CHINA'S RESPONSE TO THE AIR POLLUTION SHOCK: IMPLICATIONS FOR AUSTRALIA'S LNG EXPORTS

Report to the Australian Petroleum Production & Exploration Association

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Acronyms

bcm	Billion cubic metres
DRC	Development Research Centre (within China's State Council)
ERI	Energy Research Institute (within the NDRC)
FYP	Five Year Plan
IMAR	Inner Mongolia Autonomous Region
NDRC	National Development and Reform Commission, China
SCE	Standard coal equivalent

PART 1: THE SUSTAINABILITY AND IMPLICATIONS OF CHINA'S ENERGY TRANSFORMATION

This report addresses two questions about the sustainability and implications of the energy transformation proclaimed by the Chinese Government in 2013 and 2014, in response to the 'air pollution shock' of 2013. The first is whether the accelerated process of structural change in energy use envisaged both for the near term (2020) and for the medium term (2030) can actually be achieved. The second is what such structural change might mean, if it is indeed achieved, for international producers of natural gas and in particular for Australian LNG producers.

The report is in two parts. This first part outlines the answers that we provide to these two questions, while Part 2 provides a detailed review of the progress of China's energy reforms and of some of the many challenges that it needs to address. This analysis underpins the answers to the two questions provided in Part 1.

Question 1: *Can such an abrupt change in the structure of energy supply and demand actually be achieved in practice, or will it remain only an unattained visionary goal?*

1. ***China's energy transformation is continuing, in spite of many complexities, and air pollution remains a key driver.***

   The need to restructure energy use in fundamental ways has remained a central focus of the Chinese Government in 2014 and in the first half of 2015, in spite of the increasingly complex set of issues that China must address. While average air pollution levels in China's cities was somewhat lower in 2014 than in 2013, pollution still remains at crisis levels and public concern with air quality is intense. Regular data are now available to Chinese citizens on air pollution across China. The recent online documentary on air pollution by Cai Jing, a former CCTV reporter, was released with some Government approval and has had over 300 million viewings. Thus air pollution remains a central factor driving change in the structure of energy use and the Government's commitment to achieving such change remains strong.

2. ***The complexities that the Government has been forced to address include the economic slowdown, the sharp drop in global energy and commodity prices, and the need for market reform.***

   Implementation of the restructuring agenda has been made more complex by slowing economic activity (which has weakened the financial position of many groups which need to pursue change), by the sharp fall in oil and coal prices (which has strengthened the position of these polluting fuels relative to others), and by the need for market reform in many sectors (such as the need to increase gas prices to some final users to reduce subsidy costs imposed on distributors).

   The preliminary figures for energy consumption in China in 2014, released on 26 February 2015, reflect continued government activity to achieve change, in spite of these complexities. Coal consumption fell by 2.9% in 2014, as a result of the slowdown in heavy industry, official emphasis on reduced coal use and a strong year for hydro power. On the other side, falling oil

prices triggered a rise of 5.9% in oil consumption. Gas consumption rose by a substantial 8.6%, in spite of increased end-user gas prices, although this rate is well below that of 15.1% per annum attained over the five years to 2013. Electricity generation from nuclear, wind and solar power rose by nearly 20% in 2014. These preliminary figures need to be confirmed by later data.

3. ***Nevertheless, revision of China's energy consumption data as a result of the 3rd Economic Census showed that China's energy consumption, and particularly its coal use, is much higher than previously thought.***

China carried out its 3rd Economic Census in 2013, and this was the first census to specifically include energy consumption. China is such a big country that the national statistical system is heavily reliant on data inputs from provincial and local agencies, and those reports may be unreliable in some cases. The censuses provide an opportunity for a major audit of data sources and inputs, led at the national level, and the establishment of improved systems for the future.

The first two Economic Censuses (in 2004 and 2008) led to increases in the estimated level of GDP of about 30% in total, while the increase in the GDP level in the third Census was much lower, at 3.5%. The Statistical Communique for 2014 from the National Bureau of Statistics (NBS), released on 26 February 2015, gave a figure for China's energy use in 2014 of 4,168 million tonnes (standard coal equivalent), said to be 2.2% higher than the figure for 2013. The implied figure for 2013 is 11.3% higher than the previous figure for 2013. These data have been confirmed by the leading source of Chinese data, CEIC, with the changes ascribed to the 2013 Census.

Thus, while there has not yet been any substantial release of energy consumption data from the 2013 Census, it follows that the 2013 Census found that China's energy consumption in 2013 was 11.3% higher than previously estimated in the official data. It is also possible to infer from the limited data available that most of the increase in energy use is in coal use, with the new estimate for coal consumption in 2013 about 17% higher than the previous one. Given that coal has been the dominant traditional fuel, if there is going to be any undetected energy use it is more likely to be in coal than in other fuel types.

These new figures are likely to have major repercussions both within China and internationally. Internally this much higher level of coal use further explains the extent of pollution problems, and is likely to intensify the Government's effort to change energy structure. In global terms, the revisions amount to about an 8% increase in global coal consumption and a significantly higher level of global emissions in 2013. How the NBS incorporates the new findings into revisions of the back data will not be clear until NBS releases full revised figures, said to be due in October 2015. More generally the new figures will impact on China's ability to meet existing climate change commitments and on the processes of international negotiation.

4. ***The Government is managing the process of slowdown and structural change carefully: a 'new normal' with moderate growth rather than a continuing slump is likely.***

The Chinese Government is explicitly encouraging more modest rates of growth, with less emphasis on heavy industry and property development, while trying to ensure that growth remains close to 7% per annum. The economy has slowed more sharply than the Government

anticipated in late 2014 and in the first half of 2015, and perhaps more sharply than the GDP figures available to date indicate. For example, in the March quarter of 2015 total power consumption, which is an indicator of economic growth, was only 0.8% higher than a year earlier. The further slowing in the economy has been mainly ascribed to a fall in infrastructure spending at the local government level, itself reflecting the impact of reforms to contain local government debt and of the intense anti-corruption campaigns. The Government has been responding to this further slowing, for example by increasing loans for affordable housing, reducing interest rates (most recently on 10 May 2015), accelerating spending on large infrastructure projects and by partially reversing the local government debt reforms (by again allowing access by their financing vehicles to bank loans). While it faces challenges on many fronts, the Government does seem to have sufficient policy instruments to avoid a continuing, serious downturn.

5. ***The financial position of Chinese coal producers is very difficult and steps are being taken to support them, especially at the provincial level, while continuing to reduce the role of coal.***
With coal providing about two-thirds of China's energy consumption and being a dominant contributor to both air pollution and greenhouse gas emissions, reducing the role of coal is at the heart of the energy restructuring process. The coal industry in China has extensive overcapacity and is facing heavy losses at current low coal prices. It is also fragmented, with many small producers, and based in resource-rich but economically poor provinces. Coal firms are heavily indebted to the major Chinese banks, which themselves face severe problems with non-conforming loans. These facts mean that managing the decline in the relative position of coal is a difficult one, posing many challenges for both the central and provincial governments. As part of this process coal taxes were changed in late 2014 from a fixed tax per tonne of coal produced to a resource tax based on sales revenue, with provincial governments given some flexibility to determining the rate, within a prescribed band. The central government has also introduced a 3% import tariff for coal and reduced the export tariff on coal from 10% to 3%. In spite of the adjustment difficulties, it remains a central Government priority to reduce the role of coal, and progress was made with the 2.9% reduction in coal use in 2014 (in spite of the revelation that the base from which this reduction was achieved was much higher than previously thought).

6. ***Price reform, including for gas pricing, is critical for the energy transformation to be viable, and fundamental reforms are now being initiated in China's gas industry.***
China's gas market is oligopolistic, being dominated by three state-owned oil companies (CNPC, SINOPEC and CNOOC), and has serious price distortions. Differential prices have applied to different gas users (residential and non-residential users), and to the 112 billion cubic meters of natural gas industrial and commercial users consumed in 2012 (2012 gas consumption) and the additional consumption since then (incremental consumption). There are also variations in gas prices in different regions of China as the local governments have been responsible for setting local gas prices under the National Development and Reform Commission (NDRC) guidelines.

   The tier pricing system, and increases in gas prices within it, aimed to reduce implicit cross-subsidies in the system and to raise the incomes of gas enterprises, thus giving them increased incentives to expand gas supply. The central government asked provincial governments to

increase wholesale gas prices for non-residential users by 14-25% on 1 September 2014, on top of an increase of about 15% in July 2014, but some provincial governments were slow to respond. This reluctance reflects the fact that industrial gas prices in China are already high, especially relative to residential prices. In the USA, for example, prices for natural gas to industry are about half residential prices, whereas in China prices to non-residential users are 25-50% higher than those to residential users.

Since late 2014, the reform of the gas pricing and supply system has developed into a fundamental reform, and indeed something of a test case for reform in sectors dominated by large state-owned enterprises. This has involved a reduction in incremental gas prices to non-residential users, leading to an elimination of the two-tier system for these users, together with increases in residential gas prices; the creation of the Shanghai Petroleum and Gas Exchange, as part of a long term process to introduce market processes into the purchase, trade and distribution of gas in China; and initial steps to break-up the power of the three massive state-owned oil companies, and to introduce private capital into the supply, trading and distribution of gas in China. These reforms are likely to change the face of the gas industry in China in due course.

7. *Thus the building blocks for a major expansion of gas consumption are being put in place: pricing, infrastructure, supply and changing demand patterns.*

While there have been some variations in long-term energy development plans during 2014, and a lower rate of growth in gas consumption in 2014 (8.6% rather than the earlier double digit growth rates), the building blocks for long-term expansion in gas use are still being put in place. These include the pricing reforms, policy support for increased gas use in industry and in power generation, and the extension of distribution infrastructure to potential users. As noted further in Part 2, the NDRC air pollution work plan issued in March 2014 set a target for a gas use of 330 bcm by 2017, while the State Council long-term natural gas plan issued in April 2014 included planning for gas use of 400 bcm by 2020, with an aspirational target of 420 bcm by that year. A 2020 target of about 400 bcm was confirmed by the document China Energy Development Strategy Plan released by the State Council on 4 December 2014.

In our assessment, a near trebling of China's gas consumption, from about 140 bcm in 2012 to about 400 bcm by 2020, still seems likely, as is continued strong growth after 2020. This is a much higher level of gas consumption than generally envisaged by the gas industry and by international agencies such as the IEA. In its *Medium-Term Gas Market Report*,[1] released on 4 June 2015, the IEA forecasts that China's gas consumption will by 314 bcm be 2020, an increase of 10% per annum on the estimated 2014 level. Wood Mackenzie has recently revised down its forecasts of Chinese gas demand from 420 bcm to 360 bcm in 2020, and from 640 bcm to 560 bcm in 2030, mainly reflecting the short-term drivers of 'low oil prices and high domestic gas prices, reversal of environmental policies, competition from coal and hydro and warmer winter

[1] IEA 2015, Medium-Term Gas Market Report, International Energy Agency, Paris, at http://www.iea.org/bookshop/707-Medium-Term_Gas_Market_Report_2015

weather'.[2] In our view these revised projections give undue weight to short-term trends and underestimate the determination of the Chinese Government to achieve long-run change. A figure of about 400 bcm is consistent with the Chinese Government's own targets, which are driven by powerful environmental imperatives and are supported by a strong policy and reform focus. It would be mistake, in our view, to assume that China cannot achieve a shift to gas on the scale to which it is so evidently committed.

Question 2: *If such a surge in China's gas consumption is achieved what will it mean for additional demand for Australian LNG?*

1. ***Over the period to 2020, China's domestic production of natural gas is likely to increase strongly, but not at a rate sufficient to keep up with the projected surge in consumption.***
   The sources of increased supply of gas to China to meet this rapid expansion of gas consumption are domestic production – in the form of conventional and tight gas, shale gas and coal-to-gas (synthetic natural gas (SNG)) – and imports, both by pipeline and through LNG shipments. While conventional gas production continues to grow strongly, both shale gas and SNG are moving more slowly than expected. The expansion of shale gas production is experiencing problems, mainly related to the high costs of exploration and development for China's shale gas and to the heavy water requirements. It appears that the 13th FYP target for shale gas production in 2020 will be only about 30 bcm, half that originally envisaged for that year. There is also much debate about the environmental and other costs of SNG. It has been reported that no further SNG projects will be approved, and that the targets for SNG production by 2020 will be sharply reduced from those previously indicated. But these reports have not yet been officially confirmed.

   The latest targets from China's State Council, discussed further in Part 2, imply growth of about 12% in China's domestic gas production over 2014-20 to about 245 bcm in 2020. This growth rate is much higher than the rate of 7.5% per annum achieved over 2008-14, and more than double the recent projection of 5.5% per annum growth in China's gas production over this period in IEA (2015)[3]. The IEA's low growth projection for domestic production to 2020 reflects much lower than anticipated production of unconventional gas, for the reasons discussed above. While the IEA projection may underestimate the pressures in China to increase production of conventional and tight gas, the production targets will be difficult to achieve if the growth in non-conventional gas is limited. The State Council targets imply a rise in imports of 18% per annum over 2013-2020. If domestic production turns out below target but the Government still wishes to meet a high consumption target, this will require an even more rapid rise in imports.

2. ***If current agreements were fully implemented, pipeline gas from Russia could provide over 15% of China's projected gas use by 2020. But this is in our judgement unlikely, given different***

[2] Gavin Thompson cited in Platts McGraw Hill Financial 2015,'China's lower gas demand growth leaves NOCs facing oversupply: WoodMac', 10 June, Sydney, at http://www.platts.com/latest-news/natural-gas/sydney/chinas-lower-gas-demand-growth-leaves-nocs-facing-27495854

[3] IEA 2015, Medium-Term Gas Market Report, International Energy Agency, Paris, at http://www.iea.org/bookshop/707-Medium-Term_Gas_Market_Report_2015

interests and emphases from China and Russia, the impact of lower oil-linked gas prices on investment appraisal and the massive scale of the eastern pipeline.

While China has several sources of pipeline imports of natural gas, the major impact will come from the two new Sino-Russian pipelines to be constructed as a result of agreements signed in 2014. One is the eastern or 'Power of Siberia' pipeline, which enters China near Vladivostok and could deliver up to 38 bcm of gas per annum by 2020. An agreement was signed to implement this US$55 billion project in March 2014, with an undisclosed gas price said to be linked to oil prices. This project requires opening up new gas fields in eastern Siberia, but would deliver gas to China's north eastern industrial area and with ready links into the eastern gas grid. The other is the western or Altai pipeline, with a proposed capacity of 30 bcm per annum by 2020. A framework agreement to proceed was signed in November 2014, with a final deal targeted for 2015. The Altai pipeline is much cheaper for Russia to build than the eastern pipeline (a figure of $10 billion has been cited, unofficially), in large part because the gas will be sourced from the massive existing Bovanenkovo field in the Yamal project in north-central Russia. But it will deliver gas to the far west of China, where China already has ample supplies of gas, and hence will require heavy Chinese investment in additional pipeline infrastructure to transport the gas to the eastern areas where demand is strong.

In principle these two projects could deliver 68 bcm of imported gas per annum to China by 2020 (which would be over 15% of China's projected gas consumption), but it may be much longer before such high levels of gas supply are achieved. Construction work on the eastern pipeline has begun, although commercial uncertainties remain, and a full technical agreement on the Altai pipeline is still being discussed. Economic developments in Russia and fluctuations in global gas prices might both impact on progress in relation to these agreements and hence on construction completion dates. Also relevant is the fact that the economic imperatives facing the two parties imply different priorities for the two projects. For Russia, increasing production from underutilised fields in the Yamal project, with limited pipeline costs to Russia for delivery of gas to the west of China, makes the Altai pipeline a clear commercial priority. From China's point of view, the eastern project delivering gas to north-eastern China, close to major sources of demand and with limited additional Chinese investment required, should be given priority.

3. ***Given constraints on the expansion of new forms of domestic gas production in China and doubts about the timing of the rapid build-up in pipeline imports, it is likely that there will be a window for substantial additional imports of LNG into China after about 2017.***

For China's natural gas consumption to reach 400 bcm by 2020, import supplies will need to increase by more than 18% per annum over 2014-20 if the State Council's December 2014 projections for domestic production are achieved. If there is a substantial shortfall in domestic production, a more rapid rate of increase in imports will be required. Much of this increase in imported natural gas will need to be delivered to the eastern coast of China, and this will require continuing increases in LNG imports. While China has other sources of pipeline imports, notably Central Asia and Myanmar, if the Power of Siberia project does not achieve target delivery dates there will be further unsatisfied demand for natural gas on Chinese east coast. This should provide substantial opportunities for additional increases LNG imports towards the end of the decade, to relatively high income markets on and near the east coast which place a high premium on the improved environmental quality provided by natural gas.

4. ***Adequate regasification infrastructure is available, under construction or planned to accommodate greatly increased LNG imports into China.***

   As China's interest in and use of LNG has developed, its regasification capacity has increased rapidly, and well ahead of demand, so that there is considerable underutilised capacity in 2015. In the past decade 13 regasification terminals with a capacity of 54 bcm have been built, and seven additional ones are under construction. It is estimated by IEA (2015) that, when these seven are completed by 2017, China's regasification capacity will exceed 80 bcm. With the completion of Sinopec's first LNG terminal at Qingdao in 2014 all of the three oil and gas majors in China (PetroChina, CNOOC and Sinopec) are active in the LNG import area, and it is likely that they will continue to compete for this growing business. The Chinese Government is seeking to break up the monopoly of these three state-owned enterprises on the gas industry and to facilitate the entry of private companies, so there is also the prospect of increased activity by such companies in the regasification area. Overall, with China importing only 27.1 bcm of LNG in 2014, it is unlikely that regasification capacity will be a constraint on the growth of LNG imports out to 2020.

5. ***Increasing LNG supplies to China, from any source, will require prices that are viable for the producers but also acceptable to purchasers in China. In assessing whether this may be the case, the different dynamics of the iron ore, coal and oil and gas markets are likely to be relevant.***

   Prices for iron ore, coal, oil and natural gas have all fallen sharply in global markets in the last nine months, but the future dynamics of these markets are likely to be quite different, both in relation to global supply and demand trends and to the role of China.

   China is a dominant player in the coal and iron markets, accounting for over 50% of global consumption of both these commodities. Global supplies from many countries have been ramped up rapidly to meet rising Chinese demand, which was expected to continue. In spite of the fall in prices, some new projects are still coming on stream, for both commodities. Given China's dominance in the long-term and the sustained nature of the adjustment in its energy mix and property market, a long period of global excess supply and hence of low prices for both coal and iron ore seems inevitable.

   The oil and gas markets are quite different. China is a much smaller player in global terms, accounting for about 12% of global oil consumption and about 5% of gas consumption. While China is setting out to reduce its oil consumption, in part by improving the quality of its transport fleet and by moving to electric vehicles, this will be a longer term change with limited impact on global demand. The key 'swing factor' shaping the recent drop in oil prices has been US production of shale oil, which has added some 4 million barrels a day or about 5% of global output since 2008. Between 2008 and 2013 increased US production provided 85% of the global increase in oil production.

   On the supply side, while the bulk of conventional oil production remains cash positive on an operational basis at $50 per barrel, the high legacy decline rate of US shale oil fields could be an important factor if low oil prices persist. Rather than being from a small number of large reservoirs, output from the shale oil fields is from a large number of small wells with high

depletion rates. Hence continued capital investment is needed to maintain existing levels of production, but there are signs (such as the 35% drop in the US shale gas rig count over the past 6 months) of this investment being affected by the low oil price. On the demand side, there are already signs of increased demand for oil arising from low prices in markets such as USA and China, and this is likely to continue while prices remain low. Coupled with this demand responsiveness and with strong growth in demand for gas in the longer term, the new dynamic that shale oil introduces into oil production might imply a more sustained rise in oil prices than in coal or iron ore prices. This would flow on, in turn, to natural gas prices.

6. ***Different cyclical paths in the USA and Australia suggest that the value of the A$ in terms of US$s may remain relatively low over the medium term.***

For most of the past 60 years Australia has moved broadly in line with the global economic cycles, as exemplified particularly in the USA. But the combination of the global financial crisis (GFC) and the resources boom driven by China has broken this link – Australia's economic growth was sound while the USA went into deep recession after the GFC and now Australia remains subdued, and faces a long period of adjustment to falls resources investment and in the terms of trade, while the US recovers. Among the inevitable results of this delinking of cycles have been sharp swings in interest rate differentials and in exchange rates, with the A$ returning to parity with the US$ in late 2010, but falling significantly in the past year or so.

While short-term fluctuations in exchange rates are impossible to predict, both the persistence of low prices for key commodities (such as coal and iron ore) and the likelihood of further reductions in Australian interest rates relative to those in the US, as delinking of cycles persists, suggest that a low A/US exchange rate is likely over the medium term.

7. ***Many factors covered in this report will influence the ability of new Australian LNG projects to participate in supplying emerging Chinese gas demand over the period from 2017-2020.***

It is clearly not possible to be definitive about the scope for further large scale contributions by new Australian LNG projects in meeting China's restructured energy demand towards the end of this decade. But six points highlighted in this report suggest that conditions external to the Australian industry may be conducive to such a further contribution. These points are as follows.

i) Given the going need to restructure energy use and to reduce air pollution, China is likely to attempt to achieve natural gas use of the order of 400 bcm by 2020.
ii) This surge in demand is likely to be concentrated on the east coast, which contains large population centres with relatively high incomes but severe air pollution.
iii) Local production of natural gas will continue to expand but will not keep pace with the growth in demand, especially as China's shale gas and coal-to-gas output is likely to expand less rapidly than previously planned.
iv) There are serious doubts about the ability of the eastern pipeline from Russia – the Power of Siberia pipeline – to be operational by 2020, both because of the high cost (US$55 billion) and the need to justify construction of a major new field when Russia has surplus capacity from existing fields and gas prices are low.

v) While prices of iron ore, coal and oil/gas have all fallen sharply, the medium term dynamics of the three markets are likely to be quite different, with both the demand response to low oil prices and short-run supply responses in US shale gas production generating a recovery in oil and natural gas prices ahead of any sustained recovery in prices for coal and iron ore.

vi) With economic cycles in Australia and the USA now on quite different trajectories, and prices for Australia's coal and iron ore exports likely to remain low, a low A$/US$ exchange rate should persist over the medium term.

8. Conclusion: Implications for Australian LNG

Beyond the immediate slowdown in the Chinese economy, the period to 2020 is likely to see rapid growth in the demand for natural gas in China, strongly driven by government policy and by environmental imperatives and substantially outstripping the growth of domestic gas production over that time. This will occur in the context of fundamental reform of structures and pricing in China's gas industry, with new players entering the industry and price setting gradually shifting to a more market based system, responsive to the demand for and supply of gas in China.

This will mean rapid growth in imports of natural gas into China out to 2020 and beyond, and major investment in infrastructure to support these imports, both pipeline and LNG, is being undertaken, as is investment in the distribution system within China. Global competition to supply this additional gas will be intense, with companies based in many countries competing to supply it. Two critical factors will be the speed with which US exports of LNG exports and the markets to which they are directed, and extent to which Russian exports of pipeline gas to China develop, and whether the western or eastern route is given initial priority. The latest reference projection of the US Energy Information Administration[4] is for US LNG exports to reach about 60 bcm by 2020. While this is unlikely to involve direct LNG sales to China, US exports will clear shape the development of the East Asian market.

As is often noted, the current round of expansion of Australia's LNG capacity is likely to make it the world largest exporter of LNG by 2017 or 2018, with exports of about 85 million tonnes (115 bcm), as the seven large liquefaction projects that received final investment approval between 2007 and 2012 are completed and come on stream. Recent estimates (Cassidy and Kosev 2015[5]) suggest that only about one quarter of those exports (20 million tonnes or 27 bcm) will be to China, with Japan remaining the major market (45%) but with India's share rising to almost 15%.

There are, in our view, strong reasons to believe that Australian-based LNG producers can participate actively in the rapid expansion of China's gas market, beyond the completion of the current pipeline of projects under construction. First, Australia is an existing and respected supplier of commodities, including LNG, to China, with a strong record of quality and timeliness and raising few geopolitical risks about security of supply. As China's import dependency for natural gas rises towards 50%, the Chinese Government will be acutely aware of security of

[4] EIA , Annual Energy Outlook 2015, May 2015, at http://www.eia.gov/beta/aeo/#/?id=76-AEO2015&region=0-0&cases=ref2015&start=2012&end=2040&f=L&linechart=76-AEO2015.3.

[5] Natasha Cassidy and Mitch Kosev, Australia and the Global LNG Market, Reserve Bank of Australia Bulletin, March quarter 2015.

supply issues and, for example, of historical examples of political involvement in economic issues in the case of Russia. Secondly, the rapid growth in gas demand will be mainly centred in the provinces on or near China's east coast – these are the provinces where the air pollution problems are most acute, where industry and energy restructuring will be pushed ahead most rapidly and where higher income households will be willing to pay a premium for the advantages of natural gas. This gives LNG delivered at various points along the east coast an advantage relative to gas from China's north-west, from Central Asia or from Russia. Thirdly, the Australian LNG industry is open, transparent and operating at the leading edge of technology, with the world's leading companies and a number of Chinese partners involved. These features make it an attractive market for the big Chinese importers, who are also major gas suppliers, to participate in.

Finally, a critical issue is whether new Australian LNG projects can deliver gas to the Chinese market on terms which are both competitive and profitable in the more market-oriented conditions likely to obtain by 2020. Here is it relevant that the high level of Australian costs are already being reduced as the boom recedes, and this should continue; in the medium term, it is reasonable to expect a lower $A exchange rate, which should help to offset costs incurred in $A; and there are good prospects of further technological advances, as processes recently implemented (such as the floating LNG facility) are refined through learning by doing and further research. The final outcome will depend, of course, on the activities of the companies themselves and of many other players, as well as the scale and configuration of the Chinese gas market by 2020.

PART 2: CHINA'S CONTINUING ENERGY TRANSFORMATION: PROGRESS WITHIN POWERFUL CONTRAINTS

1. Introduction

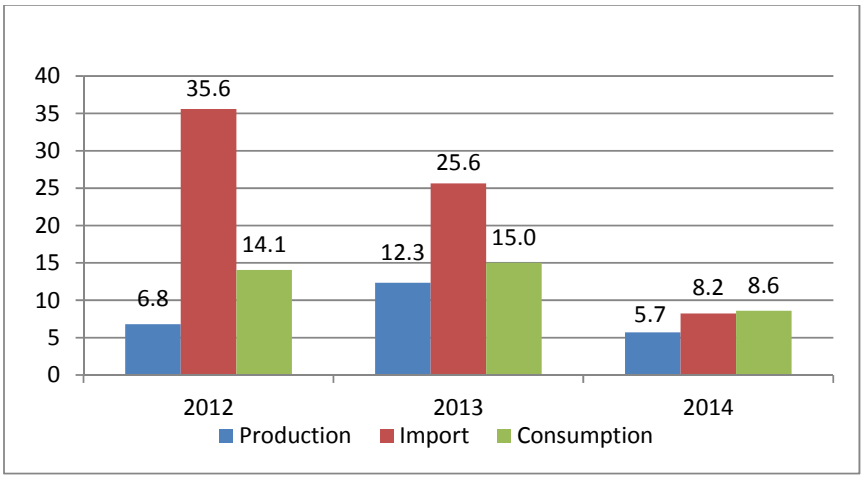
The year 2014 witnessed some unexpected changes in China's energy use. According to the preliminary estimations from the Statistical Communiqué of the People's Republic of China on the 2014 National Economic and Social Development released in February 2015, China's total energy consumption reached 4.26 billion tons SCE in 2014, up by 2.2% over 2013. While coal consumption declined by 2.9%, the consumption of crude oil increased by 5.9% and that of natural gas increased by 8.6%. China's energy intensity (national energy consumption per GDP) went down by an impressive 4.8%.

Although China's gas consumption increased at an impressive 8.6% in 2014, this growth rate is below both the growth rate achieved in 2013 (15%) and the expectation of China's National Development and Reform Commission (NDRC), which envisaged a double digit growth in 2014. Growth in China's gas imports also dropped from a high level of 25% in 2013 to single digit growth in 2014 (Chart 1).[6] Of China's total gas imports in 2014, about half came from pipelines and the other half from LNG imports.[7]

A slowdown in China's gas consumption and imports is reinforced by the monthly statistical data presented in Charts 2 and 3. In 2014, the monthly growth rate for gas consumption (on both a year to date (ytd) and year on year (yoy) basis) dropped from 9% in June to –6% in July, and then climbed to 6-7% for the remainder of the year, compared with a monthly growth of 12-20% for 2013. A clear seasonal pattern of gas consumption and imports is shown in Chart 2, where gas use and imports rose in the winter season, mainly between December and the following January. Between 2012 and 2014, the growth in China's monthly gas consumption and imports peaked in December 2013.

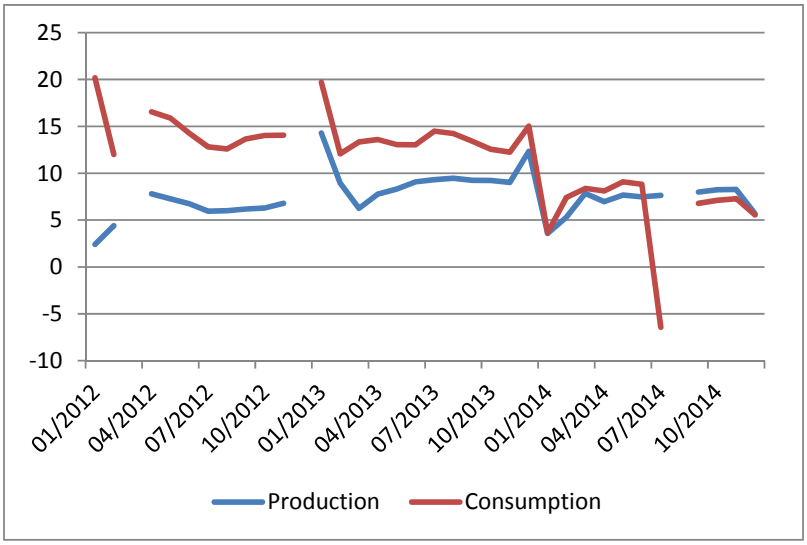
[6] The growth rates for gas consumption and imports in 2014 are based on CEIC figures of apparent gas consumption.
[7] According to the data available at CEIC, Feb-May 2014.

Chart 1. Annual growth in China's gas production, consumption and imports, % yoy, 2012-14



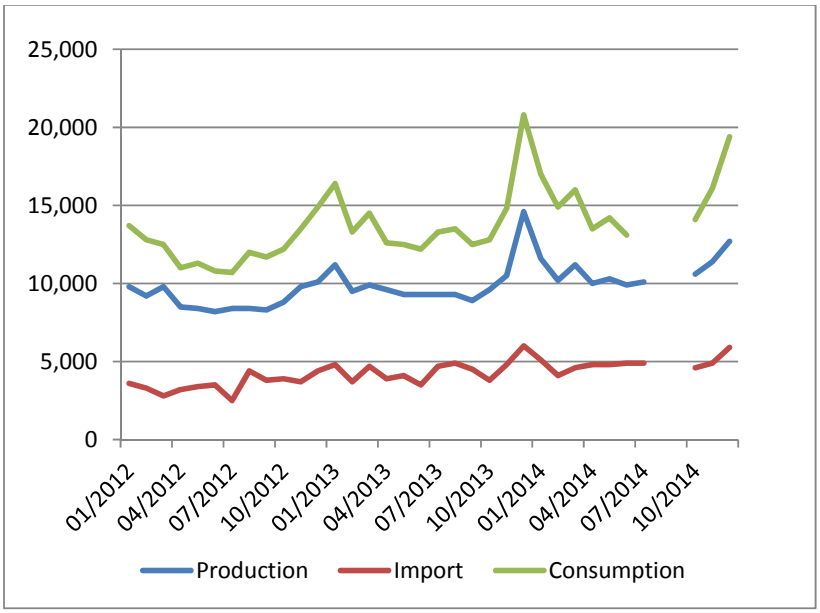
Notes: The growth rates for 2012 in the chart are calculated from the data January to November ytd, due to the missing values for Dec 2011. The growth rate for gas consumption in 2014 is based on the data from the Statistical Communiqué of the People's Republic of China on the 2014 National Economic and Social Development published by SBS.
Sources: CEIC, SBS and VISES.

Chart 2. Growth in China's gas consumption and production, %, yoy, ytd, 2012-14



Source: CEIC.

Chart 3. Monthly gas consumption, production and imports in China, million cubic meter



Source: CEIC.

China's gas consumption has been shaped, inter alia, by the country's long-term strategy on energy use, the process of economic growth, and structural adjustments and changes in the market conditions and prices for gas and other energy products. The infrastructure development for gas and other sources of energy also has had an impact on China's gas demand. The factors above are expected to continue to influence China's future gas consumption and imports. In this report, we analyse those factors which have contributed to the recent increase in China's gas consumption and make assessments of possible changes in 2015 and beyond. China's new energy development strategy formulated in 2014 is discussed in Section 2. Section 3 provides a brief review of the economic slowdown and its effects on the use of energy and gas. The changes in the gas market, with a focus on price reform, are discussed in Section 4, and the changes in the market conditions for other sources of energy, including coal, oil and renewables, are studied in Section 5. Section 6 contains concluding comments.

2. China's Energy Strategy

In response to public pressure for fighting air pollution and reducing emissions, the Chinese government firmed up its energy development strategies by putting forward the concept of an energy revolution in 2014. The changes in China's energy use mix, energy security and energy use efficiency are the key issues addressed by the energy revolution. As far as the energy use mix is concerned, the development strategy focuses on an increase in the share of natural gas and renewables, and a fall in the share of coal. Market-oriented reforms and the use of taxes and subsidies are the major instruments proposed to achieve the objectives of an energy revolution, within a framework of strong central government leadership.

According to a leading figure from the State Energy Administration, the Party's Central Committee and the State Council formulated China's energy development strategy of 'four energy revolutions and one-cooperation' based on the two important conferences and a speech by China's president

Xi Jinping. 'China Energy Development Strategy Action Plan 2014-2020' issued by the State Council on 4 December 2014 reflects such an energy development strategy and it is an important guideline for China's energy development.[8]

The new strategy is summarised in China as four revolutions and one cooperation. The four revolutions refer to revolutions in energy consumption, energy supply, technological innovation and energy system reform; the one cooperation is international cooperation. The revolution in energy consumption focuses on energy saving and industrial structural adjustments; the revolution in energy supply focuses on the diversification of energy supply and the clean use of coal, in addition to energy transportation (including pipelines) and storage; the revolution in energy technological innovation is related to China's industrial upgrading; and the revolution in energy system reform focuses on the establishment of a market-oriented system for energy price setting and energy use. For international cooperation, the key is to achieve China's energy security in an open world and to make good use of international resources.

In a speech at Caijing Magazine's Annual Conference 2015, Li Wei, the Director General of Development Research Centre under the State Council, described some details of China's energy revolution.[9] According to him, the Central Government has set the strategy for China's energy revolution, which will be undertaken in the following three stages: Stage 1 (the 13th FYP 2015-2020) aims at peaking China's coal consumption and air pollution from the exploration and use of energy and to achieve commercial production of renewable energy and shale gas, and improving energy use efficiency. The aim for Stage 2 (2020-2030) is to peak CO_2 emissions by 2030 and to achieve a balanced development of coal, oil, gas, nuclear and renewable energy. In Stage 3 (2030-2050), China will make renewable energy the major source of a greater energy supply and replace fossil fuels on a large scale.

According to Li Wei, system reforms, or deepening reforms, are the foundation for China's energy revolution in terms of energy production, consumption and technological progress. The following reforms are required:

(1) Open up the market and strengthen market competition. In the oil and gas industries, enterprises under different ownership structures will be encouraged to enter exploration, storage, processing and sale of oil and gas, and restrictions on the imports of crude and processed oil and natural gas shall be removed. The electricity market shall be opened up as well.
(2) Continue to reform the price system for energy products and electricity. The determination of oil prices shall eventually be handed over to the market, with temporary intervention from the government when market prices fluctuate too much. For gas prices, the well-gate price (wholesale prices) and retail prices will be determined by the market.
(3) Establish a long-term mechanism for energy saving by setting up a green tax system made of environmental tax and energy consumption taxes, and improve the carbon trading system. The feasibility of introducing carbon tax will be studied as well.

[8] An Interview on China Energy Strategy Action Plan by a leading figure from State Energy Bureau on 15 Dec 2014, see State Energy Bureau website: http://www.nea.gov.cn/2014-12/15/c_133855760.htm
[9] See http://economy.caijing.com.cn/20141127/3760346.shtml

The energy revolution has the following strategies and roadmap:

(1) Control over total energy consumption. The aim is to peak coal consumption by 2020 (3 billion tons SCE or below), to control oil consumption at 550 million tons in 2020 and 650 million tons in 2030, to reduce energy consumption per unit of GDP by 45% from 2005 to 2020, and to reduce it by a further 30% by 2030; and also aim to improve the share of non-fossil fuels of total energy consumption to 10% by 2020 and 15% by 2030.
(2) Improve energy use efficiency. Oil will be used mainly for transportation and the priority for coal use is power generation. Other actions include to gradually shift from the control over CO_2 emission per unit of GDP to the control over CO_2 emissions in the following three steps: by 2015, to reduce CO_2 emission per unit of GDP by 17% on the level of 2010; and after 2015, to set up a target on total CO_2 emissions by 2030, to peak CO_2 emissions.

The strategies and reforms given above are linked to the belief that global energy demand will continue to rise: from the 2010 level global energy consumption is expected to rise by 20% in 2020 and by 34% in 2030, mainly from the increased demand in South and Southeast Asia, the Middle East and African countries.

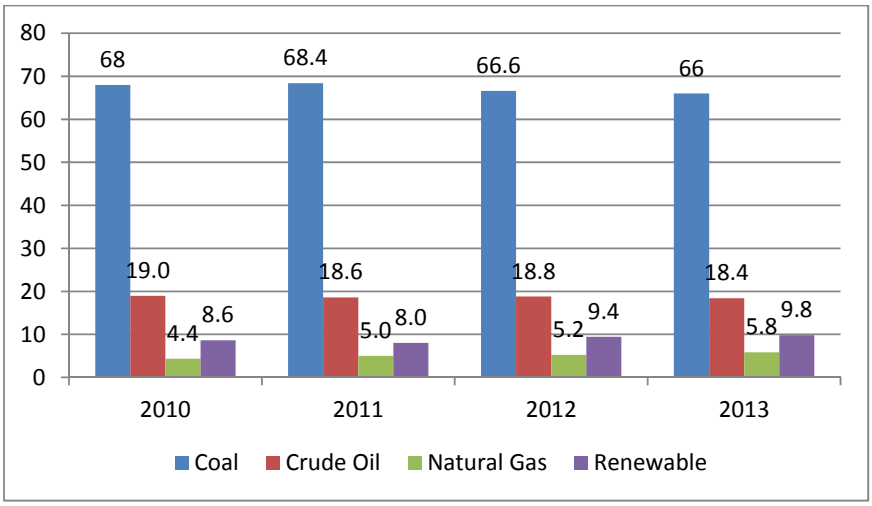
A detailed plan for China's gas consumption and supply was laid out in a joint document issued by China's NDRC, the National Energy Administration and the Ministry of Environment Protection in March 2014. Document No. 506 set the target for the consumption and supply capacity of gas to reach 250 bcm by 2015 and 330 bcm by 2017. The share of natural gas (excluding gas from coal gasification) to total energy consumption shall exceed 7% by 2015 and 9% by 2017.[10] The government targeted at that time an increase in the share of gas supply from coal gasification from 3.7% in 2015 to 9.6% in 2017, an increase of about 6 percentage points (ppt), at the cost of the share of conventional natural gas (a fall from 55.4% to 50%) in two years (see Table 1 and Charts 2 and 3). The document maintained the share of gas imports at about one third of China's total gas supply in 2015 and 2017, although this has since been superseded.

The 'China Energy Development Strategy Action Plan 2014-2020' issued by the State Council on 4 December 2014 is broadly in line with the DRC preferred targets for 2020 discussed by Li Wei in the *People's Daily* in February 2014.[11] According to the Action Plan, China's total energy consumption in 2013 reached 3.75 billion SCE, of which coal consumption accounted for 66% (a reduction of 0.6 ppt), oil 18.4% (a reduction of 0.6 ppt) and gas consumption 5.6% (an increase of 0.6 ppt yoy) (see Chart 4). Compared with the DRC target, the Action Plan reduced China's total energy consumption target for 2020 from 5 billion tons SCE to 4.8 billion tons SCE, a reduction of 0.2 billion tons SCE.[12] In the Action Plan, the share of non-fossil fuel to total energy consumption is set at 15% (the same as the DRC target). The action plan, however, adjusted the targeted share of gas from 10% (DRC target) to above 10% and the targeted share of coal from 60% (DRC target) to below 62% (see Table 2).

[10] NDRC Document 506, 2014, 'The work plan for fighting air pollution in the energy sector', March 2014. http://www.nea.gov.cn/2014-05/16/c_133338463.htm
[11] http://www.ineng.org/news/78111.html
[12] See Li Wei (2014), 'China's Future Energy Development Strategy: Construct a safe, green and efficient energy system', *People's Daily*, 12 February 2014, http://economy.caijing.com.cn/20141127/3760346.shtml.

In the joint Sino-US declaration on 12 November 2014 at the APEC meeting in Beijing, China committed to peak its CO_2 emissions and to raise the share of non-fossil energy consumption to 20% by 2030. In a subsequent article published in *Caixin*, Li Wei also adjusted the target for the share of non-fossil fuels in 2030 from 25% to 20% (Table 2).[13] It appears that the government has taken a more conservative approach in the international negotiation and commitments on climate change and energy use.

Chart 4. Composition of China's total energy consumption, %, 2010-13



Source: CEIC.

Table 1. Targets for China's total energy consumption and shares for 2020 and 2030

	Total energy consumption	Share of energy %			
		Coal	Oil	Gas	Renewable
Actual					
2013	3.75 bt SCE	66	18.4	5.8	9.8
2014[1]	4.26 bt SCE	66			
Targets					
2020	4.8 to 5 bt SCE	60—<62	15	10—>10	15
2030[2]	6 bt SCE	50	10—15	15	25-20

Notes: 1. Preliminary figures for 2014 released by China 2014 Economic and Social Development Communique. 2. See China Energy Development Strategy Action Plan 2014-2020; Li Wei (2014), China's Future Energy Development Strategy: Construct a safe, green and efficient energy system', People's Daily, 12 February 2014, http://economy.caijing.com.cn/20141127/3760346.shtml'; the joint SINO-US declaration.

The Action Plan reiterates the following major strategies:

1. Develop 14 coal bases (with a production capacity of over 100 million tons of coal) in China's central and west regions. By 2020, the coal output from the 14 bases is expected to reach 95% of total coal production in China.
2. Use up-to-date energy saving technologies to build nine large coal and power bases in China's Inner Mongolia, Shanxi, Shaanxi, Xinjiang, and Ningxia regions.
3. Expand the long distance power transmission capacity from west to east and from north to south; by 2020, the rail transport capacity for coal should increase to 3 billion tons.

[13] The share of 25% for the renewable in China's energy consumption targeted for 2030 at Li Wei's article in February 2014 is more an aspirational target, as it was not written into a formal government document.

4. Improve the energy mix: (i) Increase the domestic natural gas supply: set the goal of domestic production of natural gas at 185 bcm, shale gas over 30 bcm, coal bed methane at 30 bcm for 2020; and by 2020, the residents of cities and townships in China should be able to use gas as fuel, increase gas imports, use more gas for transportation and power generation and accelerate the development gas pipelines and storage facilities; and develop the gas pipelines to 120,000 km by 2020 for imported and domestic produced gas and increase LNG and pipe gas imports. (ii) To develop nuclear energy: to start up nuclear power generators in coastal regions and contact feasibility studies for nuclear power stations in China's inland regions, so by 2020, nuclear power generation capacity reaches 58 million kw, and capacity under construction to 30 million kw. (iii) Develop renewable energy: actively develop hydro power, with capacity reaching 350 million kw by 2020, to build 9 large wind power stations, and to reach 200 million kw by 2020, to achieve parity in the prices for wind power and coal fuel power for grid by 2020, to develop solar energy to 100 million kw by 2020, to achieve parity in the prices for solar power and grid power, and finally to develop geothermal power, 50 million tons SCE.
5. Promote coal gasification actively and discreetly, use clean technology with high efficiency and take into account the water supply. Gasification will pilot first to learn the core technologies, control energy and water use and polluters, focusing on Xinjiang, IMAR, Shaanxi and Shanxi provinces.
6. Improve energy use efficiency by adjusting economic structure and raising energy use efficiency. To link energy consumption to GDP growth, to cap the energy consumption for high energy consumption and excess capacity industries, and to control energy consumption by other industries according to the advanced standard. Newly increased capacities must meet the up-to-date domestic standard for energy efficiency. By 2020, coal consumption in Beijing-Tianjin-Hebei-Shandong shall fall by 100 million tons from the level in 2012-2020; negative growth in coal consumption is required for the Pearl and Yangtze River delta regions. To develop gas fuelled power generation in the Beijing-Tianjin-Hebei-Shandong, the Pearl River Delta and the Yangtze River Delta regions.

While the process of shifting to a new energy strategy has led to a number of statements and to some limited variation in targets, the overall thrust has been very clear. The Action Plan released by the State Council on 4 December 2014 must be taken as the most authoritative and most recent statement of the Chinese Government's position. In relation to natural gas the key targets are that by 2020 overall energy consumption will be held to 4800 million tons (SCE), that the share of gas in that consumption will be greater than 10% and that the target for domestic production of natural gas will be 245 bcm (including shale gas and coal bed methane).

Table 2 provides a quantitative assessment of these targets, for both 2020 and 2030. Taking the 'greater than 10%' share of natural gas in total energy consumption to be 11% gives a gas consumption target of 400 bcm for 2020,[14] for the overall energy consumption target shown in Table 1. Such a level of gas consumption for China in 2020 is much higher than is being predicted by most international agencies and consultants, and implies an annual growth rate in gas use of 13.8% over 2013-20, but it should not be dismissed. While this growth rate is high, it is lower than the rate of growth in gas consumption over the decade 2003-13 (16.8% per annum) since China began to

[14] The range of 2020 consumption targets for gas shares of 10-12% is 361-433 bcm.

seriously develop gas use. In 2013 gas provided 5.1% of China's energy consumption. This share, and even the projected share of 15% by 2030, is low by international standards: in 2013 gas provided 23.7% of energy use globally, 29.6% for the USA and 22.2% for Japan, a country with no commercial gas production. Aspects of the achievability of this target are discussed elsewhere in this report, but there is no inherent implausibility in it.

Table 2. Chinese consumption, production and imports of natural gas, 2012 and 2013 actual and interpreted State Council targets for 2014 (bcm)

	2012 (actual)	2013 (actual)	2020 (target)	2030 (target)	Annual change (% pa) 2013-20	2020-30
Gas consumption	146.3	161.6	400	680	13.8	5.4
Gas production	107.2	117.1	245	340	11.1	3.3
Imports	41.4	51.9	165	340	18.0	7.5
- Pipeline	21.4	27.4	na			
- LNG	20.0	24.5	na			
Imports share of consumption (%)	28.3	32.1	41.3	50		

Sources: Actual data for 2012 and 2013 are from BP (2015), not adjusted for the results of the 2013 Economic Census; targets for 2020 and 2030 are based on the December 2014 State Council Action Plan, as discussed in the text; the 50% import share of consumption for 2030 is an assumption of the authors.

The Action Plan also provides a domestic production target for 2020 of 245 bcm, which implies a growth rate of about 11% over 2013-20 (a significant increase on the growth rate over 2008-13 of 7.8%). This in turn gives gas imports of some 165 bcm by 2020, more than treble the level of 52 bcm in 2013, and implying a growth rate of 18.0% per annum over the seven-year period. The table also shows the implications of these targets for gas production and imports on the assumption that the import share rises to 50% by 2030.

It is of interest to place this target level of gas imports for China in the context of gas trade in the Asia Pacific region. In 2013 the countries of the Asia Pacific imported 295 bcm of natural gas, about 28% of global imports. These imports were dominated by three countries (Japan, South Korea and China), which accounted for over three-quarters of the imports. Given the absence of significant natural gas resources in many countries in the region, these imports were over 80% in the form of LNG. This is in stark contrast to gas imports for all other countries, which were nearly 90% pipeline gas. For China in 2013 the pipeline/LNG shares were 53%/47%. If China's gas imports grow to 165 bcm by 2020, this alone will imply an increase of nearly 40% in Asia Pacific imports relative to 2013.

In an interview with *Caixin Magazine* on 11 November 2014, Xie Zhenghua (Vice Chairman of China's NDRC at the time) placed these targets in context, making it clear that it is the strategy of the party and the government to use the climate change targets to push ahead with China's economic structural reforms.[16] Xie also acknowledged that the causes for climate change and air pollution are similar. But the Chinese government is more concerned with domestic pressure for fighting air pollution than external pressure for climate change. To achieve the goal of pollution control, China needs to improve the energy mix and to raise energy use efficiency for which China ranks at about half of the world average. Xie clarified that structural change means that China shall develop new strategic, high tech and service industries, and also develop green and low carbon

[16] (http://weekly.caixin.com/2014-11-21/100753798_all.html#page8).

industries in the manufacturing sector. So far China's Central Government has used energy intensity as an indicator to measure the performance of local governments in energy use. From 2014 on, the government is using energy intensity, as well as total energy consumption as monitoring indicators; and for the 13th FYP, the targets and indicators could be extended to total CO_2 emissions, total energy consumption, carbon intensity and energy use efficiency. The government will use a smart grid to store power to solve the problems with the generation of solar and wind power. He agrees that the frequent occurrence of smog is positive for the whole society to reach consensus on policies and measures to tackle China's environmental problems, though no one likes poisonous smog.

To moderate the increase in energy demand and improve energy use efficiency, the government is going to establish a green tax system based on environmental (and resources) taxes, consumption tax for energy and market formulated prices, which have been signalled by an increase in the consumption tax for petrol and diesel fuel on 29 November 2014 (according to Professor Liu Yijun from China's Petrol University[17]).

According to China's Premier Li Keqiang,[18] China now faces a window of opportunity for price reforms, especially energy price reforms, following sustained low CPI and PPI in the past 32 months (China's PPI has been on the negative side and CPI growth has fallen to around 2% p.a.). The current energy prices in general have failed to reflect the returns from the ownership of resources (state-owned enterprises have been allocated mining rights), environmental costs and costs for ecological compensation. The low energy prices have given rise to low energy use efficiency per unit of GDP. Price reforms, increases in energy prices and other key resource prices will also benefit energy and raw material enterprises and increase their investment.

In the 13th FYP for energy, currently being drafting, it is expected that the detailed road map for achieving the strategy will be drawn, such as how to allocate China's energy resources given the domestic and foreign market, and whether and to what extent the energy demand in the eastern part of China will be met by the transmission of power and transportation of coal from the western part of the country and by direct energy imports.[19]

3. The 'New Normal' State

At the Central Economic Conference in December 2014, China's president Xi Jinping reiterated that China's economy has entered 'a new normal state', signalled by a lower rate of growth, economic structural adjustment and a shift from growth driven by intensive capital and labour input to growth driven by innovation. At the recent annual session of the People's Congress in March 2015, in his government work report, China's Premier Li Keqiang set the growth rate for 2015 at around 7%.

[17] See *Guangming Daily*, 4 Dec 2014. http://www.china5e.com/news/news-891121-1.html
[18] 'The State Council Plans to Accelerate Price Reforms focusing on Energy Products', *China Daily News*, 17 November 2014, http://industry.caijing.com.cn/20141117/3750747.shtml
[19] See *Xinhua* news web, 'The priority of the 13th FYP for energy is to design the roadmap for achieving China's energy strategy,' 3 May 2014, http://news.xinhuanet.com/energy/2014-05/30/c_1110936213.htm?prolongation=1

An emerging feature of the 'new normal state' is a lower rate of growth accompanied by rising wages and a relatively low rate of unemployment, following demographic changes. China's manufacturing and mining industries are under increasing pressure, with continuous low PPI and CPI, rising labour costs and excess capacities. The rising wages have forced some processing enterprises to shift from China's coastal regions into Southeast Asia, such as Vietnam, rather than China's central and western regions.

China's economic slow-down has become more apparent in early 2015. China's GDP growth decelerated from 7.4% in 2014 to 7% in the first quarter of 2015.[20] The data for power consumption, a proxy used for measuring China's economic growth,[21] suggest that the real GDP growth figure could be lower than the official statistics. According to the data released by the State Energy Administration, China's total power consumption in the 1st quarter of 2015 grew by a mere 0.8% (yoy), a fall of 4.6 percentage points compared with the same period in 2014. Power consumption by the ferrous metal industry plunged by 6.8%, a fall of 8.5 percentage points, and that by the construction material industry dropped by 4.4%, a fall of 15.1 percentage points, compared with the same period in 2014. Research in China indicates that the growth deceleration in the first quarter of 2015 has been triggered mainly by a sudden fall in infrastructure investment, particularly in investment by local government. This is related to the reforms to local government debt and the anti-corruption campaigns which started to take effect in late 2014. Growth in China's public expenditures decelerated from 26% in June to 6.2% in August, and to negative 5.7% in October 2014.[22]

A growth slowdown has put more pressure on the local government fiscal revenue growth and exacerbated the local government debt problems. While China's GDP growth rate went down from 10.4% in 2010 to 7.4% in 2014, China fiscal revenues decelerated from 17.6% in 2010 to 7.6% in 2014. China's fiscal revenues increased by only 3.9% in the first quarter of 2015 (yoy), lower than the GDP growth rate. In the first quarter of 2015, a number of provinces recorded negative growth in their fiscal revenues: fiscal revenues dropped by 30% in Liaoning, 4.9% in Jilin, and 9.1% in Qinghai compared with the same period in 2014.[23]

China's central government has turned its focus from structural changes to growth, following the recent growth slow-down. On his tour to China's northeast in April 2015, China's Premier Li Keqiang argued that maintaining a certain rate of GDP growth is essential for jobs and social welfare. He was very concerned with the reduced rates of GDP growth in all the three northeast provinces and urged the three provinces to speed up their development.[24] In May 2015, the government quietly reversed the policies on local government financial vehicles. The State Council Document 43 issued in October 2014 cut off the access of local government financing vehicles (LGFVs) to bank loans. However, according to the Document 40 jointly released by the Ministry of

[20] Calculated using the data from CEIC.
[21] Power consumption is one of the three indictors in the so called 'Li Keqiang Index' to measure China's GDP growth. The other two indicators are railway cargos and new loans provided by the formal banking system.
[22] 'Why the growth is so weak', Caixin website, 22 April 2015, http://opinion.caixin.com/2015-04-22/100802438_all.html#page2
[23] See 'A drop of fiscal revenues in the 1st quarter of 2015 in a number of provinces', see Caixin magazine, 30 April 2015, http://economy.caixin.com/2015-04-30/100805596.html
[24] See ' Li Keqiang rushed to Changchun to push for growth in China's northeast', Xinhua news website, 11 April 2015, http://news.xinhuanet.com/politics/2015-04/11/c_127679109.htm

Finance, the People's Bank and the China Banking Regulation Commission in May 2015, banks are required to provide loans for the ongoing projects undertaken by LGFVs. When the loans provided to LGFV become due, the banks are encouraged to reschedule loans.[25] Recently China's NDRC also accelerated the approval of new investment projects. Around May 2015, the NDRC approved a package of investment projects with a total value exceeding RMB 400 billion, including three large metro subway projects over RMB 200 billion. Since late 2014, NDRC had already approved a number of large investment projects on information, grid, oil and gas, new sources of energy and bio-technology.[26] It is expected that total infrastructure investment in 2015 shall reach RMB 14 trillion, an increase of 24% over 2014.[27]

The lower rate of growth and the projected increase in infrastructure investment are expected to impact on China's energy production and consumption in 2015 and beyond. According to a recently released economic communique, in 2014, China's energy intensity fell by 4.3%, compared with a fall of 3.2% in 2013, the best result achieved in the 12th FYP. Studies in China found that the deceleration in China's energy consumption and the decline in energy intensity in 2014 have been caused by, among others, a slowdown in China's GDP growth, the structural changes under way and a reduction in excess industrial capacities. The structural change is shown by an increase in the share of services in GDP and a deceleration in the growth of energy intensive industries (from 10.1% in 2013 to 7.5% in 2014), mainly ferrous and non-ferrous metals and petrol chemical industries. Moreover, in 2014 the following excess production capacities were cut: the production capacity for 31.1 million tons of steel, 81 million tons of cement and 37.7 million boxes of plate glass. These meant that the reduction in excess industrial capacities were greater than the targets originally set by the government for 2014.[28]

Looking into the second half of 2015 and beyond, China's energy consumption and energy intensity will be influenced by the rate of economic growth and structural adjustments. The energy intensity will be affected by changes in the six high energy consumption industries which accounted for 79.6% of energy consumption of all manufacturers in China in 2014. Moreover, although the weight of GDP growth has been reduced in the performance assessment for local governments and officials, some local governments have resisted the pressure for reducing capacities in the high energy consumption and high pollution industries such as iron, steel production and aluminium industries as they have difficulties in identifying and developing new industries.[29]

[25] See 'Local Government Financial Vehicles started to raise their leverage again', Caixin Weekly, No 21, published on 1 June 2015.
[26] See 'NDRC Approved New Investment Projects, http://www.huaxia.com/tslj/lasq/2015/05/4422367.html
[27] 'Why the growth is so weak', Caixin website, 22 April 2015, http://opinion.caixin.com/2015-04-22/100802438_all.html#page2.
[28] 'What does a fall of 4.8% in China's energy intensity mean?' SBS website, 8 March 2015. http://www.stats.gov.cn/tjsj/sjjd/201503/t20150308_690781.html
[29] 'What does a fall of 4.8% in China's energy intensity mean?' SBS website, 8 March 2015. http://www.stats.gov.cn/tjsj/sjjd/201503/t20150308_690781.html

4. New Developments in the Gas Industry

4.1 Strategic Directions

A growing share of gas in China's energy consumption constitutes an important part of the government strategy for combating air pollution and reducing CO_2 emissions in China. As previously discussed, the government's reform targets have evolved significantly in the past 12-15 months. In March 2014, the NDRC, State Energy Administration and the Ministry of Environment Protection jointly issued 'A Work Plan for Fighting Air Pollution in China's Energy Sector', which set the following targets for the supply capacity and consumption of gas in China: the supply capacity for gas reaches 250 bcm by 2015 and 330 bcm by 2017; the share of natural gas (excluding gas from coal gasification) to total energy consumption exceeds 7% by 2015.[30] In April 2014, the State Council released an 'Announcement for Establishing a Long-Term Mechanism for Safeguarding the Supply of Natural Gas', aimed to raise the supply capacity of natural gas further to 400 bcm by 2020, with an aspirational target of 420 bcm.[31]

In the March 2014 document the government set the targets for the composition of gas supply in China for 2015 and 2017 (Table 2 and Charts 5 and 6). While these targets have been superseded by the economic slowdown from mid-2014 and by the emerging constraints on the production of non-conventional gas in China, they are of interest as indications of the government's thinking and of the adjustments since that time. In March 2014 it was envisaged that, from 2015 to 2017, a fall in the share of domestically produced natural gas (falling from 57.2% in 2015 to 49.4% in 2017) will be made up mainly by a rising share of gas from gasification (rising from 3.7% in 2015 to 9.6% in 2017). As noted elsewhere in this report, plans for sharply increased production of non-convention gas in China over the next five years or so have been substantially revised.

Table 2. Targeted composition for gas supply in China, as at March 2014 (bcm)

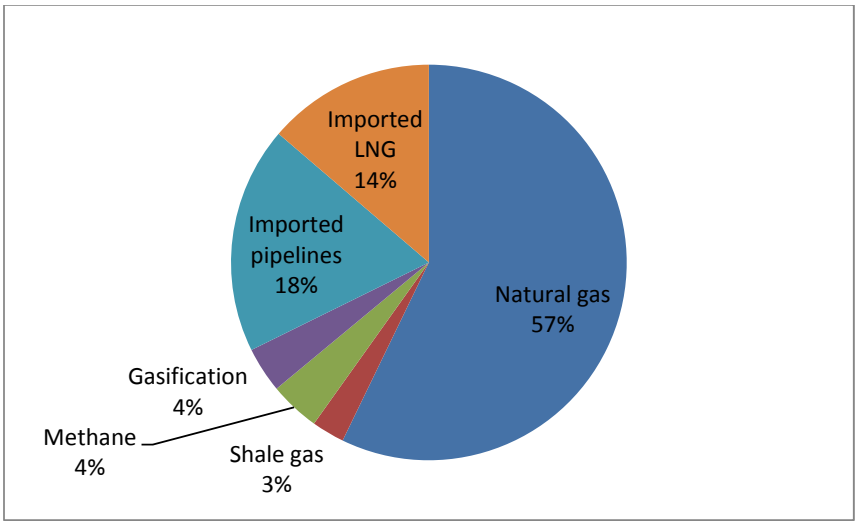
	2015	%	2017	%
Conventional natural gas	138.5	57.2	165	49.4
Shale gas	6.5	2.7	10	3.0
Coal bed methane	10	4.1	17	5.1
Gasification	9	3.7	32	9.6
Imported pipelines	45	18.6	65	19.4
Imported LNG	33.3	13.7	45.2	13.5
Total gas supply	**242.3**	**100.0**	**334.2**	**100.0**

Source: NDRC, State Energy Bureau and the Ministry of Environment Protection Document 506, 2014, 'A Work Plan for Fighting Pollution in China's Energy Sector', March 2014, http://www.nea.gov.cn/2014-05/16/c_133338463.htm

[30] NDRC Document 506, 2014, 'The work plan for fighting air pollution in the energy sector', March 2014. http://www.nea.gov.cn/2014-05/16/c_133338463.htm

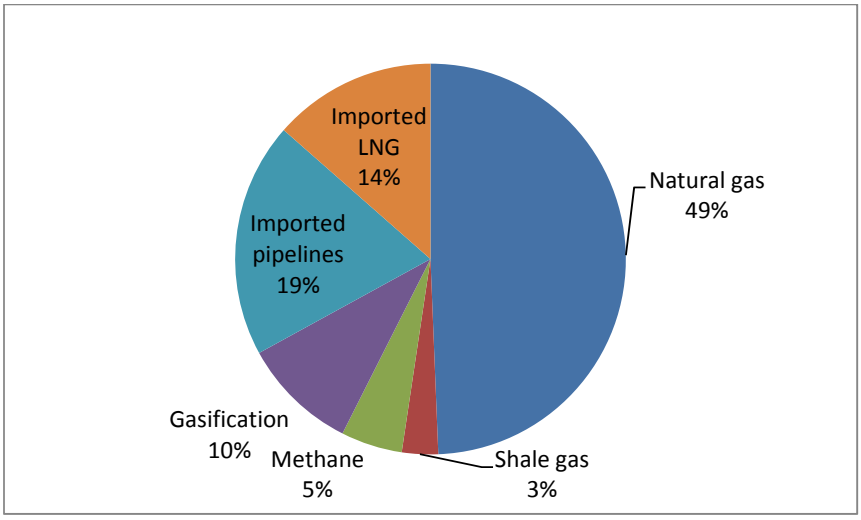
[31] The State Council, 'An Announcement for establishing a long term mechanism to safeguard the supply of natural gas in China', State Council Document 16, April 2014, http://big5.gov.cn/gate/big5/www.gov.cn/zhengce/content/2014-04/23/content_8777.htm

Chart 5. Targeted composition of gas supply in China, 2015, as at March 2014



Source: Same as Table 2.

Chart 6. Targeted composition of gas supply in China, 2017



Source: Same as Table 2.

4.2 Gas Price Reforms

China's gas market is oligopolistic with serious price distortions. The market, including gas infrastructure, has been dominated by three state owned oil companies: CNPC, SINOPEC and CNOOC. Gas prices have been regulated by the government, with differential prices applied to different gas users (residential and non-residential uses), to the 112 billion cubic meters of natural gas industrial and commercial users consumed in 2012 (2012 gas consumption) and the additional consumption since then (incremental consumption). There are also variations of gas prices in different regions of China as the local governments have been responsible for setting local gas prices under the NDRC guidelines. Gas consumption has been subsidised by the governments and the state-owned oil giants who usually cross-subsidized gas with the profit from other lines of operations.

Another important feature of China's gas markets is that, contrary to the situation in most developed countries, the final price to industry users is higher than that for residential users. Chen[32] estimated that the average national price for industry users of natural gas in China in 2013 was about $12.5/MMBtu, while that for residential users was about $10.5/MMBtu. CEIC data from China's National Statistics Bureau for 1 May 2015, based on an average of 36 cities, has the price for industrial users at 3.7 RMB/cm^3 ($16.9/MMBtu) and for residential at 2.5 RMB/cm^3 ($11.4/MMBtu). In the USA, for example, average residential prices for natural gas are comparable to those in China, in spite of much lower cost of gas, but industrial prices are about half of those for residential users.[33] This distortion is one of many that the price reform needs to address.

Price hikes have been one of the major instruments used by China's NDRC to increase gas supply and hence to raise the share of gas in China's energy use mix. The low regulated retail gas prices, subsidised by the gas suppliers and the government, have discouraged domestic gas production and imports. Following the gas price reforms in July 2013, China first introduced a 3-tiered natural gas pricing system for residential uses around March 2014. Under the system, higher retail prices apply to those households which have higher volume of gas use.[34] According to NDRC, the tiered pricing was to be applied to all the Chinese cities by the end of 2015. By August 2014, many cities in five eastern provinces had already applied the new pricing system.[35] The tiered pricing system aims at raising the incomes of gas enterprises so as to increase gas supply and imports, while protecting the interest of low income gas users who normally use less gas.[36] Moreover, NDRC instructed the provincial governments to raise their prices for non-residential gas (wholesale prices) by up to RMB 0.4 m^3 on 1 September 2014,[37] corresponding to a price jump between 14-25% over the prices in 2013.[38] This latest hike comes after a similar 15.4% increase for non-residential gas consumers in July last year when the NDRC launched a new pricing mechanism as part of broader energy reforms.[39]

However, this time the provincial governments were slow in response to the instructions from NDRC. About half of the provinces did not raise their gas prices by mid-September though they were asked to do so on 1 September. A further hike on gas prices has been perceived as a shift of fiscal burden from the central government to the local governments and industrial gas users. The provincial level governments also found it difficult to pass on the price increase to final gas users as gas prices were already at a high level following the price hike in July 2013. Of those provinces

[32] Chen, M. 2014, 'The Development of Chinese Gas Pricing: Drivers, Challenges and Implications for Demand', OIES Paper: NG 89, The Oxford Institute for Energy Studies, University of Oxford, Oxford.
[33] IEA 2015, Medium-Term Gas Market Report, International Energy Agency, Paris, at http://www.iea.org/bookshop/707-Medium-Term_Gas_Market_Report_2015
[34] This is a two or three track price system. In practice, a municipal government establishes a quota (?) based on the average household gas use in the previous period, over quota gas will be charged at higher prices.
[35] 'NDRC promotes the tiered pricing for residential gas'. *Newhua News Net* http://finance.china.com.cn/industry/energy/nyyw/20140808/2598573.shtml
[36] 'NDRC: 3 tiered prices for gas and higher prices for over quote uses', *China Economic Net*, 21 March 2014, see http://www.ce.cn/cysc/ny/trq/201403/21/t20140321_2527103.shtml
[37] 'NDRC to raise gas prices for non-residential use by RMB 0.4', *China Economic Net,* 12 Aug 2014, http://news.xinhuanet.com/yzyd/energy/20140812/c_1112045268.htm
[38] 'The dilemma for gas price hikes in China: falling oil prices versus high gas prices', Huaxia Energy website, http://blog.sina.com.cn/s/blog_490dbc3d0102v7b2.html
[39] 'China to raise natural gas prices', *Xinhua News Net* English.news.cn, 12 Aug 2014, http://news.xinhuanet.com/english/china/2014-08/12/c_126863237.htm

which had raised their gas prices, some adjusted up both wholesale and retail prices, while others raised wholesale prices only.[40] Moreover, the gas prices were already higher compared with other energy prices, so the volume of gas use went down.[41]

The price hikes for non-residential gas also caused a backlash from industrial and commercial gas users. For example, the government in Zhejiang Province raised the gas prices from RMB 2.43 m^3 to RMB 2.83m^3, making the price in the province the third highest of all the provinces in China. The industrial and commercial gas users in the province complained about the higher prices relative to those of neighbouring provinces.[42]

It was reported that higher gas prices have led to a reverse in gas use by some gas users (some of them reversed back to coal use), which tends to reduce the share of gas in China's energy use mix. According to a recent report published on the Zhuochuang website, following the gas price hikes and falling oil and coal prices, it is more costly to use gas for vehicle fuels. The price ratio of gas to diesel (as fuel for a truck to cover same miles) rose to 1.31:1. In southern China, the price of LPG fell to RMB 3680 per ton, while the price of LNG reminded high at RMB 5350 per ton, and LPG per ton generates an equivalent amount of energy as per ton LNG. The changes in prices have led to a reversion from gas to oil.[43]

A number of hypotheses have been developed in China to explain higher gas prices. According to Zhou Dadi from the Energy Research Institute (ERI), the higher prices of imported gas have been mainly responsible for the higher gas prices, as the government has set the prices based on imported prices which are higher than home-produced gas. However, researchers from the Resource and Environment Research Institute at the DRC have blamed the high pipeline costs for high gas prices. A logical conclusion is that the gas suppliers can lower their gas prices by improving efficiency for gas delivery. The institute suggests lowering gas prices by 15% from 2015 to 2017.[44]

The Chinese government has bent to the pressure for lowering gas prices, in the context of falling global prices for oil, natural gas and coal. Effective from April 2015, prices of incremental gas for non-residential users were reduced by RMB 0.44 m^3 (equivalent to a fall in gas prices by 13-19% for different provinces) and the price for stock gas (gas consumption at 2012 level) was raised by RMB 0.04 m^3, so the two prices merged into one.[45] According to a report from *Caixin*, prior to April 2015, of all gas consumption in China about 20% was incremental gas and the remaining 80% stock gas, and the prices of incremental gas were about RMB 0.48 m^3 higher than stock gas. The prices for residential gas were not adjusted this time. After the price adjustments for non-residential gas, the highest gate price for non-residential gas in Beijing would be around RMB 2.7 m^3, and RMB 2.88 m^3 for Shanghai and Guangzhou, which would be higher than the residential gas price at around RMB

[40] A local government will have to subsidize non-residential gas if it raises the wholesale prices without raise the retail prices.
[41] 'Half of the provinces did not respond to the NDRC on time', *China Economic Times*, 19 Sept 2014. see http://finance.chinanews.com/ny/2014/09-19/6610838.shtml
[42] 'Higher gas prices hit the enterprises in Zhejiang', *First Finance and Economics Daily*, 22 Dec 2014, http://news.315.com.cn/20141222/100245208.html
[43] See http://gas.sci99.com/news/16917559.html
[44] 'Discussions on gas price reforms', China energy website, 16 Oct 2014, http://www.china5e.com/news/news-886312-1.html
[45] NDRC, 'An announcement for adjusting non-residential gas prices', 26 Feb 2015. http://www.ndrc.gov.cn/gzdt/201502/t20150228_665747.html

2.4 m^3.[46] By the end of 2015, China is expected to have a uniform price system for non-residential gas and a multi-tier and progressive pricing mechanism for residential gas, offering cheap gas to about 80% of households while charging other households higher prices.[47] Following the recent price adjustments, both the residential and non-residential gas will continue to be subsidized by the governments and/or the gas suppliers, though the subsidies have been reduced by recent price hikes.

4.3 Creation of Shanghai Petroleum and Gas Exchange

While making adjustments to retail gas prices for residential and non-residential uses, the government has liberalized prices for China's off-shore produced gas, unconventional gas (shale gas, tight gas and gas from coal gasification) and LNG under direct trade (gas users purchase gas directly from gas suppliers for their own uses). According to China's NDRC, the price liberalization is designed to encourage gas suppliers to ramp up gas production and imports, to promote unconventional gas and to attract private investors into the gas industry. The following rationales were given for the price deregulation: substitution between gas and alternative sources of energy, recent increases in the supply of offshore produced gas, unconventional gas and LNG, and the strong bargaining power of those gas users under direct trade.[48]

In January 2015, a new platform knows as Shanghai Petroleum and Gas Exchange (SHPGX) was announced to influence the price formation for oil and gas in East Asia and to facilitate gas market and price reforms in China. SHPGX is a platform for a physical spot trading of oil, pipeline natural gas, LNG, unconventional gas and other energy products. This new platform was formed under a strategic alliance between Xinhua News Agency and the National Development and Reform Commission (NDRC).[49] The major motive for the creation of the platform is for China to influence the price formation for oil and natural gas in East Asia (the current benchmark East Asia price is the average Japanese import price for LNG cif) and to lower the import prices for natural gas. The contract prices for natural gas in East Asia were 1.5 times higher than those in the UK and Germany and 6 times higher than those in the Henry Hub in the USA in 2013. The sponsors of the platform aim to build the exchange into an international hub for gas and oil trade similar to the Henry Hub and the NBP in UK. The creation of the exchange is also expected to impact positively on the domestic gas market and price reforms. Following the establishment of the exchange, the long-term contract for natural gas and LNG linked to oil prices will be replaced by short-term contracts and spot trading gradually. In addition, the parallel system of long- and short-term contracts combined with spot trade will coexist for a long period.

In the short term, the impact of SHPGX on the formation of oil and gas prices is expected to be limited. It is reported that the operation of the exchange has been delayed from April to June

[46] See 'Real Progress in Price Reforms with the price cut by 10%', 28 February 2015, Caixin http://companies.caixin.com/2015-02-28/100786660.html
For the price for residential gas, see 'No adjustments are made for residential gas', Jinwanbao, 12 April 2015, http://news.163.com/15/0412/13/AN0M62H800014AED.html
[47] Beijing, 12 Aug 2014, *Xinhua*. http://news.xinhuanet.com/english/china/2014-08/12/c_126863237.htm
[48] See 'The Press Interview by the Leading Figure of NDRC', 28 Feb 2015, Http://www.ndrc.gov.cn/gzdt/201502/t20150228_665776.html
[49] See the website of Shanghai Petroleum and Gas Exchange (http://www.shpgx.com).

2015.[50] The first traded goods on the exchange will be the natural gas pipelined from suppliers to their direct users, possibly followed by the extra imported LNG from receiving terminals, unconventional gas and gas produced offshores.[51] To initiate the trade at SHPGX, CNPC has agreed to trade 6 bcm worth of pipeline gas designated for direct users.[52] The major obstacle to the successful operation of the exchange is the dominance of China's gas market by the three oil giants in the upstream of the gas supply chain. Due to the market structure of China's oil and gas market and government regulations, there will be limited buyers and sellers on the gas market. The formation of the exchange itself is, however, an indication of the government's determination to push forward market-oriented reforms for oil and gas markets in China.[53]

Parallel to the development with SHPGX, the Chinese Government has raised the wholesale sale prices for imported gas to reduce price distortion in the gas market (with import prices consistently higher than sale prices). In January 2015, the retail sale price of imported LNG rose from RMB 31.45 to 38.82/GJ (US $6.6/MMBtu) following a price hike in December 2013 from RMB 24.93 to RMB 31.45/GJ (US$5.35/MMBtu). Likewise, the retail sale price of imported pipeline natural gas went up from RMB 1.11 to RMB 1.37m^3 following the price hike from RMB 0.88 to 1.11 m^3 in December 2013. The price hikes in December 2013 and January 2015 reduced, but failed to eliminate, the financial losses suffered by the oil giants on much of their imported LNG and pipeline gas.[54]

4.4. Open-up Market for Private Investment in the China's Industry

The most difficult reform for China's gas market reforms is perhaps the reforms to the monopolistic gas market controlled by the three state-owned oil giants. The major links in China's gas supply value chain, from exploration, production, imports, to transportation, storage and trade, have been dominated by the three oil giants. Currently, private capital has been involved mainly in the infra-city gas pipelines, while the cross provincial and regional pipelines have been mainly built and managed by the three oil giants and other state-owned enterprises.

Of all the links above, what has interested private investors most is LNG imports and gas pipelines. However, to be able to import LNG, a private operator was required to have an import permit from the Ministry of Commerce and have its own receiving terminals, to be approved by NDRC. NDRC has a number of restrictions for the construction of receiving terminals by private enterprises, which has formed a glass ceiling for the entry of private capital into the import business.[55] In

[50] According to the website of the exchange, the trial operation will be launched in June and the formal operation will start in July of 2015.
[51] See 'Xinhua Newsagency Led the creation of Shanghai Petroleum and Gas Exchange', China Security News, 6 Jan 2015), http://finance.sina.com.cn/money/future/fmnews/20150106/023921230340.shtml). Here the extra imported LNG refers mainly to the imported LNG over the quantity of the planned imports. The planned imports are usually subsidized by the government or the importers for designated gas users.
[52] See 'The Operation of the Shanghai Petroleum and Gas Exchange is Delayed', Hexun website, 21 April 2015. http://gold.hexun.com/2015-04-21/175164836.html
[53] Xinhua newsagency led the creation of Shanghai Oil and Gas Trade Centre, China Security News, 6 Jan 2015, http://finance.sina.com.cn/money/future/fmnews/20150106/023921230340.shtml
[54] See 'How Can China Gain the Power in Price Determination for Imported Natural Gas', 10 Feb 2015 http://wap.cnpc.com.cn/system/2015/02/10/001528410.shtml
[55] See Hu Suli, 'The Demonstration Effect of Gas Reforms', New Century Magazine, Issue 18, 2014, Beijing, China.

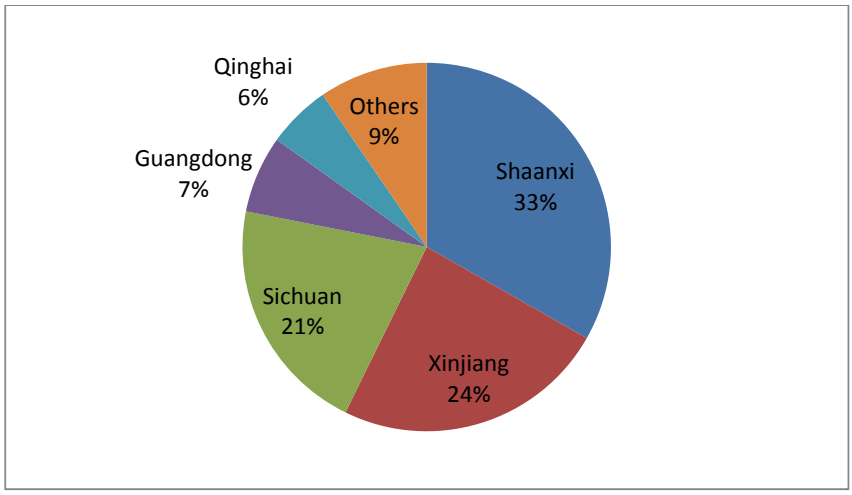
February 2014, China's National Energy Administration issued a document for opening up the oil and gas pipelines and other infrastructure equipment owned by the large SOEs to third parties, including the gas pipelines, oil and gas storage facilities, and LNG receiving terminals.[56] Following clearer signals from the central government for gas market reforms, more and more private enterprises have started to construct their own LNG receiving terminals in China's coastal regions, with the support from the local governments in these areas.[57]

The entry of private capital into China's gas industry remains constrained by the state regulation on retail prices as the import and wholesale prices are determined mainly by market forces, which gives rise to fluctuation in the incomes and profits of gas operators. The further reforms to gas retail prices are essential to private investment in the gas industry.

4.4 Changes in China's Domestic Gas Supply

China's home gas production decelerated from 12.3% in 2013 to 5.7% in 2014 (Chart 7). It seems that the effect of price hikes on home gas production since 2013 has yet to materialize. China's natural gas production has been highly concentrated in Shaanxi, Xinjiang and Sichuan provinces, who accounted for 78% of the total gas production in 2014 (Chart 7). All three big producing provinces are located in China's west.

Chart 7. China's gas production by provinces, 2014



Source: CEIC.

The commencement of operations of two large oil fields in China's Sichuan Province in 2014 raised China's gas supply capacity. The Anyue Gas Field with a reserve of 440.3 bcm and a daily production capacity of 1.1 m^3 mn started trial production in March 2014. The Yuan-ba Gas Field in Guangyuan

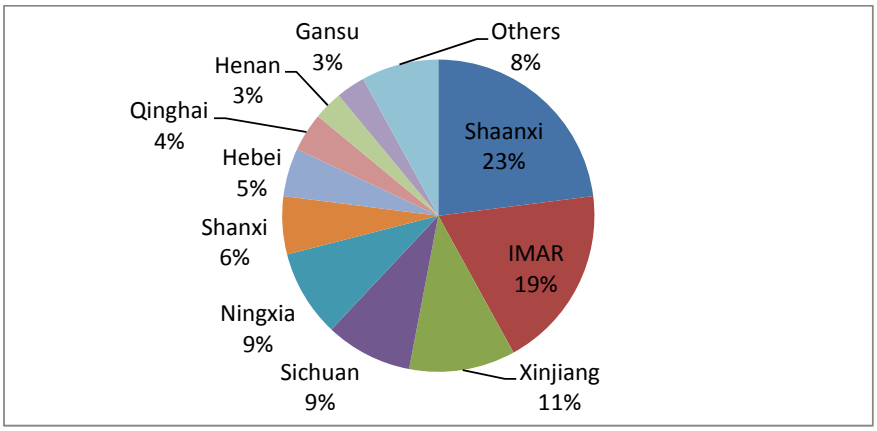
[56] See the National Energy Administration Document No 84, 2014, 'The Methods for Opening Up Oil and Gas Pipelines and Other Facilities and Monitoring Measures, 13 February 2014. http://zfxxgk.nea.gov.cn/auto92/201402/t20140224_1768.htm

[57] See 'Construction Speed up by China's Private Enterprises for Gas Infrastructure in the Coastal Regions. China Energy Website, 5 December 2014, http://www.chemall.com.cn/chemall/infocenter/newsfile/2014-12-5/2014125102556.html

across Nanchong and Bazhong prefectures of Sichuan, with a daily production capacity of 2.3 m^3 mn, started production in December 2014.[58]

China's LNG production remains small but is expanding. It is estimated that China's LNG production grew by 53% yoy in January-August 2014. China's LNG production is concentrated in its northwest regions and the four provinces in the northwest (Shaanxi, IMAR, Xinjiang and Ningxia) accounted for 62% of China's LNG production (Chart 8). In 2013, the price of imported LNG was at RMB2.6 m^3, and RMB 2.2 m^3 for imported pipeline gas. In many regions of China, the retail price was around RMB 2 m^3, which led to financial losses for LNG imports. The year 2014 has witnessed increases in LNG prices. Zhuchuan Consultancy estimated that the actual consumption of LNG in the first 8 months of 2014 reached 3.7 million tons, an increase of 50% over the same period in 2013, thanks to the government effort in combating air pollution.[59]

Chart 8. China's LNG production by province, 2014



Source: http://news.bjx.com.cn/html/20140910/545151.shtml

Some progress has been achieved in China's shale gas exploration and production, although it is less than had been anticipated. SINOPEC has been at the forefront of exploration for China's shale gas. In July 2014, the shale oil field in Hulin of Chongqing explored by SINOPEC was confirmed by the relevant authority at the Ministry of Land and Resource as the first large scale shale gas oil field for commercial production in China, with a reserve of 106.75 bcm of shale gas. The cost of shale gas production in China is high: SINOPEC quoted the cost for the shale gas produced is at RMB 2.78 m^3, which is much higher than the natural gas produced in surrounding Chongqing and Sichuan regions priced at RMB 1.9 m^3. According to SINOPEC, the production cost will go down as the company has more experience in the exploration and production of shale gas.[60] The shale gas project by SINOPEC in Chongqing has been regarded as strategically important for China's energy supply and it already had a demonstration effect. China's oil and gas giant, Petrol China accelerated its exploration for shale gas, and started its exploration and construction of gas fields in Changnin, Yibin of Sichuan Province, Weiyuan, Neijiang also in Sichuan and Zhaotong of Yunnan Province.[61]

[58] A review of China's gas market in 2014, http://gas.sci99.com/news/16985263.html
[59] http://news.bjx.com.cn/html/20140910/545151.shtml
[60] See report on China's *Caixin* 'CNOOC reveals the high costs for shale gas production', http://energy.caixin.com/?p=8322.
[61] See report on China's *Xinhua News Net*, 'Half yearly reports by the three oil giants in China', http://futures.xinhua08.com/a/20140829/1377961.shtml

The development of shale gas exploration has not prevented the government from adjusting its target for shale gas production downwards. The Chinese government has quietly cut down its target for shale gas production from 60 bcm to 30 bcm for 2020 due to its concerns for water resources and high costs in shale gas exploration and production. Although China's three oil giants remain interested in exploring shale gas, shale gas exploration and production are confronted with a variety of challenges. Royal Dutch Shell, which has a contract with Petrol China for the shale gas exploration in Sichuan Province, has scaled down its operation in Sichuan due to the complicated geographic conditions and densely populated local population which increased the costs of resettlement. The lack of surface water is another reason for the scale down of exploration in China.[62]

4.5 Gas Infrastructure Development

It was reported that China has already entered a period of rapid development of gas pipelines and LNG receiving terminals. The major pipelines already under construction and those in the pipeline include: the Xinjiang-Guangdong-Zhejiang Pipeline (construction expected to start in early 2015), the Fourth Line from Shaanxi to Beijing (will start construction soon), the Sino-Russian Natural Gas Pipeline and the 4th West-East Pipeline (already has the permit, construction expected to start in 2015), with a total length of 16,000 km. The Sino-Russia Natural Gas Pipeline is not in the original 12th FYP, so in the next four years, China's gas pipelines will increase from 8000 km p.a. to 9000 km p.a.[63]

The infrastructure projects which have attracted the most attention are the two Sino-Russian natural gas pipelines: the Power of Siberia Pipeline on the East Route and the Altai Pipeline on the West Route. Recently, there have been conflicting news reports on the progress of the two pipelines. The latest report indicates that Russia is likely to move ahead with the construction of the Power of Siberia on the Eastern route; however, this does not mean that the 'Power of Siberia' pipeline project will proceed and be completed as planned, given the large amount of investment involved and the different priorities placed by the two governments on the two projects. It is important to monitor the development of the two pipelines in the remainder of this year.

According to CNPC, the project for the construction of the Eastern Pipeline 'Power of Siberia' on the Russian side was launched in September 2014. The construction of the pipeline on the Chinese side will start in the first half of 2015.[64] The Pipeline subsidiary of CNPC has been given the responsibility for building the pipeline from Heihe in Heilongjiang Province to Shanghai, which is expected to be completed by 2018.[65] Reuters News reported on 18 March 2015 that Russia may postpone completion of the huge pipeline to bring gas from two new fields to China. The 'Power of Siberia' project may be delayed until Moscow completes a separate, less ambitious project to send gas from existing fields to China through a pipeline thousands of kilometres further west. A source

[62] 'Shell scaled down its operation for shale gas in Sichuan', *Daily Economic News*, 10 September 2014. http://www.china5e.com/news/news-883184-1.html
[63] http://news.xinhuanet.com/energy/2014-11/27/c_127255143.htm
[64] See 'Building on the Russian side of the Eastern Pipeline started up', 2 September 2014, http://business.sohu.com/20140902/n403983790.shtml
[65] The Pipeline Co under CNPC Takes the Responsibility to Build 'Power of Siberia' on the Chinese Side', see People's Daily website, 10 October 2015, http://energy.people.com.cn/n/2014/1010/c71661-25801986.html

from a consultancy firm which works with Gazprom said that the Russian gas firm should decide by summer which pipeline to build first.[66]

So far we cannot find any official response to the Reuters news from the Chinese sources. Understandably, Chinese government agencies and the state owned oil giants will not respond to unconfirmed news reports. However, reports from semi-official sources indicate that the relevant authorities in China may have been disappointed with the possible delay in the construction of the 'Power of Siberia' Eastern Pipeline. In an article published in one of China's most popular economic and financial magazines, Mr. Weidong Chen, the Chief of Energy Research at China's CNOOC (one of the three oil giants) described the news as shocking, as the Russians have already agreed to build the 'Power of Siberia' first. The project on the Russian side has already been launched, witnessed by President Putin and China's Vice Premier Zhang Gaoli.[67] He understands that the Russians may use the falling oil prices and a lack of financing as an excuse to delay the Eastern pipeline and to force China to accept its preference for constructing the Altai Line first, as the pressure from Western countries on the Ukraine issue has started to dissipate. He noticed that Russia used the same excuse to delay the building of the first cross-border bridge between China and Russia, which was agreed by both the countries, while China has already invested RMB 1 billion on the bridge and the money could have been wasted.[68] He is nevertheless confident that the impact of the delay of the 'Power of Siberia' Pipeline project on China's gas supply will be manageable, as China has already diversified its gas imports. His recommendation is that China should take a 'wait and see attitude' because China has time on its side, due to the fact that marketing power of global oil and gas has increasingly shifted from producing to consuming countries.[69]

The latest reports indicates that Russia is likely to move ahead with the construction of the Eastern Pipeline. It is reported in the Chinese media that President Putin has approved the 'Power of Siberia' pipeline gas project in early May, prior to the visit from Chinese President Xi Jinping visited Russia during 8-10 May. A number of economic and trade agreements were signed during Xi's official visit.[70] Energy analysts pointed out that the supply of pipeline gas from Russia will further diversify China's gas supply and improve China's bargaining power for the prices of imported LNG, which has dominated China's gas imports so far. In addition, the pipeline gas from Russia will play an important role in the substitution of gas for coal in China's Northeast provinces.[71]

By mid November 2014, China had imported 100 bcm of natural gas through its Central Asia Natural Gas Pipelines, the first cross-border natural gas pipeline in China. The imported gas from the pipelines has been connected to China's West-East gas pipelines and transported to gas users in China's 25 provinces (Metropolitans) as well as Hong Kong. It is estimated that 100 bcm natural gas is equivalent to 133 million tons of coal. The Central Asia Natural Gas Pipelines, built mainly by Petrol China (CNPC) have four lines, A, B, C and D. Lines A, B and C are operational and D is under

[66] See 'EXCLUSIVE-Russia could postpone gas pipe to China touted by Putin –sources. http://in.reuters.com/article/2015/03/18/russia-gas-china-idINL6N0WI48420150318
[67] Mr Chen's article is published in Caixin Magazine, an influential finance and economic publication in China.
[68] From the new report, it is unclear whether the bridge is on the 'Power of Siberia' route.
[69] Chen Weidong, 'Shocked by Russians Again', China's Caixin Magazine 27 April 2015.
[70] See 'Putin Approved the Sino-Russian Pipeline Gas East Route prior to the Visit by Xi Jinping', Tengxun Caijing, 4 May 2015, http://finance.qq.com/a/20150504/027565.htm
[71] See 'The Sino-Russia Eastern Pipeline Confirmed and Contribution to China's Gas Supply, 4 May 2015, from Yicai website, http://finance.huanqiu.com/roll/2015-05/6342784.html

construction. Different from the other three lines, Line D travels through China's southern Xinjiang Province, with a transportation capacity of 30 bcm per annum, and a total investment of US$6.7 billion. Line D is expected to be completed by 2020, by then, the total carrying capacity of the four lines will reach 85 bcm per annum, to meet over 20% of total gas consumption in China (gas consumption 400 to 420 bcm in 2020). The natural gas transported by Line D will be used mainly for north China, so is important to combat China's air pollution in Beijing-Tianjin and Hebei region.[72]

China has also accelerated the development of LNG infrastructure projects. By December 2014, the projects which have just been completed, under construction and in the pipeline reached 24 in coastal China, 7 of them have been completed and become operational, namely the LNG receiving terminals in Guangdong, Fujian, Shanghai, Ningbo of Zhejiang, Jiangsu, Dalian of Liaoning and Dongguan of Guangdong. [73]

The first LNG receiving terminal built by SINOPEC became operational in Qingdao of Shandong Province in December 2014. It was reported that the project has the capacity to handle and transport 3 million tons of LNG, an equivalent of 4 bcm natural gas, capable of providing LNG to 22 million households for gas use in China's Shandong and other parts of northern China, which is Stage 1. The capacity will be expanded to 10 million tons of LNG when the Stage 2 of the project is completed. The LNG is from Exxon Mobil in PNG. SINOPEC has Guangxi and Tianjin LDG receiving terminals under construction, and Jiangsu and Wenzhou of Zhejiang terminals under preparation.[74]

China is going to invest US$3 billion to build a LNG natural gas pipeline from the Southern Gwadar Port to the central Nawabshah City in Pakistan. After completion, oil and gas from the Persian Gulf can be transported to Kashi in China's Xinjiang Province, which has strategic importance for China's energy and economic security. This pipeline has the possibility to be extended to Iran to move 1 bcm of natural gas per day. Moreover, this pipeline enables China's oil and gas to be transported directly into the security zone from the Persian Gulf by avoiding the Indian route.[75]

5. Other Sources of Energy

5.1 Coal Challenges

A major constraint for China's energy revolution is the challenges presented by those coal producers and coal producing regions suffering from falling coal prices. The price of coal plummeted from RMB 901 per ton in November 2011 to RMB 495 per ton around November 2014 in China's Bohai Commodity Exchange.[76] Firstly, China's coal industry is suffering from serious over capacities. The 2020 target of 4.2 billon tons of coal sets a ceiling for China's coal production in the next five years. However, coal production capacities will be well beyond 4.2 billion tons. It is

[72] 'More than 100 bcm gas transported by China's Central Asia Gas Pipelines', *Xinhua News Net*, 15 Nov 2014, http://www.ce.cn/cysc/ny/trq/201411/15/t20141115_3909812.shtml.
[73] 'The first LNG receiving point by SINOPEC became operational', China Finance Information network, 16 Dec 2014. http://futures.xinhua08.com/a/20141216/1426288.shtml
[74] 'The first LNG receiving point by SINOPEC became operational', China Finance Information Network, 16 Dec 2014. http://futures.xinhua08.com/a/20141216/1426288.shtml
[75] See http://www.chinairn.com/news/20141126/171544717.shtml
[76] http://economy.caixin.com/2015-01-06/100771574.html

estimated that the current production capacity of coal is over 4 billion tons and there is an additional 1 billion tons of capacity which is under construction and being upgraded. Secondly, similar to the problems with some other excess capacity industries in China, coal de-capacity is expected to impact on China's fragile banking system as the bulk of coal investment has been financed by bank loans. Moreover, it is very difficult for the coal producers to reach an agreement to limit production as there are many medium and small producers located in different regions of China.[77] Coal mining in China is mainly underground, needs a lot of infrastructure investment, and the return on the capital investment is dependent mainly on the output level. It is therefore important to maintain a certain level of coal production. Finally, coal production concentrates fairly on the resource rich but economically poor areas, falling prices and de-capacity will impact, not only on bank loans, but on local fiscal incomes and employment.

In an effort to streamline fiscal revenues and expenses by coal producers, the government replaced the fixed tax per ton coal of produced (RMB 8-20 per ton of cokes and RMB 0.3 to 5 per ton of other coal), and irregular fees with a coal resource tax based on sales revenue (2-10% of the sales revenues) and the new coal resource tax becomes effective from 1 December 2014. The local governments are able to agree on a coal resource tax rate from a range of 2-10% for the coal producers in the province. The traditional large coal producing provinces, such as Shanxi and IMAR, have set their tax rate at 8 and 9%, while others, such as Henan and Liaoning, have set their tax rates at 2%, and Guangxi and Hunan at 2.5%.[78] It appears that the large coal producing provinces with relatively low costs of production have set their tax rate higher, while the high cost provinces, Henan and Liaoning, have set their rate at the low boundary of the tax range. The study found that the replacement of fixed taxes and fees by coal resource taxes has reduced the tax burden for the coal producers in some provinces while raised the burden in other provinces. It was noted that the government has introduced a coal resource tax at a time of local coal prices and low CPI so the tax introduction will not lead to cost pushing inflation. On the other hand, the local governments are more likely to remove fees imposed on coal producers under lower coal prices and profits.[79]

Recently, the government has provided some temporary relief to the coal industry by introducing and varying tariffs. The government introduced a 3% import tariff for coal in October 2014. China's Ministry of Finance declared on 16 December 2014 that from the beginning of 2015 China's export tariff for coal will be cut from 10% to 3% to encourage coal exports.[80] The export tariff reduction is expected to have impact limited mainly to coke export to northeast Asia (South Korea and Japan) and some Southeast Asian countries such as India, Indonesia and Vietnam, given the disparities between domestic and border prices and the transport costs. China can export both steel and coke coal to some ASEAN countries as these countries are expanding their manufacturing industries.

The coal industry and some local governments have responded to the challenges by developing coal gasification and coal oil projects. The State Energy Administration has set a target of 50 bcm for gas produced by coal gasification.[81] According to the China Chemical Industry Information

[77] See Lin Boqiang 2014, 'The new and old energy', *China Security News*, 23 Dec 2014: http://www.cnenergy.org/nypl/201412/t20141223_339036.html
[78] http://economy.caixin.com/2015-01-06/100771574.html
[79] http://economy.caixin.com/2015-01-06/100771574.html
[80] http://news.315.com.cn/20141220/100244943.html
[81] See http://www.china5e.com/news/news-892336-1.html

Centre, by October 2014, in addition to the four gasification projects which have been approved and in the process of construction, there are 17 projects already being granted permits, with a total production capacity of 121.5 bcm p.a., in Stage 1, 65 bcm per annum. There are more projects in the pipeline seeking approval or that have started construction without formal approval, mainly by central SOEs in Xinjiang and IMAR. According to incomplete reports, by April 2014, there were about 28 or more such projects, with a total capacity of 110.7 bcm p.a.[82]

China's coal gasification project by first private enterprise has become operational. Recently, the gasification project with an annual production capacity of 2 bcm, has started production. This demonstration project is located in Erdos of Inner Mongolia. The project will supply gas to Beijing-Tianjin and Hebei areas.[83] Since mid-November 2014, the coal gasification project in Xinjiang by Qinghua Coal Gasification Co. has provided 3.2 million cubic meters daily to the West-East No. 2 Pipeline. This project is expected to provide 450 million cubic meters from this winter to next spring, contributing to the mitigation of the gas supply shortage.[84]

However, China's coal gasification projects face a number of dilemmas. First, coal gasification consumes large quantities of coal, which is contradictory to the control over coal. To achieve the goal of 50 bcm gas through gasification would require 250 million tons of coal. Second, currently the prices for the gas through gasification are set by the government, not the market or producing enterprises, while the projects need large amount of investment. Moreover, China's pipelines for gas have been monopolized by a few state owned oil giants, so other gas producers have difficulties in access. Third, gasification generates emissions, which contradicts China's commitment to peak CO_2 emission by 2030.[85]

5.2 Response to Falling Oil Prices

China is obsessed with its oil security following rising oil imports: in 2013 the ratio of imports to oil consumption in China reached 57.7% and approached 60%. China has mitigated its oil risks first by developing the China-Myanmar oil and gas pipeline and obtaining the right to use Gwadar Port in Pakistan, so as to reduce the over dependence of its oil imports through the Strait of Malacca. Second, the government has accelerated the construction of infrastructure for oil reserves. The Bureau of Statistics in China unveiled on 20 November 2014, that Stage I of China's oil reserve project with a total capacity of 12.43 million tons of crude oil, including the four reserve bases in Zhoushan, Zhenhai, Dalian and Huangdao, has been completed and started operation. By 2020, when Stage III of the project is completed, the project will have a storage capacity of 69 million tons of crude oil, corresponding to 83 days of China's net crude oil imports, still short of the 90 days international safety line for crude oil reserves. Finally, the government increased its oil imports to build up its strategic oil reserves by taking advantage of low global oil prices.[86]

[82] *China Environmental Daily*, 25 Nov 2014. http://www.cenews.com.cn/sylm/hjyw/201411/t20141125_784085.htm
[83] *China Coal News*, 5 Dec 2014, http://www.china5e.com/news/news-891282-1.html
[84] China energy website, 9 Dec 2014, http://www.china5e.com/news/news-891656-1.html
[85] http://www.china5e.com/news/news-892336-1.html
[86] 'Stage I of the national oil reserve project completed and operational', Newhua Newnet 21 Nov 2014, http://news.xinhuanet.com/energy/2014-11/21/c_1113343270.htm

The falling oil prices have had a big impact on the global consumption and investment in alternative sources of energy, mainly coal, natural gas and renewables. It was observed, however, that the recent falls in oil prices had a very limited impact on China's energy strategy for reducing the share of fossil fuels. The Chinese government has deliberately raised consumption taxes for oil products by about 50% in 2014 to offset the impact of falling oil prices on the development of low carbon energy, with the tax revenue channelled to the funds for pollution control and the development of new sources of energy.[87] According to the Ministry of Finance (MoF), the increases in consumption taxes for oil products are aimed at energy saving and reducing China's emission. The effects of the tax rises on oil users have been minimized as the taxes have been raised with falling oil prices. Since the beginning of 2009, the government introduced the consumption tax, RMB 1 per litre for petrol and RMB 0.8 per litre for diesel. No adjustments had been made to the tax until November 2014.[88] The government has raised consumption three times in the last two months. The first rise was on November 2014, when the consumption tax for petrol was increased from RMB 1 to 1.12 per litre, and the tax for diesel from RMB 0.8 to 0.94 per litre.

Then, on 12 December 2014, NDRC announced they would lower the price of petrol by RMB 170 per ton and that of diesel by RMB 400 per ton. The NDRC made it clear that, based on international prices, the price of petrol should be reduced by RMB 670 per ton and that of diesel by RMB 640 per ton. The Ministry of Finance and the State Taxation Bureau has raised consumption tax for oil products, which are now RMB 500 per ton for petrol and RMB 240 per ton for diesel.[89] The tax for petrol rose further 1.12 to 1.4 per litre and that for diesel from RMB 0.94 to 1.1 per litre. Finally, on 12 January 2015, the Ministry of Finance and the State Taxation Bureau raised the consumption tax for petrol by RMB 0.12 per litre and diesel by RMB 0.1 per litre, while the prices of petrol and diesel were reduced by RMB 180 and RMB 230 per litre, respectively.[90] The tax for petrol rose further from RMB 1.4 to 1.52 per litre and that for diesel from RMB 1.1 to 1.2 per litre.

5.3 Renewables

China's major strategies and policies for the development of solar energy were formulated mainly in 2013. The newly increased capacity of distributed PV was 800,000 kW in 2013. However, the NDRC and the State Energy Administration set an ambitious target of 8 million kW for 2014. By the end of the third quarter in 2014, the newly increased distributed PV capacity was 1.34 million kW, and it is expected that the capacity for the whole year would be below 3 million kW, well short of the target of 8 million kW. The failure to achieve the target for newly increased PV capacity connected to grid can be explained by the high target, the lower than expected subsidies for PV

[87] See Cai Qimei, 'The impact of low oil prices on low carbon energy development', *Caixin* website, 6 February 2015, http://opinion.caixin.com/2015-02-06/100782077.html. Mr. Cai is a member of China's IPCC negotiation team, and the deputy director of the Planning Department at the State Strategic Centre for Dealing with Climate Change.
[88] http://news.163.com/15/0114/06/AFT9NTK900014AEE.html
[89] NDRC, 'The government raises consumption taxes for oil products while lowering the oil prices'. NDRC website, 12 Dec 2014. http://www.sdpc.gov.cn/xwzx/xwfb/201412/t20141212_651997.html
[90] 'The first hike on oil product consumption taxes', the *People's Daily* website, 13 January 2015, http://finance.people.com.cn/BIG5/n/2015/0113/c1004-26371846.html

power, and the problems associated with the property rights for roofs, connection to the grid and the difficulties in accessing finance.[91]

The year 2015 will be a time for China to fully restart its nuclear power projects after the suspension following Japan's Fukushima nuclear power plant accident in March 2011. It was reported on 17 February 2015 that the application for the operation of reactors 5 and 6 for the Hongheyin Nuclear Power Plant in Liaoning Province was approved by the Central Government, the first nuclear power project to be approved since 2013. The nuclear power project in Fujian will soon been approved. The representatives from China's inland province Hunan also asked the central government for approval of their nuclear power projects.[92]

5.4 Electric Vehicles

The development of electric vehicles seems have become the national strategy. In May 2014, President Xi Jinping declared that the development of electric vehicles is necessary for China to develop from a large producing to a strong producing country for motor vehicles. He also instructed to strengthen R&D, develop different electric vehicle products tailored to the demand and make it a strategic point for China's growth.[93] According to Ruo Da, the secretary of the National Vehicle Market Information Association, with huge amount of subsidies from the national government for the infrastructure development in the Chinese cities, China is likely to shift from market promotion to commercial production for electric vehicles, which is why China may become a strong vehicle producing country in the next 6-10 years. In 2014, China's electric vehicles are expected to reach 50,000. The expert opinion is that currently it remains a very difficult period for electric vehicles. However, if the threshold of 500,000 vehicles is achieved in 2015, the development of the industry will accelerate by itself. China is possibly in a leading position for electric vehicles in the world.

The government has started to subsidy electric vehicles. According to the news from China's Ministry of Finance on 26 November 2014, Chinese cities who sell over 25,000 electric vehicles will be rewarded with over RMB 100 million in 2015: RMB 50 million for 10,000-15,000 electric vehicles, RMB 70 million for 15,000-20,000 electric vehicles, RMB 90 million for 20,000-25,000 electric vehicles, RMB 120 million for over 25,000 electric vehicles. The reward is for subsidizing the infrastructure development for the vehicles.[94]

6. Concluding Comments

China's new energy development strategy, built upon the four energy revolutions, focuses on China's energy security and improvements on China's energy use mix and efficiency to combat air pollution and to secure China's long-term energy supply in the process of further income growth and urbanization. An increase in the share of natural gas and renewables and a fall in the share of

[91] Yu Huan, 'Why the target for distributed PV would be missed', China energy website, 5 Jan 2015. http://www.cnenergy.org/dujia/201501/t20150105_340388.html
[92] See 'China's nuclear power project re-initiated', from *China Environment News*, 5 March 2015, http://www.cenews.com.cn/xwzx2013/hyfs/201503/t20150305_788735.html
[93] See the *People's Daily*, 27 Nov 2017. http://energy.people.com.cn/n/2014/1127/c71661-26104556.html
[94] *Xinhua News*, 26, Nov 2014, http://news.xinhuanet.com/energy/2014-11/27/c_127255328.htm

coal are the key in the new energy strategy to address the issues related to air pollution and CO_2 emissions. With the key energy supply and prices controlled by the government and large state owned enterprises, the new energy strategy backs market-oriented reforms and the use of taxes to achieve the goal of the energy revolution.

The new energy strategy was tested by the falling oil prices which have a significant impact on global energy consumption and investment, and it appears that the government has coped with the change while sticking to the new energy strategy. The Chinese government has responded to the falling oil prices by raising consumption taxes for oil fuels by 50% in 2014 to offset the impact of falling prices on the development of gas and renewables, with the tax revenue channelled to the funds for pollution control and the development of new sources of energy. The new round of market-oriented reforms in gas prices initiated in 2013 and continued in 2014 have also been jeopardized by falling oil and coal prices. The government has responded by lowering the prices of incremental gas for non-residential uses in an effort to prevent a reversal from gas to coal by industrial and commercial users.

So far the biggest challenge to the new energy strategy comes from coal, with an excessive capacity industry faced with falling demand and prices. Many of China's coal mines are located in the resource rich but economically poor regions of China. The government has attempted to mitigate the suffering of the industry by developing large coal gasification projects and by building large coal and power bases in China's western regions. However the development of the coal gasification projects requires large amount of investments with uncertain returns and water supply in China's drying western regions, there are also concerns about the emissions from coal gasification.

The Chinese government is expected to implement its energy development strategy devised in 2013 and 2014 in the course of short-term fluctuations in key energy prices and economic variables. The rising pressure for fighting air pollution is set to continue, as supported by the video film by Cai Jing, a former CCTV woman reporter, where her online documentary about pollution has attracted more than 300 million viewings.

As far as natural gas is concerned in terms of energy security, China has more room in increasing its imports of natural gas than oil. By 2014, the ratio of import to domestic consumption was around 60% for oil, but only 32% for natural gas. The development in the following two areas is worth watching: the progress in China's gas market and price reforms and the signing and construction of two Sino-Russian gas pipelines. Continuous increases in the retail price of gas through market reforms are expected to encourage domestic gas production and gas imports, but have a negative effect on gas consumption. There have been unconfirmed reports that the Chinese government may raise taxes for value-added gas production in the 2nd half of this year and the increased revenue from the tax hike will be used for subsidizing gas use to combat air pollution. The establishment of SHPGX, which is expected to play a large role in the formation of gas prices over the longer term, is an important part of gas marketing and price reforms. The actual progress in the two Sino-Russian gas pipelines will be shaped by a number of geo-political factors, even though the agreement for the 'Power of Siberia' on the East route has been signed and approved by the Russian Government. It appears that the Chinese side are more willing to construct both pipelines, placing more importance on the Power of Siberia line. The construction of the pipelines will enhance China's gas security and improve China's bargaining power in the negotiation for import

prices through increased supply and diversified gas imports. The Russians have been more hesitant to proceed with the Eastern pipeline first. The Russian government may use the pipelines as the bargaining chip to lure China's investment in Russia's energy and other industries.

In general, China's major gas importers do not appear to prefer gas from particular sources. Apparently China's importers do not have a great confidence on the reliability of the gas supply from Russia, given the twists on the long-term negotiations for the supply of Russian pipeline oil and gas to China. Australia has been regarded as a reliable source of gas imports. To China, the key is to ensure a considerable level of self-sufficiency in the overall gas supply and to diversify gas imports, including the imports of both LNG and pipeline gas. Whenever the ratio of gas self-sufficiency falls, import diversification becomes more important.