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Dirty Coal:
Voluntary International Environmental Agreements and Sustainable Development in the People's Republic of China

Paul G. Harris and Chihiro Udagawa

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Abstract

*Agenda 21* is the voluminous policy document that emanated from the 1992 United Nations Conference on Environment and Development. Using a brief case study of China's energy use—specifically its use of coal—this article illustrates how the objectives of *Agenda 21* are reflected in China's economic development policies and practices. We address these kinds of questions: Has China endeavoured to implement *environmentally sustainable development*, as reflected in the chapters of *Agenda 21*? What does the case of energy use tell us about the utility of *Agenda 21* objectives in China and other developing countries? What are some of the political and economic factors that influenced this process? More broadly, what does the Chinese case tell us about the implementation of voluntary international environmental agreements in the developing world? We conclude that China has been stimulated by *Agenda 21* and other international instruments, along with other factors, to shift its economic development toward a more environmentally sustainable trajectory, as reflected in its changing policies on energy derived from coal burning. However, because economic growth remains central to development goals, these policies are only a start toward environmentally sustainable development. Environmental decline still outpaces sustainable development.
Introduction

When politicians, economists and diplomats talk about China they express concern about Asian security, economies and trade, and human rights. But they also now routinely invoke the potential for economic development in China to do great harm to the natural environment of East Asia and indeed the entire globe. They also express concern about environment-related impacts on the health of the Chinese people and their economy. Because of the potentially adverse environmental consequences of Chinese development, one observer has described China as an "environmental bombshell" waiting to explode. Many people think the best way for the Chinese "bombshell" to be defused is through environmentally sustainable economic development. Here we define "sustainable development" as economic development in harmony with the environment, or more realistically development that balances economic and environmental goals and thereby does limited harm to the environment. The notion of sustainable development was codified in Agenda 21, the voluminous policy document that emanated from the 1992 United Nations Conference on Environment and Development (UNCED, meeting at the "Earth Summit" in Rio de Janeiro). Agenda 21 offers guidelines that China can use to move its development path toward greater environmental sustainability.

Sustainable development is now perceived to be an important issue in China. It gained support in the Ninth Five Year Plan (1996-2000), and the Fifteenth Chinese Communist Party Congress (September 1997) stated that sustainable development strategies must be implemented. This sentiment was subsequently reiterated by government officials at all levels, including the premier and the president, and has been reflected in policy changes designed to actualise sustainable development. To be sure, China has experienced monumental environmental problems associated with its rapid economic growth. Among the more prominent environmental problems facing China are rapid depletion of land through conversion of agricultural land to commercial uses; pollution of all kinds, notably water
pollution from industrialization and population growth, and air pollution from automobiles and the burning of coal; degradation of soil, forests and grasslands; increased soil erosion; and the general adverse and broad impacts of the world's largest population. In the long term, these adverse environmental consequences of economic growth will pose tremendous challenges for China's economic development, political stability, and the health of the youngest generation in China (not to mention the well being of those living in other countries, and that of other species). The Chinese government has taken notice.

Our objective in this article is to use a brief case study of China's energy use—specifically its use of coal—to illustrate and understand how the objectives of Agenda 21 are reflected in China's economic development. We begin asking these kinds of questions: Has China endeavoured to implement sustainable development, as reflected in the chapters of Agenda 21? What does the case of energy use tell us about the utility of Agenda 21 objectives in China and perhaps other developing countries? What are some of the political and economic factors that influenced this process? More broadly, what does the Chinese case tell us about the implementation of voluntary international environmental agreements in the developing world?

After further explanation of our research, in the next part of this article we say more about the notion of sustainable development, and we discuss some of the objectives of Agenda 21. We then look directly at the degree to which economic development in China has reflected the objectives of several important parts of Agenda 21, using Chinese coal production and use as an indicative case. We conclude with observations about what the case of China tells us about the implementation of Agenda 21 and voluntary international environmental agreements.

Why have we chosen the China case? One can find many justifications, but chief among them is China's size and potential impact on the natural environment. Like other
developing countries, it justifiably seeks to improve the living standards of its people. However, should this be done in an environmentally unsustainable manner—as it has been so far, for the most part—the adverse impacts will be felt not only locally and nationally, but regionally and globally. China already has some of the most polluted cities in the world, but soon it will overtake the United States as the primary source of polluting emissions that contribute to global climate change. The sources of air pollution in Beijing and Shanghai are, consequently, also sources of climate change in Sao Paulo and Dhaka (and New York and London). Thus a better understanding of the Chinese case could have substantial benefits for countless people in China and beyond. Furthermore, China can be viewed as indicative of large developing countries that are trying to promote sustainable development—that is, countries seeking to balance long term environmental protection with short and medium term economic growth and development.

To be sure, one case is not enough to make sweeping generalizations about sustainable development, Agenda 21, and the implementation of other voluntary international environmental agreements. However, the Chinese case goes a long way toward these ends. Added to the research already done in this field, this brief case study can therefore be enlightening.

Sustainable Development and Agenda 21

International Environmental Diplomacy and Sustainable Development

Environmental issues emerged on the international agenda with the 1972 Stockholm Conference on the Human Environment. The governments of 114 countries agreed that their environmental fortunes were interconnected, and that they shared a single global commons. Among the important products of the Stockholm conference were the Stockholm Declaration,
the establishment of the United Nations Environment Program (UNEP), and the surrounding attention that contributed to creation of domestic environmental protection ministries. While the conference was largely devoted to environmental matters, reflecting the preferences of the industrialized developed countries, it also brought attention to questions of economic development that would be even more salient in future international environmental conferences. The Stockholm Declaration was a set of sometimes conflicting principles, some reasserting sovereignty, others highlighting the need to compromise it to deal effectively with environmental issues. UNEP soon encountered resistance from developed countries, which wanted to avoid paying for new environmental programs abroad, and from developing countries, which feared that environmental concerns would divert attention away from economic development. Other UN institutions also resisted making UNEP a strong body within the United Nations. They did not want to cede their own new environment-related programs to UNEP. Thus the Stockholm conference initially had little favourable impact on the Earth’s environment. Nevertheless, the Stockholm conference raised awareness among publics and governments about the importance of international environmental cooperation, and UNEP would eventually take on an important role in international environmental deliberations.

Twenty years after the Stockholm conference, diplomats from nearly 180 countries attended the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, making it the largest international conference to that date. Indeed, 118 heads of state or government spoke at this "Earth Summit," reflecting the growing international interest in environmental issues since Stockholm. Among the products of the Rio summit were the Rio Declaration, a statement of principles that governments agreed to consider as part of efforts to foster environmentally sustainable development; agreement on conventions dealing with climate change and biodiversity; establishment of a UN Commission on Sustainable
Development (CSD), which was intended to promote sustainable development across the UN system and to foster international funding of related programs; a weak statement on protecting and managing the world's forests; and Agenda 21. Permeating UNCED and its declarations was the demand by developing countries that "new and additional" funds be provided by the developed countries for the purposes of environmentally sustainable development.

Whether the Rio summit was a success was the focus of "Earth Summit II," held in New York in 1997. It was agreed that UNCED was somewhat successful in giving new energy to the goals of the Stockholm conference, and that it provided important guidance for environmental programs and stimulated ongoing negotiations on specific important issues like climate change. But new action on protecting the global environment was incremental at best, and the commitment by developed countries to provide new aid to the developing world went unfulfilled. Diplomats and environmentalists realized that environmental protection would be a slow, ongoing process. What emanated from Stockholm and Rio was a general agreement among governments that a move toward sustainable development was needed, and that it ought to begin sooner rather than later. But, despite two decades of discussions, this still begged the question of what sustainable development would entail.

Probably the most authoritative—and certainly the most frequently cited—definition of sustainable development comes from the 1987 report of the Brundtland Commission (the World Commission on Environment and Development), Our Common Future. This report's definition served as the basis for UN plans for UNCED and associated statements and agreements, including Agenda 21. According to that report, sustainable development is "development which meets the needs of the present without compromising the ability of future generations to meet their own needs." The precise meaning of sustainable
development will always vary, depending on the issue and the actors involved. We can say, however, that sustainable development encompasses several important areas:

First, the concept clearly represents an attempt to bridge the concerns and interests of developed and developing nations, but it applies to both. Second, it attempts to reconcile economic growth and environmental protection, rather than viewing them as tradeoffs; indeed, the Brundtland Report argues that neither is possible without the other. Third, the concept is strongly anthropocentric. It starts from the premise that human needs must be met in order to address environmental problems. Thus improvement in living conditions in poor countries... is an essential precondition for ecological preservation. Fourth, the limits to growth are not ultimately physical or biological but social and technological; it is assumed that environmental problems can be solved. Finally, the concept is extremely general, lacking in specific content as to how sustainable development is to be attained or who is responsible for achieving it. This vagueness was deliberate; it allows the idea to be adopted by virtually everyone as a way of bringing people together to seek common ground. In this formulation it is clearly a political and social construct, not a scientific concept or blueprint.13

Agenda 21
Which among these foci of sustainable development is most important is no doubt subject to differing views, including within China. It is essential to realize that all of Agenda 21 is a result of political bargaining during international deliberations. As such, its chapters and paragraphs are open to multiple interpretations, just like the underlying concept of sustainable development. It would be wrong to assume that each government’s definition of “sustainable development” is the same. In areas most affected by pollution, environmental considerations
may be foremost; in areas suffering more poverty, development will likely be the dominant consideration. In some instances sustainability, in the environmental sense, will be the primary goal; in others, it will be seen as a means to economic growth and assistance from central authorities or international institutions. Indeed, even within countries, not least one the size and complexity of China, meanings of the term and its practical implications will vary. Importantly, Agenda 21 is not a binding agreement. It is a set of recommendations only.

This begs the question of why governments would implement Agenda 21. Self-interest is the obvious explanation. In this case China can benefit from invoking technology assistance and financial aid arrangements outlined in Agenda 21 (which are more concretely codified in international environmental treaties, such as the Framework Convention on Climate Change). But this does not explain everything. Governments are also interested in doing, or being seen as doing, the "right" thing from the perspective of the international community. While compliance with international environmental treaties is expected and quite often forthcoming, even voluntary international agreements can influence state behavior by gradually reshaping conceptions of national interests in line with emergent international norms.  

Agenda 21 is broken down into four main sections (comprising 40 chapters): Social and Economic Dimensions, Conservation and Management of Resources for Development, Strengthening the Role of Major Groups, and Means of Implementation. It includes something for almost everyone. What comes through from a reading of Agenda 21 is the goal of achieving sustainable development, or more directly promoting economic development (usually meaning economic growth) without unnecessary and excessive harm to the environment. For better or worse, Agenda 21 is concerned most of all with the well-being of people (not animals, plants and the ecosystem per se). The natural environment is valuable, in this interpretation, because it benefits humans. Explicit is the need to reduce poverty and raise
living standards in the poor countries. This is to be done through fostering an international trading system favourable to developing countries, through greater international assistance in the forms of financing and technology, and through national plans, strategies and policies.\textsuperscript{15} As Bryner has argued, sustainable development "requires the creation of new incentives and penalties that promote sustainable activity; revising national economic indicators to reflect environmental considerations; reforms that ensure that market prices include more of the true costs of production; and addressing the problem of falling commodity prices that encourages developing countries to export natural resources at unsustainable rates."\textsuperscript{16} These goals are laid out in Agenda 21.

We examine several of these areas below, using the case of coal use in China as an indicative case study of their implementation (or not). It is not possible here to survey the ways in which all Agenda 21 chapters and objectives are reflected in China's development policies. Here we focus on portions of three chapters dealing with industrial economics and trade (Chapter 2), atmospheric pollution (Chapter 9), and financing considerations (Chapter 33). This sampling of Agenda 21 chapters provides a cross-section of important areas and sectors that must be considered in the context of implementing sustainable development on the ground.

\textit{Domestic Policies Related to Sustainable Development}

Chapter 2 of Agenda 21 addresses international cooperation to accelerate sustainable development in developing countries, and related domestic policies.\textsuperscript{17} Hence it tries to make the essential connections between international deliberations and interstate cooperation, on the one hand, and sustainable development on the ground in developing countries, on the other. Chapter 2 begins by focusing on creation of an international economic climate favourable to countries undergoing development (in many ways ignoring environmental
issues). The main concern of the chapter is promotion of sustainable development through trade. It brings together international and national efforts, pointing out that "reactivation and acceleration of development requires both a dynamic and a supportive international economic environment and determined policies at the national level. It will be frustrated in the absence of either of these requirements." Here we focus on the portions of Chapter 2 dedicated to management-related activities that maximize the benefits of trade liberalization for sustainable development (para. 2.14[c]) and that encourage domestic policies conducive to sustainable development (para. 2.37[f]), in particular market-based pricing of commodities.

Much of Chapter 2 is dedicated to specific policy mechanisms. According to Paragraph 2.14(c), countries should adopt, "with respect to commodities consistent with market efficiency," policies that "reflect efficient and sustainable use of factors of production in the formation of commodity prices, including the reflection of environmental, social and resources costs." More specifically, according to Chapter 2,

all countries should develop policies that improve efficiency in the allocation of resources and take full advantage of the opportunities offered by the changing global economic environment. In particular, wherever appropriate, and taking into account national strategies and objectives, countries should:

Remove the barriers to progress caused by bureaucratic inefficiencies, administrative strains, unnecessary controls and the neglect of market conditions;

Provide scope for appropriate economic instruments, including market mechanisms, in harmony with the objectives of sustainable development and fulfilment of basic needs;
Promote the operation of effective tax systems and financial sectors.\textsuperscript{22}

In other words, the prices of goods and services should reflect their true costs to the environment, to society, and to the country's resource base. More specifically, these paragraphs arguably mean that the prices of commodities should not be reduced by government subsidies, but instead should be determined by the market. Yet in so many countries—both developed and developing, China included—the prices of goods and services frequently do not reflect their real costs to society and to the natural environment. For example, coal, water and wood would be much higher in price in China were their true costs reflected. (Again, the same can be said for developed countries. They are not the focus of our analysis, however.)

\textit{Atmospheric and Air Pollution}

In Chapter 9, Agenda 21 focuses on protection of the atmosphere, which is threatened by a myriad of pollutants from countless sources.\textsuperscript{23} Chapter 9 recommends actions related to transportation, industrial development, terrestrial and marine resource development and land use, stratospheric ozone depletion, and transboundary atmospheric pollution.\textsuperscript{24} There is recognition that atmospheric pollution is first a problem of economics, and specifically of energy and resource use. Below we examine ways in which Agenda 21 paragraphs dealing with energy (coal) development, efficiency and consumption are actualized (intentionally or not) in China.

Energy use is essential to development, as the paragraphs in Chapter 9 acknowledge. However, much energy worldwide "is currently produced and consumed in ways that could not be sustained if technology were to remain constant and if overall quantities were to
increase substantially." Agenda 21 recognizes the "need to control atmospheric emissions of greenhouse and other gases, and substances will increasingly need to be based on efficiency in energy" use and increased reliance on new energy sources, with all energy necessarily used in ways that "respect the atmosphere, human health and the environment as a whole." But global energy use is growing, particularly in many developing countries. Indeed, in China energy use is having the adverse local, regional and global impacts anticipated by Agenda 21, and within a generation China is likely to overtake the United States as the world's largest energy user (in aggregate, not per capita).

Financial Resources and Mechanisms

Chapter 33 of Agenda 21 addresses the important capacity-building issue of financial resources and mechanisms. This was one of the most contentious issues in the UNCED negotiations, salting open wounds from the developing countries' failed attempts in previous decades to create a New International Economic Order and to compel more development funding from North to South. However, demonstrating the influence of developing countries in the environmental issue area, Chapter 33 is permeated with calls for "new and additional" (sometimes written as "substantially new and additional") financial resources and technology, specifically to be provided on highly concessional terms or as grants by developed countries to the developing countries. This new and additional funding for Agenda 21 and other UNCED programs was expected to come from multilateral development banks (including the International Development Association and the newly established Global Environmental Facility), specialized agencies of the United Nations and other international organizations and multilateral institutions, bilateral assistance programs, debt relief, and private funding. New forms of public and private financing were also to be explored, including, for example, tradable permits.
While Agenda 21 acknowledges that financing will come from each country's public and private sectors, Chapter 33 calls on the developed countries to increase their official development assistance (ODA).^{32}

For developing countries, particularly the least developed countries, ODA is a main source of external funding, and substantial new and additional funding for sustainable development and implementation of Agenda 21 will be required. Developed countries reaffirm their commitments to reach the accepted United Nations target of 0.7 per cent of GNP for ODA and, to the extent that they have not yet achieved that target, agree to augment their aid programmes in order to reach that target as soon as possible and to ensure prompt and effective implementation of Agenda 21.^{33}

It was agreed that the new Commission on Sustainable Development would monitor progress toward this goal. While all of Agenda 21 is, again, voluntary, this call for new funds and concessional technology transfers, as well as the reaffirmation of the 0.7 percent ODA target, was a victory for developing countries, arguably reflecting their newfound power in the context of growing concern in the developed countries about adverse environmental changes from unsustainable development in developing countries.^{34} Explicit throughout Agenda 21, and indeed the international negotiations on it and related matters, was the understanding that developing countries would not, and arguably could not, make a full transition to sustainability if new funds and technology assistance were not forthcoming. Insofar as ODA has not come into line with the UN target—indeed, it fell far short, dropping through the 1990s—the likelihood of more sustainable development is reduced. This shortfall was replaced by private investment in some countries, much of it directed at China (but very little has gone to the poorest countries that arguably need it the most).
Economic Development in China and the Objectives of Agenda 21: The Case of Coal

Since Agenda 21 was agreed by international consensus in 1992, China has paid much more attention to environmental conservation and sustainable development, even while prioritising economic growth. China has experienced rapid economic growth and significant positive developments for the environment. However, many serious environmental problems remain unsolved, and overall environmental conditions continue to deteriorate rapidly. In this section, we focus on the problem of air pollution in China (one of its most pressing environmental concerns). We will argue, mainly from an economic viewpoint, that China's coal pricing policy is important for its sustainable development. We will also look at how indicative Agenda 21 is for China's coal pricing policy. We look first at China's economic development strategy after the advent of Agenda 21, as well as related unsolved problems (e.g., future coal shortages and sulphur dioxide emissions). We then look at measures that could be taken (i.e., changes to coal pricing policy) and the obstacles to implementing these measures. We focus on the three chapters of Agenda 21 described above, asking specifically how they might apply to China's coal pricing policy. In our subsequent conclusion we point out that while Agenda 21 has its limitations, it does indeed provide indicative guidance for China—and arguably other developing countries—to implement sustainable development.

International Action on Sustainable Development and China's Agenda 21

Though China already took steps for sustainable development, after agreement on Agenda 21 it carried out more environmental conservation, while putting a priority on economic growth. Agenda 21, and the outside actors and international negotiations shaping it and closely related environmental agreements, have influenced China's policies and practices on sustainable development. Elizabeth Economy has shown that "international actors have had a significant
influence in shaping Chinese domestic environmental politics and foreign relations. The
demands of participating in global environmental regimes have forced Chinese leaders to
establish new domestic institutions and processes for managing their participation in those
regimes. Most important, these new institutions and processes favour the interests of the
environmentally proactive actors within China by radically reconfiguring the very nature of
PRC environmental politics. As Lester Ross argues, "International pressure on the PRC to
conform its conduct to international environmental norms influences domestic policy making
in support of environmental regulation," and Yu-shi Mao has observed that international
environmental agreements, "regardless of whether China has signed up to them or not, are a
significant force in promoting environmental protection in China." More broadly, the
Chinese government wants to show the world cares about environmental issues, notably by
taking voluntary action to curb the use of energy contributing to climate change, thereby
reinforcing its "claim and self-perception as a major player in world politics and to be the
leader of and speaker for developing countries."

Thus, in the period surrounding the 1992 Earth Summit (UNCED) from which
Agenda 21 emerged, China created many new agencies and promulgated new programs and
regulations geared toward environmental protection. According to Economy, "UNCED had
a profound effect on environmental policies, institutions, and thinking in the PRC. In terms of
actual policy change, the most important result of the UNCED was the formation of a
Chinese action plan to implement a policy of sustainable development." Within the space of
one year China created its own Agenda 21, which was based on one emanating from the
Earth Summit—the first country to do so. Of course, it is important to bear in mind that the
influence of Agenda 21 and associated international deliberations were unable to counter all
of the bureaucratic, political and economic forces in China pushing against more robust
implementation of sustainable development. Hence, while "international negotiations have
induced some remarkable adjustments of Chinese institutions in this issue area, and China's policies and actions are more sustainable than they would be, they are far from what is necessary to protect the environment.

China's Agenda 21 was completed in April 1993. In March 1994 the Chinese State Council adopted "China's Agenda for the 21st Century: China's White Paper for Population, Environment and Development in the 21st Century" (China's Agenda 21). The coverage of China's Agenda 21 is wide: legislation, policies, education, agriculture, environment, energy, transportation, regional development, population, health, and their mutual relation to one another. The main themes of this agenda arose first from the need for economic development, and then from concerns about protecting the environment for sustainable development. The following statement explains:

Because China is a developing country, the goals of increasing social productivity, enhancing overall national strength and improving people's quality of life cannot be realized without giving primacy to the development of the national economy and having all work focused on building the economy. . . . Given this situation, the Chinese Government can only consider strategies for development that are sustainable and only by coordinating the work of all segments of society can it successfully reach its already defined second and third strategic objectives of quadrupling its GNP against that of 1980 by the end of the century and increasing per capita GNP to the levels of moderately developed countries. At the same time, it will be necessary to conserve natural resources and to improve the environment, so that the country will see long-term, stable development.
Regarding the environment, China has improved its regulatory practices. For example in the area of air quality control, in 1995 the Air pollution Prevention and Control Law (first promulgated in 1987), was amended to include tougher regulations for controlling sulphur dioxide.

China has received substantial international aid and loans for environmental protection projects. Indeed, four-fifths of its budget for environmental protection comes from international aid. Since 1992, China has been the largest borrower from the World Bank, and in the past several years lending for environmental protection has become the fastest growth area of the World Bank's programs in China. China is also the largest borrower from the Asian Development Bank. As for bilateral aid, for China the largest bilateral donor is Japan. The Japanese government's concessional loans were, in the past, mainly for transportation projects. Since 1995 however, loans for environment-related projects (i.e., environmental conservation, sewerage and cleaner power plants) have become the primary objects of aid (Figure 1).
Figure 1: The Japanese Government's Official Development Assistant Loans to China by Sector

Note: The data and loan amounts are at the approval base, which may differ from the disbursement base. Some loans for environment-related projects are categorised into sectors other than Environment. For example, loans for cleaner power plants fall into Electric power.


Energy Use in China: Dirty Coal

These and many other recent efforts by China have been somewhat positive for environmentally sustainable development. As for economic growth, China is among the world's five fastest growing economies. Rising incomes have eased poverty and improved health in large parts of the country. As for air pollution, some cities have seen ambient air quality improvements. Particulate emissions have remained relatively flat since 1980, implying a substantial increase in controls given the near doubling of coal consumption. However, substantial problems remain for sustainable development. Concerning economic
growth, coal shortages will pose challenges. Regarding pollution, sulphur dioxide emissions and the resulting acid rain remain major problems.

China's is an energy-scare economy, with per capita coal endowments far below the world average (Table 1).48

Table 1: Coal Endowments

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>US</th>
<th>Russia</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proved recoverable reserves of coal at the end of 1999 (million tonnes)</td>
<td>114,500</td>
<td>249,994</td>
<td>157,010</td>
<td>984,453</td>
</tr>
<tr>
<td>Population as of 2000 (thousand)</td>
<td>1,275,133</td>
<td>283,230</td>
<td>145,491</td>
<td>6,056,715</td>
</tr>
<tr>
<td>Coal reserves per capita (thousand tonnes)</td>
<td>90</td>
<td>883</td>
<td>1,079</td>
<td>163</td>
</tr>
</tbody>
</table>

Note: Proved recoverable reserves are the tonnage that can be extracted from the earth under present and expected local economic conditions with existing available technology.


No other major economy is as reliant on coal as is China. Although the recent increase in oil imports moderately reduces its relative significance, coal's share of primary energy supply in China remains the highest among all the types of energy resources—the proportion was 68 percent in 1999.49 While the known coal reserves in China are 12 percent of the entire world's, China's coal consumption amounts to 24 percent of the world's. China's R/P ratio (coal reserves divided by annual production) is, therefore, 111 years—far below other regions' ratios (Table 2).
Table 2: R/P Ratio

<table>
<thead>
<tr>
<th></th>
<th>Proved recoverable reserves of coal at the end of 1999&lt;sub&gt;a&lt;/sub&gt;</th>
<th>Production in 1999</th>
<th>R/P ratio&lt;sub&gt;b&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) (million tonnes)</td>
<td>(b) (million tonnes)</td>
<td>(a/b) (years)</td>
</tr>
<tr>
<td>Africa</td>
<td>55,367</td>
<td>231</td>
<td>240</td>
</tr>
<tr>
<td>North America</td>
<td>257,966</td>
<td>1,080</td>
<td>239</td>
</tr>
<tr>
<td>South America</td>
<td>21,752</td>
<td>46</td>
<td>474</td>
</tr>
<tr>
<td>China</td>
<td>114,500</td>
<td>1,030</td>
<td>111</td>
</tr>
<tr>
<td>Asia excluding China</td>
<td>137,808</td>
<td>640</td>
<td>215</td>
</tr>
<tr>
<td>Russian Federation (RF)</td>
<td>157,010</td>
<td>249</td>
<td>630</td>
</tr>
<tr>
<td>Europe excluding RF</td>
<td>155,676</td>
<td>758</td>
<td>205</td>
</tr>
<tr>
<td>Middle East</td>
<td>1,710</td>
<td>2</td>
<td>1,140</td>
</tr>
<tr>
<td>Oceania</td>
<td>82,664</td>
<td>308</td>
<td>269</td>
</tr>
<tr>
<td>World</td>
<td>984,453</td>
<td>4,343</td>
<td>227</td>
</tr>
</tbody>
</table>


While removal of particulates (which is relatively simple) improves, sulphur dioxide emissions remain nearly out of control and still the primary cause of China's air pollution. Sulphur dioxide emissions, generated mainly from the burning of coal, have roughly paralleled the increase in coal consumption. Unless there are serious efforts to curb emissions in the near future, annual sulphur dioxide emissions from China may rise by an estimated 50 percent between 1993 and 2010. The environmental effects of sulphur dioxide emissions occur primarily through acid rain. Because the quantity of sulphur dioxide being discharged in China is increasing, the total surface area suffering from acid rain continues to expand. Acid rain in central and southwestern parts of China is relatively severe, while the situation in the south is getting worse. The area affected by acid rain is about 30 percent of China's total land area. Moreover, the problem is spreading to South Korea and Japan, where studies in some prefectures identify half the acidic fallout as originating in China.
China's inefficient use of coal is the proximate cause of its massive coal consumption and resulting sulphur dioxide emissions. Coal accounts for an estimated 90 percent of China's sulphur dioxide emissions generated from fossil fuel consumption.\textsuperscript{54} The cleaning of sulphur from coal remains difficult in China, partly because the proportion of sulphur in the coal is relatively high and the coal itself is relatively difficult to wash.\textsuperscript{55} The unwashed coal is causing increased sulphur dioxide emissions and decreased energy efficiency. Thus coal is used inefficiently and most users rely on raw coal. Until recently, China only washed some 22 percent of its coal. Although the Ninth Five-Year Plan requires all new and many existing coal mines to install coal preparation facilities, with the objective of washing 30 percent of all coal,\textsuperscript{56} the proportion remains moderate compared to about 45 percent in the United States and more than 75 percent in Europe.\textsuperscript{57}

Now is arguably the time for China to further invigorate and implement its energy policies and shift away from a coal-based development pattern to a more efficient, sustainable and environmentally friendly one.

Measures for Efficient Coal Use and Obstacles to Those Measures

Efficient use of coal is essential both to avoid future coal shortages and to reduce sulphur dioxide emissions. If China were to raise its energy efficiency to the level of developed countries, it would reduce its coal consumption by one third.\textsuperscript{58} Advanced technologies used in developed countries can improve efficiency of coal use in China. Unlike traditional sulphur scrubbers, advanced clean coal technologies offer China an opportunity to reduce emissions while improving plant efficiency or energy output or both.\textsuperscript{59} The expense of introducing such technologies, however, restricts their application in China. Coalmines have not invested in better equipment to produce high-quality coal because they lack the funds. Similarly, due to financial restrictions, China's electric power plants will not equip desulphurisation devices in

21
the near term. The initial cost of the "middle-sized" device (a device for a 0.5 MW power plant) is at least US$ 450 million, and the annual operation and maintenance costs reach at least US$ 90 million. Because it needs more energy, China would prefer another power plant rather than pay the extra costs of installing and maintaining these desulphurisation devices.60 Thus, developed countries and international aid organizations need to work even harder with China by providing the financing that helps it to introduce advanced technologies.

Coal pricing policy is also vital for efficient coal use. By increasing the price of coal so that it includes the social costs of air pollution, there will be new incentives to consume coal more efficiently. This would result in resource savings and reduced sulphur dioxide emissions. Also, quality-related prices would restrain producers from selling high-quality coal for export, which leaves the dirty coal for the domestic market.61 Prices that reflect social and environmental costs would give consumers incentives ("signals") to conserve energy and thereby reduce sulphur dioxide emissions. Coal prices that remain too low discourage consumers' efficient use and encourage harmful fuel choices. They also encourage producers' moral hazard.62

Compared with the energy-rich United States, while the steam-coal prices in China appear reasonable, those of coking coal remain low and suggest room for price adjustment (Table 3).
Table 3: Coal Prices (US$ per metric ton)

Steam Coal for Industry:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>39.88</td>
<td>42.62</td>
<td>37.64</td>
</tr>
<tr>
<td>US</td>
<td>35.59</td>
<td>35.7</td>
<td>35.6</td>
</tr>
<tr>
<td>Differential</td>
<td>4.29</td>
<td>6.92</td>
<td>2.04</td>
</tr>
</tbody>
</table>

Coking Coal for Industry:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>40.2</td>
<td>39.98</td>
<td>42.55</td>
</tr>
<tr>
<td>US</td>
<td>52.18</td>
<td>52.18</td>
<td>52.22</td>
</tr>
<tr>
<td>Differential</td>
<td>-11.98</td>
<td>-12.2</td>
<td>-9.67</td>
</tr>
</tbody>
</table>

Note: Average unit value at CIF (cargo, insurance and freight) base.


In fact, China has already taken measures to use coal price signalling, but those measures are inadequate. China removed most coal price controls in 1994. Before that price liberalization, the controlled coal prices were too low and the price differences too narrow to reflect economic costs (mainly transportation costs) and social costs. Following price liberalization in January 1994, coal prices increased. The price increase, however, was due mainly to transportation costs, which account for up to 70 percent of the delivery price of coal (compared with 30-50 percent in the United States). Price variety is, to a large extent, dependent on the economic costs of bringing coal to market. Hence coal prices, while higher, still do not reflect full social costs, keeping them low relative to alternative fuels (e.g., oil and gas). This sustains the heavy reliance on coal. While coal prices remain relatively low, there will be an under-supply of high-grade coals to the domestic market. Thus the social costs of burning coal and its quality (both are negatively correlated) should be factored into current prices. The government should lift remaining price controls and coal prices should internalise environmental factors.

The introduction of these and other coal pricing policies face several obstacles. The conservative bureaucracy in China is reluctant to make drastic changes to coal pricing policy.
The Ministry of Coal Industry, which has been absorbed into the State Economic and Trade Commission, is tradition-bound. So-called "coal bureaucrats" hold the power to decide coal prices. It is unpleasant for them that full market mechanisms should decide coal prices, or that other ministries related to the environment might have rights to affect coal prices. Furthermore, the relationship between the provincial and central governments hinders increases in coal prices that would reflect true social costs and coal quality. The resource tax on coal sales provides revenue for provincial governments, and it is dependent on the amount of coal sold. If the central government were to increase coal prices, coal sales could be curbed, thus decreasing the revenue of the provincial governments. In addition, the resource tax is not charged on washed and processed coals (i.e., relatively good quality coals). Insofar as the central government's coal pricing policy encourages the production of better quality coals, that also reduces provincial governments' revenues. Thus, the central government's coal pricing policy for sustainable development could face strong resistance from provincial governments.

Another obstacle to a new coal pricing policy is China's current short-sighted economic growth policy, which relies to a great degree on exports. Exports are one of the most important engines of economic growth in China (Table 4), and these robust exports are supported by low energy prices.
Table 4: China's GDP, Exports, and Exports to GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (bn RMB)</th>
<th>Exports (bn RMB)</th>
<th>Exports to GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>896.4</td>
<td>80.9</td>
<td>9.0</td>
</tr>
<tr>
<td>1987</td>
<td>1196.3</td>
<td>147.0</td>
<td>12.3</td>
</tr>
<tr>
<td>1989</td>
<td>1690.9</td>
<td>195.6</td>
<td>11.6</td>
</tr>
<tr>
<td>1991</td>
<td>2161.8</td>
<td>382.7</td>
<td>17.7</td>
</tr>
<tr>
<td>1993</td>
<td>3463.4</td>
<td>528.5</td>
<td>15.3</td>
</tr>
<tr>
<td>1995</td>
<td>5847.8</td>
<td>1245.2</td>
<td>21.3</td>
</tr>
<tr>
<td>1997</td>
<td>7477.2</td>
<td>1515.3</td>
<td>20.3</td>
</tr>
</tbody>
</table>


Furthermore, China's export structure has been shifting from one dominated by primary commodities to one relying on manufactured goods (Table 5). In other words, China's export structure has become more reliant on energy consumption.
Table 5: Structure of Export (US$ 100 million)

<table>
<thead>
<tr>
<th>Year</th>
<th>1985</th>
<th>1987</th>
<th>1989</th>
<th>1991</th>
<th>1993</th>
<th>1995</th>
<th>1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Goods</td>
<td>138.28</td>
<td>132.31</td>
<td>150.78</td>
<td>161.45</td>
<td>166.66</td>
<td>214.85</td>
<td>239.30</td>
</tr>
<tr>
<td>(Share in Total)</td>
<td>(50.6)</td>
<td>(33.5)</td>
<td>(28.7)</td>
<td>(22.5)</td>
<td>(18.2)</td>
<td>(14.4)</td>
<td>(13.1)</td>
</tr>
<tr>
<td>Manufactured Goods</td>
<td>135.22</td>
<td>262.06</td>
<td>374.60</td>
<td>556.98</td>
<td>750.78</td>
<td>1272.95</td>
<td>1587.67</td>
</tr>
<tr>
<td>(Share in Total)</td>
<td>(49.4)</td>
<td>(66.5)</td>
<td>(71.3)</td>
<td>(77.5)</td>
<td>(81.8)</td>
<td>(85.6)</td>
<td>(86.9)</td>
</tr>
<tr>
<td>Total</td>
<td>273.50</td>
<td>394.37</td>
<td>525.38</td>
<td>718.43</td>
<td>917.44</td>
<td>1487.80</td>
<td>1826.97</td>
</tr>
</tbody>
</table>

Note: In 1993 a new commodity catalogue was used in the customs statistics, and products not otherwise classified in the previous years have been classified and included in different categories of commodities.


China is not yet exporting high value-added products. China's strategy is to be competitive in the international market; that is, to sell cheaper products in part due to cheaper energy prices. The low energy prices could be described as "invisible subsidies" to export industries, or what some might label "environmental dumping." (Of course, other countries subsidize energy prices in various ways, with similar effect.)

**China's Coal Pricing Policy and Agenda 21**

Energy pricing policies are essential components of sustainable development. Thus it is not surprising that they are discussed explicitly in Agenda 21. Here we look at China's energy pricing policies in the context of the three Agenda 21 chapters summarized above (Chapter 2
on the relation between trade and energy prices; Chapter 9 on air pollution and energy prices; and Chapter 33 on applications to energy prices and related development assistance).

In terms of coal pricing policy, Chapter 2 points out several important issues. Most importantly, the chapter urges that commodity prices should reflect environmental and social costs (para. 2.14). It also advocates freeing up commodity markets to reflect true costs, presumably advocating price signalling of coal quality from suppliers to consumers through market mechanisms. Supplementing pricing policies that reflect true social costs, this chapter also proposes promotion of effective tax systems (para. 2.37[f]). Chapter 2 further promotes removing bureaucratic obstacles to the introduction of price policies mentioned above (para. 2.37[a]). In this context, China decontrolled coal markets and introduced a resource tax. However, as we mentioned earlier, the effect is not enough. Of course, since the focus of Chapter 2 is mainly agricultural commodities—those that depend on international market agreements, such as cocoa, coffee, sugar and tropical timber (para. 2.16)—those quite vital issues might have not been considered for coal pricing policies. In addition, though Chapter 2 points to tariff and non-tariff impediments as restrictions on international trade (para. 2.7), the chapter does not clearly caution that to keep domestic energy prices low by neglecting social cost could be a non-tariff trade barrier.

One objective of Chapter 9 is to reduce adverse effects on the atmosphere from the energy sector (para. 9.11). It urges governments to promote economic measures that improve energy efficiency (para. 9.12[h]), because energy efficiency leads to reduced adverse effects on the atmosphere (para. 9.11). China has tried to use more legalistic measures, such as amendment of the Air pollution Prevention and Control Law. As a useful step both for prevention of air pollution and for sustainable economic development by energy-savings, China should undertake economic measures, such as much more market-driven coal pricing.
In this sense, Chapter 9 would be more useful for governments if it had been more specific on the content of recommended economic measures, such as effective energy pricing policies.

Chapter 33 focuses on a vital issue for environmental protection projects: financing. Agenda 21 points out that the bulk of financing for the implementation of sustainable development will come from the developing countries themselves (para. 33.13). This could encourage governments to finance environmental conservation projects, at least partially, by implementing energy pricing policies that include new taxes or levies for wasteful emissions. At the same time, Chapter 33 calls for external funds from multilateral development banks, bilateral donors, private funds, etc. Regarding energy pricing policies of fund-receiving countries, however, the chapter warns multilateral donors not to introduce new forms of conditionality when disbursing funds to recipient countries (para. 33.14[a]). Nevertheless, the World Bank has already proposed that energy pricing policy in China should be amended to internalise costs for environmental protection. Some bilateral donors, including Japan, also expect China to increase applicable energy prices so that projects relating to energy can be implemented and maintained without outside funding. To be sure, many developing countries, including China, might view these conditions as interference in their internal affairs. However, it seems prudent for funding agencies to continue pushing for new energy pricing policies that reflect true environmental costs, and to consider attaching efficiency-related conditions (that are more environmentally prudent) on loans that are disbursed by bilateral and multilateral donors.

**Conclusion**

This brief look at one aspect of China's policies for economic development suggests that efforts by governments to negotiate sustainable development over the last three decades are, to some extent, being actualised. The principles propounded in Agenda 21 have been
reflected, to a limited degree, in China. But even in the narrow (yet vitally important) area of coal use, there is much room for additional action. This case shows that economic development and the environment are indeed related issues. Agenda 21 takes this into account, thereby indicating that energy policies—in this case coal pricing policy in China—are vital for sustainable development. However, reflecting the difficulty of negotiating detailed agreements (even voluntary ones) that can restrict national sovereignty, it does not clearly specify what energy pricing policy should be in each country. The best policies will quite often depend on each country's particular situation, such as its resource endowment, type of major energy, and so on. Thus it might be difficult for an international agreement like Agenda 21 to provide specific guidance for an issue as specific as coal prices in China. In other words, the impact of Agenda 21 may be limited to general guidance. This limitation requires all actors involved, ranging from national governments and international organizations to bilateral donors and nongovernmental organizations, to consider national circumstances. This will help overcome domestic obstacles to implementing the objectives of Agenda 21 and other international agreements intended to bring about sustainable development. This could be one of the ways for China and interested international actors to defuse the environmental "bombshell."

Importantly, however, are the underlying motivations most states have for joining and implementing Agenda 21 and other international agreements and regimes designed to promote environmentally sustainable development. If a state participates enthusiastically and genuinely desires to work toward agreed goals, its implementation will be much more robust. If it participates for other reasons, such as to garner international aid and technology, implementation will occur only insofar as actions can be justified for other, non-environmental reasons. China's participation in the Agenda 21 negotiations was guarded. It sought to protect its sovereignty and freedom of action, and it wanted to extract new funds
and technology from developed countries.\textsuperscript{70} Having said this, extant environmental awareness was strengthened among Chinese during the UNCED process, and that awareness and concern has grown substantially over the last decade as environmental conditions have deteriorated markedly. This evolution and growth in underlying support for Agenda 21’s goals suggests that China’s sustainable development policies related to coal and energy use, as well as other economic activities with environmental consequences, will become more robust in the future. Whether these policies can overcome resistance from provincial governments and officials, weak regulatory institutions, and the pervasive greed of powerful interests within Chinese government and society, is quite another matter.\textsuperscript{71} Arguably, the job of those in Beijing pushing for more sustainable development is made easier by international environmental agreements because they influence the "credibility, prestige, and financial resources of the national government."\textsuperscript{72} What this case shows is that voluntary international environmental agreements can have influence and can provide guidance for economic development. But there must be a strong willingness among all interested actors to act, as well as the associated regulatory capacity.

Of what value is Agenda 21 specifically? For China and other developing countries, Agenda 21 and other international agreements sharing its principles provide justification for obtaining international financial and technological assistance from developed countries. Conditional bilateral aid from Japan and multilateral funding from international financial institutions are manifestations of this. Furthermore, as environmental awareness grows in China and other developing countries, particularly among the general population, Agenda 21 provides guidelines and serves as a model for policy action. Increasingly, it can be used by domestic policy actors as international support for changes in economic policies and programs.
To be sure, Agenda 21 by itself is of limited utility; it would be wrong to say that it defines development policy. But it has become part of the mix of incentives, both domestic and international, that shape economic development policies. Combined with the incentives like new financing, it nudges economic policy in the direction of less environmentally destructive practices. China's environmental time bomb may yet explode (and arguably is, albeit in more-or-less slow motion), but it may do so later or in ways that are less harmful to the natural world or at least more manageable by the international community—and the Chinese themselves.

Notes

1 The authors wish to thank the International Joint-Research Program of the Centre for Asian Pacific Studies and the Centre for Public Policy Studies, Lingnan University, for financial assistance aiding our collaboration.


15 "Agenda 21," Chapter 1 (Preamble).

16 Gary C. Bryner, "Agenda 21: Myth or Reality?" in Vig and Axelrod, pp. 160. Bryner's chapter is an excellent summary of Agenda 21's objectives and of progress toward achieving those objectives after five years.

17 "Agenda 21," paras. 2.1-2.43.

18 Para. 2.2.

19 Para. 2.37.

20 Para. 2.37(a).

21 Para. 2.37(e).
Many of these areas are addressed by international agreements dealing with global atmospheric pollution, notably the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer and the 1992 Framework Convention on Climate Change, and similar agreements dealing with regional pollution. Chapter 9 recommends that countries act in accordance with these instruments and take additional voluntary actions consistent with them. See para. 9.2.


48 China's per capita endowments of crude oil and natural gas are also far below the world average (ibid. p. 49).


53 Dorian, p. 93. China's sulphur dioxide emissions have become a cross-bordered problem. Also, greenhouse gases are generated from the burning of coal. Thus coal use should be considered in terms of the global climate change as well.


56 IEA, p. 61.
Coal with low sulphur content in China is mainly for export. Thus coal with high sulphur content tends to be for domestic use (Somura, p. 194). China's largest coal production base of Datong, which is eager to enter the international market, is improving the quality of export coal (Dorian, p. 86).

Moral hazard happens when the agent's effort, offered after the contract has been signed, is not verifiable. In the circumstance where coal prices are controlled or do not reflect quality (the circumstance can be regarded as an implicit contract between producers and a coal pricing policy maker), coal producers' (i.e., agents') efforts to produce better quality coals are not verifiable, and thus the producers could tend to supply low quality coals. For more details of moral hazard, see David Perez-Castrillo and Ines Macho-Stadl, An Introduction to the Economics of Information (Oxford: Oxford University Press, 1997).

However, the Chinese government still maintains control of some major coalmines and their sales to ensure necessary supplies for key infrastructural projects (Dorian, p. 52).

China has been a net-oil-importing country since 1993. China also restrains energy prices (mainly coal prices) to abate external inflation pressure of importing oil price hike.

Although coal prices are institutionally determined by market, the prices of coal used for electricity generation are still supervised by the government and it co-ordinates the sales of coal through annual meetings (IEA, p. 51). By way of comparison, a sulphur dioxide fee is currently being charged in industry. However, the fee can be treated as an expenditure in account books and is not large enough. Also this type of levy is not feasible for numerous small users. Dorian has argued that in China coal consumption in the power sector is relatively inelastic. As evidence he points out that between 1990 and 1993 coal consumption in most other sectors stagnated or even declined, whereas consumption in the power sector increased by about 30 percent (Dorian, p. 125). This might mislead readers that the coal price hike will not result in efficient coal use. However, the price hike in that period was not large enough. Responding only to that price-hike range, one might expect the demand curve of coal in the energy sector to have been rather steep. Also, to save hard currency for importing oil, the government encouraged the conversion of oil-fired plants to coal-fired ones in that period. Further research is needed on the elasticity of coal demand curbs.

68 The resource tax has been introduced to (1) conserve energy, (2) adjust incomes among coal mines, and (3) adjust development gaps among regions (Jiang Li, Jiang Xi-Ning and Toshiyuki Fushimi, Saishin Chugoku Zeisei Gaido [The Newest China's Tax System Guide] (Tokyo: Nihon Keizai Shinbunsha, 1997), p. 134). However, as we explained, due to inefficient coal use, the tax does not realise the first purpose.

69 Although in 2000 the top export commodity in terms of value was "automatic data processing machines, etc.," the second-highest value export commodity was machine parts and accessories, followed by jerseys, women's clothes, and footwear (International Trade Center, "Country Specific Trade Analysis," available from http://www.intracen.org/menus/countries.htm, accessed June 6, 2002. According to the International Trade Center's analysis in the period from 1996 to 2000,

70 Cf. Economy, "Chinese Policy-Making and Global Climate Change."


72 Oksenberg and Economy, p. 359.
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