



**PAPER SERIES**



# **CHINA'S LONG ROAD TO A LOW-CARBON ECONOMY**

## **AN INSTITUTIONAL ANALYSIS**

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On the cover: The Gezhouba Dam or Gezhouba Water Control Project on the Yangtze River © Lu Heng

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# EXECUTIVE SUMMARY

China is the world's largest emitter of greenhouse gases from energy use and so the future of the world's climate depends to a significant extent on the willingness and ability of the country to make the transition to a low-carbon or at least a lower-carbon economy. Many analyses have highlighted the technical and economic opportunities for achieving such a transition, but few have explored systematically those features of China's society, polity, and economy, which may determine the transition path. This paper applies institutional theories to analyze the governance of energy in China in order to identify sources of adaptability and of resistance to change.

The long and continuous history of Chinese civilization has played a significant role in shaping certain attributes of government, governance, and society that can be observed today, despite the recent overlay of communism. Strong sources of institutional resilience lie within the government itself and the way it operates, and these are complemented by the behavior of powerful actors, notably the state-owned energy companies. Conversely, the government has shown the ability and the willingness to constantly adapt the institutions which govern the energy sector in response to pressing domestic needs and often by

taking into account ideas introduced from outside China.

China's path to a low-carbon economy under the prevailing institutions of governance will probably be characterized by 1) the construction of infrastructure to produce and deliver (relatively) low-carbon energy, matched by ongoing growth of high-carbon energy sources such as coal and oil; and 2) ever-increasing difficulties for the central government as it seeks to change the behaviors of local governments, industries, and households across the country.

Radical institutional change across the polity, economy, and society in China will be required in order to accelerate the transition to a low-carbon economy, but it is difficult to identify such profound institutional changes taking place. If China's transition to a low- or lower-carbon future continues to be highly constrained by the institutional forces described herein, the outlook for global warming is grim, especially if other countries follow a similar path. A logical consequence is that the international community should expend much greater effort on adaptation than we have seen to date.

# 1 INTRODUCTION

China has recently become the largest producer and user of energy in the world, as well as the largest emitter of carbon dioxide (CO<sub>2</sub>). As a consequence, the way in which China's energy sector is governed affects us all today and will continue to do so for decades to come. Yet despite its widely recognized importance, this subject is poorly understood. We are constantly being surprised by new trends, startling achievements, and unfortunate failures. As the country's economy continues to expand and energy demand rises, slight changes within China's energy sector result in ever-growing impacts in the international arena — on energy markets, on the regional and global environment, on investment in energy infrastructure, and on international relations.

Of the various external impacts, one that greatly taxes the minds of forward-thinking individuals around the world relates to China's current and future contribution to the growth of greenhouse gas emissions. This concern arises from the large scale and high rate of growth of energy demand in China, from its continued heavy reliance on coal, and from the relative inefficiency of energy consumption.

Within China itself, concerns have been growing for several years concerning the sustainability of the domestic energy sector. Periodic but widespread energy shortages, persistent high levels of pollution from energy consumption, poor safety management, and an increasing reliance on imported supplies have pushed energy up the agenda of the central government. Even without international concerns relating to climate change, energy would today be one of the major fields of policy concern for China's government.

In response to these concerns, the government and its state-owned energy companies have engaged in a number of strategies to continue raising the

domestic supply of energy while at the same time developing new and renewable energy sources and improving the efficiency of energy production and consumption. These measures have been accompanied by investment in overseas energy assets, the construction of infrastructure to import energy and to transport it across the country, and various forms of energy diplomacy. New targets have been set for the production of clean energy, for further reducing energy intensity and for constraining the rate of growth of greenhouse gas emissions (Zhang, 2011).

It is easy to be impressed by these and other recent achievements in the field of energy, and justifiably so. China could indeed lead the world to a clean energy future (Biol and Olerjarnik, 2011). But coal still dominates the energy mix and national energy intensity remains high. Further, the effective management of energy is not solely a matter of technology and price. Market mechanisms can, in principle, assist in enhancing the sustainable use of energy, but the political and social dimensions of energy production and consumption are just as important. How a country addresses profound challenges such as energy sustainability and the transition to a low-carbon economy goes deep into its political and social culture. The ability to use energy lies at the heart of all human communities, whatever their level of development, and in most industrialized and industrializing states energy companies are powerful economic actors. In both Europe and North America, we see how political and social factors shape the paths followed (or not followed) to a low-carbon economy.

As a consequence of this deep embeddedness of energy in human society, the management of energy at local, sub-national, national, and supra-national levels is a profoundly political task in all senses of the word "political." The engineers may design wonderful technologies and the economists can build quantitative models to project future

trends in energy demand if these technologies are adopted, but all is in vain without an appreciation of the societies into which these technologies are being introduced. For it is people, communities, and organizations, all with their own distinct values, norms, and priorities, who are required to acquire and use these new technologies. They will not do so unless there is a good reason or unless they are given suitable economic incentives. These incentives need to be consistent with the values, norms, and priorities of the society and need to be consistent with the wider political and economic systems in that country or community. If this is not possible, then these values, norms, priorities, and systems may need to change. Thus governance, in its broadest sense, must be placed at the heart of the low-carbon transition.

These observations open up a number of areas for study in the field of economics, politics and sociology, most notably those relating to institutions. The academic field of institutionalism provides opportunities to link the economic,

political, and social spheres and to delve into culture and long-run history. The term “institution” is taken to include the formal and informal rules of society as well as the expectations and mental models of the citizens.

This paper applies an institutional analysis to the governance of energy in China in order to identify the factors that may assist or constrain China’s path to a low-carbon or at least a lower-carbon economy. The first two sections examine China’s rising energy demand and rising carbon emissions. The subsequent two sections set the analytical framework for the paper by outlining the key ideas relating to transition management and to institutionalism. The following section examines some of the general governance institutions in China. The next three sections apply this framework respectively to energy policy-making, energy sector reform and energy regulation. The final section identifies the main implications for China’s transition to a low-carbon economy.

# 2

## CHINA'S RISING ENERGY DEMAND

Since 1949, the main priority of China's government in the energy sector has been to raise domestic production of energy and thus to enhance security of supply. It is a remarkable achievement to have expanded energy supply at a sufficient rate to support an economy that expanded by about 20-fold over the period 1978 to 2010. Over this period, energy consumption grew by more than five times and doubled over the eight years 2001-2008 (National Bureau of Statistics, 2011). In 1980, China's energy demand was just one-quarter of that of the European Union in today's configuration and barely larger than that of Japan. The country accounted for just 6 percent of world energy use. By 2006, China was consuming the same amount of energy as the European Union. By 2010, China had overtaken the United States to become the world's largest consumer of energy, accounting for 20 percent of global energy demand (BP, 2011). Despite this soaring requirement, almost 90 percent of China's energy demand is satisfied by domestic supplies.

This success in supporting economic growth has also been accompanied by an effort, unprecedented in developing countries, to supply electricity to all households. It is estimated that 99 percent of China's population now has access to electricity (Niez, 2010). This compares to less than 75 percent in India in 2009 (International Energy Agency, 2011).

The cost of this success has taken various forms. Trillions of Yuan have been required in investment in infrastructure for the production and transmission of energy, and nearly all of this has had to come from China's government, state-owned companies and state-owned banks. Foreign involvement in China's energy sector has been very modest, on account of a range of policy, legal, and administrative obstacles. As primary resources are extracted from more remote locations and more testing geology, so the unit cost of energy supply

has risen. Likewise the cost of energy imports has increased as the import requirement has grown.

Despite this vast and continuing expenditure, supply disruptions for different forms of energy persist. The period since 2003 has seen shortages of coal, electricity, oil products, and natural gas at different locations at different times. Though some of these shortages have been caused by unusual weather, or by time lags in investment in extraction, transformation, or transmission infrastructure, other shortfalls in supply have resulted from the gaming behavior of energy companies as they seek to take advantage of or to reduce the negative impact of pricing anomalies in the domestic market.

The production of energy in China has had negative impacts on different segments of society. These have included millions of people displaced by large dam projects, thousands of coal miners killed or injured each year in accidents, and entire communities abandoned as oil fields or mines reach the end of their life without any plans having been drawn up for future economic development in the locality (Andrews-Speed and Ma, 2008).

Arguably, the most serious negative long-term consequences of the government's single-minded focus on energy production rather than energy conservation have been on the environment. The production and consumption of energy in China has resulted in serious pollution at local, regional, and global levels, not least because of the continuing predominance of coal in the energy mix. At local level, land has been destroyed where coal mining has not been accompanied by land rehabilitation, rivers have been poisoned by mine effluent, solid waste and oil spills, and the air in China's cities is amongst the worst in the world (Smil, 2004; Economy, 2004). Sulphur dioxide emissions from power stations continue to create acid rain across China and neighboring countries,

*Only since 2003 has the government made real efforts to switch the focus on energy policy from the supply-side to the demand-side*

and, at a global level, China is estimated to have been the world's largest emitter of CO<sub>2</sub> through energy use since 2007 (BP, 2011).

Only since 2003 has the government made real efforts to switch the focus on energy policy from the supply-side to the demand-side, bringing in a wide range of measures to promote energy conservation and energy efficiency. Inefficient

industrial plants have been closed, new standards have been established for appliances, targets have been set for large companies and for local governments, and end-user prices for energy have been raised. These strategies are intended to have positive impacts not just on the energy sector but also on the environment, at national and global levels.

# 3 CHINA'S RISING CARBON DIOXIDE EMISSIONS

China's carbon dioxide emissions have been rising rapidly since 2002, driven by the acceleration in energy consumption. Between 2007 and 2008, China overtook the United States to become the largest emitter of CO<sub>2</sub> in the world from energy use (BP, 2011). Although per capita emissions are relatively low, the GDP intensity of emissions is high by international standards in purchasing power parity terms (International Energy Agency, 2010b). In 2010, the country accounted for an estimated 25 percent of the world's energy-related CO<sub>2</sub> emissions, up from just 13 percent in 2000 and 9 percent in 1990 (BP, 2011). Projections indicate that without radical action, China's annual energy-related CO<sub>2</sub> emissions could rise from about 7.5 gigatons (GT) per year in 2009 to 13 GT or even higher by 2035, accounting for 30 percent or more of global emissions.

A variety of projections and scenarios have been developed to elaborate what steps China should or could take in order to constrain and eventually reduce its emissions from energy use. These show a wide agreement internationally that drastic action needs to be taken in China, as in other countries, during the period 2010-2020 and then sustained beyond that time if carbon dioxide emissions are to peak by 2030 or soon after, and if cumulative emissions are to be sufficiently low to keep carbon dioxide concentrations in the atmosphere below 450 parts per million (ppm). This is the level generally considered to limit warming to 2°C.

Most industrial or industrializing countries face considerable challenges when trying to constrain and ultimately reduce the level of CO<sub>2</sub> emissions from their energy sector. The scale of these challenges is magnified in China on account of the scale and rate of growth of its economy and of its dependence on coal for primary energy. The easiest of these challenges to document is the amount of investment. The International Energy

Agency, for example, estimated that China will have to spend about US\$10 trillion between 2010 and 2050 in order to change the trajectory of CO<sub>2</sub> emissions from the "business-as-usual" scenario to the ambitious "Blue" scenario (International Energy Agency, 2010b). But, as can be seen from the rate of construction of energy infrastructure, China's energy sector does not seem to have suffered from a shortage of funding in recent years. The primary challenges relate to the making and implementation of appropriate policies. In this respect, hard choices face the government *if* it wishes to pursue a transition to a low-carbon economy:

- To what extent should the structure of the economy be changed and how can this be achieved without undermining economic growth and development?
- How to balance social equity (health, education, and income distribution) with national economic growth and with environmental protection?
- How rapidly to press ahead with energy efficiency strategies and to pursue certain energy fuel mix options such as nuclear energy?

It is easy to argue that the pursuit of low-carbon goals in China is consistent with the more pressing objective of energy security and, therefore, that policies to promote energy efficiency and renewable energy for the purpose of constraining carbon emissions have no incremental cost. However there is increasing evidence that the top leaders do indeed take the low-carbon transition seriously, for two reasons: first, because large areas of China are projected to suffer from the effects of climate change; and, second, because the external pressure on China to pursue low-carbon policies can be used by the government to push forward efforts to restructure the economy, much in the same way

that China's membership of WTO did over the past ten years or so.

# 4 MANAGING THE TRANSITION TO A LOW-CARBON ECONOMY

**M**oving to a low-carbon economy is not just a technological issue, but necessarily involves changes across the whole of a society. As a consequence, managing such a transition requires more than just decisions about which technologies to support, and is likely to need wide ranging institutional adaptations. These considerations have led to the development of the concept of a “socio-technical regime” comprised of an assemblage of institutions that develop around a particular set of technologies and that support the development and use of these technologies (Smith et al., 2005). A regime transition may be defined as a gradual process of societal change spanning the economy, technology, organizations, rules, systems, values, and behaviors — essentially, a profound change in the way in which society operates (Meadowcroft, 2009). Thus, each country facing a broadly similar set of policy challenges, such as energy security and emissions abatement, is likely to take a distinct path in transforming its energy system.

Regardless of the precise path taken, regime transitions have several common features. The most fundamental of these is the amount of time required. History tells us that some socio-technical transitions in the energy sector can take as long as 100 years, though 50 years may be a more reasonable estimate for the current energy transition given the nature of modern communication and political collaboration. Historical examples include the switch from fuel wood to coal, the rise of the internal combustion engine for road transport (Voss et al., 2009; Fouquet, 2010) and, more recently, the reduction of dependence on oil in the energy mix of most OECD nations. Secondly, the process of transition is non-linear and unpredictable, whether or not the process is directly supported by government policy. It is characterized by trial and error, by many disappointing technological and policy failures, and

by unexpected success. Thirdly, transition affects many aspects of society or, in other words, a large number of political and economic systems have to change: for example, the system for regulation and taxation, for manufacturing, for energy production and for environmental protection. These changes are likely to occur in an unsynchronized manner leading to failures of coordination or articulation between these systems. Finally, any regime change creates varying costs and benefits for different actors. Potential winners will tend to support change, potential losers are almost certain to resist the change (Fouquet, 2010).

If socio-technical regimes have an intrinsic resilience to change, it is important to identify the range of factors that act as obstacles and constraints to regime change in the context of the low-carbon transition; or, in other words, to identify those features that act to “lock-in” existing technologies and behaviors and to “lock-out” alternative technologies and behaviors. Given the all-pervasive nature of socio-technical regimes, it is not surprising that obstacles and constraints to change can be found across the physical, technological, economic, political, and social spheres (Unruh, 2000, 2002).

The adaptive capacity of a society is its ability to respond to challenges posed by changes in its environment, either in anticipation of or in response to such changes (Engle, 2011). The determinants of national adaptive capacity can be found throughout society and the economy and may include material resources and infrastructure, information technology and communication systems, human and social capital, and wealth and financial resources (Yohe and Tol, 2002). Although these factors are important, the over-riding determinants of adaptive capacity appear to lie in the institutions of governance. Indeed it can be argued that adaptability is a key component of good governance.

*Moving to a low-carbon economy is not just a technological issue, but necessarily involves changes across the whole of a society.*

# 5 INSTITUTIONS OF GOVERNANCE

Two complementary approaches to institutionalism are used to inform the current analysis. The first defines institutions as “humanly devised constraints, formal and informal, and their enforcement characteristics” (North, 1990). In his approach, Williamson (2000) has focused his attention on the rules that govern individual economic transactions, whilst North (1990) and Greif (2006) have emphasized the longer-lived institutions that are more deeply embedded in society and that play a major role in determining the long-term economic and political development of that society.

The second approach elaborates this definition and sees institutions as a shared set of self-sustaining beliefs and expectations, which may or may not be represented by rules and that govern social and economic interactions (Aoki 2001; Greif, 2006). The key to this second approach is that the rules only become institutions if they are believed by a substantial section of society.

Williamson (2000) has integrated these approaches in a scheme that identifies three levels of institution (Figure 1). At the highest level are informal “embedded” institutions characteristic of the society in question. These include traditions, norms, customs, beliefs, and expectations, or, in other words, the prevailing culture. Far from being recently devised by humans, many of these characteristics are deeply embedded in the society and are likely to have a long history.

At the second level lies the “institutional environment,” which has a preponderance of formal institutions consciously designed by humans. Most important in the study of economics are the political system, the bureaucratic structures of government, the judiciary, and the legal system. Also of great importance are the general features of the law relating to property rights, contract and

dispute resolution, systems for policymaking and implementation, and the role of civil society.

At the third level are the structures and systems that govern individual transactions, for example firms, markets, government bureaus, networks, and various hybrid structures. Conventional transaction cost economics focuses on these institutions, on explaining why different types of structure evolve in different sectors or industries, and on examining the way in which these structures shape the way transactions are carried out.

Institutions underpin all political, economic, and social behavior in a society. In the field of economics, the power of institutions to govern economic transactions and to shape economic development does not necessarily imply a power to enhance economic efficiency. Efficiency or inefficiency, be it economic or political, will depend on the nature of the institutions themselves (North, 1990).

One of the most significant implications of the study of institutions has been to show how institutions constrain the pace and direction of economic and political development (North, 2005; Greif, 2006). This path-dependency arises, not just from the constraints that institutions place on political and economic transactions, but also from the institutions’ very resilience to change. Institutions are resistant to change if they are self-reinforcing, and this self-reinforcement arises from positive feedback (Pierson, 2004).

As well as helping to explain why certain features of human society change only slowly, the study of institutions can also assist in identifying how and why behaviours in society change and why different societies have taken distinct development paths. Self-evidently, any institution that fails to be self-reinforcing will become unstable. It may also be subject to negative feedback and become

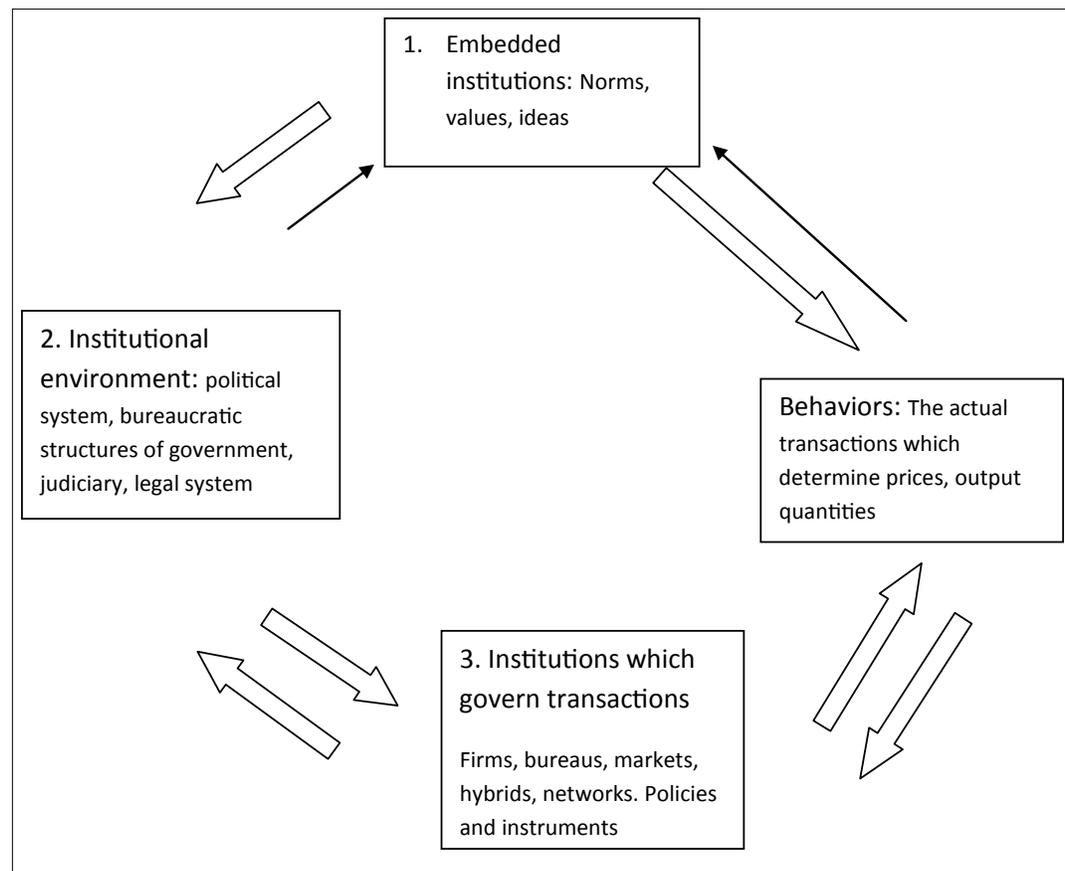
*Institutions underpin all political, economic, and social behavior in a society.*

vulnerable to change (Mahoney and Thelen, 2010). It has been argued that institutions are inherently unstable because they are the result of negotiated compromise and are open to interpretation on account of their ambiguity. Such instabilities may be restricted to the institution itself, or may affect a number of institutions. In the latter case, instabilities may arise from the position of the institution within the wider institutional framework.

efficiency,” which refers to the willingness and ability of a society to acquire new knowledge, to innovate, to take risks through experimentation, and to eliminate unsuccessful political and economic organizations and institutions. Culture is an important determinant of adaptive efficiency. Ideological conformity, whether rooted in history or imposed by dictatorship, may reduce a society’s adaptive efficiency (North, 2005).

North (1990) captured the idea of openness to institutional change in his term “adaptive

Figure 1 Diagrammatic representation of the three levels of institution and how they determine or constrain behaviors in transactions. (Wider arrows indicate greater influence) Source: Adapted from Williamson (2000)



# 6

## CHINA'S INSTITUTIONS OF GOVERNANCE

China's ancient culture and the modern approaches adopted by the Communist Party are important sources of resilience and path-dependency for Beijing's institutions of governance. In terms of institutionalism, the sources of resilience lie in the embedded institutions and in the institutional environment.

The resilience of the embedded institutions goes back hundreds or thousands of years and such institutions include the centralization of power, the role of ideology and slogans, and the preference for conformity and consensus (Pye, 1992; Fukuyama, 2011). Chinese society is characterized by the importance of hierarchy and the family and by the distinctive nature of traditional social capital. Close attention is paid to the appropriateness of words and actions as against the search for an absolute truth. Certain mental models also appear to have a long history, such as the understanding of the relationship between man and nature, and the preference for national self-sufficiency. In the strategies of government agencies, the unwillingness or inability to regulate mineral extraction effectively appears to have its roots in imperial times, as do the practices of false reporting and feigned compliance.

Some features of the current institutional environment have their roots in these long-standing embedded institutions, whilst others have arisen from innovations or adaptations introduced by the Party since 1949. The highly centralized Leninist state structures built around the old State Planning Commission persist to the present day, albeit in modified forms (Lieberthal, 1995; Oksenberg, 2001). The continuing authority of the National Development and Reform Commission and of the large state-owned enterprises exemplifies this. The fragmentation seen in modern China has been exacerbated by economic and political reforms over the last 35 years, but can be traced back to imperial times when the emperor needed

networks of spies to monitor his local officials. Today, the party fulfils this role (Fukuyama, 2011). It is the party that remains the key formal institutional source of resilience, with its control over key appointments in government and in state-owned enterprises and over the careers of these officials. The party retains effective monopoly over key policy decision-making and control of the legal system. Its success in co-opting different segments of society has helped maintain its authority.

But it is all too easy to emphasize the resilience to change and thus to ignore the remarkable and, in economic terms, successful changes that have been implemented since the late 1970s. The sources of this adaptive capacity can be found in the top leadership of the central government, at the local government level and across society at large.

From the late 1970s through to the 1990s, the top leadership has been energetic and persuasive in its advocacy of the need to introduce market forces to the domestic economy and of the need for foreign trade and investment. In this, the leadership has been successful in leaving behind many of the governing ideologies of the Mao era. The strategies that ensued showed openness to ideas from outside China and a willingness to learn from experiments within the country (Heilmann, 2008). The government has displayed an astonishing capacity for social learning at all levels, though not necessarily in a truly collective manner embracing all levels of government. The fragmentation of government, along with the sheer heterogeneity of the country, has resulted in multiple centers of institution building, which in turn has exacerbated this fragmentation, creating substantial challenges for central government. But, at the same time, this fragmentation has allowed for local policy initiatives, some of which have been successful and have then been taken up by the central government. But this economic success can be attributed as much to the latent organizational

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and entrepreneurial skills of the population, as to the ability of the government itself.

Within the party and the government, the last two decades have seen progressive changes including the pluralization of policy decision-making and modest democratization within the party (Shambaugh, 2008). The civil service has been professionalized and the role of ideology reduced. The government continues to introduce elements of a modern legal system. Chinese society is also

changing. Younger generations have a different set of values and priorities from those of their parents and grandparents. An embryonic civil society is emerging and is more willing to take action against parties seen to be undermining social interests, usually at a local level. This trend has been aided by the internet and the press's increasing willingness to criticize both state and private actors, while still refraining from criticizing the central government or the party.

# 7 ENERGY POLICYMAKING IN CHINA

Sources of resilience to changes of energy policy in China are numerous and can be identified in the tangible features of the energy sector as well as in the institutions of governance. Despite this combination of forces, which act to “lock-in” the energy sector and constrain the transition to a low-carbon economy, the government retains the capacity to introduce new policies and strategies. This mix of resilience and adaptability has profound implications for the nature and speed of its transition to a low-carbon economy. On one hand, certain steps can be taken that make a substantial contribution to progress along this transition. On the other hand, the framework of policymaking and the prevailing policy paradigms appear to change only slowly.

The tensions that exist between resilience and adaptability create a high degree of ambiguity in the future trajectory of China’s energy transition and paralysis in strategic policy thinking. They have also resulted in the development of fundamental policy discontinuities within the energy sector. This is exemplified by the contrasting approaches to pricing for crude oil and coal, on the one hand, and for electricity supply and oil products, on the other hand. These pricing discontinuities are an important source of instability and continue to cause major difficulties in a progressively commercialized energy sector. Not only is such instability typical of what transaction cost economics would consider to be a hybrid governance structure, that is to say a mix of government control and the market, but these discontinuities have become sources of “friction” that should trigger policy or institutional change. But to date the government has failed to take steps to eliminate these discontinuities. Rather it has succeeded in maintaining social and political stability through incremental adjustments.

A notable example of policy paralysis concerns the reform of the energy industries and markets. After

a number of relatively radical measures in the 1990s and early 2000s, the reform process has ground to a halt since 2003. Indeed, it would be fair to say that the main “Level 3” institutions that govern transactions in the energy sector have changed very little since the beginning of the 21<sup>st</sup> century, and that any policy innovations at Level 3 have been introduced with little change in the “Level 2” institutional environment.

In the absence of further change in the major institutions that govern the energy sector, the transition to a low-carbon economy is likely to be highly path-dependent, constrained by the prevailing processes of policymaking, by the lack of an authoritative energy agency, by the mix of powerful actors such as state-owned energy enterprises, and by the preferred administrative policy approaches. Policy initiatives are likely to be incremental rather than radical.

If funds continue to be available at their present generous scale, the government is likely to be successful in promoting the continued rapid expansion of capacity for a range of new and clean energy-generating technologies such as wind, solar, hydro, and nuclear power, as well as shale gas, shale oil, and coal-bed methane. A further requirement for this continued success will be that no significant popular movements arise against any one or more of these forms of energy, as has happened in many OECD countries. This would require the government to make substantial improvements to its capacity to manage the environmental effects of energy production. Were the availability of state funds for the energy to diminish significantly and if the profits of the energy companies were no longer robust, then the level of investment in new and clean energy could decline rapidly. In these circumstances, further reform of the energy industry and markets would probably be required.

*The tensions that exist between resilience and adaptability create a high degree of ambiguity in the future trajectory of China’s energy transition and paralysis in strategic policy thinking.*

In contrast, those policy initiatives that require a redistribution of benefits or that run counter to prevailing values and norms are likely to face greater obstacles, either because powerful actors

will obstruct the policymaking process or because, once approved, the policy will be difficult to implement (Kong, 2009).

# 8

## ENERGY SECTOR REFORM IN CHINA

Since the early 1980s, the government has shown itself willing and able to take steps to change the structure of the energy industries, the systems of governance and the energy prices in order to improve the performance of the energy sector and to address the prevailing energy challenges of the day. In this, the government has shown itself open to ideas from the international arena, especially during the 1990s and early 2000s (Andrews-Speed, 2004).

This willingness to undertake reform to the energy sector has been tempered by reluctance or inability to follow through to the logical end-point of privatization, market liberalization, and competition, unlike in other industrial sectors. Although the continued state ownership and control over the energy sector is hardly atypical of developing and transition nations, the nature of the factors that have restrained further reform provide us with insights into sources of wider institutional resilience.

At the level of embedded institutions, it appears that the belief in the necessity of state ownership of and direct control over the energy and natural resources sectors is still strongly held by some key actors. More practical reasons also exist for the reluctance to push on with energy sector reform. Arguably one of the most important of these is the desire of the government to use the energy sector and the state-owned companies as tools to address policy challenges ranging from security of energy supply to inflation, diplomacy, and employment. Further, the high priority now being given to energy efficiency and to new forms of energy requires radical adjustments to investment patterns and operational behaviors by energy producers and energy consumers. In the short-term, the government is almost certainly more able to implement these new policies through the well-tried administrative instruments rather

than hurriedly introducing competition and experimenting with market incentives.

Behind these very reasonable sources of reluctance to pursue further sector reform lie some less benign influences from actors with a vested interest in maintaining the *status quo*. Of these, the most powerful are the state-owned energy companies that are not only drawing great benefit from the current operating environment but are also applying their economic and political influence to delay, if not prevent, measures that might reduce their strong economic position and to negotiate different forms of compensation should they be obliged to take financial losses. In this, they receive at least implicit support from members of the political elite who have financial or other links with these corporations. In addition, a range of other actors, mainly at local government level, are able to take advantage of the energy sector in its current partially marketized state. Rents are available for capture without the restraining force of a market or of an effective legal system (Cheng and Tsai, 2009).

These factors have acted together to constrain the progress and nature of institutional change in China's energy sector and have resulted in an energy sector stranded between the plan and the market; or, in the words of Minxin Pei, a "trapped transition" (Pei, 2006). If the energy sector and the wider economy were still largely planned, the traditional administrative approaches would be more effective. If the energy sector was more liberalized, economic instruments, if judiciously applied, might assist the transition to a low-carbon economy. As it is, the implementation of energy policy faces numerous obstacles.

*This willingness to undertake reform to the energy sector has been tempered by reluctance or inability to follow through to the logical end-point of privatization, market liberalization, and competition.*

# 9 ENERGY SECTOR REGULATION IN CHINA

The difficulties of policy implementation and regulation permeate all sectors of China's economy, but are particularly daunting in the energy sector. Energy is a key input to economic development, both local and national, and the rate of growth of the economy has resulted in sustained rapid growth of energy production, transformation, and consumption. This necessarily places great strain on those agencies charged with introducing new policies to the energy sector, with regulating the production and use of energy, and with constraining the negative environmental and social consequences of energy production and use. These challenges are exacerbated by the scale of the rents available in China's energy sector, especially those arising from the structural and price reforms carried out during the last 15-20 years.

The nature of the policy instruments chosen is vital to the success of policy. China's government continues to prefer administrative instruments such as bans on certain activities or plants that fail to meet certain standards, legal obligations on government agencies and enterprises, and career incentives for officials. Economic incentives are slowly gaining ground, but generally take the form of loans and grants for investment. Price signals have tended to be directed at enhancing the production of energy rather than at constraining consumption. Voluntary agreements have started to be used to encourage energy efficiency improvements. The quantity of official information, education, and rhetoric relating to the need to save energy and protect the environment has increased, but the impact on societal behavior is, to date, ambiguous or variable at best. This preference for administrative instruments is consistent not just with past policy but also with the character of much of the energy industry and energy markets that, despite reforms, remain under government control to a significant degree. However these policy instruments often provide confusing signals

and produce unintended consequences due to the partially reformed nature of the energy sector.

Within the government itself, deficiencies in implementation and regulation can be traced to long-lived structures and operational practices that prevail across agencies charged with these responsibilities, as well as to perverse and contradictory incentives at lower levels of government. The multiple tiers and lines of agencies in China's framework of state government foster poor coordination and even competition between agencies. It has also produced complex systems of reporting for regulators and for those they regulate, as well as contradictory and ambiguous policies and regulations (Andrews-Speed, 2004). The effectiveness of individual agencies may be further constrained by their rank in the hierarchy, by a shortage of suitably skilled staff and other resources, and by a poor capacity to collect data and monitor performance. A combination of a weak legal system and the continued prevalence of bureaucratic discretion impede effective and consistent enforcement of policies, laws, and regulations.

A range of principal-agent problems can be found amongst governments below the provincial level. Local government officials have generally seen economic growth as their first priority, in order to benefit both their local area as well as their personal careers. Such economic growth also provided opportunities for rent-seeking, clientelism, and corruption that benefitted the local political and economic elites. Set against this over-riding objective of economic growth, other policy goals set by central government have been treated as having lower priority, especially when they appeared to lie in direct conflict with short-term economic growth. In the case of the energy sector, such "alternative" policy goals have included the effective management of primary energy resources, energy

*The difficulties of policy implementation and regulation permeate all sectors of China's economy, but are particularly daunting in the energy sector.*

*Initiatives are likely to be successful if they can be driven through with abundant funding and the direct involvement of a small number of large state-owned enterprises.*

efficiency, environmental protection, and workplace safety.

The ability of local governments to obstruct policy implementation is enhanced by the formal hierarchical ranking of agencies at local government level. Implementing agencies, such as the Environmental Protection Bureaus and even the courts are subordinate to and funded by local governments (Edmunds, 2011), and the influence of civil society and the press is inconsistent at best. As a consequence, senior officials in local government are able to limit the impact of policy initiatives coming from above through a combination of inaction, feigned compliance, and false reporting. If the policy program has a relatively long-duration, and if the higher levels of government continue to demonstrate their intent to ensure compliance with a given target or objective, the recalcitrant local governments can respond by taking actions that may achieve the goals set but that undermine the spirit of the policy.

The government can be very effective at overseeing or promoting the construction of infrastructure to produce, transform, and transport energy, but has been less effective at managing the negative side-effects of such projects. The government has shown itself capable of achieving certain regulatory goals in the energy sector, provided that sufficient care is taken in planning and consensus building, that adequate resources are available, that the number of actors to be regulated is relatively small in number and mainly owned by the state, and that the energy policies are supported by policies in other sectors. The effectiveness of policy implementation and regulation deteriorates as the actors affected increases and as their ownership becomes more diverse, if the policy is implemented in a short-lived, campaign-style program, or if measures in other sectors undermine the attainment of energy policy objectives.

Two key requirements for success in policy implementation appear to be the availability of plentiful funding and the influence of the Communist Party over the career progression of government officials and state enterprise managers (Heilmann, 2005). The capacity of the state to regulate the energy sector as a whole remains relatively weak, particularly with respect to the efficient and clean production and consumption of energy across the nation. This weakness can be attributed to a variety of long-standing factors, such as the complex, multi-tiered structure of government, the lack of strong pricing signals, the immaturity of the legal system, and the low level of participation by civil society. Conflicts of interest continue to constrain the effective regulation of energy and the environment at local levels, though some individual policy initiatives do succeed in overcoming these barriers, at least in the short-term. A further source of path-dependency lies in the shortage of skills needed to implement a radical change of direction in the energy sector.

These observations show that the character of China's systems for policy implementation and sector regulation are changing only slowly and are highly path-dependent, constrained as they are by the wider institutional environment. Success is attained if the policy approaches are consistent with the overall institutional environment and with other policy initiatives, and if the incentives for local government officials can be aligned with national policy objectives. These observations have strong implications for the nature of China's transition to a low-carbon economy. Initiatives are likely to be successful if they can be driven through with abundant funding and the direct involvement of a small number of large state-owned enterprises. Thus the rapid expansion of cleaner forms of energy such as natural gas, nuclear power, hydro-electricity, and wind power is likely to continue apace. In these cases, challenges remain relating to

technical standards, environmental damage, skill levels, and safety management.

In contrast, policy programs that rely on changing the behavior of large numbers of local government agencies, enterprises, or citizens are less likely to be successful on account of the prevailing nature of the regulatory regime. The wider use of economic instruments such as higher energy prices, energy taxes, caps on energy use or carbon emissions, and emissions trading appears to provide attractive opportunities to encourage the shift to a low-

carbon economy. But these options too face a familiar range of obstacles in an economy where social equity is an important policy priority, where many major producers and users of energy are partially state-owned and face soft budgetary constraints, and where fundamental conflicts of interest persist at local government level. With respect to the last of these obstacles, a critical consideration is the need to change the incentives for local government officials.

*Policy programs that rely on changing the behavior of large numbers of local government agencies, enterprises, or citizens are less likely to be successful.*

# 10 THE OUTLOOK FOR CHINA'S LOW-CARBON TRANSITION

*Significant or even radical institutional change across the polity, economy, and society in China will be required in order to accelerate the transition to a low-carbon economy.*

The analysis presented in this paper suggests that China's path to a low-carbon economy under the prevailing institutions of governance will have the following characteristics:

1. Construction of infrastructure to produce and deliver (relatively) low-carbon energy will continue on a large scale, but this will be matched by ongoing growth of high-carbon energy sources such as coal and oil. The decline in the proportion of coal in the energy mix will be only gradual.
2. Efforts to constrain the total consumption of primary energy will encounter ever-increasing difficulties as the central government seeks to change the behaviors of local governments, industries, and households across the country.

These inferences lead to the conclusion that China's path towards a low-carbon economy in the present institutional environment is likely to be very gradual. The exact level of emissions will depend heavily on the trajectory of economic growth and on the evolving structure of the economy.

If the arguments presented in this paper are accepted, then significant or even radical institutional change across the polity, economy, and society in China will be required in order to accelerate the transition to a low-carbon economy. Within the energy sector, the government will probably need to resurrect the lapsed reforms to energy companies and markets as well as adapting the structures and functions of the government itself. It will need to develop greater coherence between policies for different sectors so that they collectively support the transition to a low-carbon economy. The financial sector and social policies have the most direct relevance to the energy sector, as well as policies affecting the structure of the economy. Government will also need to find more

effective ways to engage citizens in addressing the low-carbon challenge.

To date it is difficult to identify such profound institutional changes taking place. Although the governance institutions show a certain degree of adaptive capacity, the adaptations pursued tend to be incremental, constrained as they are by the resilience of the wider institutional environment. Therefore the probability is low that the country can follow the more optimistic transition paths proposed by some observers.

This pessimistic outlook need not apply across the whole of China. A growing number of city and provincial governments are taking innovative steps to reduce energy and carbon intensity as well as other forms of pollution, as mentioned earlier. These initiatives not only provide direct benefits to the local citizens and contribute to the national effort to reduce carbon intensity, they also act as useful experiments and examples for other regions.

The second half of 2011 and the early weeks of 2012 saw a number of policy proposals being floated for new approaches to constrain energy use and carbon emissions. These included a carbon tax and emissions trading, as well as the possibility of creating a Ministry of Energy in the next government. These proposals display a continued determination on the part of the central government to address the low-carbon challenge and to deploy radical measures, including economic instruments. But it is difficult to see how such measures could be successfully implemented across the nation in a sustained manner given the range of persistent institutional obstacles.

If China's transition to a low- or lower-carbon continues to be highly constrained by the institutional forces described herein, the outlook for global warming is grim, especially if other countries follow a similar path. A logical

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consequence is that the international community should expend much greater effort on adaptation than we have seen to date.

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