Coal and Renewables in China

GSI REPORT

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GSI Global Subsidies Initiative

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Executive Summary

China has set a target to peak absolute carbon emissions around 2030 (National Resources Defense Council [NDRC], 2015; White House, 2014). A key part of this transition will be due to a decrease in coal use and an increase in renewable energy use. Subsidies to the coal industry increase the overall supply of coal and reduce prices, leading to the consumption of larger quantities of coal and increased competition with renewable energy. The environmental and health costs of coal use, particularly local air pollution, need to be addressed by, over time, removing subsidies that promote its use.

China's exceptional economic growth has been fuelled with an unprecedented expansion of the electricity system, famously reported as building one coal plant per week at its peak in 2006 (Myllyvirta, 2015). But this expansion has come at a high cost in the form of air pollution, estimated to be responsible for the premature deaths of 4,000 Chinese people per day (Rohde & Muller, 2015) and greenhouse gas (GHG) emissions.

In response to the issues associated with coal use, policies are increasingly being put in place to curb coal consumption. In addition, the government set targets to increase the share of non-fossil fuel energy, including renewables, in the primary energy mix to around 20 per cent by 2020 (Climate Action Tracker, 2015). In 2014 there was a fall in absolute coal consumption (English. News.cn, 2015), and while this may also be attributable to a change in the national economic situation, there is a clear shift in government policies away from coal and towards cleaner alternative sources of energy.

The cost to society of coal use includes the financial cost of providing subsidies to the coal industry in addition to the cost of externalities, including GHG emissions and air pollution. This report explores the cost of coal in terms of subsidies and externalities and discusses the extent to which coal subsidies act as a barrier to the development of renewable energy. It finds that China is supporting the coal industry through the provision of billions of dollars' worth of subsidies to consumers and producers. In addition to the financial cost, these subsidies increase consumption of coal, producing externalities including air pollution and GHG emissions. The combined cost to society of subsidies and externalities to coal dwarfs the cost of subsidies to renewable energy (Figure 1).

A reduction in subsidies would increase the cost of coal. This should, in time, lead to reduced consumption, although this is complicated by the regulation of energy prices in China. This would free up public money for other priorities and have environmental benefits in terms of a reduction in air pollution and GHG emissions.

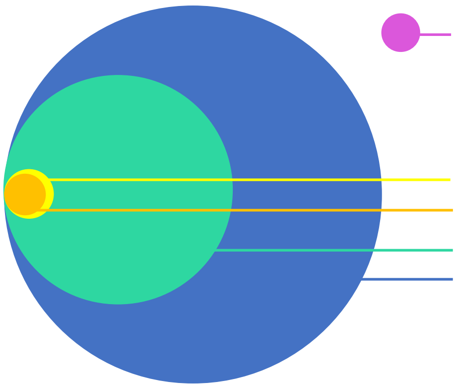

Figure ES1: Cost of subsides and externalities to the coal industry compared to subsidies to renewable energy (2013 or nearest available data)[a]

Notes on figure:
a) Ranges indicate the range of all available data. Size of circle indicates average of all available data.
b) Renewable energy subsidies based on Shen & Luo (2015) and IEA (2014)
c) Producer subsidies based on (Xue et al., forthcoming)
d) Consumer subsidies based on Lin & Ouyang (2014) and IEA (2014)
e) GHG emissions based on Coady, Parry, Sears, & Shang (2015) and Authors' calculations
f) Air pollution based on Coady, Parry, Sears, & Shang (2015), NRDC (2014) and Chinese Academy for Environmental Planning (2014)

USD values are:
- *USD 7-16 billion (renewables)*
- *USD 6 billion (producer)*
- *USD 1-26 billion (consumer)*
- *USD 167-667 billion (GHG emissions)*
- *USD 31-367 billion (Air pollution)*

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1.0 Energy Context

The energy system in China is multifaceted and complex. To provide a concise discussion of the issues caused by subsidies and externalities in the energy sector, this paper will limit discussion to coal and renewable energy, as coal is associated with severe environmental externalities, and increasing renewable energy is one potential pathway to transformative change in the sector.

The coal industry has been powering China's transition from developing country to global superpower. China has been the largest producer of coal since 1985, producing nearly half of the world's coal in 2014 (International Energy Agency [IEA], 2015b). Prior to 2009 China was a net exporter of coal, but demand and price competition have seen imports increase considerably; by 2012 imports accounted for 8 per cent of consumption (IEA, 2015a).

The coal industry has been the object of a number of reforms to tackle negative social and environmental impacts. A key part of these reforms has occured through the consolidation and closure of smaller private mines. Reducing the total number of mines from over 40,000 in 1995 to around 7,000 today (Energy Foundation, 2013; National Bureau of Statistics of China, 2015). However, 2014 saw a 2.9 per cent fall in coal consumption, raising the prospect that measures to reduce the dominance of coal in the energy system may be taking effect (National Bureau of Statistics of China, 2015).

In the electricity sector, coal remains the dominant fuel, but several factors highlight the changing market dynamics. First, the share of coal in the electricity mix has begun to decline, down by approximately 2 per cent in 2014 in terms of capacity (China Electric Council, 2015). Correspondingly, renewable energy is increasingly accounting for a greater proportion of new generation capacity, accounting for the majority (68 per cent) of new capacity in 2013 (Bloomberg New Energy Finance, 2014). Development of new thermal generation capacity by the "big five" state-owned companies has also dropped (Davidson, 2014a).

Second, 39 gigawatts (GW) of coal-fired generation capacity was installed in 2014—approximately three plants every four weeks—yet the rate of utilization of existing plants has fallen from 60 per cent in 2008 to 54 per cent in 2014. This decline in utilization points to an overcapacity of coal generation and undermines the business case for further investment in new capacity.

One factor in continued use of coal is the impacts of subsidies that support the sector. In particular, without guaranteed offtake agreements that ensure enough hours of generation to cover costs and the availability of low-cost credit, it is possible that investment in capacity would already have fallen and utilization of existing plants reduced, pushing the plants towards becoming stranded assets[1] (Davidson, 2014b; Myllyvirta, 2015). For a definition of the term "subsidy" used in this context, see Box 1.

Box 1: What are subsidies?

The term *subsidy* is often used in a pejorative sense to describe government actions that increase revenues or lower costs for recipient groups. The Global Subsidies Initiative (GSI) adopts a definition based on the World Trade Organization's (WTO's) Agreement on Subsidies and Countervailing Measures (ASCM). The ASCM is supported by 158 countries and defines the four categories of subsidies that exist:

1. A direct transfer of funds or liabilities, such as the provision of grants.
2. Forgoing or otherwise failing to collect revenue, including tax exemptions and reductions.
3. Providing goods or services below market rates, such as the provision of land, services or inputs.
4. Providing income or price support, for example through price regulation.

This definition makes no distinction as to whether a subsidy is justified. Subsidies may indeed be justified where they have been put in place to correct a market failure, such as the unsustainable depletion of a natural resource.

In the context of fossil fuels, subsidies are often split into two non-exclusive categories: those that reduce the cost of consuming fossil fuel-based energy, called consumer subsidies, and those that support the domestic production of fossil fuels, called producer subsidies.

For further discussion on subsidy definitions see Beaton et al. (2013)

[1] Stranded assets are assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities.

The treatment of coal also affects renewable energy generators. Curtailment and non-connection in the wind energy sector have been common, in part due to the technical constraints of electricity grids that are struggling to keep pace with expanding wind generation, but also because of the presence of subsidies.

In 2015 China published details of renewable energy plans as a part of a submission to the United Nations Framework Convention on Climate Change's Intended Nationally Defined Contributions. The plan included an intention for GHG emissions to finally peak in 2030 and to meet 20 per cent of primary energy from non-fossil sources by 2030. This would require around 800-1,000 GW of new non-fossil fuel generation, around three times the current level (Climate Action Tracker, 2015).

Recent figures from the United Nations Environment Programme Finance Initiative (UNEP-FI) show that investment in renewable energy in China is the highest in the world by some margin and growing rapidly. In 2014 investments in renewable energy reached USD 83 billion, up 33 per cent from the previous year (Frankfurt School UNEP, 2015). As of the end of March 2015 cumulative photovoltaic (PV) capacity stood at 33.1 GW (China National Energy Administration, 2015). The current rate of installation indicates that, by the end of 2015, the 35 GW outlined under the 12th Five-Year Plan will certainly be exceeded. However, the development of renewable energy is likely to have been hindered by the subsidies that have been granted to coal.

2.0 The Conflict Between Coal and Renewable Energy

Coal subsidies privilege the production of coal and coal-fired electricity generation over other energy sources such as renewable energy. First, subsidies reduce the cost of capital (e.g., credit support and operating costs) by subsidizing production such that coal-fired power generation is cheaper compared to other sources than it would be without subsidies. Second, guaranteed offtake of generation ensures that coal-fired stations continue to run, and other generation sources such as renewable energy are curtailed.[2] This, in turn, damages the commercial position of renewable energy generators, causing either a drop in deployment or an increase in the cost of subsidies to renewable energy.

Renewable energy generators also receive subsidies to bridge the gap between costs and the financial value of the electricity they generate. As more renewable energy is generated to meet renewable energy deployment targets, the cost of renewable energy subsidies will increase. The total cost of subsidies to renewable energy is estimated to reach CNY 100 billion in 2015 (Shen & Luo, 2015). Currently, much of this cost is met by a charge on electricity consumption, but as costs rise further, sources of funding will need to be identified, and reallocating the money currently spent on coal subsidies is one possible source (see Cottrell et al., 2013). In turn, this is will improve the likelihood of renewable energy targets being successfully delivered.

The provision of subsidies to both coal and renewable energy industries creates a conflict between the objectives of the two subsidies and raises the cost of delivering renewable energy targets. A key justification of renewable energy subsidies is that the subsidies are needed to redress the market failures of underpricing of air pollution and GHG emissions. Coal consumption is a major contributor to these problems, making the justification for simultaneous subsidization of coal difficult. In addition, the increase in coal capacity at a time of stagnating consumption has led to declining utilization. Continuing to support coal could also therefore be considered an inefficient use of resources.

[2] Curtailment of renewable energy generation will be the subject of a forthcoming IISD report.

3.0 Subsidy Estimates

In the context of coal policy, the consideration both of the impacts of subsidies and the impacts of externalities is essential. After all, it is the external cost of air pollution and GHG emissions that have led to targets to cut air pollution, reduce the share of coal in the energy mix and increase the share of renewable energy. For example, the Action Plan of Air Pollution Prevention and Control establishes an annual limit[3] of PM2.5 of 35 μg/m^3, which is estimated to require a reduction in national $PM_{2.5}$ emissions of 57 per cent by 2030 (China Council for International Cooperation on Environment and Development, 2014).

There are a number of estimates for fossil fuel subsidies in China. Due to differences in methodology and definitions, subsidy estimates are not always directly comparable. See Box 1 on subsidy definitions and Box 2 on subsidy estimation methodologies.

Box 2: Subsidy Estimation Methodologies

There are two common methodologies for estimating subsidies. These are known as "price-gap" and "inventory" approaches.

The inventory approach involves constructing an inventory of government support policies affecting the production and consumption of fossil fuels and considering the cost or impact of each in turn. This method is used by the Organisation for Economic Co-operation and Development (OECD) and the GSI. This method not only identifies the aggregate level of subsidies, but also the policies responsible. Disadvantages include the labour intensity of the analysis and the frequent lack of available data.

The price-gap approach estimates the gap between domestic energy prices and reference prices (the "price gap"). If the domestic price is lower, a consumption subsidy is deemed to exist. The IEA and International Monetary Fund (IMF) use this method. The reference price for electricity is based on the cost of production, transmission and distribution of electricity in individual countries. Using the price-gap approach alone is useful in order to enable comparisons among countries where the main form of support is through administrative pricing or export restrictions, but it does have some drawbacks. For example, a price-gap analysis will not reveal producer subsidies that arise when energy producers are inefficient and make losses at benchmark prices.

For a summary of the subsidy estimation methodologies applied by the OECD, IEA, IMF and GSI see GSI (2014).

[3] $PM_{2.5}$ indicates particulate matter of less than 2.5 micrometres in diameter.

International organizations play a role in providing high-level multi-country analysis, mainly using price-gap type approaches. These estimations can be generally divided into estimates of consumer subsidies and producer subsidies (see Box 1).

3.1 CONSUMER SUBSIDIES

The IEA estimated that consumer subsidies to coal were USD 1.39 billion in 2011 (CNY 8.8 billion) (IEA, 2014). The IMF estimated post-tax subsidies for coal in China at USD 2,134 billion (CNY 1,507 billion), which accounts for 3.23 per cent of GDP and 14.27 per cent of government revenues in 2011. IMF post-tax estimates controversially include externalities including the cost of health impacts and others. The inclusion of externalities considerably increases the estimate. Under the ASCM, externalities are not included in the definition of subsidies; however, the failure to reflect the cost to society in the cost of activities that emit GHG emissions or have adverse health impacts is a certainly a market failure.

A number of estimates from Chinese academics have applied a similar price-gap methodology to the IEA. Lin and his colleagues' research found coal consumer subsidies of CNY 53.2 billion (USD 8.3 billion) in 2007 (Lin & Jiang, 2011) and around CNY 158.19 billion (USD 24.7 billion) in both 2008 and 2010 (Lin & Ouyang, 2014).

3.2 PRODUCER SUBSIDIES

Joint research from the Overseas Development Institute (ODI) and Oil Change International (OCI) estimates fossil fuel exploration subsidies with a focus on the activities of state-owned enterprises (SOEs). The research recognizes that coal producer subsidies exist but does not present a comprehensive estimate of their magnitude (Pickard & Makhijani, 2014).

A recent assessment by the GSI (Xue et al., forthcoming) set out to identify and measure producer subsidies using an inventory approach, reviewing government policies to identify which policies might confer a subsidy. This assessment identified 18 producer subsidies to the coal industry in 2013. It was possible to quantify 10 of these with a total estimated value of CNY 35.7 billion (USD 5.6 billion) in 2013. Estimates of the subsidies to coal producers in China are shown in Table 1.

Table 1: Subsidies to Coal Producers in China (CNY billion)

		STATE LEVEL	REGIONAL LEVEL	TOTAL
Government revenue foregone	Value-added tax (VAT) rebates	1.7		1.7
	Resource tax reform (wipe out various charges from local fees, funds and taxes at the same time) (from 2015)			
	Temporary tax and fee relief (Shanxi 6.3, Inner Mongolia 0.72, Shaanxi 3.15)		10.2	10.2
	Tax breaks for new technology application and depleted coal mines			
	Tax breaks for occupational allowance			
	VAT rebates for coalbed methane production	1.1		1.1
Direct and indirect transfer of funds and liabilities	R&D from public budget	0.3		0.3
	Direct subsidies to listed coal companies	0.6		0.6
	Compensations for the coal mines that are shut down in the coal phase-out plan	5.6	0.8	6.3
	Coalbed methane production subsidies	0.3	0.1	0.4
	Investment in fixed assets (excluding rural households), state budget, mining and washing of coal	7.7		7.7
	Special fund for risky exploration of overseas mine resources	0.1		0.1
Income or price support	Raising import tariff			
	Waving import tariff for certain advanced equipment			
	Reduction of export tariff (From 2015)			
Provision of goods or services below market value	Exemption for land-use fee of coal mines			
	Providing Inner Mongolia producers with coal railway transportation below fair market rate		7.2	7.2
TOTAL		17.4	18.3	35.7

Source: Xue et al. (forthcoming)

The identified subsidies included value-added tax (VAT) rebates for coalbed methane production, R&D from the state budget, direct subsidies to listed coal companies, compensations for the coal mines that are shut down in the coal phase-out plan, coalbed methane production subsidies, investment in fixed assets (excluding rural households) from the state budget and a special fund for risky exploration of overseas mine resources. A full description of this analysis is presented in Xue et al. (forthcoming).

A further key subsidy is the credit support available to SOEs in the form of preferential interest rates for borrowing. It is difficult to calculate the value of credit support available to the coal industry due to a lack of data. However, it is believed that the system of state-owned banks and access to credit for SOEs is significant. If these were taken into account, the overall cost is likely to be far higher.

Producer subsidies to coal have a number of impacts on downstream sectors. First, the subsidies reduce the effective cost of production, thereby increasing supply. The increased supply creates a downward pressure on prices and an upward pressure on consumption. In the context of the electricity sector, the presence of producer subsidies favours the production of electricity from coal over competing technologies, including renewable energy generation. It must be noted that not all of the producer subsidies listed in Table 1 promote additional production. Some of these subsidies are designed to mitigate problems caused by coal use, for example, by promoting gas cleanup equipment or promoting R&D that may lead to efficiency improvements in the future.

3.3 SUMMARY OF SUBSIDY ESTIMATES

A summary of the recent subsidy estimates is presented in Table 2. Due to differences in methodology, the figures are not directly comparable. Box 2 outlines the difference between the price-gap and inventory approaches to subsidy estimation.

There are some limitations for estimates for producer and consumer subsidies to the coal industry and gaps in the data available. Extrapolating from the available data presented in Table 2, it is estimated that the combined total for producer and consumer subsidies is in the order of CNY 100 billion, excluding externalities. This figure is similar to available estimates for subsidies to renewable energy in 2015. The scale of coal subsidies indicates that the impacts are likely to be considerable and may be acting against renewable energy. Phasing out coal subsidies alone would promote a faster transition to renewable energy. A reallocation of a portion of coal subsidies to support renewable energy could further accelerate this transition.

Table 2: Summary of Estimates of Subsidies and Externalities in China

ORGANIZATION/ SOURCE	YEAR	COST ESTIMATE		DESCRIPTION	TYPE(S)
		USD BILLION	CNY BILLION		
IMF (Coady, Parry, Sears, & Shang, 2015)	2015	2,134	13,561	Post tax – Coal; Includes externalities	Consumer and externality
		1,734	11,020	Air pollution external costs for all fossil fuels	Externality
		433	2,752	GHG emissions external cost for all fossil fuels	Externality
	2013	1,630	10,361	Post tax – Coal; Includes externalities	Consumer and externality
		1,329	8,446	Air pollution external costs for all fossil fuels	Externality
		356	2,263	GHG emissions external cost for all fossil fuels	Externality
IEA (2012, 2014)	2011	1.39	8.83	Coal consumer subsidies; price-gap subsidy analysis	Consumer
	2010	2.01	12.78	Coal consumer subsidies; price-gap subsidy analysis	Consumer
	2013	7.0	44.64	Subsidies to renewable energy	Producer (renewable energy)
Lin & Ouyang (2014)	2010	24.7	158.19	Consumer subsidies calculated through price-gap approach	Consumer
GSI (Xue et al., forthcoming)	2013	5.6	35.7	Bottom up, inventory analysis of coal producer subsidies	Producer
	2013	163–651	1,044– 4,172	Authors' calculations of social cost of carbon emissions from coal consumption based on high and low scenarios	Externality
Chinese Academy for Environmental Planning (2014)	2010	33	212	Cost of health impacts of air pollution based on a human capital approach	Externality
Natural Resources Defense Council (2014)	2012	163	1,040	Combined environmental and health damage costs of coal production and consumption*	Externality
Shen & Luo (2015)	2015	15.7	100	Subsidies to renewable energy	Producer (renewable energy

** Estimate is based on total health and environmental costs of CNY 260 per tonne and coal consumption of 4 billion tonnes per annum.*

It should be noted that subsides do not necessarily have negative impacts. Where a subsidy scheme realizes the intended benefits at a reasonable cost, its existence may be justified. Evaluation of each subsidy would be needed to answer that question. However, in general terms, subsidies are often costly, tend to benefit the rich more than the poor, have a myriad of unintended consequences and are very difficult to remove (Beaton et al., 2013).

4.0 Externalities

The external costs of coal use include, but are not limited to, the cost to society of GHG emissions and local air pollution.

4.1 AIR POLLUTION

Air pollution is one of the most important environmental challenges facing China today. The combustion of coal contributes significantly, along with other sources (notably, road transport), to poor air quality in large parts of China. Coal combustion produces more than 100 times the amount of particulate matter than natural gas per unit of energy generated and has been found to be a major contributor to local air pollution (Caoa, Shenb, Chow, Qi, & Watson, 2009). Local air pollution is a significant contributing factor to ill health and mortality in China: some estimates suggest that 1.6 million deaths per year (17 per cent of total annual deaths) can be attributed to air pollution (Berkeleyearth, 2015). Overall cardiorespiratory deaths account for 55 per cent of total deaths in China, compared to 42 per cent in the United States, despite greater problems with obesity in the United States (Rohde & Muller, 2015).

The cost to society of the health impacts of air pollution has been estimated at 6.5 per cent of China's GDP annually (roughly USD 535 billion in 2012) (Krane & Mao, 2015). A further impact of air pollution is the impact of sulphur dioxide on agriculture. One study estimated agricultural losses of USD 1.43 billion due to sulphur dioxide pollution (Wei, Guo, Marinova, & Fana, 2014).

The IMF "post-tax" subsidy estimate, which, unlike the many other definitions, includes externalities, includes an estimate for the external cost of health impacts from air pollution from all fossil fuels in China of USD 1,734 billion (CNY 11,119 billion) in 2015 (Coady, Parry, Sears, & Shang, 2015). This externality accounts for 76 per cent of the total subsidy estimate. In the United States, local air pollution only accounted for 30 per cent of all the IMF post-tax subsidy, highlighting the dominance of coal in China and the importance of addressing air pollution. The IMF estimates that post-tax coal subsidies account for 94 per cent of all fossil fuel subsidies in China, so it is possible to attribute the vast majority of the estimate to coal combustion. Other estimates for 2010 produced by the Energy Foundation (2013) put the health costs of air pollution much lower, at CNY 212 billion, although, by their own recognition, they use a conservative methodology. If a willingness-to-pay methodology rather than a human capital approach is used, the authors estimate the cost to be approximately three times this value (Chinese Academy for Environmental Planning, 2014).[4]

4.2 GHG EMISSIONS

The costs to society of GHG emissions have been the subject of much discussion. The price at which carbon is traded (e.g., on the seven pilot carbon trading schemes currently operational in China or the EU Emissions Trading System) could be used to estimate the cost, although this may undervalue the true cost, as these markets are not yet considered to adequately match the external cost of carbon emissions. According to a recent survey, prices in May and June 2015 ranged from CNY 9 per tonne (USD 1.4 per tonne) in Shanghai to CNY 42 per tonne (USD 6.6 per tonne) in Beijing (De Boer, Roldao, & Slater, 2015). The price of carbon in the EU Emissions Trading System has previously been depressed due to widespread over-allocation of allowances, the global financial crisis and other issues relating to the design of the scheme.

A number of studies have attempted to develop a view of the true cost of carbon dioxide emissions, and these generally suggest a much higher value, depending on the assumptions used. For example,

[4] For a discussion of willingness-to-pay versus human capital approaches see Seethaler, et al. (2003).

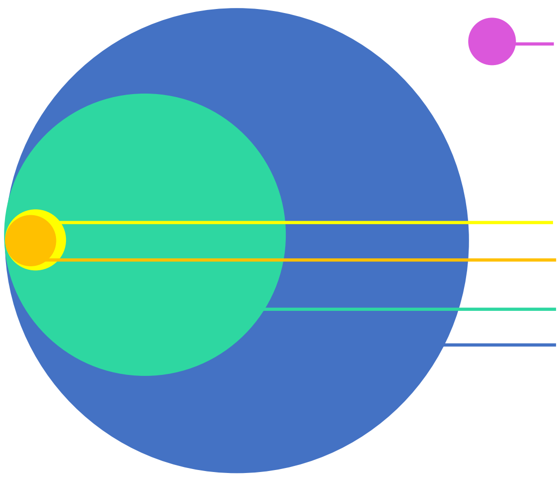
the social cost of carbon calculated by the U.S. Government's Interagency Working Group on Social Cost of Carbon in 2013 estimated 2015 values of USD 11, USD 36, USD 65 and USD 105 per tonne, depending on the discount rate (Interagency Working Group on Social Cost of Carbon, 2013), but these are still well below values calculated elsewhere. Using the same modelling approach, but varying the assumptions on damage functions and the associated economic costs, Ackerman & Stanton (2011) calculate a 2010 social cost of between USD 28 and USD 893 per tonne.

In 2012 China emitted 6,513 million tonnes of carbon dioxide as a result of coal consumption, around four fifths of total emissions (U.S. Energy Information Administration, 2015). Using a low and high value of USD 25 and USD 100 per tonne of emissions gives a range of costs between USD 163 billion (CNY 1,035 billion) and USD 651 billion (CNY 4,136 billion). The IMF's estimate of consumer subsidies for global warming for all fossil fuels is roughly in the same ballpark at USD 356 billion (CNY 2,262) in 2013.

5.0 Linking Subsidies And Externalities

The cost to society of coal use includes the financial cost of providing subsidies to the coal industry in addition to the cost of externalities, including GHG emissions and air pollution. An overview of the relative scale of subsidies and externalities is presented in Figure 1. The size of each subsidy or externality component is presented as the average of all available estimates, and the range of estimates is provided in the label. Data presented is from 2013 or the nearest available year. The year that the data comes from is noted in the figure. The figure is designed to give an indication of the approximate size of externalities and subsidies.

In China, by far the largest cost related to the coal industry is the impact of air pollution on human health. GHG emissions are the second largest, followed by consumer and producer subsidies to coal. Consumer and producer subsides to coal serve to lower the cost of coal-related activities, increasing the consumption of coal. Phasing out coal subsidies would not only



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reduce the cost to the public budget, freeing up resources for other purposes, but would also reduce consumption of coal, in turn reducing GHG emissions and air pollution. The reduction in coal subsides would have a positive impact on pollution at a less-than-zero cost to the government.

Beyond phasing out subsidies, policies should seek to build the cost of pollution into the operating costs of activities with negative environmental and social consequences. This is known as the "polluter pays" principle or Environmental Fiscal Reform.[5]

Figure 1 shows that, according to available estimates, China is currently spending comparable amounts subsidizing both coal and renewable energy, yet the cost to society is far greater from coal use. Most sources of renewable energy generation do not directly cause air pollution and have far lower associated GHG emissions. Policy responses should therefore focus on ways that promote a reduction in the subsidies to coal and seek to build the cost of negative externalities into the operating cost of the industry.

Political economy plays a role in the existence of subsidies. Industries that employ large numbers of people attract special consideration, as a loss of employment would be both unpopular and socially harmful. As industries grow large, they become strategically important and able to demand favourable treatment by policy-makers.

Finally, subsidies continue to exist because reform is politically difficult. Removal of subsidies creates winners and losers. Those losing out will be motivated to oppose reform. Reform of fossil fuel subsidies generally involves a detailed planning process to map the impacts of proposed reforms and to design mitigation measures where these reforms have undesirable social or environmental consequences.

From an environmental perspective, coal subsidies have predominantly negative impacts. It is possible that some measures, such as support for efficiency-boosting investments, do have positive environmental consequences, at least in the short term. However, the overall impact of coal subsidies is to increase the consumption of coal with a corresponding reduction in the consumption of more environmentally benign sources of energy. By this measure, the continuation of widespread subsidies to the coal industry is at odds with environmental objectives.

6.0 Conclusions

- Subsidies to the coal industry have negative environmental consequences because they lead to oversupply, overconsumption and the crowding-out of other, cleaner alternatives, especially renewables. These impacts are in conflict with a number of the stated objectives of the government and come at a considerable cost to the government budget.
- The GSI, other organizations and academics have established a number of estimates for producer and consumer subsidies that show the widespread subsidies to the coal industry in recent years.
- Externalities, including the cost of environmental and health impacts, from coal use should be considered explicitly in the design of energy policy instruments including subsidies. A reduction in subsidy spending would also reduce the environmental externalities, including air pollution, at a less-than-zero cost.
- Removal of coal subsidies would have a positive impact on the targets to achieve a rebalancing of the energy mix away from coal towards renewable energy by discouraging coal use. Reallocating funds to support renewable energy in the early stages of renewable market expansion could further enhance this effect.
- IISD will continue to estimate, measure and evaluate subsidies to coal in China and to highlight the role of externalities in the electricity sector.

[5] The case for environmental reform is outlined in the IISD report *Green Revenues for Green Energy* (Cottrell et al., 2013).

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