetration rate of renewables may equally slow down. In this case, demand for gas could remain at current levels to provide for baseload power and backup in the next 25 years with the opportunity for significant more gas in the mix when favoured over coal for lower CO_2 emissions. The intermittency issue could however also drive battery technologies to evolve quickly. When the system cost to address intermittency using batteries for storage fall significantly, the market will drive further growth and uptake of renewables at the expense of gas. In that case, gas demand will fall significantly and investment in new gas-fired capacity or coal-to-gas switching will be circumvented by investments in (distributed) renewable power solutions.

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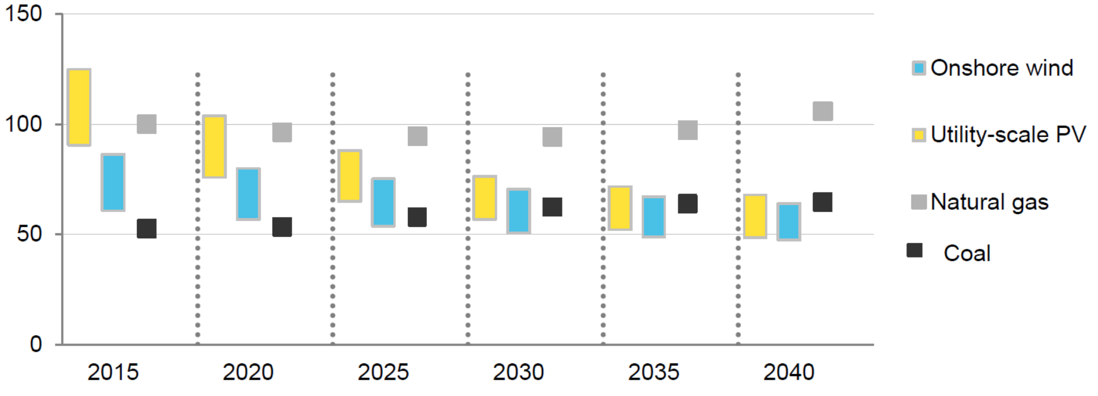
[13] Royal Dutch Shell, UIB Power Group, November 2015
[14] Bloomberg New Energy Finance, 12 October 2015

China

For China, a typical emerging power market and perceived to be a future heartland for LNG sales, the picture appears to be even more difficult for gas. As shown in picture 5.2, solar and wind will be significantly cheaper than gas by 2025, while gas remains almost twice as expensive as coal until 2040.



Note : Capacity factors – onshore wind – 25-35%, Solar PV: 10-15%

Figure 5.2 – Levelised cost of electricity in China in USD/MWh [15]

In China and other fast developing economies requiring low energy costs, renewables are still in an early stage of adoption. However, the country has an ambitious renewable energy programme and plans to grow renewable capacity to 300 GW by 2020. As these mega projects come on line, power prices will fall and renewables will further challenge an increased adoption of gas in the power mix to meet demand growth.

An additional factor impeding the uptake of gas to power is shown in figure 5.3. Nuclear and coal-fired power are much cheaper to build in China than gas-fired power, implying a gas (imported LNG) price less than USD 5.5/mmbtu for CCGT to compete with coal-fired power without CO2 charges.

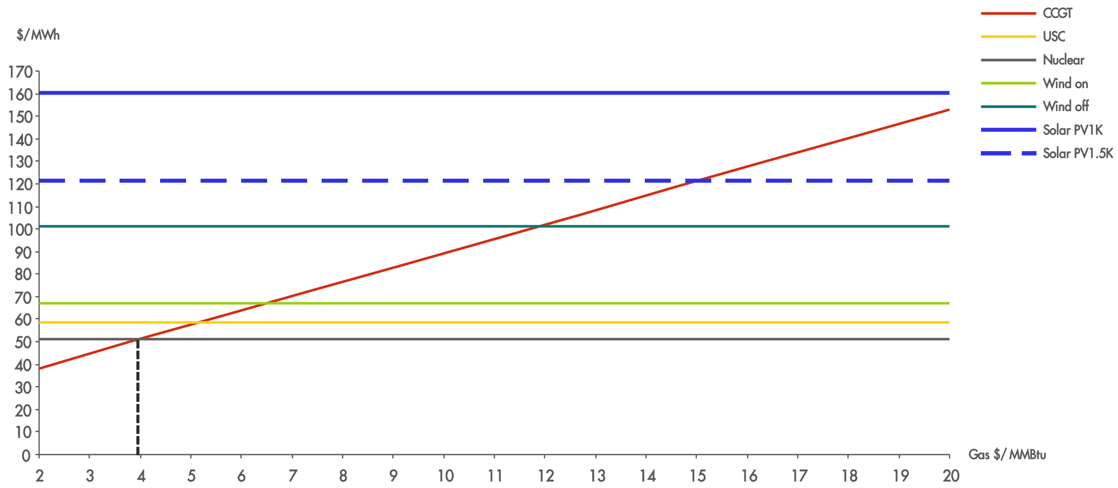


Figure 5.3 – Gas price in China for CCGT to compete with other power generation technologies [16]

This is primarily because of the high use of imported components in CCGT plants in China. The capital costs for a coal power plant in China is less than 5% higher than that of a CCGT plant, whereas in Europe it is up to 150% higher than what a CCGT plant costs. So in addition to a gas volume limits due to the ambitious Chinese renewables growth plans, there is a gas price limitation due to the competition with coal-fired plants. It is therefore expected that gas may constitute no more than 5% of the Chinese energy mix by 2030. Yet, the country is also suffering severely from high levels of hydrocarbon pollution in urban areas. Although this is caused mainly by cars, it is possible that the political situation may change in favour of cleaner gas-fired power. This would require government support for a functioning carbon market with prices in excess of USD 100/t. The recent slow-down of the Chinese economy may prevent such a shift.

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[15] Bloomberg New Energy Finance, 12 October 2015
[16] Chart collated from various public domain sources

6. Environmental policies and regulatory environment

Today there is widespread acknowledgement among the nations of the world that global warming of more than 2°C will have seriously negative consequences for life on earth. In Copenhagen 2009, the countries stated their determination to limit global warming to 2°C between now and 2100. To reach this target, climate experts estimate that global greenhouse gas (GHG) emissions need to be reduced by 40-70% by 2050 and that carbon neutrality (zero emissions) needs to be reached by 2100 at the latest. In Paris 2015, the countries reaffirmed the goal of limiting global temperature increase well below 2°C, while urging efforts to limit the increase to 1.5°C, and established binding commitments by all parties to make nationally determined contributions (NDCs), and to pursue domestic measures aimed at achieving them.[17]

About 35% of total global GHG emissions are currently generated by the power sector including heat production. Hence, in developed and emerging countries around the world, policies and regulations are being put into effect to influence the choice fuels and investments in (new) power generation capacity. On the one hand, these measures are aimed at stimulating the uptake of renewables in the energy mix, like subsidies or rebates for installing solar PV panels, feed-in tariffs for delivering electricity back to the grid and investments in net metering and smart grids. On the other hand, it is about measures to discourage the use of hydrocarbon fuels and constrain or capture GHG emissions. Two increasingly accepted and applied measures, potential having a big impact on the use of gas in the energy mix, are carbon (CO2) pricing and a ban on (gradual phase-out of) coal-fired power.

Carbon pricing

The enforcement of emissions policies and regulations in the form carbon (CO2) taxation and emissions trading schemes (ETS) is getting more widespread on a global scale, as illustrated by figure 6.1 below.

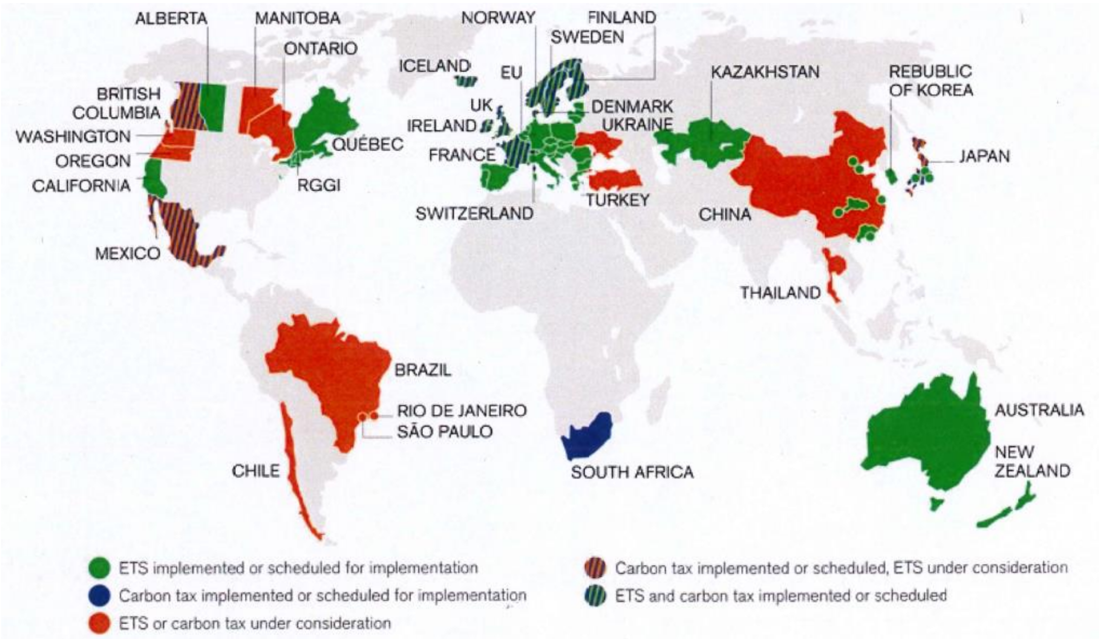

Figure 6.1 – Status of carbon pricing and emissions trading around the world (2015) [18]

In mature power markets like Europe, carbon pricing mechanisms help gas to bridge the gap with coal. However, so far current trading schemes have not been not serving this purpose as carbon prices are nowhere close to the levels to achieve parity. At the current prices of gas and coal, carbon prices need to be over $40/t of CO2 to achieve parity in the cost of running gas and coal plants. Actual carbon prices are currently below $10/t of CO2. This has resulted in coal-fired plants being the most economical to run for baseload and peak power in countries like Germany and The Netherlands. In these markets, more specific gas favouring government policies and related subsidies are required to influence the choice of power generation capacity being deployed, as only a few countries put a significant price on carbon emissions.

[17] United Nations Conference on Climate Change, COP21/CMP11, 30 November -11 December 2015
[18] PwC, November 2015

In some emerging power markets pilots have started with carbon markets, which could curb the use of coal in the power sector and pave the way for gas. In China though, attempts not to frustrate economic activity has led to an easy availability and oversupply of emission permits, resulting in low carbon prices not picking up. There are no examples of carbon pricing and trading schemes in closed power markets to support investment in renewables. For a lack of political will they are unlikely to emerge in the near future.

Ban on coal

In a special report issues in June 2015, Energy and Climate Change[19], the IEA concluded that the peak in energy-related emissions needs to reached by 2020 latest if a maximum increase of 2°C is not be exceeded. In their view, one of the key measures to bring this peak forward is to progressively reduce the use of (the least efficient) coal-fired power plants and banning their construction entirely. Putting such a measure into effect in the near term (before 2020) across emerging power markets like China, could facilitate gas to be the most likely alternative next to the deployment of renewables to switch from coal, meet power demand growth and provide for a backup system. However, longer term (after 2020) it is foreseen that due to its cost and limited impact on GHG emissions, gas will lose competition in these markets against nuclear power and a rapid and large scale deployment of renewables in combination with cost-effective storage solutions.

A less apparent scenario is unfolding in more mature power market like Europe. The abundance of shale gas supplies from the United States and low gas prices in global markets could support significant coal-to-gas switching in Europe, offering large climate benefits (every tonne of coal that is replaced by gas delivers about 1.3 tonnes of CO2 savings). This will require seriously low global gas prices, hence could be a temporary incentive for switching, or get the support from a functioning carbon market (carbon price of USD 40/t of CO2 or more) to win the competition with coal. Companies like Cheniere [20] in the United States are betting on this (near term) window of opportunity and expecting an increase of LNG demand in Europe from 31 to 92 mtpa by 2025. Other sources predict that coal may have peaked in 2013 and that coal-to-gas switching in Europe will happen driven by low gas prices as pictured in figure 6.2 below.

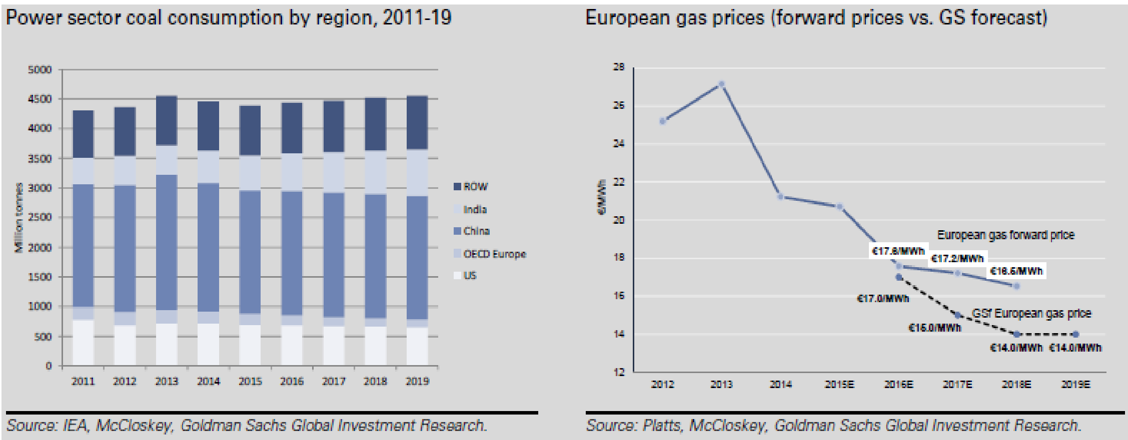

Figure 6.2 – Coal may have peaked in 2013 as European gas prices will continue to decline [21]

So far widespread coal-to-gas switching has not happened in practice. On the contrary, in mature markets like Germany and The Netherlands gas-to-coal switching has resulted from government policies to subsidize renewables. Coal-to-gas switching driven by low (shale) gas prices may remain only a US story, also as most emerging and developing nations seem to opt for a twin-track of cheap coal and renewables to power their economic growth. This leaves the conclusion that a much stronger enforcement in the form of a complete ban on coal-fired power may be required, to unlock the opportunity for coal-to-gas switching in the near term and for zero GHG-emissions alternatives in the long term. The United Kingdom is a country that recently adopted a gradual phase out of coal-fired power plants by 2025, switching to gas in the near term and adding new nuclear capacity in the long term to meet their low carbon electricity targets.[22]

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[19] IEA, Energy and Climate Change, June 2015
[20] Cheniere Energy Inc., Corporate Presentation, October 2015
[21] Goldman Sachs, Global Investment Research, November 2015
[22] BBC News, 18 November 2015

7. Growth opportunities for the global LNG business

From the reflections in the previous sections of this essay, it is apparent that despite unpredictable lead times, major changes continue to unfold in the power sector with a significant transformation of the energy mix underway. In mature markets power demand is expected to remain flat or even decline, despite an increasing electrification of energy demand. Emerging and closed power markets face particular challenges to satisfy rising energy demand while also meeting economic growth, energy security and environmental goals. Renewables are receiving strong support in a growing number of countries, mostly in mature power markets like Europe and North America. Coal and nuclear face challenges to deployment in some countries and enjoy support in others (e.g. nuclear in the United Kingdom). Natural gas-fired power generation has been frustrated by an abundance of cheap coal supplies in some cases and by capital and operating cost in others (e.g. CCGT in China). This section brings the different forces driving change in the power sector together and draws conclusions on the key factors affecting opportunities for the global LNG business to grow between now and 2040.

Continued growth of electricity demand is not a straightforward indicator for LNG

The world's population will grow to 9 billion in 2040, up from 7 billion in 2010. On a global scale, this will result in electricity demand growing faster than the revolutionary growth in supply from renewables, even when including new hydro and nuclear power.[23] From this perspective, there should be plenty opportunity for additional LNG supplies to the power sector. However, power demand growth and supply preferences vary widely by power market archetype. In mature markets like Europe, there will be decline in electricity demand coupled with a rapid uptake of solar PV and wind power at the expense of utilising installed gas-fired plants. In emerging markets like China, growth in demand continues to be met by lowest cost supply from coal in combination with additional nuclear power and large scale renewables projects to meet CO2 emissions targets. In closed markets like the Middle East, low cost oil and deployment of renewables keeps deferring options for gas. Electricity demand growth as such is therefore not a straightforward indicator to conclude on growth markets for the global LNG business.

Additional renewables capacity captures the demand growth in emerging markets

The outlook for the global power generation mix is an expected shift away from coal and oil, as pictured in figure 7.2 below according to the IEA Bridge scenario[24]. In this scenario the share of coal in the energy mix will fall from about 30% to 20% in 2030, while the share of gas will remain stable at 20-25%. The rapid growth in the share of non-hydro renewables from about 10% to 30% captures more than 80% of installed capacity growth until 2030. Gas and coal capacity are added in emerging power markets like China and India to meet growing demand. Coal is replaced by gas (or nuclear) in mature power markets like Europe.

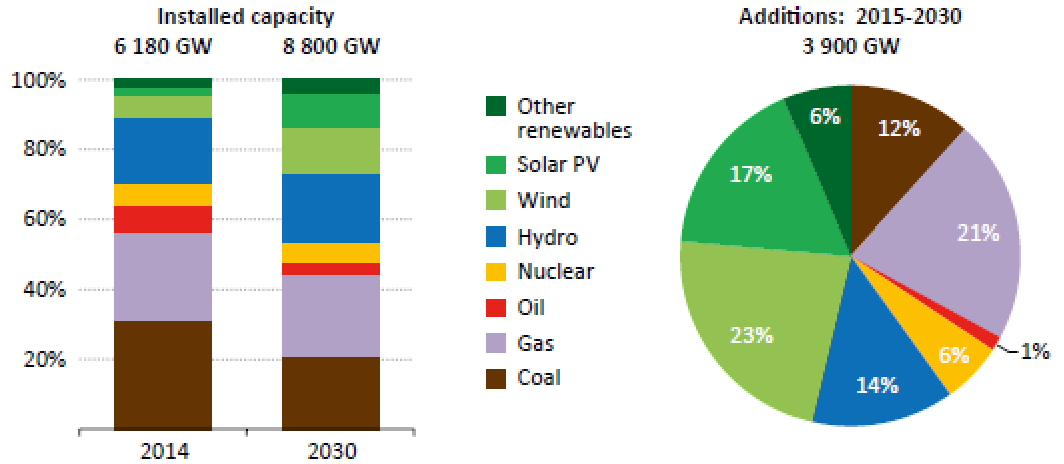

Figure 7.1 – World power generation capacity mix and capacity additions [25]

[23] NRC Handelsblad, 25 November 2015

[24] Scenario based on a successful outcome of COP21, aimed at identifying ways to facilitate a peak in global GHG emissions from the power sector at an early date (i.e. before 2020).

[25] IEA, Energy and Climate Change, June 2015

Of the growth in gas capacity of about 550 GW, 2/3 is added in emerging markets and 1/3 in mature markets. In mature markets, gas will replace coal and provide backup for renewables. With power demand growth being negative in these markets and the United States self-sufficient with shale gas, this leaves a growth opportunity for new gas-fired power of about 360 GW. Assuming 50% would depend on LNG, this is equivalent to 40-60 mtpa or a market growth of only 20%, much less than the 60% growth projections in LNG supply capacity by 2030.[26] This suggests that the increase in electricity consumption in emerging markets will be met by the growth of renewables and provide only marginal scope for more LNG supplies.

The biggest threat for gas-fired power may come from the consumer side

Finding solutions for the intermittency issue of renewables has gained worldwide momentum. Particularly developments in battery technology, driven by the recent increase of electric vehicles, offers great potential to become the missing link between the intermittent nature of electricity supply from renewables and continuous demand profiles. When the cost of batteries continues to decline as expected, they will become an affordable consumer device paying for itself by savings on electricity bills. This could reduce on-grid demand for electricity to a very low level, particularly in suburban and rural areas, leaving thermal power plants idle and subsequently power utility companies to go bankrupt. This scenario, which may very well become reality in the next 25 years, will lead to a very significant shrinkage in global LNG demand.

Rapid expansion of renewables challenges the role of gas-fired power to lower emissions

About 90% of new power generation capacity to be installed between now and 2040 will be in emerging markets.[27] It may be a misconception in the energy industry that gas is going to play a significant role as a cleaner alternative in these markets to reduce CO2 emissions and resolve pollution issues in urban areas. Recent commitments and announcements indicate most emerging and developing nations will opt for a twin-track of cheap coal and renewables. As an example, out of every 4 GW of renewable capacity that is being added until 2040, 1 GW will be installed in China.[28] The rationale for this approach is that higher cost of renewables can be offset by the low cost of coal to meet demand growth, preempting a potential role for more expensive CCGT and LNG imports in meeting GHG emission targets.

Carbon pricing and coal-to-gas switching are not yet paving the way for LNG growth

Long-term investments in development of gas fields and LNG infrastructure require guidance from functioning carbon markets and carbon prices at levels allowing gas to win the competition with coal. In turn, this should drive decisions on coal-to-gas switching with more credible opportunities for gas to replace existing coal-fired plants in mature markets and avoid new coal-fired plants in emerging markets. In practice, although widely accepted and deployed, carbon markets are disturbed by an oversupply of issued carbon rights and resulting low carbon prices to satisfy different political motives. As of yet, growth opportunities for LNG in mature, emerging as well as close power markets still have to come from lowest cost of supply or otherwise be unlocked by a self-imposed ban on coal like recently in the United Kingdom.

LNG suppliers will have to trade volume of supply against lower prices

A supplementary, overarching observation from the discussions on demand growth, investments in new capacity and coal-to-gas switching, is a trade-off between volume and price that may characterise the future of LNG markets. Suppliers of LNG will have to trade a higher of volume of supply against lower contract prices. On the one hand, gas will increasingly be favoured to replace more carbon-intensive fuels and backup the integration of renewables. China and India will be the main centres of gas demand increase driven by power demand growth, while in Europe gas use will not return to the peak reached in 2010 due to negative power demand growth, limited incentives for coal-to-gas switching, and the rapid uptake of renewables. On the other hand, suppliers of LNG seemingly have been expecting a much larger increase in gas demand from coal-to-gas switching in mature markets and gas being favoured to fuel growth in emerging markets. The 50% volume growth of gas in the energy mix by 2030 is outpaced by an expected 80% increase in LNG supply capacity, of which more than 50% is coming from cheap shale gas resources in the United States. This imbalance will have a downward effect on long-term contract and spot market prices, perhaps even down to levels of USD 5/mmbtu, where it could trigger widespread coal-to-gas switching in both mature and emerging gas markets and result in demand driving prices up again.

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