



# Stories of Coal Phase-Out: Lessons learned for China

IISD REPORT



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## Stories of Coal Phase-Out: Lessons learned for China

August 2016

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## Acknowledgements

The authors gratefully acknowledge the financial support of the Energy Foundation China.



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# 1.0 Introduction





## 1.0 Introduction

The G20 Summit in Hangzhou on September 4–5, 2016, was first one to follow the December 2015 Paris Agreement that set new ambitious climate goals. Meeting the climate change challenge requires a significant shift in countries' policies. While each country's situation is unique, international forums such as G20 and United Nations Framework Convention on Climate Change (UNFCCC) meetings at the country leader, minister and working levels offer a platform to exchange experiences and lessons learned.

China has been playing a proactive role in both the G20 process and international climate negotiations with a keen interest in learning from other countries in order to support its own energy transition. The Intended Nationally Determined Contribution (INDC) that China submitted to the Paris process details the climate action plan, which supports an emissions peak around 2030 and includes reduction of the total coal consumption. The 13th Five-Year Plan, published in March 2016, includes plans for a cap on coal-based generation, as well as targets for renewable energy, energy efficiency and carbon intensity. China's energy shift challenge lies now in implementing these ambitious goals at both the national and provincial levels.

This briefing note offers a summary of several countries' experiences implementing energy policy shifts in an area of particular interest to China: the transition away from coal to cleaner fuels and a low-carbon economy. Using the International Institute of Sustainable Development's (IISD's) "window of opportunity" framework (Harris, Beck, & Gerasimchuk, 2015), these case studies are analyzed in terms of the four critical elements of success: context, champions, concerns and complementary policies. In the second part of the briefing note, we apply the same framework to China's own experiences in phasing out coal around Beijing. The briefing note aims to assist policy-makers, the expert community, media and all others interested in the lessons learned that countries can exchange and benefit from international experience, including within the G20 and UNFCCC processes.

### 1.1 The Stories of Coal Phase-Out

Coal phase-out implies several interlinked policies: the shut-down of coal mines, an exit from coal-fired electricity generation, government-driven divestment from coal, and removal of government subsidies to the industry as well as public finance to coal both domestically and abroad. These policies can be rapid or gradual, and sometimes they are part of much broader energy sector developments, including, for instance, transition from a planned to a market-based economy in Eastern Europe (Suwala, 2010).

The selection of the case studies in this briefing is determined by just one consideration: the authors felt that these stories are worth telling. Bringing them to the attention of the international audience adds their experiences to the stories that are more widely known and well-documented, such as Germany's *Energiewende* (Heinrich Boell Stiftung, 2013) and the experiences that IISD has analyzed in detail: reform of the coal sector in Poland (Suwala, 2010) and the complete phase-out of coal-fired electricity in Ontario (Harris, Beck, & Gerasimchuk, 2015). Hence, this briefing reflects on the experiences of:

- California's phase-out of coal-fired generation and import of coal-based electricity
- Denmark's phase-out of coal fired electricity
- France's phase-out of coal mining, coal-fired generation and public finance for coal
- The phase-out of coal mining and coal-fired electricity generation around Beijing in China.

In the conclusions section, we summarize lessons learned not just from the four cases described in the briefing, but from the broader literature.

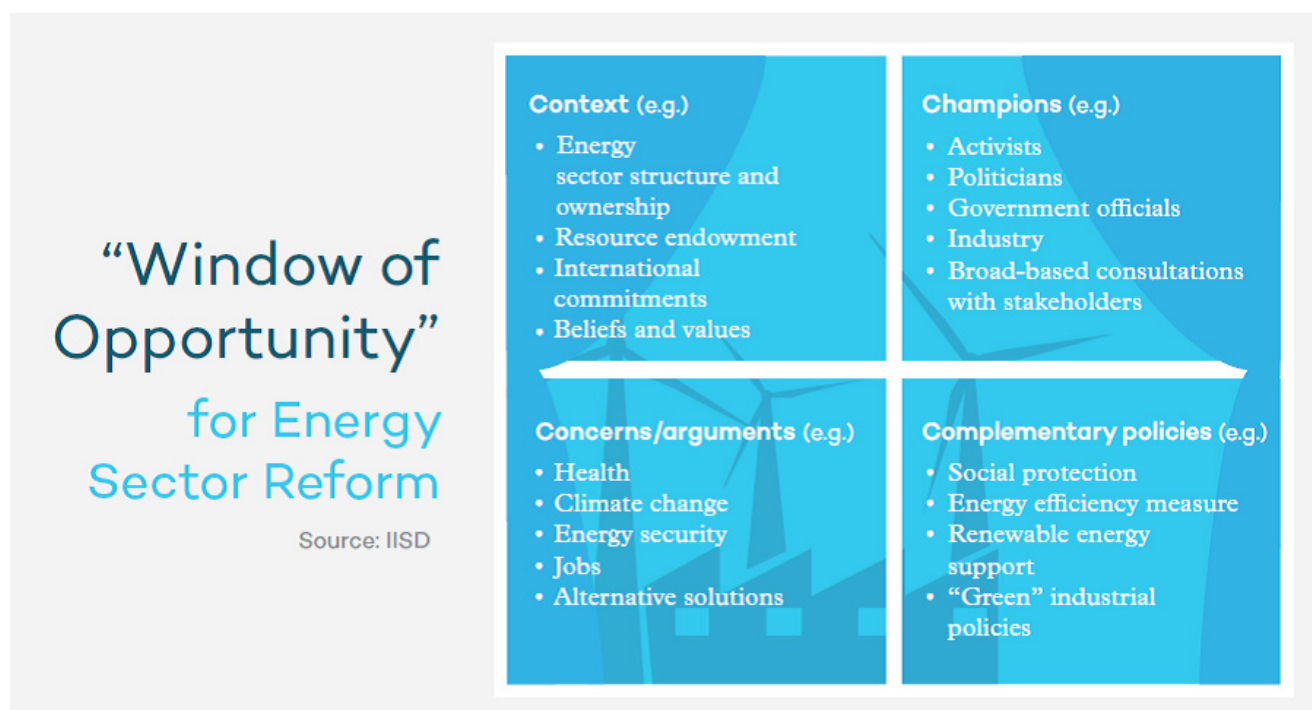
### 1.2 The "Window of Opportunity" Framework

IISD has developed a "window of opportunity" framework that helps to encapsulate the conditions required for reform to be successful (Harris, Beck, & Gerasimchuk, 2015), as illustrated in Figure 1. There are four dynamics that influence reform in the energy sector (though the framework can be applied to other sectors too):



- **Context:** What is the structure and ownership of the energy sector? What is the national resource endowment? What international commitments have been made? What are the national beliefs and values with regards to energy and the environment?
- **Champions:** Who are the politicians, government officials, industry representatives, activists and stakeholders that can promote the reform process, as decision-makers or stakeholders?
- **Concerns/arguments:** What are the concerns about, or arguments for and against, reform with respect to health, climate change, energy security, jobs and alternative solutions?
- **Complementary policies:** What policies exist or should be put in place to support reform in areas such as social protection, energy efficiency, renewable energy support and green industrial policies?

The argument is that, with the proper conditions in each of these four “window panes,” reform can be successful. This is borne out in a review of existing success stories, as highlighted below.



An aerial photograph of a city, likely Los Angeles, showing a dense residential area in the foreground with many houses and palm trees, and a city skyline with several skyscrapers in the background. A large blue triangular overlay is positioned on the left side of the image, containing the text '2.0 International Examples' in white.

# 2.0 International Examples



## 2.0 International Examples

### 2.1 California

Nature of reform: phase-out of coal-fired electricity generation in-state and phase-out of coal-fired electricity imports to California

Period: from 2006 to 2025 (expected) (California Energy Commission, 2015a)

#### 2.1.1 Context

California's energy sector structure easily lent itself to coal phase-out. California does not have recoverable coal reserves (U.S. Energy Information Administration, 2015). From 2000 to 2007, California already had a very small percentage of overall in-state generation coming from coal at roughly 1.5 to 2.5 per cent, between 3,183 and 4,269 gigawatt hours (California Energy Commission, 2015b).

California and Californians have a long-standing culture of being “green and innovative.” California was one of the first states in the United States to develop and launch a carbon cap-and-trade system. It was understood very early in that process that the cap-and-trade system would look to reduce emissions in the electricity sector, which serves as another motivator to move away from coal. Most influential was the passage of AB 32, the Global Warming Solutions Act of 2006, which required by law that California reduce its greenhouse gas (GHG) emissions to 1990 levels by 2020 (Air Resources Board, 2014), driving a wide range of emission reduction activities, including a shift away from coal electricity. The first scoping plan in response to AB 32 explicitly states that “divest from coal-fired power plants” is a component of efforts to reduce GHG emissions (California Air Resources Board, 2008).

The coal phase-out plan has at its core Senate Bill 1368, which was the key piece of legislation supporting the phase-out as it set the emissions standard for baseload generation at 1,100 lbs of carbon dioxide per megawatt-hour (MWh). This bill effectively serves as a ban on new coal generation unless it employs carbon-capture technology (California Energy Commission, 2006). The California Energy Commission first introduced the policy in 2005 (Chang, 2007). The California State Assembly has also approved a bill that would order state employee funds to divest from companies that make a majority of their revenues from coal electricity. The move could redirect up to USD 240 million in pension assets away from coal interests, while the overall value of these pension funds is estimated to be nearly half a trillion U.S. dollars (Timmer, 2015).

#### 2.1.2 Champions

Then-governor Arnold Schwarzenegger and State Senate president pro tempore Don Perata served as champions of California's coal phase-out, with Perata sponsoring and Schwarzenegger signing SB 1368 in 2006. Schwarzenegger himself became known as a champion of climate action at the time, indirectly acting as a champion on the move away from coal. In response to this clear legislative direction, utilities have actually accelerated their move away from coal-based generation ahead of schedule, and several utilities and power generators sponsored SB 1368, including PG&E, Southern California Edison, Calpine and Constellation. Environmental organizations were also a part of the champion's alliance in this process, including the Natural Resources Defense Council, which sponsored the legislation. Upon signature by Schwarzenegger, he remarked, “This bill will protect California consumers from hundreds of millions of dollars in extra costs by requiring utilities to place their long-term bets on clean energy sources” (Ralph, 2006).

#### 2.1.3 Concerns and Arguments

Motivation for action on climate change was very high at that time, with AB 32 and the Western Climate Initiative driving action domestically. The emission reduction policies in place in California are credited with





providing significant motivation for the phase-out in California (California Energy Commission, 2015a). As indicated above, most coal power in California prior to the phase-out was imported as well so there is a security benefit.

Air quality, and its impact on health, is also an ongoing concern in California. An annual study by the American Lung Association called *State of the Air* ranks the most polluted cities in America based on ozone, year-round particle pollution and short-term particulate pollution. For perspective on California's air quality situation (American Lung Association, 2016):

- Six of the seven most polluted cities by ozone are in California.
- All of the seven most polluted cities by year-round particle pollution are in California.
- Six of the top nine most polluted cities by short-term particle pollution are in California.

Motivation to improve California's air quality and get off the "worst air" list is a driving factor for a shift to renewable energy in the state (Pettit, 2014). While coal-fired generation is a small contributor to air-quality challenges compared to transport sources, a shift to renewable energy will lead to air quality improvement.

### 2.1.4 Complementary Policies

A suite of other green policies, including continued expansion of renewable energy, has accompanied California's coal phase-out. The U.S. Environmental Protection Agency's Clean Power Plan has led, as expected, to accelerated retirement and conversion of existing coal-fired plants in California (California Energy Commission, 2015a), although the impact will likely be higher on electricity imports, rather than in-state generation. Since California had little investment in domestic coal generation, the issue of compensating investors for stranded assets also did not come into question.

## 2.2 Denmark

Nature of reform: phase-out of coal-fired electricity generation

Period: ongoing since 1990s, to be completed by 2030, potentially 2025

### 2.2.1 Context

The speed with which coal was replaced with renewable energy, particularly wind, is remarkable. Coal accounted for 83 per cent of Denmark's electricity generation in 1994 and 34 per cent in 2014 (Energistyrelsens, 2015). In 2011 as part of its energy strategy, Our Future Energy, Denmark committed to completely phasing coal out of Danish power plants by 2030 (The Danish Government, 2011).

Most of coal used in Denmark's electricity and district heating sector is imported. Historically, the shift to clean energy and energy efficiency has been driven by energy prices and security dating back to the 1970s (Danish Energy Association, n.d.).

Another driver of coal phase-out in Denmark is the country's commitment to emission reductions within the European Union (EU). As part of the EU commitment Denmark has pledged to reduce GHG emissions by 40 per cent by 2020 relative to 2005, including a commitment to reduce GHG emissions from the sectors not covered by the European Union Emissions Trading System by 20 per cent (Danish Energy Agency, n.d.).

### 2.2.2 Champions

The Government of Denmark, through various leaders and ministers, has been a champion of clean energy transition and climate change, with major commitments to wind energy, climate change emissions and fossil fuel subsidy reform. The vibrant pro-climate civil society and Denmark's successful wind industry has also helped champion the reform.



### 2.2.3 Concerns and Arguments

The issue of climate change in Denmark serves as the primary argument for the development of cleaner energy sources. Denmark was the host for the 15th UNFCCC Conference of the Parties (COP 15) in 2010, where world leaders reached the Copenhagen Accord, which included many countries taking on emission reduction targets for the 2020 time frame. Denmark has also been a global leader in efforts to reform fossil fuel subsidies as a way to reduce GHG emissions, supporting its reputation for action on clean energy (IISD, 2015). Energy security is also a motivating argument, as the majority of coal used in Denmark is imported (Andrei, 2014).

### 2.2.4 Complementary Policies

Substantial support for Denmark's efforts move away from coal derives from its support for renewable energy. Denmark has committed to making 100 per cent of its energy supply renewable by 2050, with a short-term target of 50 per cent of electricity consumption by 2020 (Danish Energy Agency, n.d.). Already, on days of favourable conditions, Denmark has seen that its wind capacity can provide over 100 per cent of energy needs (Nelsen, 2015). Energy-efficiency measures are also planned as a major way to meet increasing demand in the future (The Danish Government, 2011).

Energy-efficiency programs and measures are also intended as a way to assist energy users with the transition to a green economy by helping them adjust to higher prices for fossil fuels (resulting from the removal of fossil fuel subsidies). Job creation is also projected in the renewable energy sector, which will help to offset job loss related to fossil fuel use (The Danish Government, 2011).

## 2.3 France

Nature of reform: 1) phase-out of coal mining; 2) phase-out of public finance to coal

Period: 1960s–present

### 2.3.1 Context

Coal used to play an important role in French economy and society. In the mid-20th century the industry produced 60 million tonnes of coal and employed 150,000 people. At its peak, the industry employed over 300,000 miners (Lichfield, 2011). In the immediate post-World War II time frame, the industry was nationalized and was projected to produce 65 million tonnes of coal per year (Laan, Beaton, & Presta, 2010). The political decision to end coal mining completely in the mid-1990s was highlighted by the economics of the coal industry, where domestic coal was costing more than three times as much as imported coal. This process actually started in the 1960s when coal production targets were reduced and coal mines began to close. Significant effort went into investment, economic development and worker retaining to assist in the transition away from coal production for workers. Demand for domestic coal fell further due to the combination of increased price disparity with cheap imported coal and heavy investment in nuclear energy in the 1970s (Laan, Beaton, & Presta, 2010). An agreement was reached in 1994 to close all of the remaining mines.

In addition to its domestic action on coal production, France has also taken action to reduce coal generation internationally. In order to align its domestic and international strategies, France also announced that it was ending supports and investments in coal generation internationally (Littlecott, 2015b; Barbière, 2015). While there has not been a formal moratorium on new coal generation, there is no intention of building new facilities (Littlecott, 2015c).

France has also moved away from coal as an energy source overall. With the domestic mining industry closed, all coal used was imported and no longer supported domestic jobs. Between 2010 and the end of 2015, France reduced its coal-fired electricity generation by 60 per cent as a result of plant closures. In 2014, coal



represented only 2 per cent of electricity generation, a figure that is now even lower given additional closures in 2015 (Littlecott, 2015a). This shift away from coal generation is driven in no small part by international climate commitments, including within the EU. As the host of the COP meeting in December 2015, an event where world leaders discussed climate change, and particularly reduction of GHG emissions, the spotlight was on Paris to take action on climate change. In response to this pressure, the government, among other policies, committed to reducing consumption of fossil fuels by 30 per cent by 2030, and get 32 per cent of energy from renewable sources (Climate Change News, 2014). France is also subject to the EU's INDC to the UNFCCC of a 40 per cent reduction in GHG emissions by 2030 compared to 1990 (Council of the European Union, 2015).

### 2.3.2 Champions

The government started the move away from coal (at least production) as far back as the 1960s, so the list of those who championed the cause is lengthy and spans generations. Cooperative dialogues between levels of government (national, regional, local), the European Commission, trade unions and the state authority (Charbonnages de France) were credited with managing the phase-out and worker transitions as part of broad reforms (Laan, Beaton, & Presta, 2010). But there has also been criticism over the fact that the phase-out of production took so long. More recently however, President Hollande, Environment Minister Royal and the broader Socialist government that came to power as a result of 2012 elections have been credited as champions of the move away from coal, not only domestically, but also internationally (Littlecott, 2015c). In addition, financial institutions BNP Paribas, Societe Generale, Credit Agricole and Natixis are credited for efforts in restricting financial support for coal mining and coal power generation (Littlecott, 2015c).

### 2.3.3 Concerns and Arguments

Analysis has shown that there is little in the way of market drivers for new coal power in France (Littlecott, 2015a), highlighting that the economic arguments for new power do now support greater coal generation. The arguments against domestic coal production have also been highlighted, mainly that it is uneconomical compared to imported coal and dependent on subsidies staying in place.

Health arguments were not a factor in the desire to move away from domestic coal production and have not been identified as a main driver of the shift away from the use of coal for energy generation; climate change is a stronger driver. The impacts of climate change can have negative health-related consequences, but these have not been singled out as a motivator for phasing out coal.

### 2.3.4 Complementary Policies

From the 1960s to the 1990s, a series of programs were negotiated and implemented to assist workers transitioning out of the coal-production sector. This culminated in 1994 when the government negotiated a substantial aid package with unions and came to an agreement where miners would be paid 85 per cent of their salary until their 45th birthday and 80 per cent thereafter until normal retirement age, while keeping health and social benefits (Lichfield, 2011).

To replace coal in the coal mix with cleaner power, France has supported deployment of renewables and energy-efficiency measures. France has also set a target to increase the share of energy from renewable resources in gross final energy consumption to 23 per cent by 2020 (Ministère de l'écologie, de l'énergie, de développement durable et de la mer, 2009). Measures to promote energy efficiency include, for instance, zero interest loans that support energy-efficient home improvements (Carbon Brief, 2014) as well as new efficiency rules for building codes (Schüle, et al., 2013).

# 3.0 Beijing Coal Phase-Out





## 3.0 Beijing Coal Phase-Out

Nature of reform: shut-down of coal mines and coal-fired plants around Beijing

Period: 1997–present

### 3.1 Progress of Beijing's Coal Phase-Out

One of the challenges that the Beijing authorities are confronting now is pollution control. Coal is the most carbon-intensive fossil fuel, a major contributor to fine particulate matter (PM<sub>2.5</sub>) and other air pollutants. Phasing out coal is one of the critical steps that the Beijing government has identified in its determination to fight environmental pollution, improve the quality of people's lives and transition to low-carbon growth. Beijing is on its way to phase out coal and has achieved remarkable results.

In 2014 Beijing closed the power plant owned by China Datang Corp, one of the four biggest coal-fired power plants in Beijing. Shortly after, in March 2015, power plants owned by Guohua Electric Power Corp. and Beijing Energy Investment Holding Co. were also closed. China Huaneng Group Corp.'s 845 megawatt power plant will close in 2016. The closures mean reducing annual coal use by 9.2 million metric tonnes, cutting carbon emissions by about 30 million tonnes, and reducing sulfur dioxide, nitrogen oxide and dust by 10,000, 19,000 and 3,000 tonnes, respectively.

After the phase-out of coal-fired facilities, four heating and power cogeneration centres were established, providing heating and electricity needs for each city. The cogeneration centres will add clean power capacity representing 25 per cent of the city's total electricity load. Replacing Beijing's coal-fired power generation with natural gas is optimizing the city's energy structure, cleaning the heating and electricity systems, and improving the efficiency of energy supply.

Beijing's coal mines are mainly located in the Fangshan and Mengtougou areas, west of the city. Before 1997, there were more than 1,363 state- and country-owned coal mines in Beijing that serviced 11 townships and a population of 180,000. Coal mining operations showed disorder and safety challenges, as accidents were happening frequently (coal.com.cn, 2003). From 1997 to 2012, following the government's closure policy on closure, readjustment and reorganization of coal mines, 1,150 small mines were shut down, and only 15 per cent of mines were allowed to operate, resulting in a dramatic change in the coal mining structure. After 2007, Beijing had only a few coal mines remaining, which were soon to have mandatory closures. By June 2010, Beijing had banned, abolished and closed all kinds of illegal, unsafe, and inefficient small coal mines in its jurisdiction. Nationally, China had planned to close more than 2,000 smaller coal mines from 2013 to the end of 2015, but Beijing has already completed its allocated quotas in advance (Wang, 2014).

In the areas of abandoned mines, the local government is investing in ecological recovery projects, planting trees in some surroundings with suitable conditions. During the 12th Five-Year Plan period, the government has made more efforts to rehabilitate those disused, closed and abandoned coal mines in order to improve the conservation of water and ecosystems. Some workers from the closed coal mines were transferred to the new jobs created by the ecological rehabilitation projects.

Like most northern areas in China, Beijing has plenty of heating and industrial coal-burning boilers. Since 1999, the local government has mobilized financial resources to retrofit these coal-burning boilers by replacing them with natural gas in order to reduce emissions. As of 2015, within the fifth ring of the city, there are no more coal-burning boilers, and it is expected that all coal-burning boilers will be retrofitted by 2016 in the greater Beijing region as an action required by the air pollution control measures.

Since 1998, Beijing has started to reduce coal consumption in the total energy consumption mix. Besides replacement of coal-burning boilers, the government took specific measures to phase out energy-intensive, highly



polluting enterprises and implement coal-to-electricity projects for residents both in cities and rural areas to reduce coal consumption (Wei, 2015). By 2012, Beijing reduced coal use by 7 million tonnes. As a result, coal consumption in Beijing has dropped to 23 per cent in 2013 in the energy consumption mix, compared with 47 per cent in 2000 (National Bureau of Statistics of China, 2013). In 2014 consumption dropped below 20 per cent. Beijing has set up a cap for total coal consumption by 2017: cutting coal consumption by 13 million tonnes and decreasing the share of coal consumption by lower than 10 per cent of the total energy consumption structure. While coal use declines, Beijing is encouraging broader use of gas, solar and wind, and it is hoped that 90 per cent of energy consumption by 2017 will come from those renewable energy sources.

Applying the analytical framework developed by IISD, the progress of Beijing's coal phase-out will be analyzed from the four key elements: context, champions, concerns and complementary policy. It aims to understand the major driving forces that push the changes of the energy system from the social and political perspectives.

## 3.2 Context

### 3.2.1 Environmental Pollution and Economic Development

China's transition has been marked by the highest rate of growth in gross domestic product (GDP) ever seen. China's rapid economic development model is not sustainable according to many observers (Zhang & Crooks, 2012). If measured only by GDP, China's economy grew by 422 per cent from 1990 to 2008. When China's economic performance is assessed against the Inclusive Wealth Index (IWI) which takes into account natural capital (e.g., forests, fisheries, fossil fuels, minerals and agricultural land), the Chinese economies only increased by 45 per cent from 1990 to 2008 (United Nations University International Human Dimension Programme & United Nations Environment Programme, 2012). China's development is challenged by environmental degradation and ecological damage. In 2003, the total cost of air and water pollution in China was CNY 362 billion, about 2.68 per cent of GDP for the same year (World Bank, 2007). It is reported that air pollution might have caused about 1.2 million premature deaths in China in 2010 alone and Beijing has registered a 60 per cent rise in lung cancer cases in the past decade (The Lancet, 2012).

The central government has called for a change of developing pathways: going green and building ecological civilization became the guiding principals for China's future development. Local governments are required to take concrete measures to adjust economic structures, optimize resource usage and protect the environment. This shift of development path and transition toward a low-carbon economy drives Beijing to practice new development ideas by adjusting the energy structure to solve the severe pollution issues that have been a barrier for further development. Coal phase-out obviously is one of the major steps for Beijing to address the environmental situation.

### 3.2.2 Emission Reduction Targets and Actions

During the 12th Five-Year Plan period, the quantitative tasks of emission reduction of major air and water pollutants were allocated to local governments for implementation, and the environmental indicators are linked to local officials' performance and promotion. Later in 2013, the Chinese government issued air and water pollution control action plans, respectively, and each identifies 10 priorities for which local governments have to work out suitable and effective measures to control pollutants and to minimize the environmental and social damages caused by pollution.

Even though there are different results and arguments regarding the major sources of  $PM_{2.5}$  in Beijing, many agreed that  $PM_{2.5}$  and other air pollutants emitted from transportation and vehicles, coal burning, industrial processing, construction dust and other sources are at the top of the listed sources. Research released by the Chinese Academy of Science indicates that coal burning is one of the major sources for  $PM_{2.5}$  and other pollutants in Beijing, accounting for 22.4 per cent of  $PM_{2.5}$  and more on many days. After Beijing won the right to host the winter Olympics in 2015, the local government promised to reduce  $PM_{2.5}$  emissions by 45 per cent against the 2012 level by 2022. To reach this target, changing the coal-dominated energy structure by reducing



coal consumption and phasing out coal have been the top solutions, and shifting toward a clean energy system is the inevitable choice for the local government.

### 3.2.3 Adjusting the Position of the Capital

Beijing once was positioned to function as multiple centres of the nation, including political, economic, cultural, financial and industrial centres, as well as the hubs of the national transportation and information systems, meaning that heavy industries and energy-intensive sectors were the important components of the city's economy. Along with rapid urbanization, urban sprawl and increasing population, the capital was like a huge construction zone, consuming lots of steel, cement, glass and energy. According to the statistics, the population in Beijing reached 21.516 million in 2014, with 86.4 per cent of the population living in the city (Beijing Statistic Bureau, 2015).

To deal with the disadvantages and pollution that the mega city is confronting, the local government redefined Beijing's position and decentralized its functions. The government reiterated Beijing's position as China's cultural, political, international exchange, and science, technology and innovation centres and weakened its leading role in the nation's economy by excluding this function from the adjusted urban orientations. Following the new city planning, Beijing has moved out, closed down and transferred some heavy and energy-intensive industries, and the government will no longer approve the new sectors and businesses that do not fit the capital's functions. Meanwhile, the economic structure of Beijing is transitioning from the industrial-dominated model to a service-industry dominated one, with tertiary industry accounting for 80 per cent of the economy (Beijing Statistic Bureau, 2015). This transformation makes no room for high-carbon and polluting industries to survive and strongly supports the actions that phase out heavily energy-intensive sectors, such as the coal industry, in Beijing. As the majority of its population is working for the service industry, Beijing's coal phase-out would have limited impacts on employment.

### 3.2.4 Impacts of Special Events on Coal Phase-Out

During the course of Beijing's coal phase-out, it is worth mentioning the impacts of the two important events, the Olympics and the Asia-Pacific Economic Cooperation (APEC) summit, on energy reform in Beijing from the views of social development and an enabling political environment.

When preparing for the Olympics—following the themes of green, technological and humanitarian Olympics—the local government was determined to use this opportunity to green the city and to improve the environmental quality by integrating environmental, technological, economic, regulatory and administrative measures. For the Beijing Olympic games, 57 local laws, regulations and standards relevant to improvement of air quality were issued by the local government beginning in 1999, and investment for the environment increased to CNY 26.6 billion in 2008 from CNY 10.1 billion in 1999 (Ma, Liu, & Liang, 2010). The local government invested in environmental infrastructures such as waste-to-resources, city parks, green lands and environmental monitoring systems. The public transportation system was also upgraded using clean power. By the end of 2007, Beijing modified small coal-burning boilers and remodelled heating stoves through the coal-to-electricity project for more than 300,000 households in the city (Greenpeace, 2010). These efforts significantly enhanced the capacity of environmental governance for the different levels of governments.

Research indicated that air quality in Beijing did improve as a result of the hard work for the Olympics. Days with better air quality in the urban areas significantly increased compared with 2000 in Beijing, and mean air concentrations of major pollutants such as sulphur dioxide, carbon dioxide, nitrogen oxide and PM<sub>10</sub> were all reduced (Wu et al., 2010). The most important contribution of the green Olympics for Beijing is the all-round public involvement in the greening movement, which improves people's environmental awareness and creates an enabling social environment for behavioural change toward the environmentally friendly lifestyle and consumption model. It has laid a foundation for accelerating the coal phase-out process and is making remarkable progress in controlling the environmental issues.

In 2014, when the APEC summit was held in Beijing, extremely strict pollution control measures gave the city



a rare breath of fresh air for a week. Residents even created a new term, APEC blue, to describe the wonderful days with good air quality during the summit. These temporary measures included limiting the number of cars on the road, granting leave to people working in certain types of institutions, reducing production and shutting down factories, and suspending coal-burning in factories and firms. Without questioning whether these measures were useful in the long term, temporarily, APEC blue did last several days until the end of the conference.

Research conformed that during the APEC,  $PM_{2.5}$  in Beijing decreased by 40–62 per cent compared to no policy actions and measures (Beijing Environmental Protection Bureau, 2014; Wei et al., 2015; Liu et al., 2014). The efforts contributed by surrounding provinces in Hebei and Tianjin also played a role in decreasing the pollutants. For example, total  $PM_{2.5}$  concentrations during the emission-control policy period were reduced by 26 per cent and 39 per cent in Shijiazhuang and Tangshan, respectively (Wei et al., 2014), and major pollutants in other regions reduced 30 per cent (Liu et al., 2014). Among the measures, suspending burning coal and industry production contributed to reductions of sulphur dioxide, nitrogen oxide,  $PM_{10}$  and  $PM_{2.5}$  by 207, 374, 168, and 97 tonnes, respectively. Observations also indicated that the APEC blue measures improved the air quality, as polluted days decreased (Liu et al., 2015).

APEC blue demonstrated that air quality in Beijing would be improved by introducing integrated emission reductions, prevention measures and joint actions by Beijing, Tianjin, Hebei (Jing-Jin-Ji), as well as other regions (Wu et al., 2010). After the APEC summit, officials were concerned about how to retain the APEC blue permanently, and the government was convinced that pollution could be mitigated by a certain degree by taking strict, integrated and effective measures and actions. The public's demand for translating APEC blue to a permanent Beijing blue places higher pressure on the local government and officials, and this would be a major driving force for the government to input more effort and resources and to take more progressive actions pushing forward the reforming of the fossil fuel-dominated energy system.

### 3.3 Champions

Unlike coal phase-out in other countries, under the Chinese political system no champions would lead Beijing's coal phase-out movement and play a key role in pushing the decision-making process, since both the central and local governments are active actors and players during the course of coal phase-out. Clearly, there are two different levels of governance systems involved in Beijing's coal phase-out. On the central government level, policies and regulations on banning small coal mines, capping coal consumption and environmental protection provide a strong support for Beijing's coal phase-out.

#### 3.3.1 Policy Support from the Central Government

Several policies from the central government are directly linked to Beijing's coal phase-out, and these policies guide local governments to work out concrete measures to realize the goals and targets of controlling energy-related emissions and minimizing the negative impacts of energy reform.

First, a series of policies on industrial adjustment and energy conservation and emission reduction measures were issued by the State Council and the National Development and Reform Commission (NDRC), and jointly announced by relevant governmental agencies. This included phase-out of outdated capacity and production overcapacity enterprisiers; approval of large, efficient and advanced coal-fired power plants; improvement of energy efficiency in sectors; and innovation of clean technologies and productions, etc. These policies helped save coal consumption through efficiency improvement and structure adjustment.

Second, policies on coal mine safety and monitoring rules, merger/reorganization of coal mines and closure of small-size coal mines were issued by NDRC and the National Energy Agency (NEA). These policies address the major challenges that China's coal industry is confronting now, such as low centralization, wasting of resources, environmental pollution, disordered mining and frequent industrial accidents. For example, closures of coal mines with annual output of no more than 90,000 tonnes, ending approval of construction on coal mines with





annual capacity of less than 300,000 tonnes, and disapproval of coal mines with annual capacity of less than 900,000 tonnes and with potential risks. For the healthy development of the industry, coal mine enterprises are required to continue with mergers and acquisitions to reduce the number of old, unsafe mines; to improve work safety; and to protect the environment. The closure and merger policies not only accelerate the adjustment of coal industry structure, but also force outdated coal mines to phase out and help relieve the condition of coal production overcapacity.

Third, the government published a series of environmental regulations to enhance actions to control pollution in the nation. In 2013, the State Council released an Air Pollution Prevention Action Plan that identifies 10 key measures to control air pollution. In 2014 six governmental agencies jointly released detailed measures and actions to implement the air pollution control plan; meanwhile, six provinces and seven governmental agencies formed a coordination group to lead and guide the actions of air pollution control. In order to deal with heavy smog and improve air quality,<sup>1</sup> those policies emphasized the importance of energy conservation and emission reductions, energy efficiency, reform of energy structure and development of renewable energy.

Additionally, polices for a coal consumption cap directly support coal phase-out. The State Council issued the Energy Development Strategy Action Plan (2014–2020) in November 2014, which clearly put forward China's energy development targets to 2020, adopting coal consumption reduction targets and reducing the proportion of coal consumption in the key economic development regions in Beijing-Tianjin-Hebei-Shandong, the Yangtze River Delta and Pearl River Delta regions. NDRC and relevant departments issued Interim Measures for Coal Consumption Reduction Replacement Management in Key Areas in December 2014, which highlights that key cities should set a cap for coal consumption for the sake of air pollution control, typically those for which air quality is ranked in the top 10 worst in the country. These cities should reach a negative consumption of coal in total amount compared with the previous year (NDRC & NEA, 2015).

Fourth, a financial support policy was introduced to support the upgrading of facilities and to minimize the social impacts of structure change and air pollution control actions. To implement the air pollution control plan, the government invested CNY 10 billion in 2014 to implement the plan, and special reward measures were designed to support outdated and production overcapacity enterprisers to phase out the market. NDRC and Ministry of Finance introduced preferential measures on finance and taxation to support the upgrade of the safety technologies of the merged coal enterprises. To protect those workers who were affected by the merger, acquisition and phase-out of coal mines, funds were allocated to train workers, to support their social security and pension, and provide opportunities for self-employed and self-dependent innovation.

### 3.3.2 Local Government Implementation Measures

On the provincial level, local governments responded to central government policies by taking specific measures to put these polices into practice. Under the Chinese governance system, Beijing and other provinces set up similar institutions to implement the superior authorities' policy while making local policy or action plans.

In 2012 Beijing officially released a document, the 2012–2020 Beijing Air Pollution Control Measures, to identify the priorities of actions to control air pollution. This document sets up specific targets for emission reductions: compared with 2010 levels, by 2015, Beijing was to cut  $PM_{2.5}$ ,  $PM_{10}$ , total suspended particles, sulphur dioxide and nitrogen oxide emissions by 15 per cent; by 2020, all the major pollutants will be cut by 30 per cent from the 2012 levels. This action plan specifies concrete measures that different sectors would practice for reaching the emission reductions targets, including emissions disclosure, clean energy and coal consumption caps, industrial structure adjustment and government accountability.

Furthermore, in September 2013, the local government launched a new document to direct the air pollution control actions, the *Beijing Clean Air Action Plan 2013–2017*. This interim plan aims to reduce  $PM_{2.5}$  emissions by 25 per cent compared with 2012 levels by 2017, controlling  $PM_{2.5}$  at the level of 60  $\mu\text{g}/\text{m}^3$ . This policy identifies eight pollution-control projects to implement emission source control and energy structure

<sup>1</sup> On December 12, 2014, NDRC and other ministries issued a temporary plan for replacement and reduction of coal consumption in the key regions.



adjustment. Later, the local government assigned 84 key pollution control tasks to different sectors and enterprises to carry out under the supervision of the authority administrators, along with an input of CNY 770 billion to support the efforts on fighting air pollution.

Pollution control in Beijing would not succeed without collaborative actions in the Jing-Jin-Ji region, other provinces and integrated pollution control plans. At this end, the local government uses the opportunity of the Jin-Jin-Ji cooperated economic region initiative to push forward air pollution actions by reaching several agreements and cooperation mechanisms with other regions. For example, a cooperated committee was formed to guide the cooperation and coordinates the regional actions. Beijing supported Langfang and Baoding with CNY 0.46 billion and Tianjin funded Cangzhou and Tangshan to the amount of CNY 0.4 billion for collective pollution control actions with Hebei.

The local government committed to strong financial support for pollution control and coal phase-out, with subsidy measures and incentive policies being put in place. For industrial coal-burning boilers, the government increased the financial subsidies by investing in 30 per cent of the total retrofit project. For coal-to-electricity projects, the government subsidized each project for 30 per cent of its investment, and the municipal electricity company covers the rest of the cost. For households, the government bore two thirds of the total cost if residents bought clean stoves that use high-quality coal.

### 3.4 Concerns/Arguments

When heavy smog hit the majority of the nation in 2013, it resulted in broad public participation in discussions about air pollution. This was unusual in the history of the environmental movement in China. Accordingly, from January 1 to March 31, the websites of the three mainstream media outlets (SINA, SOHU, and TENCENT) received more than 600,000 comments on the blogs discussing pollution from residents in Beijing (Beijing Economic Information Net, 2013). The public across the nation expressed their worries about the impact of heavy smog on health, and they were concerned about the solutions to the problem, China's future development and environmental change. The discussions lasted more than three months and provided a real opportunity for the general public to educate themselves and improve their awareness of environmental protection. Using social media, the public voiced their strong demands for a clean environment and a decent life, showing that people cared about the changing environment and that they wanted to become an important part of the environmental movement in China.

Over the past three decades, there have been great improvements in the economic and material lives of Chinese citizens as a result of the nation's economic growth. However, economic improvement alone cannot buy the happiness of the Chinese people, as they are concerned with more than just economic well-being. An online survey with more than 3,000 participants from across the nation indicated that 83.3 per cent of respondents were not satisfied with the air quality of their living areas, and 86.3 per cent reported that their lives were very seriously affected by environmental pollution (SINA.COM.CN, 2013).<sup>2</sup> Evidence also indicates that the Chinese public's welfare measured by life satisfaction is decreasing as air pollution gets more severe. Many Chinese believe that high economic growth is achieved at the expense of the environment and natural resources, but this is not a sustainable strategy in the long term. They believe that it is equally important for the government to prioritize economic growth and environmental protection and that this policy priority is for the sake of more balanced development for the nation and the quality of life of the public.

In 2015, during the National People's Congress and the National Congress of the Communist Party, a poll conducted through the Internet on air pollution control measures attracted 13,778 participants. Among the different air pollution control measures, participants were asked to choose the most effective ones in their opinion. Participants thought that closing heavily polluted enterprises (26.44 per cent), reducing coal consumption and using more clean energy (22 per cent) and increasing afforestation ratio (20.4 per cent) are the three most effective measures for controlling air pollution (Xinhua News, 2015) The result may imply that the Chinese public would have a positive attitude toward the energy reform and coal phase-out.

<sup>2</sup> This survey ended on May 1, 2013.



### 3.5 Complementary Policies

China has been the world's largest GHG emitter since 2007, and it is experiencing the negative impacts of climate change on social and economic development. Therefore, mitigation and adaptation to climate change have emerged as important issues that China needs to address while pursuing sustainable and healthy economic development. Over the past decade, China has actively taken measures in various fields to tackle climate change. For example, the National Climate Change Plan (2014–2020) puts forward China's main objectives and key tasks to address climate change before 2020. In June 2015, the Chinese government submitted its INDC to the UNFCCC and committed to reaching its GHG emission peak by 2030. By then non-fossil fuel energy will account for 20 per cent of the energy mix, and carbon dioxide emissions per unit of GDP is expected to decrease by 60–65 per cent compared with 2005 levels. The climate policies repeatedly stress the key role of greening the energy sector to mitigate climate change. Among the measures to address climate change, improving energy conservation and energy efficiency, optimizing energy structure and developing renewable energies have significant potentials to reduce China's coal consumption and improve coal-use efficiency.

Following the Nation's 12th Five-Year Plan, Beijing's energy consumption per 10,000 CNY-GDP will have decreased by 17 per cent compared to the year 2010, there will be a clear reduction of the carbon emission intensity, and carbon dioxide emissions per 10,000 CNY-GDP will decrease by 18 per cent compared to the year 2010. Beijing introduced a market-based mechanism that is considered as the cheapest, most effective measure to implement the emission reduction targets. As one of the seven carbon market pilots in China, Beijing officially operated the carbon cap-and-trade system in November 2013, covering industrial sectors, power and building sectors. Companies emitting 10,000 tonnes of carbon dioxide annually, directly or indirectly, are mandated to report and verify their emissions under the rules, and companies consuming 2,000 tonnes of standard coal per year are regulated to participate in the carbon trading market voluntarily.

# 4.0 Lessons Learned for China





## 4.0 Lessons Learned for China

The experiences of coal phase-out internationally and around Beijing provide several insights for China's policy goal of capping coal use and shifting to a lower-carbon economy nationwide. Each country's circumstances are unique, yet there appear to be several patterns worth noting.

In terms of context:

- Reform design as well as its chances of success are heavily determined by the resource endowment as well as existing production and consumption patterns. Most of the successful examples of coal phase-out come either from the jurisdictions that have little or no coal reserves (California), or have considerably depleted them over time (France, Germany, mines around Beijing).<sup>3</sup> In these cases, coal phase-out is assisted by energy security and trade balance policies that seek to reduce dependence on imported fuels. The coal depletion factor becomes increasingly topical for China as well since, if China's coal reserves continue to be extracted at the current rate, the country will run out of domestic coal before 2050 (ChinaDialogue, 2016). This consideration makes coal phase-out a plausible policy change in China.
- Notwithstanding all domestic policy complexities, international clean air regulations and climate change commitments can be very important drivers for coal phase-out. For France and Denmark, the governments' climate commitments in the EU and active role in UNFCCC played an important role. Green standards of the International Olympic Committee also determined cleaner air policies in Beijing. In this sense, countries can "domesticate" their international climate commitments and China can use its active international role in G20 and international climate talks to facilitate coal phase-out domestically.

In terms of champions:

- No reform happens without its champions. In the reviewed examples, these champions come from both within and outside governments, even including the public when it demands changes to current policies. Certainly, political leadership at the high level is a key ingredient for reform, but this must be backed by support at the local and grassroots levels. It is also important to engage business stakeholders that, if not completely supportive, must at least be willing to work with government on reforms. Many reform experiences have also shown that consultations with stakeholders have also been critical for building motivation and support for reform. China's champion for coal sector reforms is the central government and, in particular, NDRC, which has a long-term vision of energy policy. NDRC will strongly benefit from engaging with various potential reform champions at all levels.

In terms of concerns and arguments:

- If health and/or climate change concerns are prominent within the country, these can serve as drivers for reform. In particular, health and local pollution concerns have been very prominent drivers of coal phase-out in Beijing and Ontario. Air pollution and its negative health implications are a critical concern for many other cities in China, as they are undermining people's well-being and the economy on the long-term basis. Therefore the pressure will grow for a nationwide coal phase-out and other cleaner energy solutions in China. In both Denmark and France, climate change has been a major motivation to shift away from using coal to generate electricity.
- Having a strong domestic market in one or more alternative energy solutions can also be a benefit. The prospect of green jobs to emerge from an energy sector transition can assist in driving reform. China has a large renewable energy sector that, provided it overcomes its own growth pains, can substitute for coal in the energy mix, as in the example in Denmark and other countries.

In terms of complementary policies:

- Barriers to reform need to be addressed through complementary policies to support reform. First of all, these policies should include aid packages for people and regions that rely on the coal industry. Experiences in Denmark and France suggest that a gradual transition, support for workers and a package

<sup>3</sup> In some cases, such as France, resources may remain, but are not economically competitive to extract.



of policies widely negotiated with and co-designed by different stakeholder groups can be possible, although France's example has been extreme in this case and highlights how this progress can drag out if not carefully managed. In an ideal scenario, new jobs can be created in a low-carbon sector of the economy. Beijing's coal phase-out suggests that a comprehensive policy package is required that fits local realities and situations. This package should include clear goals, suitable timetables, efficient financial supports, available technologies and broad public participation. Once designed, the policy package has to be put in place and implemented appropriately.

- Coal can only be phased out if there are viable energy alternatives, including renewables, other fuels and energy-efficiency measures.
- In the case of potential energy price increases, this can be addressed through low-income support programming or other social protections. If there are barriers to renewable energy taking the place of coal, these policies may take the form of regulatory or financial supports to renewable energy or energy efficiency. These policies could also take the form of green industrial policies to address competitiveness concerns or training/retraining for workers in transitioning sectors.

Beijing's practice of coal phase-out and other countries' experiences may provide inspiration for finding practical steps to implement a stronger move away from coal in China. Transition toward a clean energy system would experience at least three stages: 1) a coal-dominated energy system, with the replacement of clean coal (high-quality coal/CCS) and natural gas (without/with CCS) undergoing; 2) a diversified energy system, with coal, natural gas, renewable energies and other kinds of clean energy co-existing; and 3) a renewables-dominated clean energy system, with renewable energy making up the majority of the energy structure, supplemented by coal, natural gas and other clean energy. It is clear that China's energy reform has a long way to go and there will be more difficulties and barriers ahead. Supports from different levels of government, sectors and industries, as well as actors in society and players in the market, are needed to take collective actions pushing forward energy reform.



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