A Comparison of Natural Gas Pricing Mechanisms of the end-user markets
In USA, Japan, Australia and China

China-Australia Natural Gas Technology Partnership Fund
2013 Leadership Imperative

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<td>Japanese Crude Cocktail</td>
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<td>Local Distribution Company</td>
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<td>MCM</td>
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<td>NDRC</td>
<td>National Development and Reform Commission of China</td>
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<td>NG</td>
<td>Natural Gas</td>
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<td>NYPSC</td>
<td>New York State Public Service Commission</td>
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<td>OGJ</td>
<td>Oil and Gas Journal</td>
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<td>Tonne of Oil Equivalent, defined as 107 kcal</td>
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Executive Summary

The primary focus of this project was to find a better way of natural gas pricing mechanism in China through study of different pricing and deregulation procedures in different countries and selected cities, with the ultimate desire to positively influence relevant gas companies and government entities in China. The findings indicate a strong desire to deregulate the natural gas market in China step by step. To be able to do this, however, it needs time and patience to liberalize the LNG import Natural gas pipeline exploration rights and other activities related to the value chain of natural gas. It also became obvious that the new reform of natural gas pricing in China was only at the starting point. Experience shows that open gas markets do not evolve automatically, but require policy action and the creation of a stable and transparent policy framework under which the market can then transform. Liberalization of any gas market is largely driven by governments and then by the appointed regulatory authority.

This project has highlighted the need to do several things if China wants to improve its natural gas pricing mechanism. They are indicated as following:

• Government’s role in regulation should be clearer and easier to operate. Some specific tasks in upstream and downstream can be left to regional governments (as happens in the United States between FERC and state regulators), as long as the division of roles and duties is clear. An independent regulator needs to be established without the potential influence of government, therefore pricing regulation can be constant in the long run. In order to establish an independent regulator, a national gas law has to be passed first. Access to gas pipeline and pricing mechanism should be clear and remains unchanged, thus the investors would be able to predict the cost and revenue before investment.

• China needs to think carefully about the indexation it wants to put in place, notably whether oil is appropriate as being the only linkage to be used in the formula. This implies a careful choice of the coal index to be potentially used in the formula (import cost or another index should be transparent, reliable and not based on governmental prices) as well as of the weighting given to coal in the formula.

• Market openness is a critical element to start liberalization. This usually begins with the largest gas users, which became eligible to choose their supplier. This was facilitated by TPA to pipelines. Even many countries with fully open markets still limit switching and show a strong preference for regulated gas prices. Opening markets to small gas users may therefore not be regarded as a priority by China.

• Availability of information is critical at all stages. This applies to basic information regarding the market (supply, demand, and imports), access to the infrastructure (access and tariffs, capacity available), as well as wholesale prices. An independent regulator needs to be established without the potential influence of government, therefore pricing regulation can be constant in long run. In order to establish an independent regulator, a national law of gas has to be passed first. Access to gas pipeline and pricing mechanism should be clear and remains unchanged, thus the investors would be able to predict the cost and revenue before investment.
01 Introduction

1.1 Background

China faces many challenges in the coming years to achieve the 12th Five-Year Plan (FYP) target of significantly increasing domestic gas use by 2015. All sources of gas supply – domestic production, including unconventional sources, as well as imports of liquefied natural gas (LNG) and pipeline gas – will be necessary in order to satisfy a demand level by 2015 which could be up to twice that of 2011. Bringing sufficient gas supplies is only one part of the equation: gas needs to be transported to the final end-user, and to support regional developments while ensuring that security of gas supply is met. This requires therefore significant investments on the midstream and downstream sides as well.

As pricing is one of the most important factors influencing the supply and demand curve, this study will take a close look at the challenges facing China’s gas pricing mechanism and learn lessons from other major gas markets in the USA and Japan. Australia is producing a great amount of gas to the world, especially to the Asia-Pacific region. However, we found Australia’s NG price is as high as the Japanese NG price. It is very interesting that Australia’s gas pricing mechanism is also similar to Japan. At the same time the price mechanism in Australia is different from east to west.

The members in this group are students selected by the CANGTPF, who are working in NG industry for a long time in the upstream, midstream and downstream of NG industry. One of them is working in the local government regulating the NG price, as the NG industry is largely a nature monopoly in China.

The Chinese government is trying to improve its pricing mechanism for utilities, such as NG, electricity, water and waste water treatment. In 1998, China established a mechanism for domestic oil price to follow the international market. Oil product prices could be set based on international crude oil prices, and taking into consideration processing costs, taxes and appropriate profit margins. Recently, NDRC has announced a more frequent adjustment of oil price linking to the international crude oil price, though the local government still needs to announce the end-user price. The reform indicates that China is on the way to liberalizing the market for oil price.

China started to import NG in 2006, and became a net NG importer in 2007. Today, imported NG account for more than 20% of total NG consumption in China. Therefore the Chinese government can’t afford to subsidize or cross-subsidize NG in the long run. A more efficient NG pricing mechanism is needed to maintain sustainable development of NG industry. The Chinese government started a reform in December 2011 in Guangdong and Guangxi. The city gate gas price will be linked to fuel oil and LPG prices (Shanghai imported prices). This aims at liberalizing the upstream prices, in order to promote in particular future unconventional gas production. In the first stage, prices will be changed annually before moving to quarterly changes. In July, NDRC announced a sharp increase in price for the non-residential end users, which indicates the beginning of the new pricing reform of NG in China. In the long term, delete natural gas price is expected to be formed through market competition, where the government will only supervise monopoly prices like pipeline transportation prices and urban gas distribution fees.
However, every coin has two sides. Market competition may improve efficiency, but at the same time taking the variety of different districts of China into consideration natural monopoly is not always a barrier to development. The question is which road is more suitable for China in the near future and in the long run.

1.2 Definition of Pricing Mechanism

Pricing Mechanism in this project means the coverage of cost for a price, the structure or components of a price and the frequency of price adjustment. Pricing mechanism studies the influential parties involved in pricing, the laws and regulations governing the pricing behavior and the procedures adjusting or making a new price.

For some countries, there is no difference in NG prices for residential users and for non-residential users, for example Japan. Some countries link NG prices with crude oil, while other countries purchase NG at a market based price. The natural gas price in China is strictly controlled by the government. The domestic NG price is based on a cost-plus mechanism and can be kept stable for a long period of time. However, with the increasing pressure in the international NG market, the low price and fixed pricing mechanism will become a barrier for sustainable development the NG industry. It will be hard for the pressure of new contract LNG price to be passed to the residential users.

Natural gas pricing can be divided into two categories according to how many buyers and sellers are involved. Natural gas prices in the first case, involving a single producer and single buyer, would be negotiated between the parties. In the second case, where there are many buyers and sellers of gas, traded prices are most influenced by supply and demand. Most gas markets in the world are between the two extremes as described above.

According to some studies, the gas markets in the world can be divided into four groups. One is “gas-on-gas” market where there are abundant of sellers and buyers. North America and UK belong to this group. The second is “indexed to substitute energy price” market because of historical reasons where the sellers encourage the users to switch between fuels. Continental European countries and some countries in South-East Asia are belonging to this group. The third is “oil-linked” gas market, especially indicated by Japan. The fourth is regulated gas market such as in China.

Regulated markets dominate much of the other regions of the world. In these regions, the gas markets are relatively immature and largely controlled by the State. The gas prices may be nationally set (by decree in many cases) and all supply is entered into a gas ‘pool’. The state manages the differences in supply prices, and may choose to sell gas at prices less than the average ‘pool’ price for political reasons. There is no transparency in prices, any free markets, and very little incentive – unless they receive special license from the government – for private sector investment in supply or infrastructure. If the mandated gas prices are artificially low, such as in the Middle East, inefficient consumption of energy often occurs.

1.3 Overall Purpose of this Project

We notice there are four major styles of pricing mechanism existing in the world, one is linked with oil, another is deregulated market price, another is free market price, and another
is regulated price. China belongs to the last one. In China, utility prices are highly regulated by the government, which causes inefficiency and high costs. With a view to attain sustainable development, China is approaching deregulation of utility price.

We will study the difference the between regulated price market, deregulated price market and liberalized price market, to understand the benefits and disadvantages of each kinds of price market, to research the ways to approach to a liberalized price market.

In order to do so, we analyzed the supply and demand of each country the regulatory affairs related to the gas pricing principles and different pricing mechanisms. In addition, we find it is necessary to compare the level of price and the disposable income. The regulators or the government has to be concerned about the affordability of consumers when setting a price.

1.4 Proposed Outcome
This report will be presented to the CANGTPF as a fruit of three-month training. It will be useful for further study for the following groups of students sponsored by the fund. The report will be presented to NDRC and to Shanghai Municipal Government as a reference to pricing policy making. It will also be presented to relevant giant NG companies in China for a better understanding of NG pricing mechanism in the world. The report will enhance the understanding of regulated, deregulated and market-oriented NG pricing mechanisms, and suggests a blueprint pave the way for liberalization of NG price in China.

Through this report, the reader may find pricing mechanism of NG involves a series of things, such as free market entry for importing or exploitation of NG. It may also require a free market in the power generation industry. It also requires some preconditions such as franchising NG distribution rights to private owned companies. The government regulator needs to be more independent. These are reform and research fields of interest and requiring further studies.

The way to market price of natural gas is a long journey. It takes time and patience to reach that goal. The thesis we are undertaking is mediation about what should be improved for the Chinese natural gas value chain in a short term and in a long term.

1.5 Structure of the Report
The first section of the report states the purpose, main focus and expected outcome of this study. The second section t is a comparison of market and pricing mechanism in USA, Japan, Australia and China. The third section is a further study of selected cities within the above mentioned countries. It compares the price structure, price level and frequency of price adjustment in selected cities, which illustrates the difference between regulated, deregulated and market price mechanism. The fourth section focuses on the Chinese NG pricing reform and the current challenges Chinese government is facing. The fifth section tries to draw a conclusion of the study and make some suggestion for the Chinese government to improve its pricing mechanism.

02 Gas Market & Pricing Mechanism in USA

2.1 USA Natural Gas Demand
Natural gas is believed by many to be the most important energy source for the future. The abundance of natural gas coupled with its environmental soundness and multiple applications across all sectors, means that natural gas will continue to play an increasingly important role in meeting demand for energy in the United States.

The natural gas demand in the United States could be 26.55 trillion cubic feet (TCF) by the year 2035. That is an increase of 16 percent over 2009 demand levels. In comparison total energy consumption is expected to increase by 20 percent (from 94.79 quadrillion British thermal units to 114.19) by 2035. The EIA predicts an annual energy demand increase of 0.7 percent over the next 26 years (New York State Energy Plan).


The residential sector represents about 4.9 TCF or 21 percent of total U.S. natural gas consumption for 2008. Residential natural gas demand is largely a function of heating demand and is highly weather sensitive. Over 70 percent of annual residential consumption occurs during the five winter months (November through March). The commercial sector represents about 3 trillion cubic feet or 13 percent of total U.S. natural gas consumption for 2008. Demand in the commercial sector has been relatively flat over the past ten years. The industrial sector accounted for approximately 6.7 trillion cubic feet or 29 percent of total U.S. natural gas consumption in 2008. Demand in the industrial sector has decreased about 18 percent in the last decade (New York State Energy Plan).

**2.2 USA Natural Gas Supplies**

Since natural gas is a national market, developments nationwide regarding gas supply are critical to the U.S. Natural gas dry production totaled 20.5 TCF in 2008, which was six percent higher than in 2007. About 98 percent of the natural gas produced in the United States comes from production areas in the lower 48 States. There has been a significant shift in gas supplies from conventional or traditional supply areas and sources to unconventional or new supply areas and sources.

Higher natural gas prices resulted in increased drilling activity, particularly in areas that were formerly too expensive to develop. Higher prices have also contributed to the development of improved drilling and production technology that has allowed for the economic production of natural gas in deep water areas in the Gulf of Mexico and other large unconventional resources. Natural gas prices peaked in the summer of 2008 and are much lower now, which has resulted in a decline in drilling activity. It is anticipated that natural gas prices and the number of operational drilling rigs need not return to 2008 levels for production to increase.

In 2008, the United States imported approximately 4 trillion cubic feet of natural gas mainly
from Canada along with some LNG from a number of countries. Another source of the U.S. natural gas supply is from imported LNG. In 2008, the U.S. received about 400 billion cubic feet (1.1 billion cubic feet per day) of LNG imports, a decrease from 2007 levels which were 771 billion cubic feet (2.11 billion cubic feet per day). The 2008 annual LNG imports represent about 1.7 percent of total U.S. natural gas requirements. (New York State Energy Plan)

The U.S. domestic production has increased with the development of new supply basins, so the need for substantial increased volumes of imported LNG has diminished for the near term.

2.3 USA Natural Gas Pricing Mechanism

In the early stages of the US gas industry, prices were not regulated. This changed with the 1938 Natural Gas Act which started to introduce regulation, in particular on gas prices. The next four decades until 1978 saw a progressive growth of regulatory oversight of gas prices. The US Supreme Court’s Phillips Decision in 1954 resulted in a wellhead price regulation that lasted until 1978. The US system in the 1950s to 1970s appears, therefore, to have been quite similar to the current Chinese gas system, with regulatory agencies controlling most parts of the business in different parts of the gas value chain. One notable difference is that US pipeline companies were often separate from producers, and were buying directly from them.

In the mid-1970s, a new regulatory system set a uniform national wellhead tariff based on an average of current and expected costs of gas production, but this applied only to contracts signed after 1975. Meanwhile, historical tariffs remained low. Despite the resulting sharp increase of wellhead prices, shortages were even worse, while gas demand was boosted. The Natural Gas Policy Act of 1978 aimed at solving these shortages by deregulating partially wellhead gas prices while retaining most interstate gas pipeline under price control. Further deregulations (the Federal Energy Regulatory Commission “FERC” Orders 380 and 436) followed up to 1985. They allowed utilities and then later other customers to contract directly with producers at market prices, and have the gas transported to their sites on pipelines subject to third-party access regulation.

While the combination of the deregulation of wellhead prices and the two oil price shocks resulted in a 15-fold increase of wellhead prices from 1970 to 1984, a slower economic growth combined with higher gas prices at a later stage led to a reduction in gas demand, so that wellhead prices dropped back to levels close to USD 1.8/MBtu by 1985. With the Natural Gas Wellhead Decontrol Act of 1989, all price ceilings of the Act of 1978 were removed by January 1993 (EIA, 2012b) rather than by 2000. In 1989, controls on over 60% of gas production were lifted, while another 33% had never been subject to the price controls of the 1978 Act. (New York State Energy Plan)

Liberalization changed the structure of the US gas industry. Before, strong regulation applied to the different stages, from production to transmission to distribution, and to long-term contracts between producers, interstate pipeline companies and distribution companies. Liberalization and open access to pipelines starting in 1985 led to the creation of the competitive wholesale gas market and a new type of company appeared – gas marketers,
which are the link between producers on one side, and distribution companies as well as large consumers on the other side. The liberalization of gas marketing and wholesale gas prices attracted many new companies and created competition among marketing firms and gas producers, which increased the pressure on wholesale gas prices.

Over the past 20 years, there has been little change in the way US gas pricing works. Gas trading occurs at several physical hubs located on interstate pipelines. Today futures reach until 2022. At present, gas prices are set by supply/demand balances but also still depend on the development of oil markets.

03 Gas Market & Pricing Mechanism in Japan

3.1 Japan Natural Gas Demand

Japan is the world's largest importer of LNG, second largest importer of coal and the third largest net importer of oil. Japan has few domestic energy resources and is only 16 percent energy self-sufficient. It is the third largest oil consumer in the world behind the United States and China and the third-largest net importer of crude oil. Japan is one of the major exporters of energy-sector capital equipment, and has a strong energy research and development (R&D) program supported by the government, which pursues energy efficiency measures domestically in order to increase the country's energy security and reduce carbon dioxide emissions.

On March 11, 2011, a 9.0 magnitude earthquake struck off the coast of Sendai, Japan, triggering a large tsunami. The earthquake and ensuing damage resulted in an immediate shutdown of 12,000 MW of electric generating capacity at four nuclear power stations. Other energy infrastructure such as electrical grid, refineries, and gas and oil-fired power plants were also affected by the earthquake, though some of these facilities were restored. Between the 2011 earthquake and May 2012, Japan lost all of its nuclear capacity due to scheduled maintenance and the challenge facilities face in gaining government approvals to return to operation. Japan is substituting the loss of nuclear fuel for the power sector with additional natural gas, low-sulfur crude oil and fuel oil.

Japan relies on LNG imports for virtually all of its natural gas demand and is the world's largest LNG importer. According to OGI, Japan had 738 billion cubic feet (Bcf) of proven natural gas reserves as of January 2012. Natural gas proven reserves have declined since 2007, when they measured 1.4 trillion cubic feet (Tcf). Most natural gas fields are located along the western coastline. (Source: EIA Japan Analysis [http://www.eia.gov/countries/cab.cfm?fips=JA])

Although Japan is a large natural gas consumer, it has a relatively limited domestic natural gas pipeline transmission system for a consumer of its size. This is partly due to geographical constraints posed by the country's mountainous terrain, but it is also the result of previous regulations that limited investment in the sector. Reforms enacted in 1995 and 1999 helped open the sector to greater competition and a number of new private companies have entered the industry since the reforms.

3.2 Japan Natural Gas Supply
Japan produced 174 Bcf of natural gas in 2010. Japan's largest natural gas field is the Minami-Nagaoka on the western coast of Honshu, which produces about 40 percent of Japan's domestic gas. Exploration and development are still ongoing at the field which Inpex discovered in 1979. The gas produced is transported via an 808-mile pipeline network that stretches across the region surrounding the Tokyo metropolitan area. Inpex is building an LNG terminal with a 73 Bcf/y capacity at Naoetsu port in Joetsu City which will connect its domestic pipeline infrastructure with its overseas assets by 2014.

Because of its limited natural gas resources, Japan must rely on imports to meet its natural gas needs. Japan began importing LNG from Alaska in 1969, making it a pioneer in the global LNG trade. Due to environmental concerns, the Japanese government has encouraged natural gas consumption in the country. Japan is the world's largest LNG importer, holding about 33 percent of the global market in 2011. (EIA Japan Analysis)

Japan has 32 operating LNG import terminals with a total gas send-out capacity of 8.7 Tcf/y, well in excess of demand in order to ensure flexibility. The majority of LNG terminals is located in the main population centers of Tokyo, Osaka, and Nagoya, near major urban and manufacturing hubs, and is owned by local power companies, either alone or in partnership with gas companies. These same companies own much of Japan's LNG tanker fleet. Five new terminals are under construction and anticipated to come online by 2015 and could add between 200 to 300 Bcf/y of capacity. (EIA Japan Analysis)

Several factors favor the use of LNG over other fossil fuels and other sources to replace nuclear energy after the 2011 earthquake. Current government carbon-abatement policies and the government's pledge to lower GHG emissions support natural gas as the cleanest fossil fuel to replace capacity. Also, gas remains cheaper than oil in contrast to the aftermath of the last major earthquake in 2007, after which fuel oil made the biggest gains from incremental demand. Destruction of coal-fired electric capacity was widespread in the area affected by the earthquake, allowing for gas to compete with coal on a cost-basis. However, Japan's higher gas demand for power and a tighter LNG global supply market over the past year has led to an overall increase in short term prices from $9/MMBtu before the crisis to over $16/MMBtu at the end of 2011.

3.3 Japan Natural Gas Pricing Mechanism

The Japanese city gas industry has developed mainly in urban areas. Originally the government regulation allowed city gas companies to run their businesses under exclusive supply franchise areas in recognition of the huge initial investment and economies of scale. In turn, they had a supply obligation to their franchise areas after the government's price setting approval that provided a reasonable price level that protected small consumers from abuse of regional monopoly power.

As of October 1998, there are 238 gas companies among which there are 68 public corporations and 170 private companies. Four city gas companies, namely Tokyo Gas, Osaka Gas, Toho Gas C and Saibu Gas dominate with a combined 75 percent market share. Most of them are vertically integrated companies to which regional monopoly is permitted.
Private Japanese firms dominate the country’s large and competitive downstream oil sector, as foreign companies have historically faced regulatory restrictions. But over the last several years, these regulations have been eased, which has led to increased competition in the petroleum refining sector. Chevron, BP, Shell, and BHP Billiton are among the foreign energy companies involved in providing products and services to the Japanese market as well as being joint venture partners in many of Japan's overseas projects. To date, Japan has taken three steps to liberalize the gas market:

The Gas Utilities Industry Law was amended in 1995. The law allowed industrial customers with contracted amounts of more than 2 million cubic meters per year to directly negotiate prices with suppliers.

The Gas Utilities Industry Law was further amended in 1999. The deregulation for large volume supply was extended by lowering the annual contract volume to 1 million cubic meters per year and over. Regulations for third-party access for the supply of large volumes of natural gas were also established.

In June 2004, the Diet passed the amended Law on the Gas Utilities Industry that stipulated that customers with the contracted amount of 0.5 million cubic meters per year could freely choose suppliers. The law was further amended in April 2007, and those customers with contracted amounts of 0.1 million cubic meters per year are allowed to choose their suppliers.

While the previous regulations limited investment in the gas sector, the reforms enacted in 1995 and 1999 helped open the sector to greater competition and a number of new private companies have entered the industry since the reforms.

04 Gas Market & Pricing Mechanism in Australia

4.1 Australian Natural Gas Demand

Australia is endowed with significant natural gas resources and has been exporting liquefied natural gas (LNG) since 1989, although gas itself plays a less important role in domestic primary energy demand with 25% in 2010/11 compared with coal (33%) and oil (36%). Renewable sources, including hydroelectricity, wind, solar, and biomass that are consumed on a lesser scale, accounted for about 6 percent of the total consumption. (Source: EIA International Statistics, June 21, 2013)

Even though Australia has experienced a steady rise in domestic natural gas consumption over the previous decade, the market for domestic consumption of gas in Australia is somewhat limited. However the government is interested in reducing carbon dioxide emissions through the use of cleaner fuels such as natural gas. Australia consumed 973 Bcf of gas in 2011, rising about 47 percent over the past decade. On average, domestic consumption has been around 70 percent of total production, although this share has dropped in the past few years as LNG sales expand. The country's industries are the major consumers of gas, with a 32 percent market share in 2010, according to Geoscience Australia. The second largest consumer is the power sector at 29 percent. The mining industry's share was 23 percent, and the residential sector's share was 10 percent. Australia implemented a carbon tax in July 2012 that is likely to
shift more electricity generation from the coal-fired to gas-fired facilities. The Australian government projects that the natural gas share of primary energy consumption will increase to 35 percent by 2035. (EIA International Statistics, June 21, 2013)

4.2 Australia Natural Gas Supply

Australia benefits from large natural gas resources; proven gas reserves amounted to 3.67 trillion cubic meters (Tcm) at end 2011 according to BP’s Statistical Review 2012. This represents more than 80 times current gas production. Australia is the second largest holder of proven gas reserves among OECD countries, behind the United States.

Around 92% of Australia’s conventional gas resources are located in the Carnarvon, Browse and Bonaparte Basins off the north-west coast. Smaller resources are also located off the south-east coast in the Gippsland, Bass and Otway Basins.

In order to meet the sharply rising demand of the domestic market, Australia plans to implement a national reservation policy that would require major LNG projects to set aside 15% of gas production for local industry and households. Domestic gas reservation has worked in Western Australia. (Australia’s Domestic Gas Security Report 2012)

4.3 Australia Natural Gas Pricing Mechanism

Energy retailers buy electricity and gas in wholesale markets and package it with network (transportation) services for sale to customers. While state and territory governments have been responsible for regulating retail energy markets before, the State Government determines the maximum retail tariffs, gas retailers may charge their small use customers. When determining retail tariffs, the Minister for Energy will take into account the amount that retailers must pay to purchase and transport the energy to their customers.

The Australian Energy Regulator (AER) is taking on significant functions under national reforms. The transition date for the National Energy Retail Law (Retail Law) varies among participating jurisdictions—Queensland, New South Wales, Victoria, South Australia, Tasmania and the Australian Capital Territory (ACT). The law commenced in Tasmania (for electricity only) and the ACT on 1 July 2012. The Retail Law aims to ensure effective protection for small energy customers—residential energy users and small businesses annually consuming less than 100 megawatt hours (MWh) of electricity or one terajoule (TJ) of gas.

Now retail gas prices are regulated only by the governments of New South Wales, South Australia and Western Australia; all other jurisdictions have removed retail gas price regulation. However, all jurisdictions have agreed under the Australian Energy Market Agreement (AEMA) to phase out retail price regulation where effective competition can be demonstrated. The AEMC is the commission responsible for monitoring competition.

In addition, joint selling by major gas producers is the single biggest barrier to competition in
WA and leads to higher gas prices. The ACCC (the Australian Competition and Consumer Commission) has intervened in the market to authorize joint selling by the North West Shelf and Gorgon producers. These authorizations expire at the end of 2015.

Australian gas prices have historically been relatively stable because of provisions in long term contracts that include a defined base price that is periodically adjusted to reflect changes in an index such as the CPI (Consumer Price Index). In addition, prices have been capped by the price of coal (a major competitor for use in electricity generation).

Domestic gas prices have sharply increased over the past few years in response to a number of factors including: the expiration of mature long term contracts; increasing domestic consumption and export demand through the development of additional LNG facilities; sustained pressure on exploration and development costs; the development of higher cost sources of gas; the expected introduction of the Carbon Pricing Mechanism; high oil prices that have flowed through to Australian LNG contracts and accentuated the gap between domestic and international (netback) prices; and increasing network charges to reflect rising capital and operating expenditures of transmission and distribution.

05 Gas Market and Pricing Mechanism in China

5.1 China Natural Gas Demand

With the development of natural gas pipeline networks, China’s demand for natural gas has rapidly increased from 24.5 bcm (67 mcm/d) in 2000 to around 130 bcm (356 mcm/d) in 2011. Overall demand is expected to continue along an increasing trend although at a lower growth rate. According to IEA’s estimation, China’s primary gas demand will rise on average by 6.7% to over 500 bcm in 2035. The gas use will grow more concentrated in the power generation and heat plants, representing around 37% of total primary gas demand in 2035. (IEA World Energy Outlook 2011)

In 2011, imports are estimated to have increased to around 31 bcm, versus a total demand of 130 bcm. Almost 30% of the total LNG imports came from Australia, while Qatar, Indonesia and Malaysia accounted for some 19%, 16% and 13% of the total LNG imports, respectively. (Source: IEA Gas Pricing and Regulation: China’s Challenges and IEA Experience)

5.2 China Natural Gas Supply

China’s natural gas production has surged from 27.2 bcm in 2000 to 96.8 bcm in 2010 and an estimated 103 bcm in 2011, with a compound average growth rate of about 14%. According to the latest evaluation of the country on oil and gas resources, China’s natural gas reserve is estimated to have reached 56 trillion cm; recoverable gas reserves have reached 22 tcm. It is mainly distributed in nine basins like Tarim, Sichuan, Ordos and Qaidam, accounting for around 84% of the total recoverable resources. (IEA Oil & Gas Security Emergency Response of IEA Countries: People’s Republic of China)

The Chinese gas market is characterized by oligopolies and monopolies in several parts of the
gas value chain with three dominating companies. China’s upstream natural gas sector is mainly dominated by CNPC, Sinopec and CNOOC. CNPC is the largest natural gas producer and supplier among them. According to CNPC, in 2009, its natural gas reserves and output accounted for around 80% of the total. It also operated around 90% of the total gas pipelines of the country. As for gas distribution, distribution companies are owned and managed by local governments, while most natural gas is delivered to some major industrial users directly by producers. Shaanxi Yanchang Petroleum (Group) Co., Ltd. is the only local oil gas enterprise which has the qualification for exploration and development apart from the Big Three.

Competition from smaller players and new entrants is therefore relatively limited, despite some recent improvement. Many enterprises with no exploration and development qualification for gas and oil, such as Sinochem Group, CITIC Resource of CITIC Group and Zhenhua Oil, have no other option than either foreign tender offering from the Ministry of Land and Resources (MLR), block transfer by companies with qualification, co-operation with one of the four enterprises or acquisition of foreign assets. If existing exploration licenses cannot be transferred to these players, their only option is residual conventional gas plus some unconventional gas, which requires technological expertise.

The midstream sector (pipeline transport and storage) can be seen as a by-product of the three big companies’ exploration, import and sales activities: the pipelines are mostly built by and in accordance to the production and import plans and sales strategies of the three big players. The West-East pipelines or the Puguang-Shanghai pipelines are good examples. In this area, like for gas production, CNPC largely dominates, and even Sinopec struggles. Access to the grid or to LNG import facilities for other parties seems rare and, if any, is based upon bilateral negotiation and agreements.

Apart from the Big Three National Oil Companies (NOCs), there are few private companies that can import gas. However, in 2006, the monopoly of import and export of natural gas previously held by the Big Three was finally ended, when ENN Energy, a private company, became the fourth company with the right of import and export gas. Nevertheless, ENN Energy did not build any receiving infrastructure, so that in the absence of third-party access, import and export rights have not been implemented yet.

In the downstream sector, a variety of domestic suppliers exist with various ownership structures. Some are private companies such as ENN Energy Holdings, China Gas, while others belong to the local government. The standard market place for these distribution companies seems to be the city gate, while direct access to sources is limited. The big three NOCs are currently trying to take over some of the domestic markets, probably in expectation of future benefits since regulated retail gas prices are expected to be increased. They are consequently trying to enter the retail sector while the local distribution companies are already present, usually supported by the local governments. These distribution companies therefore face capped end-user prices on the retail market and new competition from the Big Three. By entering the retail market, the Big Three will complete their vertical integration throughout the whole gas value-chain in several regions.

5.3 China Natural Gas Pricing Mechanism

Currently, NDRC is the major government entity monitoring the gas market and price.
However, authority is split between different ministries and agencies, while both the central and the local governments also have distinct powers. There is no existing natural gas law to define the powers of a regulator and a regulatory framework for access to infrastructure. Such a law could establish a gas market structure that would provide a reliable level playing field for all participants, and would thus ensure private investors’ confidence. It could also help to avoid progressive structural consolidation throughout the gas value-chain, and thereby ensure highest cost-efficiency through market competition while strengthening security of supply. The sooner these structural changes were imposed, the lower the level of market monopolization – and its associated welfare losses, created by monopolistic prices and sub-optimal system architecture – would be.

China’s natural gas price is determined mainly based on production costs, which is relatively low compared to other alternative energy sources. The government started a reform in December 2011 in Guangdong and Guangxi. The city gate gas price will be linked to fuel oil and LPG prices (Shanghai imported prices). This aims at liberalizing the upstream prices, in order to promote in particular future unconventional gas production. In a first stage, prices will be changed annually before moving to quarterly changes. In the long term, the natural gas price is expected to be formed through market competition, where the government will only supervise monopoly prices like pipeline transportation prices and urban gas distribution fees.

Like other energy prices, natural gas prices have been under government control in China. In the case of oil and oil products, expanding imports have pushed domestic prices closer to international market prices since China became a net oil importer in 1993. In 2007, faced with increased demand and increasing imports, the government ceased price controls for coal and began reforms towards a market mechanism base. To promote the use of natural gas use, the government has maintained a “cost-plus” based price mechanism. This has resulted in relatively cheap prices compared to international markets – particularly as a substitute for coal. The gas price mechanism was sustainable until recently (i.e. until LNG imports began in 2006) because China was self-sufficient in natural gas. However, this mechanism is now being challenged by the projected significant increase in gas imports.

06 Further Studies of Gas Market and Pricing difference in cities of selected countries

6.1 New York, USA

Natural gas unbundling is operational statewide in New York, with the exception of a few small utility companies representing less than 1 percent of residential and small commercial customers. According to the New York State Public Service Commission (NYPSC), 16 percent of residential customers purchase natural gas from marketers, which the State calls “energy service companies” (ESCOs), as of January 2010, up from the 14 percent participation in November 2008 and the 11 percent in November 2007. Only 2 percent of the State's residential customers participated in December 1999.

In August 2004, NYPSC issued two policy statements that affirmed the commission's commitment to customer choice and outlined strategies to boost participation in competitive markets.

These strategies include: opening all utility retail functions (except delivery) to competition, expanding consumer education programs, continuing the option for suppliers to have utilities
handle billing, and encouraging aggregation programs and utility-specific programs that help customers switch to third-party suppliers. In May 2005, NYPSC approved a plan by Central Hudson Gas and Electric Company to provide guaranteed savings to customers who purchase natural gas from marketers.

In 2008, NYPSC continued its efforts to accelerate the State’s transition to a competitive retail energy market and conducted a review of retail access policies. It determined that the retail market was well enough established that ratepayers should no longer pay the costs of promotional programs.

NYPSC in 2008 directed all LDCs to establish ESCO referral programs. As of December 2009, four LDCs have ESCO referral programs in their service areas that give customers the opportunity to obtain a 7-percent discount off the utility's commodity price for an introductory period when switching to an ESCO. By the fifth day of each month, ESCOs must post a snapshot of prices for residential services as of the first day of the month. Reported price offers also must include information on terms and conditions, such as the type of price offer (fixed, variable, and capped), types of payment and billing options, cancellation fees, deposit requirements, and late payment charges. (New York State Energy Plan)

NYPSC also directed LDCs to continue to give natural gas customers an opportunity to obtain information about marketers and compare energy services. Marketers must be certified by NYPSC and use standard contracts. According to NYPSC, nearly 100 percent of the State’s largest gas customers are being supplied by marketers.

The natural gas market price paid by customers is composed of three major components: the wellhead price paid to the producer, interstate gas pipeline transportation costs, and the local distribution company’s delivery charge.

As shown in Figure 1, natural gas commodity prices have shown an increasing trend with a high degree of volatility over the past 10 years. Natural gas commodity prices have ranged from approximately $2 per MMBtu in early 1999 to peaks as high as $12 to $14 per MMBtu in recent years.

![NYMEX Monthly Closing Price](image)

**Figure 1** NYMEX Monthly Closing Price

*Source: NYMEX. Monthly Closing Price.*

Retail prices include the commodity cost of natural gas and the pipeline and LDC delivery charges. Since the commodity price makes up a significant portion of the customer’s delivered

20
price, retail prices have exhibited a similar pattern of growth and volatility. As shown in Figure 9, the average delivered price of natural gas to residential customers in New York was about $8.20 per MMBtu in January 1999, climbing to $24.50 per MMBtu in August 2008, and decreasing to about $15 per MMBtu in March 2009. New York average delivered price to customers is approximately $3.00 per MMBtu higher than the national average.

6.2 Tokyo, Japan

The Gas Utilities Industries Law stipulates three principles concerning the city gas rate setting to provide a reasonable gas price that protects small consumers from monopoly power. The principles are as follows: **Price should be determined according to the cost required for providing service. Price should be based on a fair rate of return, and customers should be offered fair prices taking into consideration different usage patterns and service conditions.**

To be more concrete, the first principle indicates that reasonable city gas pricing can be attained when the following two conditions are satisfied.

\[
\text{Total revenue from gas sales} = \text{Total cost for gas supply}, \quad \text{And City gas price per user} = \text{Supply cost per user.}
\]

This means that city gas companies should offer gas prices that cover total costs while providing adequate, reliable and high quality service to its customers.

The second principle indicates that determining the rate of return should be based on appropriate management costs and revenues required for sound future development of the company. The third principle means that customers should be offered prices reflecting the difference in services and load characteristics. In other words, the third principle refers to the basis of gas pricing as a whole, meaning that fair gas prices can only be set when offered gas prices appropriately reflect the cost differences caused by the difference in service conditions. (APEC Energy Practices Natural Gas End use Prices 2001)

Between 1972 and 1995, the standard fixed ratio of equity to debt was changed from 60:40 to 30:70, reflecting the actual financial structure of city gas companies. The return on equity (8 percent) was computed by a simple arithmetic average of the following four factors: one-year time deposit rate (5.5 percent), the dividend yield to preferred stockholders (6.858 percent), the after-tax return on equity of all industries excluding the city gas sector for the five years from 1966 to 1970 (11.69 percent), and optimal dividend yield (11 percent). Until 1988, the return on equity for major city gas companies was 8 percent, and for smaller companies 8.22 percent. In 1988, the return on equity for major city gas companies was reduced to 7.2 percent and for smaller companies to 7.82 percent because of lower interest rates.

Since 1995, the return on equity has been set at the appropriately weighted 5-year average of 'the average returns on equity of all industries excluding city gas industry' as the upper limit, and 'the interest rate of public corporate bonds' as the lower limit. The return on debt is set at the average interest rate on debt of all city gas companies for the preceding year.

The fluctuation in gas resource prices is calculated on the basis of actual values in customs clearance statistics for both LNG and LPG. Arrangements have been made to avoid price hikes. Please see the table 1 of Tokyo gas rates for August 2013 based on fluctuations in gas..
resource costs and adjustment of gas rates (Tokyo District, etc.).

Table 1  Tokyo Gas rates for August 2013

<table>
<thead>
<tr>
<th>Monthly consumption volume</th>
<th>Rate A (yen/month)</th>
<th>Rate B (yen/month)</th>
<th>Rate C (yen/month)</th>
<th>Rate D (yen/month)</th>
<th>Rate E (yen/month)</th>
<th>Rate F (yen/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 20 m³</td>
<td>724.50</td>
<td>1,110.90</td>
<td>1,312.50</td>
<td>1,774.50</td>
<td>6,709.50</td>
<td>12,589.50</td>
</tr>
<tr>
<td>21 to 80 m³</td>
<td>167.30</td>
<td>147.98</td>
<td>145.46</td>
<td>143.15</td>
<td>133.28</td>
<td>125.93</td>
</tr>
<tr>
<td>81 to 200 m³</td>
<td>165.92</td>
<td>146.60</td>
<td>144.08</td>
<td>141.77</td>
<td>131.90</td>
<td>124.55</td>
</tr>
<tr>
<td>201 to 500 m³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>501 to 800 m³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>over 801 m³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Tokyo Gas Company website www.tokyo-gas.co.jp

6.3 Perth, Australia

In West Australia, gas prices are regulated jointly by Economic Regulation Authority and Australia Competition under the supervision of Australia Energy Regulator and Consumer Commission (ACCC). The pipeline tariff and distribution tariff are under government control with a maximum revenue control, while the upstream gas price is market-oriented.

The DomGas Alliance is Western Australia’s peak energy user group and represents natural gas users, infrastructure investors and prospective domestic gas producers. The Alliance promotes security and affordability of gas supply. Alliance members represent around 80 percent of Western Australia’s domestic gas consumption and transmission capacity and supply gas and electricity to 800,000 households and 200,000 small businesses.

Western Australia’s domestic gas supplies are heavily reliant on one major pipeline for shipment. The potential for greater competition is limited given the prohibitive capital costs facing new entrants. Improvements therefore need to be made to the transparency of this sector and the manner in which incremental expansions in capacity can be added.

The small businesses and householders account for around 4 per cent of the state’s overall gas consumption. Retail gas prices in Western Australia have increased sharply since 2007/2008 and are among the highest in Australia. This has coincided with the increase in wholesale gas prices (representing around 30 per cent of a residential retail bill) and a series of regulated tariff increases from the state’s household retailers.

In Western Australia, gas prices have risen sharply from $2.50 per gigajoule to as high as $12/GJ. In Queensland, gas prices have risen from $3-4 per gigajoule to $6-7/GJ. With the Queensland energy market characterized by shorter term gas contracts, the hit to local industry and households will be faster and harder than in WA. East Coast gas producers are
now talking publicly of even higher prices - up to $8/GJ (Origin and AGL) and up to $9/GJ (Santos). (Source: Australia’s Domestic Gas Security Report 2012 )

6.4 Shanghai, China

In April of 1999, Pinghu Oil-Gas Field in the East China Sea started to supply natural gas to Pudong District of Shanghai, which commenced the use of natural gas in Shanghai. In January of 2004, the First Gas Pipeline Project from West to East China started to supply NG to Shanghai and the large-scale utilization of NG commenced in Shanghai. In November of 2009, SHLNG Project, with imported LNG from Malaysia, was put into operation. In March of 2010, the Sichuan to East China Gas Transmission Project started to supply natural gas to Shanghai. In June of 2012, the Second Gas Pipeline Project from West to East China connected Shanghai and started to supply NG to Shanghai. LNG users increased substantially, and users of town gas decreased continuously in Shanghai. In 2011, the gas users totaled 7.6 million households among which the NG users totaled 4 million, users of manufactured gas decreased to 1 million and LNG users were around 2.6 million.

![Figure 2](natural_gas_utilization_from_2001_to_2012_in_shanghai.png)

**Figure 2** Natural Gas utilization from 2001 to 2012 in Shanghai

Sources: Shen Energy Group: Natural Gas Development and Utilization in Shanghai, 2012

Shanghai lacks primary energy and obtains coal and petroleum from other places. In order to use clean and efficient energy, Shanghai Municipal Government encourages the use of natural gas and made policies to develop natural gas industry in Shanghai. 14,000km Gas Pipelines including Networks along rural and suburbs, several major connection lines between the two ring Networks, urban NG Transmission and Distribution Pipelines.

The Shanghai Municipal Government Plan for Energy Development from 2011 to 2015 advocates to optimize structure of primary energy and increase ratio of clean energy. Consumption of NG plans to increase from 4.5 billion m3 in 2010 to 9 to 10 billion m3 in 2015. And the ratio of NG in primary energy will increase from 6.3% to 11%. It is predicted that Shanghai will need 9 to 10 billion m3 of NG in year 2015. (Shen Energy Group: Natural Gas Development and Utilization in Shanghai, 2012)

Upstream price and cost of major pipelines connecting to the Shanghai Gate are regulated by
NDRC, while retail price and pipelines within the city are regulated by SHDRC. Shanghai Gas Group is the major gas seller in Shanghai, which is also a state owned company belonging to the Shanghai Administrative Committee of State Owned Companies. The price is firmly controlled by the local government.

6.5 Comparison of Pricing in selected cities

Through comparison of natural gas price in four selected cities (see table 2 for details), it is easy to find that Shanghai’s natural gas price is the lowest both in residential area and non-residential areas. It is because Shanghai uses most of natural gas purchased from domestic market and also because Shanghai purchases LNG from Malaysia at a relatively low price at a long-term contract.

It is also obvious that residential gas price is much lower than non-residential gas price in Shanghai, while the price of residential gas price is relatively higher in other selected cities. The reason for this is Shanghai Pricing Bureau regulates the gas price not only according to the cost-plus profit mechanism, but also according to the affordability of different styles of ender-users. The cost of distribution of natural gas to residential users is higher than that of non-residential users, however the residents are regarded as sensitive to price adjustment and consumption of natural gas is regarded less of flexibility. In Shanghai, it is very common to subsidize the residential users by the non-residential users both in gas price and the prices of other utilities.

### Table 2  End-user gas prices in selected cities, 2013

<table>
<thead>
<tr>
<th>city</th>
<th>Industry</th>
<th>Public Services</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>8.28</td>
<td>8.32</td>
<td>11.57</td>
</tr>
<tr>
<td>Tokyo</td>
<td>38.86</td>
<td>42.65</td>
<td>51.26</td>
</tr>
<tr>
<td>Perth</td>
<td>34.64</td>
<td>34.64</td>
<td>50.33</td>
</tr>
<tr>
<td>Shanghai</td>
<td>15.03</td>
<td>16.86</td>
<td>11.42</td>
</tr>
</tbody>
</table>

Note:
1. Prices have been converted from CNY/m3 to USD/MBtu using an average annual conversion rate between currencies. NG 1 m3=35700BTU 1 RMB=6.13 USD.
2. As Tokyo and Perth natural gas price is digressively structured, we chose the average price of monthly consumption of 200 cubic meters as an example for public services users and 1000 cubic meters monthly consumption for industrial users. Residential consumption data is the average annual consumption per household in the region from relevant government website announcing statistics.

Source: Shanghai gas price from SHDRC website, Tokyo Gas group, Alinta Energy, New York State Energy

A single comparison of gas price among selected cities doesn’t reflect the real consumption power of people in different countries. In order to give a clearer picture about the gas price, we compare the annual gas cost via the disposable income per household (see table 3 for details). Through the comparison, it is shown that Shanghai gets the lowest percentage of gas cost via disposable income per household, which means Shanghai residential users spend less than other cities. There are two reasons: one is they consume less gas, and the other is the price of natural gas is relatively lower than others taking their income into consideration.
### Table 3 Residential gas cost and comparison with selected cities, 2011

<table>
<thead>
<tr>
<th>City</th>
<th>Gas price (USD/MMBTU)</th>
<th>Gas consumption per household (MMBTU)</th>
<th>Gas cost annually per household (USD)</th>
<th>Disposable income per household (USD)</th>
<th>Gas cost/disposable income</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>12.73</td>
<td>83.8</td>
<td>1,067</td>
<td>55,246</td>
<td>1.93%</td>
</tr>
<tr>
<td>Tokyo</td>
<td>51.26</td>
<td>13.71</td>
<td>702.96</td>
<td>54,975.39</td>
<td>1.28%</td>
</tr>
<tr>
<td>Perth</td>
<td>50.33</td>
<td>10.48</td>
<td>527.46</td>
<td>46,420.2</td>
<td>1.14%</td>
</tr>
<tr>
<td>Shanghai</td>
<td>11.42</td>
<td>7.17</td>
<td>81.89</td>
<td>12,985</td>
<td>0.63%</td>
</tr>
</tbody>
</table>

Note: prices have been converted from CNY/m3 to USD/MBtu using an average annual conversion rate between currencies. NG 1 m3=35700BTU; 1000KWh=3.412MMBTU; 1 RMB=6.13 USD; 1 AUD=0.9102 USD

Source: Shanghai gas price from SHDRC website, gas consumption and disposable income from Shanghai Statistic Bureau. The information of other cities is also from website of relevant government entities.

Pricing is not only price but also closely related to pricing forms. Through the following comparison (see table 4 for details), it is obvious that many cities covering all the cost of natural gas from production to distribution. Only Shanghai does not cover all the costs. The pricing formula is not clear the Shanghai in gate price and in different end user prices. It is a weighted price rather than a price with clear structure. In addition, the pipeline cost is not clearly defined in the cost of natural gas. When the price is not sufficient to cover all the cost, the government usually subsidizes the natural gas indirectly, for example not the whole pipeline construction fee is reflected in the cost.

In addition, Shanghai natural gas is a single price. It is easy to understand, but not able to cover all of the fixed cost like capital investment of pipelines. Some of the investment is not reflected in the price. The gas price of residential users in Shanghai has to be adjusted after hearing and a complicated procedure of reporting, therefore it usually takes more than two years for the gas companies to adjust the price. However, in other selected cities it is easier to adjust the gas price and usually on an irregular basis.
Table 4  Pricing Forms in selected cities

<table>
<thead>
<tr>
<th>City</th>
<th>Parts of cost</th>
<th>Pricing Form</th>
<th>Time Period for adjustment</th>
<th>Linked with oil</th>
<th>Regulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>All the cost</td>
<td>Price for Basic volume + consumption volume; digressive</td>
<td>Anytime</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Tokyo</td>
<td>All the cost</td>
<td>Price for Basic volume + consumption volume; digressive</td>
<td>Three months</td>
<td>linked</td>
<td>Yes</td>
</tr>
<tr>
<td>Perth</td>
<td>All the cost</td>
<td>Price for Basic volume + consumption volume; digressive</td>
<td>Once a year</td>
<td>Not closely linked</td>
<td>Yes</td>
</tr>
<tr>
<td>Shanghai</td>
<td>Not all the cost</td>
<td>Single price</td>
<td>Uncertain</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Sources are from website of relevant government entities and relevant gas companies.

07 Key challenges in pricing and regulatory reform in China's gas market

7.1 Overview

We notice that there are different types of pricing mechanism existing in the world, some are linked with oil and some are deregulated or basted on market price. China belongs to the fourth type of pricing mechanism that is strictly regulated. Ten years ago, the gas market in China is mainly self-sufficient, but now China is becoming more and more dependent on imported gas. Now the LNG gas is the major source of imported gas in China, and LNG pricing mechanism has significant impact on domestic gas market in China. In addition, China is facing challenges including dealing with more expensive imports, unconventional gas production, and avoiding cross-subsidies between large users and residential users. Also the pricing structure, whereby the upstream and pipeline tariffs are regulated based on a cost-plus approach and differ depending on the end user must be changed. Inefficient investments along the gas value chain, from upstream, import infrastructure to midstream (pipelines and storage) is essential to ensure a timely and safe development.

In China, utility prices are highly regulated by the government, which causes inefficiency and high cost. With a view to attain sustainable development, China is approaching deregulation of utility price. We have studied the current pricing reform happening in Guangdong and Guangxi provinces. These reforms are not successful currently, but are meaningful to gain experience. Shanghai Energy Exchange Market is also a pilot project Chinese government learns to liberalization of the natural gas price.

7.2 LNG Pricing Systems

There are two pricing systems co-existing in the global LNG trade. One is famously called the “S-curve” linked to oil, commonly used in the Asia-Pacific basin, and the other is based on the competitive market prices of natural gas, used in more flexible LNG trading in the Atlantic basin.

Typically S-curve pricing formula is expressed as:
S-curves are intended to reduce price risks by mitigating the impact of either rapidly rising or falling oil prices. The sellers need to have some form of price floor, protecting their liquefaction projects from oil price collapse. As a trade-off, buyers want upside protection. Floor and ceiling prices can be set to offset such risks. In actual contracts it is more common to change the slope, which represents the oil-gas price relationship, above and below certain price levels.

The other LNG pricing system is based on natural gas market prices. During the 2000s LNG trade expanded rapidly in the Atlantic market. International oil companies (IOCs), which had liquefaction plants in Trinidad and Tobago, Nigeria and other countries as well as terminals in Europe and North America, started flexible LNG trading based on schemes called “arbitrage” and “self-contracting”.

These IOCs took marketing risks and started selling the re-gasified gas from LNG (in many cases, via pipeline) directly to the final consumers in North America and Europe. Since LNG cargos going into the UK and the US had to compete with other pipeline gas, they were priced based on Henry Hub and NBP prices. (Source: IFRI: Decoupling the Oil and Gas Prices 2011)

7.3 Key challenges in natural gas pricing in China

Chinese Natural Gas pricing is tightly regulated by the government. LNG price is based on contract and usually set according to the S-Curve pricing mechanism. The domestic upstream gas price and the pipe line tariff are controlled by the central government, while the end-user gas price is regulated by local governments. The pricing issue is by far the most important issue as it interacts with all the other aspects. This includes dealing with more expensive imports, incentivizing future unconventional gas production, and avoiding cross-subsidies between large users and residential users. Also the pricing structure, whereby the upstream and pipeline tariffs are regulated based on a cost-plus approach and differ depending on the end user must be changed. Incentivizing efficient investments along the gas value chain, from upstream, import infrastructure to midstream (pipelines and storage) is essential to ensure a timely and safe development.

Chinese gas industry is characterized by an oligopolistic structure dominated by three companies. In most parts of the gas value chain, other players have limited roles. The gas industry needs a clear regulatory framework; this can be compromised by overlapping powers from different agencies and from the central and local governments.

Some of the issues faced by China regarding gas are not new, but as Chinese gas demand reached over 130 billion cubic meters (bcm) in 2011 (CNPC Research Institute, 2012), making it the fourth largest gas market in the world, they have become more acute and could represent obstacles to further demand growth. The 12th FYP aims at doubling the share of gas in the primary energy demand, which means almost doubling gas demand by 2015 from the 2011 consumption level.

China’s current price regime for domestic natural gas comprises three elements: (A) ex-plant price; (B) transportation tariff; and (C) end-user price (Wu 2008). Both (A) and (B) are under the control of the central government, while (C) is under the control of the local government of each province. (A) is determined principally on the production cost of natural gas
(wellhead cost plus purification fee, including financing cost and tax) plus the appropriate margin for producers (IRR 12%). (B) is determined based on the pipeline cost (construction and operation) plus the appropriate margin (IRR 12%) with the variation of transport distance from each gas source to each city gate. The city gate price is (A) + (B). These are fixed prices and can be reviewed as being within 8% of former prices, but not regularly (in fact, the price increase has been implemented on an ad hoc basis and sometimes more than 8%). Each provincial government determines (C) by taking into account the distribution cost, alternative fuel prices and other market policy factors. With regard to gas imports (at present, only LNG to Guangdong), end-user prices are remote from government control and are determined according to import prices.

The issues regarding gas pricing levels are multiple, ranging from the rapid increase of procurement costs of imported gas to the resulting widening gap between domestic gas and imported gas prices and the difficulty to pass through the cost increase to the final end-user and make gas-fired plants competitive in the power sector. While some issues such as the lack of a market-based approach, the low level of regulated residential gas prices are not new, the divergence between prices for different gas supply sources really gained significance over the past two years. China is becoming increasingly import dependent, while costs of imported LNG and pipeline gas have sharply increased.

As China becomes increasingly import dependent, a widening gap has therefore appeared between city gate prices from different sources, in particular between that from cheaper domestically produced gas and more expensive imported pipeline gas from Turkmenistan and LNG (new contracts as well as spot LNG). For example, city gate prices at Shanghai are estimated to range between USD 8/MBtu (for gas from domestic sources transported through the first West-East pipeline) and USD 13/MBtu (for Turkmen gas imports) and even USD 17 to 18/MBtu for spot LNG imports as of end 2011.

This widening gap will become even worse in the next four years with increasing volumes of imported gas. Turkmen imports accounted for 4 bcm in 2010, and increased to 15.5 bcm (12% of total gas demand) in 2011 and are expected to further increase as the contract states 40 bcm. CNPC has been said to be losing money on Turkmen imports (CNY 1/m3 according to press reports, which would equate to CNY 15.5 billion for the year 2011. Spot LNG has also become very expensive (USD 17/MBtu) due to a combination of increasing oil prices and LNG markets tightening after Fukushima. Meanwhile, new sources of LNG such as Australian LNG expected to start by 2014 to 2015 are unlikely to be cheap given the high capital costs of these projects (and possible delays would make them even more expensive). Keeping city-gate gas prices low will keep the distortion between the different sources of gas and could slow future increase in gas imports. (IEA Gas Pricing and Regulations: China’s Challenges and IEA Experience)

Chinese gas prices in end-user market are not low. They are high compared to end-user prices in some OECD countries, notably the United States where industrial gas prices were at around USD 5/MBtu in 2011. A key issue is lower residential end-user gas prices, which are regulated, and often kept low to avoid triggering high inflation rates. As can be seen in Table 4, residential prices are usually the lowest compared to industry, commercial, power and transport sectors. This reflects cross-subsidization in order to protect residential consumers. Increases of residential gas prices are done through public hearings on a local basis, so that reforms decided by the Central Government could fail to be implemented locally. Some regional residential prices are also lower than the corresponding price of imports, creating
losses along the gas value chain since the costs of transport, distribution and storage cannot be appropriately covered. This situation is the opposite of what can be observed in many OECD countries, where residential users usually pay higher prices than other users (excluding the specific social tariffs to protect the poorest). This cross-subsidization among gas users can also distort the market’s reaction to fuel prices and in the case of China could be counterproductive for gas use in the industry and commercial sectors (see table 5 for details).

### Table 5 End-user gas prices in selected Chinese cities, 2013

<table>
<thead>
<tr>
<th>City</th>
<th>Industry</th>
<th>Public Services</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>12.98</td>
<td>12.98</td>
<td>10.42</td>
</tr>
<tr>
<td>Tianjin</td>
<td>12.79</td>
<td>12.79</td>
<td>10.05</td>
</tr>
<tr>
<td>Chongqing</td>
<td>10.24</td>
<td>10.46</td>
<td>7.86</td>
</tr>
<tr>
<td>Shi Jiazhuang</td>
<td>13.48</td>
<td>13.48</td>
<td>10.97</td>
</tr>
<tr>
<td>Tai Yuan</td>
<td>12.57</td>
<td>12.57</td>
<td>9.60</td>
</tr>
<tr>
<td>Shanghai</td>
<td>15.03</td>
<td>16.86</td>
<td>11.42</td>
</tr>
<tr>
<td>Nanjing</td>
<td>13.48</td>
<td>13.48</td>
<td>10.05</td>
</tr>
<tr>
<td>Ningbo</td>
<td>17.59</td>
<td>17.59</td>
<td>12.79</td>
</tr>
<tr>
<td>Guangzhou</td>
<td>---</td>
<td>---</td>
<td>15.76</td>
</tr>
<tr>
<td>Shenzhen</td>
<td>---</td>
<td>---</td>
<td>15.99</td>
</tr>
</tbody>
</table>

Note: prices have been converted from CNY/m³ to USD/MMBTU using an average annual conversion rate between currencies. NG 1 m³=35700BTU 1 RMB=6.13 USD Source: Magazine of China Energy Price Association, March 2013.

Affordability is very important, but while keeping residential gas prices at lower levels compared to other categories gives the opportunity to these customers to consume gas, it also encourages inefficient use of gas, forces the government or companies to bear the losses and can potentially result in industry or power generators lacking access to gas, as gas demand is still supply-driven in China (and expected to remain so in the next five years). Such a system can backfire by creating lower industrial output and lead to public dissatisfaction. There are actually many differences between sectors and regions. In the industry and residential sectors, the alternatives are expensive oil products, so that it should be possible to increase gas prices given current oil prices levels. While domestic consumers in general could afford an increase of their gas bills, an increase of gas prices to the industry and commercial sector would have an overall impact on all prices including essential products such as food.

Finally, the key sector is power generation, where gas competes against coal. Regulated and capped power prices make it difficult to pass through high gas prices unless there are regional shortages. This issue must be addressed for gas demand to increase in this sector and to play its role in meeting the flexible-and peak-times of electricity demand and to curb coal demand growth. This will require infrastructure and markets to be flexible to accommodate such demand fluctuations. The environmental benefits of gas as well as its flexibility should be recognized in the pricing system, which therefore imposes reforms in the electricity sector to be performed in parallel.

### 7.4 The new pricing reform of natural gas in China

The recent pilot pricing reform (see appendix 1 for details) indicates a move towards a netback pricing and away from a cost plus regulated approach. Under the new system, city-gate prices would be linked 60% to fuel oil and 40% to liquefied petroleum gas. These linkages reflect the competitors of gas in the industry and household sector respectively, but
fail to take into account the competition against coal. These prices are those of Shanghai (customs data), raising the question of when the reform would reach this specific market. The ultimate goal of this reform is to liberalize ex-plant gas price and pave the way for more wholesalers involved in the upstream market.

At the same time, Chinese companies and policy makers have shown growing interest in creating a hub in Shanghai that would be based on the Shanghai city gate price, when the NDRC reform is extended to Shanghai.

The Shanghai Petroleum Exchange (SPEX) introduced LNG trading in December 2010. But until recently, volumes were relatively low (400 tons per day during winter and 200 tons per day during summer). Most of the LNG comes from CNOOC’s Shanghai LNG terminal. In the summer of 2012, SPEX launched a natural gas peak-shaving spot trade, covering early July to mid-September. It aimed to ensure supply to gas-fired power plants during the summer period. It is also an opportunity for companies to get rid of expensive contracted LNG, which could not be sold otherwise. Companies such as Petro China, CNOOC, Shenergy Group and Xinjiang Guanghui were to put 100 million cubic meters (Mcm) on the trading platform, again mainly from LNG. Such an experience is unlikely to affect significantly the Chinese gas market, which has annual volumes 1 000 times higher. Depending on the results of the summer trading, SPEX may decide to have a winter trading. Nevertheless, this experiment – instituted just a few months after the NDRC launched pilot price reforms – demonstrates a willingness to move to market prices and, at the least, promises to provide opportunities for participants to experiment with trading.

Over the past decade, this reform has started to create a more market oriented oil and gas sector, including the state-owned companies. But this reform stopped at some crucial elements for the gas market, and is still characterized by a patchwork of targets and strategies, institutions and companies as well as regulations and practices. The gas market has a fragmented and monopolistic structure, regulation of prices at different stages based on a cost-plus approach, lack of access for small, medium-sized and foreign companies to existing infrastructure and thus markets, and a lack of a clear, efficient and transparent regulatory framework as well as diffuse and overlapping regulatory authorities.

08 Conclusion and Suggestions

8.1 Conclusion

Liberalization aims to let markets adequately determine the natural gas price while ensuring reliable gas supply. OECD countries are at different stages of liberalization, the most advanced being the United States and the United Kingdom.

The policy framework for natural gas needs to provide clear signals for both market investors and participants. This is usually achieved through gas-related laws giving the development objectives for the gas industry as part of the countries’ energy sector. The laws often determine the parts of the infrastructure to be regarded as natural monopolies which will then subsequently become subject to regulatory oversight.

America and Australia have often a regulator in place to regulate access and tariffs of the natural monopoly parts of the gas market in order to prevent for the abuse of market power. These regulators often look after both electricity and natural gas markets. In case of
substantial domestic production, a separate regulator dedicated to oil and gas upstream issues may exist.

Setting an adequate network charge is crucial to promote both competition and network investments. OECD experience distinguishes two main methodologies: the cost-plus and the incentive-based regulation. Additionally, cost regulation limits the allowed revenues to avoid cross-subsidization and also to prevent abuse of market power.

The key aim of gas market liberalization is to let markets adequately determine the price of gas delivered from suppliers to customers while ensuring reliable gas supply. Economic theory and experience from countries with liberalized markets suggest that liberalization requires openness of the gas sector as a whole, from licensing and exploration in the upstream sector to trade and transportation to the final customer.

This openness ensures a reasonable level of competition between gas-supplying companies, lifting if necessary any pre-existing monopolistic supply structures. Amongst IEA member countries, the United States and Canada were the first to liberalize gas markets in the late 1970s, followed much later in the 1990s by some European IEA member states, notably those belonging to the European Union. By contrast, liberalization is still at very early stages in Turkey, Japan and Korea. The European Union, as a region, has been the last IEA region so far to turn to market openness and competition.

Open markets can prevent monopolistic behavior, which is typified by profit maximization through producing fewer goods and selling them at higher prices than would be in the case under Open markets tend to reveal market-oriented prices, to maximize the use of existing capacity, and to facilitate efficient and timely scale-up of infrastructure. The existing inefficiencies of monopolistic markets are often referred to as “deadweight losses”.

Experience shows that open gas markets do not evolve automatically, but require policy action and the creation of a stable and transparent policy framework under which the market can then transform. Liberalization of any gas market is largely driven by governments and then by the appointed regulatory authority.

The question of the interdependence of liberalization of power and gas markets is an important one, as the power sector has often proven to be one of the key drivers for gas demand, and the absence of power market liberalization can affect the evolution of gas consumption. Experience differs widely; in the European Union, the liberalization of power markets has usually been a step ahead of gas markets, while in the United States, liberalization of the power sector is at different stages in different states.

Depending on the market situation, especially the countries’ general experience with (private) companies’ investments and engagement, but also on the dominance of the incumbents, the market growth, import dependency and market transformation can be a lengthy process and the outcomes are not always comparable.

8.2 Suggestions

**Improve Government’s Role:** The government’s role should be clearer and easier to operate. Some specific tasks in upstream and downstream can be left to regional governments (as happens in the United States between FERC and state regulators), as long as the division of
roles and duties is clear. More workable plans and more detailed policies are needed. USA and Australia markets are usually guided by white papers and gas-related laws, which constitute a clear policy framework giving the government’s policy objectives regarding natural gas development and providing the basis for investors and market participants. They set the development objectives for the gas industry and the rules regarding infrastructure regulation, and/or domestic gas production and the entities (ministries, regulators) in charge of overseeing different parts of the gas value chain. Such policy documents should be consistent, and in China not limited to the government’s Five Year Plans.

One of the key lessons is that liberalization takes time, usually a decade, before reaching any quantifiable results. Given China’s objective of rapidly increasing gas demand, the accent should be put on liberalizing the upstream sector, introducing wholesale prices, which also implies introducing third-party access to transmission pipelines, and developing infrastructure.

Select Proper Pricing Index: The pricing challenge is the most important to be addressed as pricing issues have knock-on effects in the whole gas value chain. Additionally, the gap between domestic gas prices and import prices requires this issue be tackled rapidly as China is set to become increasingly import dependent over the coming decades.

The United States moved to a market-based system combined with third-party access to pipelines. The NDRC of China has already engaged a pricing reform in two provinces taking a netback approach based on oil products priced indexation. China needs to think whether oil is appropriate as being the only linkage to be used in the formula. Oil products are pertinent when it comes to residential/commercial use and also for some industry, but coal is also an important competitor to natural gas, notably in the power generation sector. This implies a careful choice of the coal index to be potentially used in the formula (import cost or another index should be transparent, reliable and not based on governmental prices) as well as of the weighting given to coal in the formula. China could implement the NDRC reform progressively, province after province, to test such indexation in provinces where the share of coal generation is particularly high.

Have more Openness in Gas Market: Experience from selected countries shows that market openness was a critical element to start liberalization. This usually begins with the largest gas users, which became eligible to choose their supplier. This was facilitated by TPA to pipelines. While opening markets to large users is essential to competition, many markets in selected countries took a longer time to introduce this for residential users. Even many countries with fully open markets still limit switching and show a strong preference for regulated gas prices. Opening markets to small gas users may therefore not be regarded as a priority by China. However, China can learn some experience from selected countries, where markets are opened to the whole sailors and gradually to big users step by step.

Have more Transparency in Policy Making and Monitoring: Availability of information is critical at all stages. This applies to basic information regarding the market (supply, demand, and imports), access to the infrastructure (access and tariffs, capacity available), as well as wholesale prices. Currently Chinese government is approaching to open the cost and price information to the public. In this procedure, there are a lot of things to do, such as establishing relevant pricing laws and regulations, standard of performance and quality, and expert teams or independent technical supporting agencies. Most important is the regulator should be more independent from the government and from the operators. In order to achieve this goal, a
series of laws and regulations guiding the pricing regulatory behavior are preconditions to privatization and deregulation. It is difficult procedure and requires reallocation of interests between private sectors and state-owned sectors, but this procedure will definitely benefit the whole wellbeing of China.
Appendix1: China Natural Gas Pricing Reform

There have been many different proposals to tackle the pricing issue over the past few years; one of which was to increase the ex-plant price by CNY 1.5/m³ (USD 6.3/MBtu) compared to the current average of CNY 1.15/m³ (USD 4.8/MBtu), but this has not been pushed forward. End December 2011, the NDRC announced the start of a pricing reform in Guangdong and Guangxi, but this reform is actually different: the system is based on a netback approach rather than a cost-plus approach. The reform is so far limited to these two regions. Guangdong is a relatively large consuming area with over 10 bcm consumption, while Guangxi is a small market with a demand of less than 1 bcm. Guangdong sources its gas from offshore domestic production, LNG and started receiving Turkmen gas through the second West-East pipeline at the end of 2011 as well as LNG truck imports from neighboring provinces.

Under the new system, city-gate prices would be linked 60% to fuel oil and 40% to liquefied petroleum gas (LPG). These linkages reflect the competitors of gas in the industry and household sector respectively, but fail to take into account the competition against coal. These prices are those of Shanghai (customs data), raising the question of when the reform would reach this specific market. The formula takes calorific differences into account, and includes a 10% discount to promote gas use. The system plans for an annual increase in a first stage before moving progressively to quarterly changes. Although this change is not expected to result in a price increase in the short term (prices in these two regions are already among the highest in China), it should ultimately result in price increases when the first change occurs. Monopoly activities should remain regulated.

Such a reform raises questions on how fast it will be expanded to other regions, how quickly there will be a move towards quarterly price changes and how high the regulated price will have to be to allow for a desired level supply-side delivery and competition. Some answers were already given by the announced plan in July 2012 to extend the reform to Shanghai as well as to Sichuan, which will start receiving Turkmen gas in 2013.

The ultimate goal is to liberalise ex-plant prices and pave the way for the development of unconventional gas based on market prices, which in practice means that there will be many sellers and buyers trading in an open wholesale market. This implies to move the reform to those regions that depend more on domestic supply. Additionally, given that the netback approach covers the cost of producing and bringing gas to the market, defining a price for transportation for third parties will become imperative in order for them to get the appropriate revenues from their gas. Finally, the reform does not define the level of end-user prices, but encourages establishing upstream and downstream mechanism through hearing. Seasonality and the cost of storage are not included in the netback calculation. This is imperative to avoid seeing local distribution companies getting squeezed by having to purchase more expensive gas while being unable to pass through these cost increases. The Guangdong and Guangxi Price Bureaus supervise the local sales prices and should explore and establish a stepwise gas tariff.

Source:(Source: IEA Gas Pricing and Regulations: China’s Challenges and IEA Experience)
Reference

USA
5. “Short-Term Energy Outlook U.S. Natural Gas Consumption”, Published by EIA, Available at http://www.eia.gov/forecasts/steo/report/natgas.cfm

JAPAN

AUSTRALIA
12. “Australian Gas Resource Assessment 2012” author are Marita Bradshaw and Lisa Hall of Geoscience Australia, Alan Copeland and Nina Hitchins of the Bureau of Resources and
13 “Energy in Australia 2012” available at:
18 “Economics and Industry Standing Committee: Inquiry Into Domestic Gas Prices”
19 Published by the Legislative Assembly, Parliament of Western Australia, Perth, and March 2011.
20 Available at: www.parliament.wa.gov.au

CHINA
23 “Gas Pricing and Regulation: China’s Challenges and IEA Experience”, published by International Energy Agency, authors are Anne-Sophie Corbeau, Dennis Volk, Jonathan Sinton, Julie Jiang Jiang Ping, Tammy Teng, Li Boshu and Yue Fen, available at http://www.iea.orgs
25 “Natural Gas Policy Trends in China, published by IEEJ (the Institute of Energy Economics, Japan)”, authors are Li Zhidong, Visiting Researcher, IEEJ and Professor Nagaoka University of Technology, published in May 2013, available at http://eneken.ieej.or.jp
27 “Australia-China Future Dialogues”, published by Griffith University, Brisbane, on 4 July 2013, available at http://www.griffith.edu.au


