4

Coordinated International Action

In the long run, only a comprehensive, harmonized international climate policy can reconcile competing concerns of climate change and international competitiveness. A global carbon tax or cap-and-trade regime covering all major economies could fit the bill, and many approaches have been proposed that carefully devise such far-reaching regimes. Sadly, these options are likely to remain distant hopes for some time to come. One reason is the continued (and not entirely unjustified) insistence of some developing countries that they want to see some serious action from the big, rich polluters before they take their own sweeping national measures. Another is the sheer technical and institutional capacity needed to implement a cap-and-trade system, which remains years away in most major emerging economies.

It does not follow, however, that emerging economies are ready to do nothing. On the contrary, China, for instance, is already taking serious steps and will likely do more. The question for policymakers around the world is how, in the face of an eclectic mix of policies and commitments from a range of countries, to evaluate each other's efforts, to prevent carbon emissions leakage, and to deal with political concerns about affected industry sectors.

The trade measures discussed in the previous chapter are intended to level the carbon playing field by indirectly imposing a cost on foreign producers, by way of an emissions allowance requirement or other costs imposed at the border, equal to that domestic producers face as a result of US federal climate policy. Including such provisions in climate legislation (1) could prevent the displacement of energy-intensive production to uncapped countries; (2) incentivize other countries to adopt emissions reduction standards comparable to the United States; and (3) provide enough assurance to US carbon-intensive industries to win passage of domestic legislation. While the logistics of implementing these provisions are challenging, and their effectiveness in delivering these benefits mixed, they at least offer concrete tools to address competitiveness concerns. Proponents of trade measures themselves argue such measures are second-best approaches. The ideal outcome (from both climate and competitiveness standpoints) is to have major trading partners impose similar costs on their industry directly, rather than having US Customs do so at the border.

First, US trade measures alone would cover only a fraction of global trade in carbon-intensive goods (table 4.1). Of the 1,113 million tons of steel produced in 2005, less than 9 percent involved the United States. While the American market is slightly more important for aluminum, paper, and cement, US imports still account for less than one-fifth of global trade. Acting alone, the United States could see trade measures undercut, as dirtier producers would simply redirect their exports from the United States to countries without carbon tariffs, allowing those countries to export more low-carbon products to the United States (box 3.3).

Second, even if all developed countries adopted trade measures for carbon-intensive goods, the overall impact on industrial CO_2 emissions would be limited. Only one-third of the steel produced worldwide is traded, less than China's consumption of domestically produced steel alone. For cement, only 7 percent of global production crosses international borders. A regime that covered all internationally traded carbon-intensive goods would address only 29 percent of global emissions from those industries.

Finally, as discussed in the previous chapter, imposing carbon costs at the border would have mixed results for the competitiveness of US firms:

- Major trading partners could take action that would be "comparable" from a climate standpoint but impose no additional costs on industry.
- Most imports of goods covered by trade measures come from countries that are less carbon-intensive than goods produced in the United States.
- Trade measures covering just carbon-intensive intermediate goods could harm the competitiveness of downstream consuming industries.
- While most proposed measures would defend the domestic market from lower-cost imports, foreign markets will see the most growth in demand in the years ahead.

Persuading major trading partners to impose similar costs on their carbon-intensive industry as those imposed in the United States would address these concerns. Ideally, various national programs would trend

Table 4.1 US role in global production, trade, and carbon emissions, 2005 (millions of metric tons)

	Global production		Global trade		US production		US imports		US share of global CO_2 (percent)	
Industry	**Volume**	**CO_2**	**Volume**	**CO_2**	**Volume**	**CO_2**	**Volume**	**CO_2**	**Production**	**Imports**
Steel	1,113.45	1,971.65	360.93	639.12	93.22	96.21	29.88	52.91	4.88	2.68
Aluminum	31.90	543.48	32.79	558.65	2.48	74.78	5.23	89.09	13.76	16.39
Chemicals	553.80	1,529.97	72.16	148.78	105.90	376.73	15.95	32.88	24.62	2.15
Paper	354.09	485.14	144.94	198.58	81.44	159.38	21.54	29.51	32.85	6.08
Cement	2,130.00	1,063.72	150.74	75.28	100.90	96.65	33.65	16.80	9.09	1.58
Total	4,183.24	5,593.96	761.56	1,620.40	383.93	803.76	106.25	221.19	14.37	3.95

Note: CO_2 includes both direct and indirect emissions.

Sources: IEA (2007c); United Nations Comtrade database, 2007; International Iron and Steel Institute, *Steel Statistical Yearbook,* 2006; US Department of the Interior/US Geological Survey, *2005 Minerals Yearbook;* UN Food and Agriculture Organization, FAOSTAT database, 2007; and authors' estimates.

toward harmonization, allowing efficiencies to be realized and guaranteeing greater environmental integrity. While many assume that convincing developing countries, China in particular, to agree to voluntarily impose costs on its carbon-intensive industry would be impossible, there may be more scope for such collaboration than first meets the eye. And even in the face of developing-nation hesitation to impose such costs, the United States can play a pivotal role in developing a harmonized carbon market by helping these nations transition to new technologies and increase their administrative and regulatory capacity.

Prospects for International Engagement: The Case of China

There is an increasing understanding in China of the grave risks from climate change. As a country with large vulnerable coastal populations and often-stretched water resources, these risks are very real. Furthermore, there is perhaps a fuller understanding of the science at the highest political levels in China than is the case in the United States. The recent National Climate Change Programme laid considerable emphasis on the seriousness of the climate challenge for China.[1]

While Beijing has, to date, resisted binding emissions reduction commitments in the international arena, it has begun implementing measures at home that reduce the competitiveness of carbon-intensive Chinese industry. The prevailing wisdom a decade ago among government officials was that any economic activity that could be done in China should be done in China. In order to boost local economic growth, provincial officials sought to attract big-ticket investments like steel mills, aluminum smelters, and chemical industry parks by offering free land, low taxes, and cheap energy (Rosen and Houser 2007). These local incentives, aided by a financial system biased toward lending to heavy industrial state-owned enterprises, dramatically expanded energy-intensive industry starting in 2002, as Chinese producers sought to meet surging Chinese demand for goods like steel, aluminum, chemicals, and cement.

By 2006, energy demand had grown more in just four years than it had during the previous 25 years, with heavy industry largely to blame. Manufacturing accounts for 60 percent of all energy consumed in China, two-thirds of which is attributable to the five carbon-intensive industries included in this study. The steel sector alone consumes more energy and emits more CO_2 than all Chinese households; chemical production uses more energy than all the personal cars clogging the country's new roads;

1. China's National Climate Change Programme, prepared under the auspices of the National Development and Reform Commission, People's Republic of China, June 2007, available at http://en.ndrc.gov.cn (accessed February 15, 2008).

and aluminum smelters surpass the entire commercial sector in terms of electricity consumed. So while the United States' climate problem comes from its consumers (75 percent of all US emissions are from transport, commercial and residential), China's comes from its producers.

In addition to creating energy security and environmental challenges at home, this surge in heavy industry has created tensions in China's economic relationship with its major trading partners. In 2002 China was the world's largest steel importer, with a $10 billion steel trade deficit. By the end of 2006, China had become the world's largest steel exporter and was running a $10 billion trade surplus. The change in the trade balance of steel and other energy-intensive goods was responsible for 30 percent of the growth in China's global trade surplus during that period.[2]

Policymakers at the national level have begun taking steps to curb the growth in energy-intensive industry. As China needs to create tens of millions of new jobs each year to absorb migrant workers from rural areas, as well as those laid off from mothballed state-owned enterprises, diverting the country's economic resources into heavy industry makes little macroeconomic sense.[3] Total employment in China in the five carbon-intensive industries included in this study is less than 14 million people and has remained roughly unchanged since 2000 despite the sharp growth in industrial output.[4] This number is less than that for service-sector employment in Guangdong province alone. In addition, with dense population and overwhelming reliance on coal, heavy industry takes a significant toll on public health. China's State Environmental Protection Agency estimates that sulfur pollution alone costs the country $60 billion per year in economic losses, nearly equal to the economic value created by the entire steel industry.[5] Officials in Beijing have attempted to curb the growth in carbon-intensive sectors by raising the price of energy, limiting the availability of bank lending, and withholding project approval.[6] They have also repealed tax rebates exporters of energy-intensive goods used to receive for goods sold abroad and in doing so have voluntarily imposed an additional cost on domestic steel, aluminum, chemical, and cement pro-

2. Data obtained from the China General Customs Administration via the CEIC China premium database, ISI Emerging Markets.

3. Tom Miller, "Booming Economy Creates 12m Urban Jobs," *South China Morning Post*, March 13, 2007.

4. Data obtained from the National Bureau of Statistics via the CEIC China premium database, ISI Emerging Markets.

5. "500b-Yuan Loss from Sulfur Cloud," *South China Morning Post*, August 4, 2006; National Bureau of Statistics via the CEIC China premium database, ISI Emerging Markets.

6. Juan Chen, "China Regulators to Share Data to Curb Loans to Polluters," Dow Jones International News, July 19, 2007; Howard W. French and Li Zhen, "Beijing Seeks Energy Cuts; Localities Find Loopholes," *New York Times,* November 24, 2007.

ducers equal in price to a \$50 per ton carbon tax for certain products (Eichelberger, Kelly, and Lim 2007).

It is still too early to see just how much impact these measures will have in helping China curtail its growing energy demand and CO_2 emissions. But these measures demonstrate that the often-discussed trade-off between environmental protection and economic growth for China is largely a false choice. While Beijing may bristle at the prospect of economywide emissions caps, the leadership could be engaged in ways complementary to its existing economic objectives but that also mitigate some of the competitiveness concerns held by US industry.

Models for Cooperation on Industrial Emissions

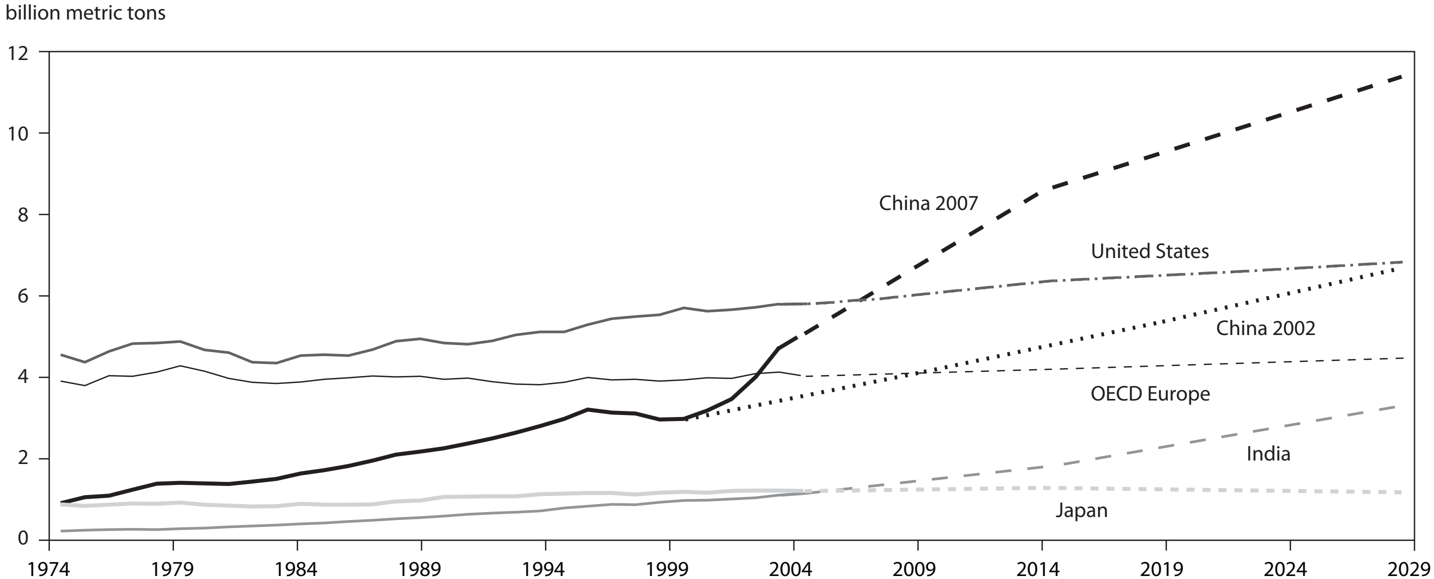
The defined economywide limits on greenhouse gas emissions that the industrialized world agreed to under the Kyoto Protocol, while providing the most environmental certainty, are not the only available strategies for emissions abatement. In fact, for developing countries, whose economic structure and growth are still very much in flux, absolute limits may not be appropriate, as they require establishing a credible baseline for future emissions.

In China, for example, the rapidly changing structure of the economy has made establishing such a baseline quite difficult. The International Energy Agency (IEA), in its *2002 World Energy Outlook*, predicted annual Chinese CO_2 emissions would reach 6.7 billion metric tons in 2030. Only five years later, the IEA revised that figure upwards by 70 percent, a margin of error greater than total European emissions today (figure 4.1). During the intervening period, China had not changed the types of energy on which it relied nor the efficiency with which it was consumed. Rather, the structure of the Chinese economy had changed dramatically as heavy industry outpaced light industry and services. Similarly, if a baseline for future Chinese emissions was established based on today's projections, it could end up being 70 percent higher than reality if a structural adjustment of the same order of magnitude took place in the other direction and China's heavy industry migrated to other parts of the world.

In addition, Beijing correctly points out that per capita emissions in China are one-fifth the level in the United States (figure 4.2) and that holding the United States and China to the same economywide caps would be inequitable for Chinese citizens. The leadership may, however, be more receptive to proposals that would specifically target carbon-intensive Chinese industry rather than relatively low-carbon Chinese consumers (Lewis 2007).

The notion of international agreements covering emissions from certain key industrial sectors has gained traction in recent years for one reason: They address industrial competitiveness concerns in the developed coun-

Figure 4.1 Annual CO_2 emissions, historic and projected, 1974–2029

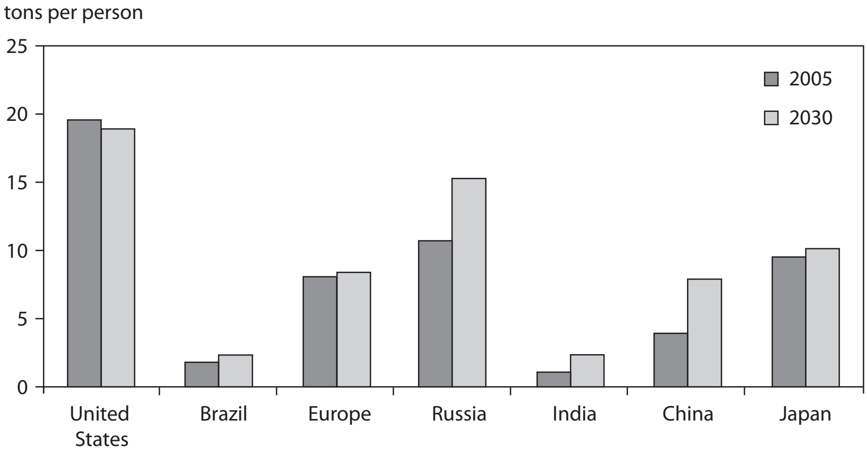


OECD = Organization for Economic Cooperation and Development.

Notes: The International Energy Agency (IEA), in its 2002 *World Energy Outlook,* predicted annual Chinese CO_2 emissions would reach 6.7 billion metric tons in 2030. Just five years later, the IEA (2007b) revised that figure upwards by 70 percent.

Sources: Historic data (before 2007) are from IEA (2007c); projections (after 2007) are from IEA (2007b).

Figure 4.2 Per capita CO_2 emissions, current and projected



Sources: Economist Intelligence Unit Country Data, Bureau Van Dijk Electronic Publishing, 2007; IEA (2007b). Brazil 2030 forecast is from International Energy Agency, *World Energy Outlook 2006*.

tries while being more palatable for developing countries (Bodansky 2007). Sectoral agreements are less economically efficient than economy-wide programs in achieving emissions reductions (Bradley et al. 2007), but if economywide commitments are a nonstarter for developing countries, then sectoral agreements can serve as useful alternatives. And given the outsized role of industry in the carbon footprint of China and other large emerging economies, sectoral agreements could be structured to cover the majority of both current and projected emissions from the developing world through 2030 (IEA 2007b). This is not to say that other sectors would be wholly neglected—after all, new energy technologies, efficient appliances, and vehicle innovations will all emerge from global markets, in which the developing world will surely be a major player. But by focusing developing-country commitments on producers rather than consumers, an agreement may generate real support, as well as help China in particular meet other domestic policy goals (box 4.1).

Sectoral agreements could involve different forms of substantive commitments, could be legally binding or nonbinding, and have varying degrees of environmental stringency. In particular, sectoral agreements can take three forms: emissions targets, technology standards, and policy harmonization.

Emissions Targets and Trading

Emissions targets could set explicit limits on the amount of emissions from particular sectors. Such targets are usually proposed in connection

Box 4.1 Lessons from WTO accession

As negotiations kick off for a successor agreement to the Kyoto Protocol, a key question is the type of commitment that can be expected from China under a post-Kyoto international climate framework. Given the well-publicized challenges in reconciling the national leadership's policy with the disparate incentives facing local officials, the question has centered as much around what type of policies Beijing will be *able to enforce* as around the type of commitments they will be willing to make. While it is true that enforcement at a local level continues to be difficult on many issues, it is wrong to assume that Beijing has lost its ability to make the provinces listen. The careers of local officials are in the hands of national policymakers, who rank performance using metrics set in Beijing. While investment-led economic growth has been the principal criterion for promotion in recent years, the energy and environmental consequences of this development model has prompted the leadership to start changing the formula. Policies aimed at "rebalancing growth" in a more sustainable direction are rising in importance and gaining teeth.

In years past, Beijing has looked to international agreements as useful tools in aiding economic reform at home, particularly when such reforms were resisted at a local level. China's accession to the World Trade Organization (WTO) is a perfect example. In the 1990s, progressive policymakers saw the carrot of WTO membership as a way to help incentivize and win support for economic reforms they had already been pushing. Under the leadership of Premier Zhu Rongji, the national government forced fairly painful economic adjustment on the provinces, in part to ensure that China met the requirements for WTO accession.

The contrast in the success of WTO accession in changing policy in China and the failure of trade sanctions, or the threat thereof, to do the same is the difference between inducement and coercion. Membership in a multilateral organization like the WTO, in addition to serving the country's long-term economic interests, was a point of national pride for Chinese leadership. The international prestige it offered helped reformers build consensus for the difficult structural adjustments required for accession. Similarly, eliciting Beijing's involvement in an international climate framework that helps progressive policymakers meet economic objectives at home (like disciplining heavy industry) will be most successful if presented as an opportunity for China to demonstrate leadership on a key global issue. Threatening the use of sanctions in order to coerce China's involvement may well make it harder for those in Beijing already inclined to take a more active role in an international climate agreement to build support for such action at home.

with emissions trading, which has the potential to promote greenhouse gas emissions abatement where it is least costly. At least three forms of emissions targets would be attractive for sectoral action.

A fixed limit on emissions within a particular sector—i.e., a sectorwide emissions cap—would be similar in form to targets adopted in the Kyoto

Protocol, although the scope of the target would be confined here to one or more individual sectors. An agreement might involve absolute reductions or limitations on future growth in a particular sector, perhaps with targets differentiated by country. The challenge with such an approach is that it does not fully account for the volatile nature of industrial production. As stated earlier, an investment-led surge of heavy industry in China was responsible for the upside surprise in CO_2 emissions between 2002 and 2007. The end of the current investment wave could lead to a contraction in industrial CO_2 emissions, without any improvement in efficiency, but those emissions would only pop up in other parts of the world as urbanization takes off there. For internationally traded sectors, defined limits would create a quota system similar to the Multi-Fiber Arrangement, which would reduce the economic efficiency of industrial production.

The second approach to sectoral targets involves capping the quantity of emissions per unit of economic output. These intensity targets, particularly at the sectoral level, can avoid some of the economic uncertainty associated with fixed targets yet do so at the cost of certainty regarding environmental outcomes; emissions reductions are ultimately determined by the actual output of a sector rather than by setting a specific level of allowed emissions (Herzog, Baumert, and Pershing 2006). Exchange rate effects and differences in product type can make intensity targets measured in terms of emissions per unit of economic value difficult to define.

The third type of target uses the physical unit of production, rather than the economic value, as the denominator in calculating carbon intensity. For example, the carbon intensity of a ton of steel would be measured as embedded emissions divided by weight. Most trade measures would use this approach in assessing embedded carbon at the border. While there is still uncertainty in terms of environmental outcomes, harmonization across countries with such a target is easier than with an economic value intensity target. The International Iron and Steel Institute (IISI 2007) issued a policy paper in support of such treatment for the steel industry at the climate negotiations in Bali, Indonesia. Both the American Iron and Steel Institute and the China Iron and Steel Association have expressed support for such an approach.[7]

Under all three types of targets, emissions credits could be traded across borders to improve the economic efficiency of the system as a whole. From a competitiveness standpoint, however, the key would be to ensure that the targets were binding. "No-lose" targets with emissions trading, where developing countries are not bound to meet a target but allowed to sell credits if it is exceeded, would be less successful in preventing emissions leakage. If possible, the targets should also cover the sector's indirect emis-

7. AISI (2007); Peter Marsh, "China Trade Body Backs Check on Steel Emissions," *Financial Times*, October 10, 2007.

sions, such as electricity generation or coke manufacturing, to as great an extent as possible.

Standards

Standards are a second kind of substantive commitment that could characterize a sectoral agreement. Standards tend to focus on technologies, processes, or products, rather than the resulting emissions. *Technology standards* might mandate the use of a specific technology or process. With many technology-specific policy options, technology lock-in is a risk, and agreements must be carefully designed to avoid such outcomes. Of added concern is the relatively poor track record of government policies in picking optimal technologies.

Alternatively, *performance standards* can be technology neutral. Such a standard might require a certain level of energy efficiency in appliances or motor vehicles. A performance standard could be applied at the level of a technology (e.g., refrigerators) or in some cases at the broader sectoral level (e.g., all electric power production). Performance standards can also overlap conceptually with harmonized emissions rates—or benchmarks—discussed earlier, which can be viewed as an *emissions performance* standard.

Some critics of the Kyoto Protocol maintain that a standard-setting approach, unlike the protocol, has a self-enforcing quality that would promote compliance and global participation (Barrett 2001, 2002; Benedick 2001). This dynamic is achieved through "network externalities." For instance, if the United States and the European Union enacted automobile performance standards (for domestic production and sale), other countries would find it in their economic interests to also adopt those standards. Otherwise, cross-border trade and investment would be impeded. The catalytic converter is one example of a common technology standard that has achieved widespread global adoption, even though its purpose is to address a local environment problem (Barrett 2001).

For carbon-intensive products like steel and cement, the application of product standards is slightly different. Unlike automobiles or refrigerators, emissions from steel occur during the *production* of the good, rather than its *operation*. As such, incentives are only created for foreign producers to reduce process emissions if those emissions are somehow measured and charged at the border. Agreements on standards are easier in industries with more homogeneous production processes.

Policy Harmonization/Coordination

Substantive commitments within sectoral agreements could also take other forms, such as agreements pertaining to taxation, subsidies, or treatment of waste. While such unilateral reforms might be justified, it is also the case that "[i]nternationally coordinated action can facilitate the process of removing environmentally damaging subsidies" (Pershing and MacKenzie 2004). For instance, common subsidy reforms could help level the playing field to promote renewable energy technologies (Pershing and MacKenzie 2004). Other kinds of policy harmonization and coordination might include product recycling requirements (e.g., for aluminum) or government procurements requirements (e.g., for low-emission vehicles). Cooperative efforts on research and development of specific technologies—such as carbon capture and storage or nuclear power—might also be considered "sectoral."

For carbon-intensive industries, policy coordination could come in the form of an agreed carbon tax for internationally traded goods, similar to agreements on border tariff levels as part of the World Trade Organization. But in the case of carbon, it would be a negotiated minimum price rather than a maximum tariff. While an economywide carbon tax might be a nonstarter for developing countries, there is more potential for agreement on taxes for specific internationally traded industries. As mentioned earlier, China recently imposed the equivalent of a $50 per ton carbon tax on steel exports to achieve energy and environmental outcomes and did so voluntarily and unilaterally.

In many sectors, the groundwork has already been laid for constructive international engagement. Efforts to benchmark energy use and share technological best practices exist in the steel, aluminum, and cement industries (Bradley et al. 2007). The Asia-Pacific Partnership on Clean Development and Climate aims to do the same by bringing together the United States, China, India, Australia, South Korea, Canada, and Japan in a public-private partnership.[8] And even within China, the government has launched a "Top 1000" program, which issues energy-efficiency targets to the 1,008 most energy-intensive companies in the country and benchmarks their performance (Price and Xuejun 2007). These programs could serve as the basis for developing-world commitments, provided that the United States first demonstrates a commitment to addressing its consumer-led emissions as well.

Sectoral agreements can, and should, complement rather than replace other types of climate commitments. Global sectoral agreements for key traded industries should not be seen as an alternative to economywide targets for developed countries, as has often been the case in the United States. Likewise, taking part in a sectoral agreement does not mean developing countries cannot adopt other climate policies, from vehicle efficiency standards to renewable energy targets.

8. For more information on this partnership, see www.asiapacificpartnership.org.

Need for US Leadership

It is difficult to ignore the fact that the United States has remained distant from international climate policy negotiations in recent years. And since an inclusive international agreement is the best-case scenario for ensuring that climate policy does not adversely affect US competitiveness, this abstinence has not served US interests well. To have any chance of influencing China on climate change and prevent a significant loss of the "consumer surplus" that results from free trade the United States must first demonstrate a much stronger commitment to addressing its own emissions, both historic and projected. Developing countries argue that until the United States leads, they can hardly be expected to follow and that ultimately, the developed world will need to help them bear the costs of adjustment. Population, average wealth, and historical emissions buttress this argument. This is compounded by the raft of policies and measures that China is already undertaking, which, as noted earlier, arguably leave the United States with some catching up to do.

Many current bills in the US Congress note the absence of the United States from negotiations of late and the desirability of reengagement internationally. However, in a number of bills, international negotiation is explicitly linked to a review process to assess the *adequacy* of other countries' commitments. This review in turn can trigger a reduction in US action or the enactment of other trade measures discussed previously. While this trigger mechanism is intended to placate enough of the competitiveness concerns of carbon-intensive industry to win support for US federal climate policy overall, in terms of a negotiating strategy, it could risk poisoning the well for more constructive engagement with major trading partners. This is particularly troubling if the trade measures, once invoked, would not provide the desired protection for US industry.

Scope for International Agreement

The good news is that the scope for positive engagement is large and growing. To relatively little fanfare, the UN process transformed itself profoundly at the end of 2007, with a new agreement in Bali on a two-year negotiating agenda. Under the Kyoto Protocol's first commitment period, there was an iron-clad divide between developed and developing countries: The former took on emissions caps at a national level; the latter only a generalized commitment to integrate climate into their development plans. The Bali Action Plan, agreed to in December 2007 at the Thirteenth Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), dramatically reduces that gap. The plan calls for enhanced action on climate change, including space for developing countries to articulate specific commitments under the post-2012 agreement. Both developed and developing countries would commit to undertaking "nationally appropriate mitigation actions . . . in a measurable, reportable and verifiable manner" (UNFCCC 2007b). This language is clearly a key step toward a global regime in which all countries participate. The most important remaining distinction is that developing countries can expect "technology transfer and financial support" to help them implement their commitments. Exactly what this means in practice will need to be defined during the coming two-year negotiations.

A second important innovation in the Bali Action Plan is that "cooperative sectoral approaches and sector-specific actions" are also part of the negotiating agenda. In addition, technology provisions are littered throughout the text, as well as framed as an explicit commitment to "enhanced action on technology development and transfer" (UNFCCC 2007b). These sectoral and technology measures will need to be defined in the coming two years, but in principle there is a lot of scope here for real engagement to both bring about genuine emissions reductions and create a level playing field for carbon-intensive industries.

The price for this greater diversity of commitment types will be eternal, or at least enhanced, vigilance. US policymakers or their agencies will find themselves having to judge whether the measures of other countries are appropriate relative to those of the United States; whether they are likely to be implemented; and whether, assuming they are implemented, additional protection is needed to prevent carbon leakage.

The international trading system will likely play a key role in addressing these issues on a multilateral basis going forward. The importance of global trade in delivering low-carbon technology at affordable prices was highlighted at Bali by a joint US-EU proposal to eliminate tariff and nontariff barriers to environmental goods and services. The World Bank (2008) estimates that global trade in climate-friendly technology, currently about $70 billion per year, will need to expand substantially for the world to achieve cost-effective reduction in emissions.