KAPSARC Energy Workshop Series

KAPSARC
مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

Beyond the 'Green Economy': China's Path to Sustainability

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About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is an independent, non-profit research institution dedicated to researching energy economics, policy, technology, and the environment across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

Legal notice

Key Points

While developed economies plan their transition from a 'brown economy' to a 'green economy', China is embarking on its journey directly to the 'golden economy'—a future in which energy, water and land use are harmonized with social and economic needs, including meaningful employment in areas with good housing and services.

It is an ambitious vision and success will likely depend on:

- understanding how transitions take place in practice;
- making the right trade-off between greater wealth and greater equality;
- internalizing the many market externalities that currently challenge China's development; and
- being prepared to learn lessons from both the East and the West.

Success seems more likely if 'eco-concepts' can be incorporated into daily life, through people's jobs, houses, and their relationship with energy.

Summary for Policymakers

One of the major emerging trends in China's energy transformation is the development of economically and environmentally sustainable energy use. Efficiency measures will play a role in achieving that aim, but key to the issue is the question of transitions. How does a nation transition its energy systems to achieve higher efficiency, transition to new technologies and to renewable power and also extend the transition more broadly to the social and economic level? If the traditional developmental model is seen as the 'brown economy'—reliant upon fossil fuels, heavy industry and the struggle to balance rising economic wealth with improving quality of life—how can China fast-track its development and transition away from this unsustainable model to a sustainable 'green economy'? A previous workshop noted that China has become a world leader in developing green technologies and green economy models, but this development remains piece-meal. China has often done well when adapting 'lessons learned' from the West to a Chinese context, but there is a lack of suitable international role models for this. In addition, it is not even certain that achieving the green economy is the correct objective for China.

Transition policies around the world have lacked coordination, being selected to achieve sometimes competing objectives, without necessarily resolving tensions and contradictions. Simply swapping 'clean energy' for fossil fuels within the existing infrastructure is proving expensive even for developed economies. China requires a more economically efficient approach or its transition to a green economy will remain incomplete.

However, the country has a greater ambition—a future in which energy, water and land use are all coordinated, in which buildings are designed with a minimal environmental footprint in both construction and use, and in which people are provided with meaningful employment in areas with good housing and services. This might be termed the 'golden economy'. But achieving this will take more than merely the abstract theoretical realization that policies need to be coordinated. It will require:

- a deeper understanding of how transitions take place in practice;
- a recognition that high growth rates do not necessarily lead to greater equality and that social factors need to be considered together with 'pure' economics;
- a long-lasting approach to internalizing the many market externalities that are currently challenging China's development, to the benefit of society; and

– an understanding of the benefits that can arise through international cooperation and of learning lessons from both the East and the West.

Efficiency measures and renewable energy alone will not deliver true long-term sustainability. If the future lies in the golden economy, then far-reaching coordinated policy and action are required. It could be that China is best placed, with a combination of political will, social acceptance and lack of 'infrastructure lock-in', to achieve this.

Background to the Workshop

In April 2105 KAPSARC hosted the third in its series of workshops on China's Energy Economy to explore the role efficiency can play for China in its pursuit of sustainable development. The workshop, held in Hong Kong, built on the previous workshop held in Riyadh in November 2014. In the event, efficiency was merely a starting point for a discussion of a more radical vision going beyond a green economy.

This series of workshops is designed to facilitate a continuing, open and collaborative space for the discussion of some of the most pressing questions facing the development of China's energy economy as they arise from KAPSARC's research on the country. Each workshop is presented as a self-contained discussion, but one that leverages off the policy and economic knowledge platforms KAPSARC is constructing. In this way, they become a forum for cross-discipline interaction that advances the research agenda while also leading to policy relevant insights.

Between 2003 and 2011, annual energy use grew at an average of 8 percent in China, against a world backdrop of 2 percent and a BRICS average of 4 percent. This growth rate more than halved in the years 2012-2014. In the years since the start of the 11th Five Year Plan (2006-2010), China's long-term trend of improving energy productivity resumed, following a hiatus at the start of the decade. But this sustained increase in energy productivity notwithstanding, the country is yet to achieve its desire for harmonious and sustainable development, as espoused by former President Hu Jintao. The economy is currently slowing and environmental challenges have no short-term solution in sight.

Introduction

Energy productivity in China has risen markedly over the last thirty years, though it still remains significantly lower than in either the European Union or Japan. This is partly because of China's greater reliance on heavy industry and the massive over-capacity the country has in its iron, steel and cement sectors. And to a degree this also stems from the inefficiency in the country's processes, industrial and other. Yet there are significant changes taking place. If China's average growth rate in energy consumption across the years 2003-2011 was 8 percent, it fell to only 3.7 percent between 2012 and 2014.

Though the reduced rate of growth in China's energy use has partly resulted from a slowing economy, it has also been a product of a concerted policy move. The environmental and social problems that have arisen from China's rapidly growing energy use have become politically sensitive. The now-banned documentary *Under the Dome* can only underscore the problem for the public and the authorities.

The response has been four clear policy priorities:

1. Control the growth rate of consumption;
2. Foster green energy;
3. Support harmonious and sustainable development; and
4. Seek international cooperation in energy security.

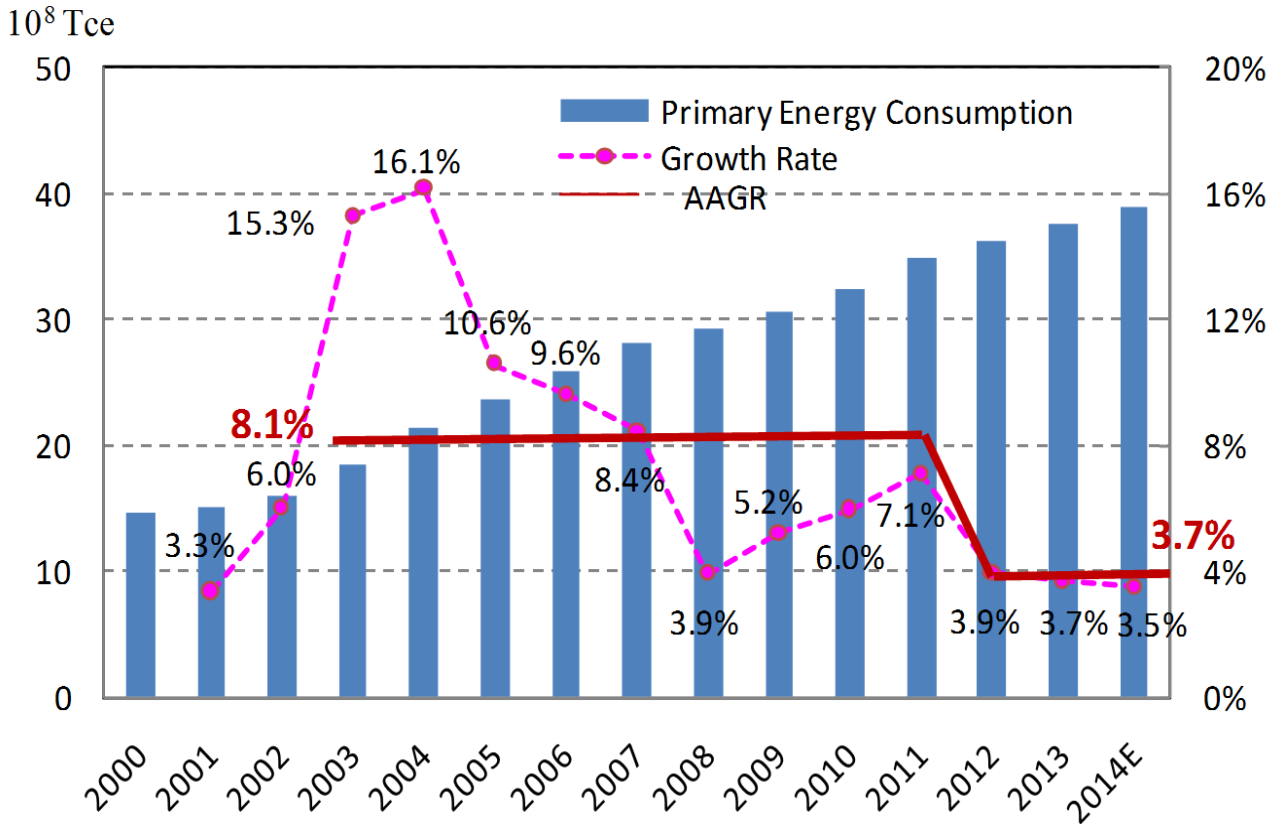

Figure 1 – Since 2000, primary energy consumption has risen every year, but at declining rates from its 2004 peak of 16.1 percent.
Source: ERI

These four themes, articulated by the country's policymakers, require a coordinated understanding of the fundamental requirements of society. For China to reach its harmonious and sustainable future, it has set its sights on transitioning from a conventional 'brown' economy reliant on fossil fuels, through a 'green' economy with its transition to renewables, to a future-proof 'golden' economy. In this 'golden' economy, development and sustainable growth are attuned to the needs of individuals at both macro and micro levels, and a properly regulated market incentivizes growing efficiency, strong environmental protection and the enforcement of rules designed to ensure an equitable and sustainable future.

Striving for the Golden Economy

The traditional model for development in the twentieth century relied on heavy industry and extensive use of fossil fuels. Some countries no longer see heavy industry as core to their economy and some have pursued energy efficiency measures to mitigate their energy demand and its environmental consequences. Yet few, if any, have fully eschewed the brown economy.

For many the next step is a transition to the green economy, though this transition is proving difficult to accomplish. In the short run, fossil fuels remain the most cost-effective source of energy and, for governments with short-term goals of satisfying the

immediate energy demands of their society, large-scale use of renewables is perceived as too expensive and unreliable. Beyond the current price signals, and in the absence of a price on the net externalities of fossil fuels, the model most policymakers adhere to when assessing energy transitions appears flawed. If conventional wisdom envisages a simple switch from one technology to another as the new entrant becomes ever cheaper following technological innovations and growing uptake, reality is more complicated. Technological innovations affect not only the incoming technology, but also the incumbent. In addition, if the new entrant secures significant market share, the incumbent may be priced at its short run marginal cost for extended periods, reopening the cost gap. The result is a transition that is delayed for longer than many policymakers expect or have the political will to fund.

KAPSARC's framework supplements the conventional view of transitions. As time progresses, technological advances and growing implementation reduce the costs of a new technology while the incumbent may face rising costs, including through environmental taxes. Yet the anticipated cross-over point is often delayed as the incumbent innovates—shale gas and light tight oil in North America providing recent examples. The relatively small scale of its supply chains may create cost pressures for the new technology if it becomes sufficiently cost competitive to wean itself off the policy support that, ironically, both enhances and sets limits on its rate of deployment.

Successful transitions are most likely when directed by effective policy. Yet this in itself requires clarity of objective, coordinated planning and rigorous enforcement. None is easily achieved, but all are required for the golden economy.

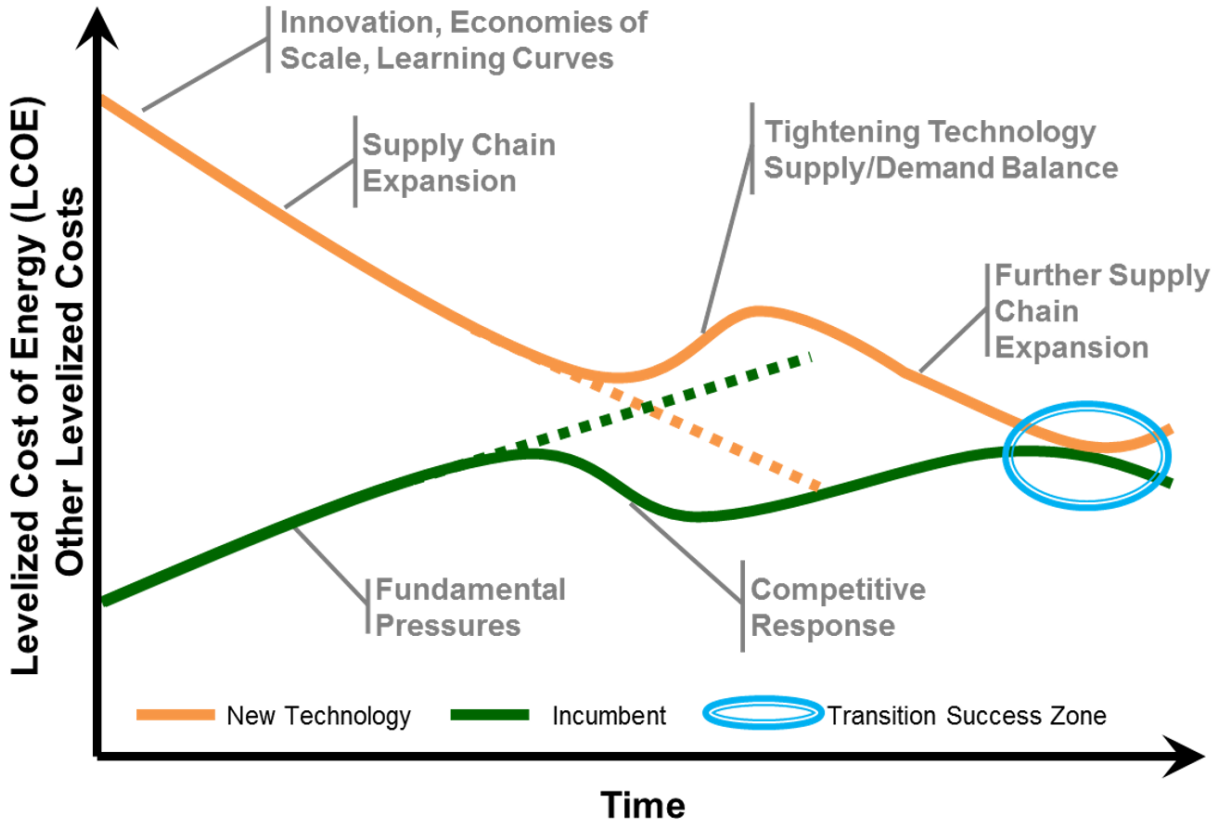

Figure 2 – Illustrative energy cost trajectories in KAPSARC's transition framework.
Source: KAPSARC

Despite these issues, China may be well placed to be a leader in the transition away from the brown economy. In the post-Mao era, the country has an impressive track record in policy reform and economic restructuring. What could take half a century elsewhere has been achieved in a decade in China; what took decades in other countries might be accomplished in a matter of years.

It could be argued that China's economy has seen three major revolutions in the last thirty years. In 1985 the agricultural economy saw the abolition of collectives and the expansion of household contracting. In 1995 the manufacturing economy saw a substantial expansion in China's factory base as it became the workshop of the world, a position cemented after its World Trade Organization (WTO) accession. 2005 heralded the business economy, in which a series of Chinese companies became global names.

On a shorter timescale, the last decade has shown China's ability to make infrastructure transitions. Alongside the proliferation of airports came the construction of what is now the world's largest high-speed passenger rail network. In tandem with the expansion of China's coal-fired electricity generation, the country has emerged as the largest producer and user of renewable electricity.

The question facing China is not whether it can make a transition, but which transition it should make. Definitions of the green economy are changing. What was once a purely environmental term centered on renewable power and reduced emissions has taken on a wider, social dimension and it is this that has led to discussion—and definition—of the golden economy.

The social definition of this golden economy exposes just how daunting a task such a transition will be. Integrated, harmonious, sustainable, coordinated; individually these buzzwords have been hard to deliver, together they represent a very real challenge.

High Growth Does Not Guarantee Greater Equality

The call for harmonious and sustainable development is about much more than just air quality or climate change. At the core of the golden economy is the need to structure and integrate energy and economic systems around the fundamental requirements of society.

No less true in China than it is for politicians in the West, job creation remains paramount, even given China's emerging demographic trends. Linking job creation to green industries in a way that does not see the poorest or most socially disadvantaged locked out of the emerging economic opportunities will require strong political backing and well-coordinated policymaking.

Properly incorporating green technologies into everyday life will also require more than just fitting scrubbers to factory chimneys. Just as with job creation, for the transition to a golden economy to succeed, it must be integrated into people's everyday lives, including their homes. Shelter, water, food and energy and all the basic units of survival must be properly integrated and upgraded if the golden economy is ever to emerge in a meaningful way.

The challenge for policymakers is that quality job creation and infrastructure upgrades are difficult, costly and time-consuming. Economic growth, most often seen as a social good, can actually make these transitions harder. Despite the greater opportunities that high growth rates make available, if growth is too fast, uncoordinated economic expansion can make the installation of the integrated systems required for the golden economy a challenge for the authorities. The experience of local governments in China would put the threshold at 5-8 percent. Above 8 percent and proper integration is very difficult; at rates closer to 5 percent, governments can more easily start implementing the policies required for a golden economy. The slow progress of Europe

towards its own green transition may serve to put China's task in perspective. Growth rates of 1 percent have not galvanized structural changes and any fall in emissions may have been an unintended consequence of economic collapse, not a carefully choreographed response to green policies. Europe's golden economy is still some way off.

China cannot afford such economic slowdown. The maintenance of social stability, on which the country's prosperity, security and future rest, requires robust growth. Yet this represents something of a conundrum for Beijing, since it involves four challenges that often appear to demand conflicting solutions:

- Continued high rates of economic growth will worsen the environmental challenges facing the country, which could increase the risk of protest and social instability.
- Rapid economic growth has not delivered a more equal society. China's Gini coefficient—a measure of inequality—has risen markedly over the last fifteen years, even if millions have also been lifted out of direct poverty. The perception of inequality has gained relevance as a potential source of discontent.
- Falling economic growth rates, while relieving the pressure to resort to short-term dirty energy technologies, create new pressures as job creation becomes ever more pressing.
- The pool of money for substantial infrastructure projects that could both stimulate the economy and deliver new green technologies has dwindled as it is deployed to other pressing areas of concern.

Internalizing the Externalities

What are China's options? Time and again talk returns to the development of properly functioning markets with strong price signals that incentivize economically efficient use of the country's scarce energy and water resources. Establishing such markets, which are integral to both the green and the golden economy, requires time. Policymakers who continually introduce new and frequently changing command-and-control regulations may undermine establishment of the long-term mechanisms. However, the transition to the golden economy is not just a question of will. Three examples serve to underscore the need for clear, coordinated policy.

1. Emissions from coal use

China's economy has become steadily less polluting, but it has also grown. Emissions per unit of GDP have fallen since 1990 but risen in aggregate. Despite this growth in absolute levels of emissions, Beijing has been successful in developing and implementing a policy framework to deal with the brown economy's pollutants, mainly through the implementation of clear targets, promulgated by the center, with firm political support and slowly improving enforcement.

The short-term contra-trend following China's entry into the WTO notwithstanding, emissions per unit of GDP for most major pollutants have fallen markedly over a 20-year period, some by as much as half. The golden economy implies that emissions should fall in absolute terms, rather than accepting that society should be richer but less healthy.

Sulfur dioxide emissions reduction has been particularly successful in recent years. This is the pollutant most closely associated with coal use. Its reduction, not only in relative, but also absolute terms, testifies to the efficacy of China's coal policies even during a time when coal consumption has increased. For all the negative press China has received over the enforcement of its environmental policies, it is clear that when properly formulated, implemented and enforced, policy instruments can deliver.

2. A need for holistic, consistent policy?

Controlling coal has become a major theme of government action, but coal's competing roles as power source, environmental scourge, domestic resource and home-grown job creator have led to a range of policy responses, not all of which are working in the same direction.

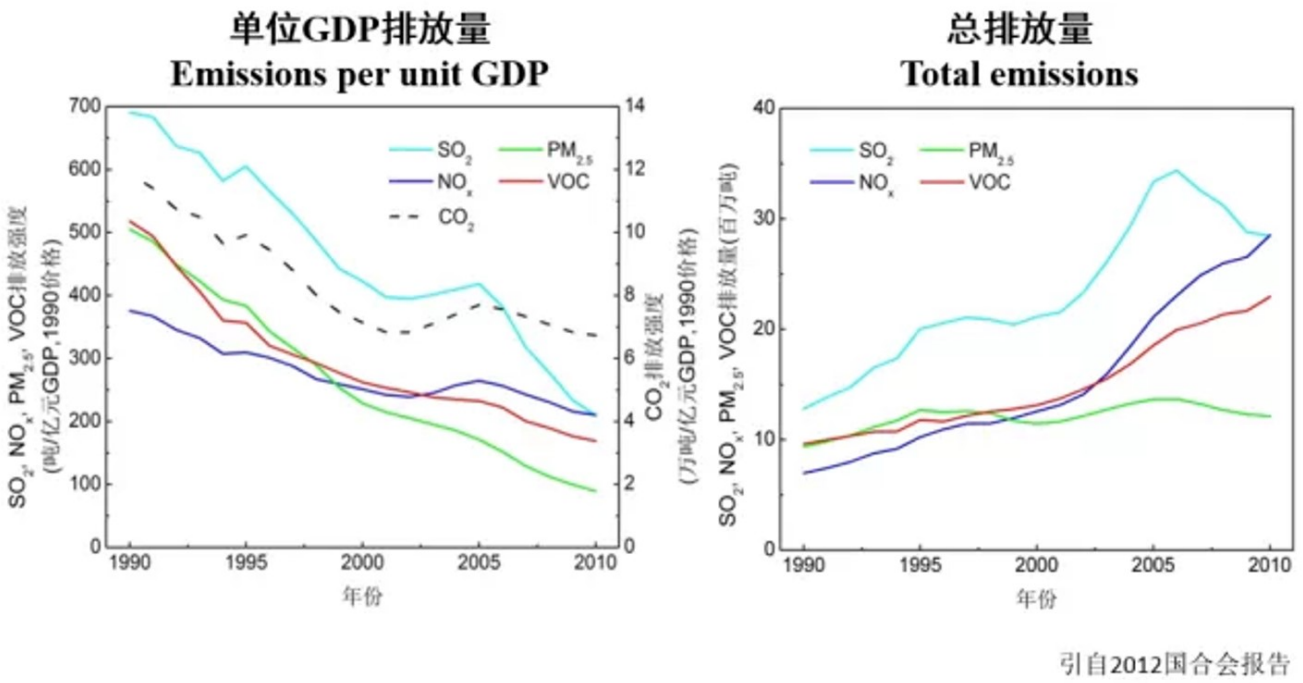

Figure 3 – China's emissions per unit of GDP and in absolute volume terms.
Source: HKUST

A series of restrictive policies has been implemented to reduce coal use and its negative environmental consequences. This has been achieved through import restrictions, quality standards, taxation and outright moratoria, with softer policies promoting displacement with gas. Yet coal's social importance has seen the industry boosted at the same time through preferential taxes, capacity expansion and the promotion of new technologies.

Without proper coordination, different policy instruments can end up clashing with each other, as different ministries pursue competing aims. Alignment around a shared vision of the golden economy might improve clarity of policy objectives and encourage better ministerial coordination in the drafting of policies.

3. One size does not yet fit all

At both macro and micro levels, policies encounter challenges when they do not take account of regional differences.

China has implemented a series of fuel standards in an attempt to control gasoline consumption, improve urban air quality and catch up with the emissions regimes in force in the EU and U.S. Yet the success of these measures has been undermined by a lack of enforcement, accompanied by a shortage of suitable fuels. Beijing itself might have a fuel standard requiring no more than 10ppm of sulfur, but outside the capital sulfur levels in fuel can rise to 335ppm. The cheaper, low quality fuel available at the city's borders can easily 'leak' across the border, weakening efforts to improve Beijing's air quality. Expanding the mandates to a wider geographic area would require sufficient fuel supplies for the whole country.

At the more macro policy level, central government targets that energy consumption should peak by 2030 cannot always be easily translated to the country's provinces. Different cultural habits, local resources and industrial structures leave the various provincial and municipal governments facing very different challenges. For example:

- Hebei's energy challenges may revolve around its reliance on coal and its overcapacity in heavy industry;

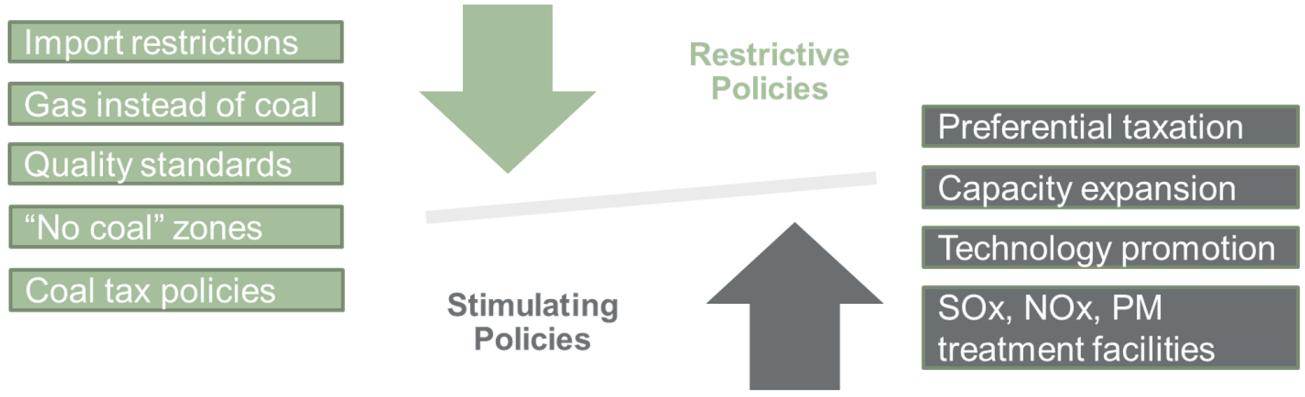

Figure 4 – Competing policies cloud the thrust of overall coal policy in China.
Source: KAPSARC

- Beijing's energy consumption is most likely linked to its growing middle class and expanding car ownership; and
- Chengdu, the capital of Sichuan province, can take steps to electrify its energy consumption within the city limits, but has little control over the fuel-source of the electricity it must import.

In addition, issues and opportunities in one locality might not even register in another. Local culinary and social norms result in Chengdu's producing more than 7 thousand tonnes of food waste each day. This may prove beneficial, though, not only to the local soap industry but also to developers of waste-to--power plants.

Regardless of how the policy is framed and whether or not policymakers turn to the markets to achieve their aim, long-term sustainability demands that China effectively internalize the externalities that have blighted its development so far by recognizing the costs of pollution, resulting health issues and inefficient use of resources.

How best to do this so as to benefit society and where to focus attention are two key questions that will face all governments. If consumption taxes are raised, should the money be invested in hospitals to help mitigate the health impacts of pollution, or should the money be directed into environmental protection measures to stop the problem at source? Which is the most cost-effective? Which will deliver the longest lasting benefits?

What is more, policymakers must increasingly bear in mind the timeframe in which they must operate. Delays in implementation not only affect the up-front costs, but also alter the long-term clean-up costs.

东加西合起来是东西: East Plus West Makes Something

How, then, should China jump from the brown economy to the golden one? How can its villages become eco-villages?

What lessons can China learn from abroad and what lessons can it export? As discussed in the previous workshop, China has become a world leader in developing a sustainable green growth model. It is still in the midst of major campaigns to urbanize and develop and will continue to try to lift millions out of poverty. At the same time, it is developing a new, much more robust foreign policy: the launching of the Asian Infrastructure Investment Bank; the promulgation of the One Belt One Road (一带一路) policy; and an increased focus on international cooperation around energy security.

In Mandarin, the word for ‘something’ is made up of the words for ‘East’ and ‘West’. From this comes the saying ‘to make something you have to merge East and West’. In developing its new maritime Silk Road, China is certainly hoping to build something greater than either the East or the West alone.

Efficiency measures by themselves are not enough to deliver China the harmonious and sustainable development its policymakers desire. It seems likely that what is needed is a broad-based economy and society—wide transition away from the old brown economy, beyond the green economy, to a golden economy. In this golden economy, markets incentivize environmental stewardship and policies deliver integrated plans for a sustainable future, bottom-up, in which not only do renewable energy supplies replace fossil fuels, but eco concepts are incorporated into daily life, through jobs, houses and the people’s relationship with energy.

About the Workshop

KAPSARC convened a workshop in April 2015 with some 30 international experts to facilitate a discussion to explore China's path to sustainable development.

Philip Andrews-Speed – Principal Fellow & Head, Energy Security Division, Energy Studies Institute, National University of Singapore

Chen Zhanming (陈占明) – Associate Professor of Energy Economics, Renmin University of China

Brian Efird – Program Director, Senior Research Fellow, KAPSARC

Amro Elshurafa – Senior Research Associate, KAPSARC

Fan Ying (范英) – Director, Centre for Energy and Environmental Policy Research, Institute of Policy and Management, CAS

Philipp Galkin – Research Fellow, KAPSARC

Gao Lin (高林) – Professor, Institute of Engineering Thermophysics (CAS)

Han Wenke (韩文科) – Director General, Energy Research Institute (NDRC)

He Hui (何卉) – China Regional Lead, International Council on Clean Transportation

Huang Haifeng (黄海峰) – Assistant Dean, HSBC Business School, Beijing University

Huang Haosen (黄浩森) – Director, Chengdu Economic Research Academy

Huang Yonghe (黄永和) – Director, China Automotive Technology & Research Center (CATARC)

David Hobbs – Head of Research, KAPSARC

C.S. Kiang (江家骅) – Chairman, Sustainable Development Technology Foundation

Leo Lester – Research Fellow, KAPSARC

Li Jifeng (李继峰) – Deputy Division Chief, Economic Forecasting Department, State Information Center

Li Lailai (李来来) – China Country Director, World Resources Institute

Luo Rui (罗锐) – Senior Consultant, ICF International

William Overholt – President, Fung Global Institute

Qi Liang (梁琦) – Assistant Research Professor, Energy Research Institute (NDRC)

Kwok Shum – Senior Lecturer, Hong Kong University of Science and Technology

Su Bin (苏斌) – Fellow, Energy Studies Institute, National University of Singapore

Sun Leihong (孙雷红) – Director, Energy Research Institute (NDRC)

Wang Tao (王韬) – Resident Scholar, Carnegie-Tsinghua Center for Global Policy

Yang Fuqiang (杨富强) – Senior Advisor on Climate and Energy, National Resources Defense Council

Yang Guangyao (杨光耀) – Vice-President, Broad Group

Yao Yang (姚洋) – Dean, National School of Development, Beijing University

Yuan Jiahai (袁家海) – Associate Professor, North China Electric Power University

Zhang Chi (张驰) – Director, Barclays

Zhang Lei (张磊) – Associate Professor, China University of Mining and Technology

Zhao Jimin (趙吉敏) – Associate Professor, Hong Kong University of Science and Technology

Zou Lele (邹乐乐) – Associate Professor, Institute of Policy and Management, CAS

Notes

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About KAPSARC's China Energy Policy Research

Our goal is to understand the context of China's energy economy, decision-making process and (even) social mores. This understanding will enable the collection of relevant and accurate data both to feed analysis and drive the interpretation of model outputs. The project aims to analyze and assess information to obtain policy relevant insights. Its focus is on investigating the global consequences of changes to energy markets within China.

The overall objective is to combine an understanding of the fundamentals of China's energy economy, derived from KAPSARC's Energy Model for China, and of the policy landscape, through the construction of the KAPSARC Energy Policy Database. The two platforms and the associated knowledge can then be used to answer a range of questions around the reform of China's energy sector, ultimately leading to an informed view on the future of China's energy mix.

In line with KAPSARC's overall objectives, the aim is to produce policy relevant insights that may assist actors outside China to understand the consequences of decisions taken by actors in China.

The Energy Workshop Series supports the overall project by providing a space for a continuing dialogue that raises the key issues, provides feedback on current work and can set future directions. In addition, the workshops are an open collaborative forum that enables the discussion of particular questions that feed into the overarching research agenda.

About the Team

Amro Elshurafa is a Senior Research Associate working on cost and technology assessments. Credited with 30+ papers and 5 patents, he holds a PhD in electrical engineering specializing in micro- and nanosystems.

Philipp Galkin is a Research Fellow specializing in economic and policy analysis. He holds a PhD in International Economic Relations and an MBA.

Brian Efird PhD is a Senior Research Fellow and Program Director for Human Geography at KAPSARC leading teams on China, India, Local Content, Policy, and Bargaining Models.

Leo Lester is a Research Fellow leading the China Research. Previously working in strategy and portfolio development for an international oil company, he has a PhD and is a CFA and FRM.

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