

Global Emissions Migration and a Revenue Neutral Carbon Tax: *A Summary of Policy Options Working Paper*

Wyatt F. Boyd, wfb2104@columbia.edu
July 2008



(Photo Credits: <http://www.flickr.com/photos/visschman/1811118917/>)

Cumulative global energy investments are expected to exceed US \$10 trillion by 2030 and global energy demand is projected to double from 2005 levels by 2040. (IEA) The extent to which this capital and growth will flow into renewable energy will be determined to a large extent by the shape of future climate change policy. Where there are policy disparities between economies, investments could migrate to lesser regulated markets with cheaper compliance costs. This emissions migration could negate both the environmental and economic goals of any proposed climate change policy framework. This paper will explore ways to mitigate the harmful effects of emissions migrations (or leakage) absent an immediate uniform global climate change policy. This seems a reasonable and instructive assumption, given the ongoing international stalemate between the largest non-Annex-1 economies and industrialized Annex-1 economies under the United Nations Kyoto-Copenhagen framework.

While it is becoming ever more likely that there will be a mandatory greenhouse gas emissions regulatory scheme, the form such a scheme will take remains highly unclear. This uncertainty will only keep clean capital on the sidelines and make any transition to clean energy infrastructure more costly. This paper then will also evaluate policy approaches for dampening the effects of emissions migration based on their timeliness. Options range from a global emissions cap like the United Nations ongoing post-Kyoto Copenhagen framework, to domestic cap plans like the federal Climate Security Act or California's Global Warming Solutions Act, to a direct carbon tax. This paper will make the case that a revenue neutral carbon tax provides the greatest opportunity for reaching political consensus and mitigating emissions migration via cross-subsidization. But whichever policy ultimately wins out, there will be an ever growing market for clean energy via more favorable economics for such investments, and thus a stronger incentive for non-compliant economies to adopt a similar standard to capture such investment flows. The opportunity costs for being outside an emissions regulatory structure and permitting emissions migration will only increase over time. So it appears there is the potential for global carbon price disparities and resultant emissions migration to self-correct via the demand pull of a growing clean energy market. There is historical precedent for this mechanism; the United States and the European Union were the first to place price signals on both sulfur dioxide and ozone emissions, with other less developed countries soon following when the economic and environmental benefits were clearly demonstrated.

Any domestic price on carbon dioxide emissions absent commensurate foreign price signals could amount to competitive barriers for domestic producing firms. The perception of lower prices and more favorable business environments abroad could lead domestic operating firms to relocate outside the United States. Such emissions migration or leakage simultaneously reduces the intended CO₂ emission reductions while impeding domestic economic growth and so is highly undesirable. However with a revenue neutral price on carbon, achieved either via offsets or dividends, the net costs faced by domestic firms relative to foreign could remain unchanged. This paper will discuss the extent to which significant carbon leakage represents a barrier to the stated environmental and economic goals of a revenue neutral carbon tax. It will also provide a summary analysis of the policy instruments available to reduce such barriers where they may exist.

There are three general possible approaches to addressing the potential for emissions migration. They are as follows.

- 1) Attempt to institute **World Trade Organization (WTO) compliant cross-border wealth adjustments or tariffs** proportional to the difference between domestic and foreign prices on carbon
- 2) Do not seek any cross-border wealth adjustment policy with the expectation that **with domestic leadership other economies will replicate U.S/EU policy over time**, as was the case with SO₂, ozone and particulates, thus significantly reducing and eventually eliminating the potential for emissions migration
- 3) Attempt to “**level the playing field**” for domestic producers via **non-trade related cross-subsidization** (like domestic tax policy offsets or subsidies)

Below is a discussion of the approaches and policy instruments available for each of these three broad approaches and the general costs and benefits associated with each. Each “route” or potential policy framework for addressing carbon migration is examined in five subsections: the broad strategy, tactical approach, strengths and benefits, weaknesses and

risks and barriers to implementation. The conclusion includes a comparison of the three general approaches and a recommendation of the optimal route. This optimal route constitutes the best set of goals for future U.S. legislation seeking to mitigate both climate change and concerns of carbon migration.

1) The WTO Route

Broad strategy (what is it?): This approach would seek to levy additional costs on imports to the United States equal to the differential in carbon pricing between domestic and foreign policies. Such a case would be brought under the dispute resolution process of the World Trade Organization as outlined by the WTO agreement *Understanding on Rules and Procedures Governing the Settlement of Disputes*. This framework has been in place since the creation of the WTO in 1995 under the Uruguay Round of trade negotiations. Under the framework, case disputants and the Director-General (DG) of the WTO first seek to reach an agreement before the case is considered for acceptance by a Dispute Settlement Panel (DSP, also referred to as the Arbitration committee periodically) consisting of three to five WTO members. Only about 30% of cases make it to the DSP, with the rest being settled privately among the parties. (Griffin, 19) The WTO encourages parties to “settle out of court” and so typically provides ample opportunity for parties, in consultation with the DG, to seek such pre-arbitration agreements. (WTO) Senator Jim Webb explored bringing suit in conjunction with the 2008 Climate Security Act legislation and concluded that the typical timeframe between pre-case consultation and consideration by a DSP is “at least eight years.” (Webb) While such a timeframe is not mandated, the pre-DSP stages can be quite lengthy as the WTO seeks to gather information and resolve the case pre-dispute. Of the 30% of claims that reach the DSP, 70% on average are appealed to the Appellate Body, whose decision is binding. Since 1995, 369 complaints have been brought before the WTO and 115 ruled on by a Dispute Settlement Panel report. (Leitner and Lester) An inherent risk of pursuing this route is that it will almost certainly not be implemented (or even resolved) within a decade. In the interim there could be significant emissions migration, as well as damage to important U.S. trade relationships via a potentially nasty settlement process.

If such a claim is brought by the United States against countries not commensurately pricing carbon, it has already been made clear that it would be challenged by multiple trading

partners, including China and India. So the thrust of this strategy is mounting a successful legal argument before the WTO Dispute Settlement Panel. The General Agreement on Tariffs and Trade (GATT) of the WTO Articles 3, 11 and 20 are the key parameters of successfully implementing such a cross border wealth adjustment policy. Article 3 stipulates that cross border cost adjustments must not discriminate by country of origin (for instance as being against the United States) or by economic sector. A “carbon tariff” then must be shown to equalize the explicit cost differential between the United States and each trading partner relevant to their specific carbon pricing policy. Any tariff levied above this differential would be considered an illegal trade subsidy and so this approach must include a robust carbon measuring system and a country by country pricing scheme per amount of carbon. Article 11 of GATT places overall limits on the extent of tariffs and quotas for each country. This level can be exceeded however if it is successfully argued that a domestic carbon price is equivalent to a foreign subsidy. So any new carbon cross border wealth adjustment is not a new tariff, but rather a restoration of the previous level before the carbon price was imposed.

Even if a cross border adjustment is found to be in violation of GATT Article 3 and 11, it could still be justified under the environmental exception clause, Article 20, which states such adjustments are permissible if they are found to be, “relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restriction on domestic production or consumption.” A successful argument here must essentially show two things: the climate system is an “exhaustible natural resource” and the violation of GATT is of equal proportion in both the U.S. and foreign exporters. The “WTO Route” is predicated on a favorable WTO arbitration ruling and so involves inherent and significant uncertainty. If this approach is pursued it will likely involve years of negotiations and arbitration, conspicuously not addressing the potential for emissions leakage in the interim. And if the climate system is not ruled as an exhaustible natural resource and any cross border adjustment is found to be equivalent to an illegal tariff, this approach will have done nothing to address emissions leakage. Additionally, even with a favorable WTO ruling, it is unclear what reciprocal actions may be undertaken by valuable U.S. trading partners who may seek adjustments of their own. Seeking such tariffs then may serve to move the global economy to a more protectionist stance and serve to slow future open and free trade arrangements.

Tactical approach (how would it be implemented?): There are three possible tactical facets to this strategy, none of them mutually exclusive. In fact it would probably be ideal to pursue them in succession. The first is that the U.S. seeks a tariff or quota against imports that equates the point of origin cost of production with the new domestic carbon price. The WTO generally prohibits tariffs with the exception of agriculture; however this approach could be effective if it is argued not directly as a tariff but as a means to offset what amounts to a foreign subsidy when other member countries fail to adequately price carbon. Seeking GATT Article 3 and 11 compliance should focus on arguing that other members' failure to act amounts to a violation of these articles, and so they should either adjust their prices domestically or face tariffs.

The second approach would require the United States to seek environmental exemption under Article 20. Given the failure of the U.S. in the shrimp-sea turtle case, which is a couple orders of magnitude lesser in importance than the carbon case, it is unlikely that this approach would be successful. The crux of the problem is not in defining the climate as an exhaustible resource that should be protected, but that the U.S. has implemented a program that does provide discriminatory cross border adjustments based on the local conditions in the producing nation. Such a system would not only be administratively complex and burdensome, it would almost assuredly be difficult even to define. A main sticking point in the United Nations Framework Convention on Climate Change has been the issue of defining responsibility for climate change intertemporally. Defining that system in the context of trade adjustments would not be easier. For instance, placing a higher adjustment on China because they have no domestic price and have large carbon intensive industries would likely be rejected by G-77 countries. Placing a lower adjustment level on Chinese imports would probably illicit a strong reaction from the European Union and other developed trading blocks, as countries that already had a price in place and were less responsible would face a relatively higher trade barrier. The obvious solution to this dilemma is a flat global carbon tax, where all members face the same per unit price. However, this is a difficult grand bargain to strike. The third approach is for the U.S. to bring the case before the WTO again after it has developed and implemented a system that does seek to uniformly price imports, based on such parameters as the method of production and purchasing power of the producing country. Such a system would always face opposition, but it could be a successful appeal before the arbitration committee.

Strengths and benefits: As noted by Pauwelyn 2007 in *U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law*, potential benefits of a WTO competitiveness provision include: internalizing the social cost of carbon at a global scale, legally eliminating the potential for emissions migration, widening the coalition of domestic actors willing to support carbon pricing and incenting other countries to adopt robust carbon pricing policies. (3) A WTO ruling in favor of the United States is the strongest and most direct way to allay any concerns over emissions migration and a loss of domestic competitiveness. The 1997 Byrd-Hagel Resolution in the United States rejected the Kyoto Protocol and thus a price on carbon unanimously 95-0 in the Senate, almost entirely on the concerns that the United States would not accept an agreement where developing countries were exempted from a similar price. Absent such developing countries entering into a binding price or CO₂ cap agreement, which seems unlikely, or Congress dramatically reversing course on this point, an import duty is the only way to essentially legislate compliance in foreign countries. However, as explored further in the section below, the significant uncertainty regarding any WTO ruling makes this a potentially unsatisfactory argument for those who would oppose climate change legislation.

In a recent House testimony on energy prices, the financial investor Michael Masters of Master Capital commented that the argument that investors would exit the U.S. market because of tighter energy price controls (he was referring particularly to speculation rules) is “hot air”. (Masters Testimony) The United States is the largest economy in the world, the largest energy user, the largest food producer and the largest user of many raw materials and so a domestic carbon price could in effect provide a demand pull situation, incenting other countries to adopt similar carbon price controls to have access to the U.S. market. This argument may buttress pursuing climate legislation even when a WTO ruling is uncertain. At best there will be full cross border price adjustments, while at worst other countries would have to adopt to a significant extent to operate within the U.S. market, which could very well be a stepping stone to their full sovereign compliance not too far down the road.

Another key argument in support of pursuing WTO competitiveness adjustments as fully and aggressively as possible is that it would send a strong international signal of what the United States expects of other countries' climate change plans. Even if there is a strong likelihood of

a WTO defeat, there is significant potential value in arguing the case regardless. The state of international trade law regarding the climate and greenhouse gases is undeveloped and unclear (which is why a WTO complaint would be brought in the first place, to clarify and build doctrine) and so the case could develop key bodies of knowledge for the future eventual global adoption of a carbon price. Just as the Shrimp-Sea Turtle case resulted in a defeat for the United State's position, it did result in the acknowledgement of U.S. environmental law, particularly the Endangered Species Act. While the U.S. could lose, this case establishes important precedent for a future complaint that could ultimately be successful. This "tiered" approach could ultimately have a much better chance of success, for instance by first pursuing general GATT compliance, and only then the exception status under Article 20, and then finally seeking to remove any differential treatment of foreign economies that is the primary burden of proof for such an argument.

Arguing a GATT article 20 case could provide a valuable forum for the needed discussion of historical and future responsibility for greenhouse gas emissions and how to weight this in the pricing and adjustment costs of WTO member countries. It is unlikely that the U.S. could devise a system initially that would be fully compliant with the most favored nation principle and fully took into account all local conditions in measuring, auditing and pricing foreign imports. With information via a long and rigorous arbitration process, this valuable information could be gathered. A key strength of the WTO process is that it can be multifaceted and involve multiple cases that may ultimately bolster a final international compromise. Pursuing the WTO route ultimately jump starts a conversation that must occur if there is to ever be a global price on carbon. Both the United Nations Framework Convention on Climate Change and the current Doha round of the WTO negotiations have not been thus successful in such a conversation.

Weaknesses and risks: As noted by Pauwelyn 2007 the potential costs of a WTO competitiveness provision include: inefficient barriers to unrestricted trade, potential manipulation and exaggeration by domestic actors, damaging important trade relationships and the potential of future agreements, complex and expensive administration, and the uncertainty of a WTO challenge and arbitration process and risk of an adverse ruling. (5) The largest of these concerns is almost certainly the potential for damaging existing valuable international trade arrangements and reciprocal trade sanctions levied as retaliation. The

Economic Times wrote recently about India's response to the possibility of a European Union carbon import duty, noting that there would be no hesitation on India's part to challenge any such levy: "India plans to take up the issue with the EU on a bilateral level first and refer it to the WTO only if the bilateral approach failed." (The Economic Times) The article then goes on to explain the merits of a potential WTO case, citing government officials who say that even under the environmental exemption Article 20 of GATT that, "in the case of the proposed carbon tax, the EU's case at the WTO will not be strong enough."

These views are almost certainly shared by virtually every other major developing exporter, particularly China and Brazil. These countries are fueling much of their impressive economic growth via exports and will interpret any market restriction as a threat to this growth. They will also probably see it as an attempt by more developed countries to legislate in their own country, and thus challenge it as a threat to their very sovereignty. The best that could be realistically hoped for by pursuing the WTO route is a hard-fought ruling in favor of carbon import duties, and largely insignificant retaliation in the form of similar duties that are struck down by the WTO. The greatest risk is that such tariffs will lead to the suspension of key trading arrangements, higher tariffs for U.S. duties in some of our largest export markets, and dangerous impediments to the global trade agenda, such as the current Doha round. The costs of impeding future trade arrangements and reduced market access for American exports is uncertain. China, India and developing countries have a strong case to reject a carbon duty, particularly considering their historically low emissions of greenhouse gases and currently large reliance of manufacturing based exports. The risk is high that a carbon tariff would either be rejected by the WTO or be accepted and lead to trade restrictions whose costs exceed the benefits of an effective domestic carbon subsidy.

Another risk is that the subsidy argument could be entirely turned on its head as other WTO members seek cross border adjustments for arguable U.S. subsidies. Members that had a price on carbon before the U.S. (like the European Union) could seek to punish the U.S. for the decades it was the largest CO₂ emitter. Additionally, the U.S. currently provides the equivalent of \$12 billion in subsidies for oil and coal energy producers (GAO) which could bolster this argument. As economist Joseph Stiglitz has written: "In most of the developed countries of the world today, firms are paying the cost of pollution to the global environment, in the form of taxes imposed on coal, oil, and gas. But American firms are being subsidized –

and massively so. There is a simple remedy: other countries should prohibit the importation of American goods produced using energy intensive technologies, or, at the very least, impose a high tax on them, to offset the subsidy that those goods are currently receiving.” (Stiglitz) If the United States seeks cross border adjustments, it could incite other member nations to seek such adjustments against the U.S. for its historical role in treating the climate as an open and free waste disposal. Every developed (or Annex-1) country has ratified the Kyoto Protocol except the United States, and a number of others have had more stringent greenhouse gas emission policies than the U.S. for many years. The notion then that the United States would seek environmental trade sanctions may not just be rejected by other parties, but lead to costly and lengthy (potentially decades long) retaliation.

Barriers to implementation: The main barrier to this approach is the uncertainty of any WTO Dispute Settlement Panel or binding Arbitration Committee ruling. Seeking cross border wealth adjustment assumes there is a domestic price on carbon in the first place, but the uncertainty of seeking to resolve potential emissions migration via the WTO route could provide significant uncertainty to preclude any such policy in the first place. By directly seeking to alter the tariff structure under the WTO, this approach implicitly assumes emissions migration and issues of international competition to be a genuine problem. Yet it offers no guarantee that these issues will successfully be resolved. Or put another way, no one can know for sure how the WTO would rule. The 1998 ruling against the United States in the “shrimp-sea turtle” case is a prime example of the risk the U.S. runs in seeking international trade arbitration. A successful defense does not need to disprove climate change, the efficacy of the U.S. carbon pricing system, or even that the adjustment is permissible as a tariff. As in the sea-turtle case, all that needs to be shown is that the United States is treating all countries equitably commensurate to their “common but differentiated” local conditions. Unless the U.S. can clearly show it is holding all nations to the same standard, adjusted to their economic, political and potentially historic (given the long-term nature of emissions buildup) responsibility – the WTO would likely rule against the United States. A successful WTO ruling rests on the United States already having robust climate legislation in place, but passing such legislation could prove very difficult if the primary means to manage emissions migration is through the uncertain and unpredictable WTO arbitration process. So the WTO route poses a real chicken and egg dilemma that is the key barrier to it evolving.

2) The “Lead and Others Will Follow” Route

Broad strategy (what is it?): This would seek to “pull” the global community into an equivalent carbon pricing scheme by being the first to adopt and legitimize a carbon tax or similar carbon price. This approach may or may not argue that a domestic price on carbon amounts to a competitive disadvantage, but argues that it is irrelevant as other economies will adopt similar policies once the United States leads. This indeed was the case with the Montreal Protocol targeting ozone depletion and acid rain (sulfur dioxide emissions) where the U.S. and EU adopted more stringent standards that were then later adopted by the international community. This argument also relies on the historical and cultural role of the United States as a leader in international affairs that does not predicate its strategic agenda on the aims of other countries. This is a versatile approach because it does not directly engage in the issue of terms of trade equalization but appeals to a salient and historically consistent foreign affairs strategy.

As Bob Hilton, director of business development for environmental control systems at the large power systems company Alston puts it, “[Europe and the United States] have gone back and forth as to who steps up first – on particulates, on sulfur dioxide. And each time, China has followed. But not until then: they expect the more advanced countries to move first.” (Krupp, 172) This could be called the Domino Theory, where lesser developed countries will all follow the leadership of developed countries once they prove the salience of either a cap or tax climate policy. This has certainly been the case with United Nations climate change negotiations, where the Kyoto protocol was originally passed with only 55% of industrial (Annex-1) countries ratifying it when it came into force in 2005. Today 36 of the 37 Annex-1 economies and 134 non-Annex-1 nations have ratified the protocol, with the United States now being the sole industrial nation abstention. In a span of some three years, the member rate increased from 55% to nearly 100% as early adopting nations signaled to others that this was an important and positive international agreement. If the global community, led by the most advanced economic and democratic nations in the world, leads on this issue it is very likely China and India will soon accept mandatory emission reductions. If however the largest economy in the world with the largest per capita energy use in the world and over six times the per capita income as China continues to free-ride on global

greenhouse gas emissions, there is little to no probability that China and India will accept a price on carbon. Full global compliance with an international climate regime will not happen absent U.S. and E.U. leadership.

There is also a strong implicit incentive for developing economies to accept a global price on carbon given strong and unilateral U.S. leadership on the issue. Foreign firms and producers will want to both maintain their current position within the largest economy in the world, as well as be competitive in the burgeoning new U.S. market for clean energy. There is a powerful carrot here. To have such access they would be forced to comply with the new U.S. domestic policy, and virtually all of the largest, and even many of the more modest, developing nation emitters (any with exposure to the U.S. market) will be forced into partial compliance through this mechanism. This will present a strong channel for these firms to “learn by doing” and remove many potential uncertainties for action by their domestic governments. Many of these firms will probably also lobby their governments to adopt a similar policy when the benefits of a clear price signal and of new clean energy investments are demonstrated. This route then attempts to pull other economies into compliance both politically and economically. With each new domino that falls in the spread of a robust and clear carbon price signal, the issue of emissions migration and U.S. competitiveness in an increasingly globalized economy will become less of an issue. As more economies adopt policy stance similar to the U.S. (or currently 36 industrialized economies) the world will be closer to a global price on emissions. And as Stiglitz writes, this is the ultimate solution to emissions migration: “There is a way out, and that is through a common (global) environment tax on emissions. There is a social cost to emissions, and the common environmental tax would simply make everyone pay the social cost.” (Stiglitz) It is very likely that with strong and bold U.S. leadership the transition to such a global system will be much more rapid.

Tactical approach (how would it be implemented?): As this argument is predicated on such legislation providing net economic growth and pulling other countries into compliance, no post-legislation approach to addressing leakage would be required per se. The tactical approach would then be the political economy of climate legislation negotiations. The current “state of play” in the U.S. discussion of climate legislation and the advantages of a revenue neutral provision on a national scale are discussed in third route section.

Strengths and benefits: The idea that the United States is a leader and superpower is almost universally accepted both domestically and abroad. The idea then the United States should not build a clean energy economy without the endorsement of developing countries is one unlikely to poll well. The key to pursuing this route is to frame the debate that America is and always has been a leader and that sooner or later other countries will replicate our policy as it is a win for the economy, the environment and national security. There is a strong environmental precedent for this route, in fact is the strategy that has worked for every other major global environmental framework – from ozone to toxic substances to acid rain. This approach has strong in-built incentives, namely access to the largest economy in the world and significant new economic investments that are currently curtailed for a lack of transparent market rules. Today Japan produces 70% of the world's solar cells, and Germany half of the rest. This is growth, investment and jobs that the United States are simply handing over because a lack of any coherent Federal climate policy. As Stern has noted, the costs of action on climate change are below the costs of inaction. Every year of inaction however narrows the gap between the two.

The new report *National Security Implications of Global Climate Change Through 2030* by the U.S. National Intelligence Council outlines the increasing national security risks of a failure to curb CO2 emissions. As seen recently in Canada, there is the potential for significant political gains for the party that can effectively frame this debate. As observed recently in the *Financial Times*: “For sure, the politics is a challenge – but not, I am willing to bet, as hard as conventional wisdom insists. Carbon is bad: tax it and use the money to cut other taxes. A new kind of politician could do something with that.” (Cook) Today is a political climate marked by a profound frustration in the current trajectory of American politics. Over 60% of Americans today disapprove of America's current energy policy, and over 80% desire more U.S. action on climate change. It would seem that public opinion is firmly in support of this route and the party that effectively communicate the triple bottom line (economic, environmental, security) benefits of a revenue neutral price on carbon can build a resilient electoral platform and coalition.

Weaknesses and risks: There are many liabilities attached to pursuing this route. The most apparent is that other large emitters will not follow or not follow in a timeframe necessary to prevent dangerous anthropogenic climate change, although this is not generally consistent with the history of international environmental regulation. There is no reason that this route

must be static however. If other countries are not “following our lead” then cross border wealth adjustments can be pursued. The U.S. case would almost certainly be bolstered under this scenario, as other economies had more time to adjust and implement their own policy and trade restrictions were pursued only as a last resort. This would also be way to show a good faith effort in trade negotiations. Another potential weakness of this approach is that countries like China and India have made it clear that they do not feel historically responsible for the current state of the climate or climate change generally as they were not large emitters throughout the American and British industrial development period. Lesser developed economies also place a higher premium on energy access and are largely more dependent on higher energy intensive production processes. It is imperative for these economies to maintain a steady reliable flow of energy to sustain their 6-10% annual economic growth rates and transition into the developed world. And of course energy development is directly linked with economic growth, meaning it will become easier for China to invest in cleaner energies if they can reach higher levels of development. Economic growth fosters increased savings and access to international trade, acting as catalysts for the development and deployment of clean technologies. Developing countries have a strong argument then that the best way they can diversify their energy infrastructure and reduce their emissions is to reach a developed world level of income. Investments in clean energies would then involve a lower transition cost and no reduction in standards of living. This is an argument non-Annex-1 economies have made for 16 years to escape responsibility under the United Nations Framework Convention on Climate Change.

However climate scientists would point out that this is all the more reason to implement robust climate change mitigation policy sooner rather than later, as the costs to the climate of such high economic (and thus energy) growth in the interim is so high. It is estimated for instance that the carbon dioxide emissions from coal in the next three decades will exceed all combined emission from coal in the last 300 years. (Krupp,) To avoid this dangerous scenario, it is critical that rapidly developing economies place economic and energy development on equal footing. United States leadership in this area is only going to improve the probability that developing economies make this decision. It is certainly not a particularly persuasive argument for the United States to free-ride on climate emissions because the developing world is free-riding, especially when every other advanced industrial nation has adopted more stringent emissions reductions. In late 2007 the U.S. was passed by Chinas as

the world's largest emitter of greenhouse gases, so the magnitude of leadership the U.S. can provide in emission reductions is narrowing. If the U.S. waits long enough to implement policy, other larger economies and emitters may adopt the position of the U.S. for the last two decades that the costs are higher because of their larger economies. This makes it all the more vital that the U.S. lead sooner rather than later. The costs of delay, both for the physical climate and the political climate are significant.

Barriers to implementation: The primary barrier to successfully implementing this strategy is in the political economy of U.S. climate change negotiations. That is, the main problem is getting started. In order for the U.S. to lead, it must accept differentiated responsibility for the climate change problem. To date it has shown a strong reluctance to do anything of the sort. A prime example is the Byrd-Hagel resolution of 1997, where the U.S. Senate voted 95-0 that the U.S. would not price carbon unless other emitters were held to a similar standard. While there has been an increased realization in the last decade since Byrd-Hagel that the United States must exert leadership in global climate policy, coupled with the growing consensus that building a sustainable economy will lead to sustained economic growth, the U.S. policy-making apparatus is still locked at the hip with China and India on climate policy.

Many in Congress will try to frame the debate that America is giving others a free pass rather than America as leader. It will also be argued that an incremental approach does not give guarantee that the necessary emissions reductions will be achieved. This may be true, however the U.S. is responsible for 20% of global emissions and so it will slow such growth significantly even if such actions are initially unilateral. Additionally, there are no 100% guarantees of emissions reductions under any approach. The whole point however is that with leadership, these reductions become far more probable. A cap with a safety valve or grandfathering, or any number of other provisions, provides not guarantee of the states emissions cuts. The essential argument must be that it is essential that a solution to climate change begin in the United States as it is our historical responsibility and it will be cheaper than inaction (see the Stern Review on the Economics of Climate Change). This route is dependent then on framing the issue as one of "best alternatives" or probabilities, not of absolute guarantees. In other words, all parties want the same outcome, it is a question of the best path to get there. Given that the global "grand bargain" approach has proven utterly elusive in nearly two decades of efforts, there is strong evidence that an incremental

approach would be more effective in reaching the desired outcome of economic and environmental progress.

3) The Indirect Subsidization Route or the “*A revenue neutral price on carbon increases the United States’ global economic competitiveness*” Route

Broad strategy (what is it?): As noted by Pauwelyn 2007 in *U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law*, the potential non trade related competitiveness adjustments include: flexibility mechanisms which reduce abatement costs (like the Clean Development Mechanism), setting the emissions baseline to current emissions levels (“grandfathering”), excluding key industries from full compliance, cross-subsidization (reducing costs elsewhere level to the cost imposed on carbon), safety valve provisions and incenting other countries to join by reducing the baseline domestically. (8) This section will focus solely on the potential for cross-subsidization via either tax offsets or dividends equal to the level of carbon taxation.

This approach argues that any competitive disadvantages brought about by a relative change in terms of trade will be more than offset by increased domestic efficiency resulting from a revenue neutral carbon tax. This efficiency could come from a variety of mechanisms, such as increased income generation and production incentives via tax offsets elsewhere or via increased economic growth spurred by new clean energy investments. Providing more incentives for positive economic outcomes, like income or labor or capital investment, and more disincentives for bad economic outcomes, like climate altering carbon dioxide emissions, we will get more of the “good” and less of the “bad”, and thus by definition have a more efficient economic equilibrium. With a revenue neutral provision, the net tax burden on producers will remain unchanged and so economic gains resulting from a more efficient tax code will more than offset any terms of trade imbalances. In addition, a long term price signal of \$30-80/ton CO₂ would make many current alternative technologies price competitive with traditional technologies and so there would be massive new investments in such technologies. This new economic investment would be a spigot for new jobs creation, financial capital inflows from around the world and increased GDP growth. As Isaac Berzin, co-founder of GreenFuel Technologies, an emerging sustainable energy startup in Silicon Valley clearly explains it, today’s energy producers are in a near impossible situation absent

clear market signals: “Carbon dioxide is a big risk hanging over the head of utilities...But they need to provide more electricity, because we all keep adding demand. So what do they build? If they build coal, in five years when they have to pay to clean up their carbon they’ll look like idiots. If they build natural gas, which is expensive, they’ll look like idiots now. But what if they clean up their carbon dioxide...Well, now they’re American heroes.” (Krupp, 106)

This economically inefficient price discovery mechanism would be resolved with clear a clear domestic price signal via a tax – getting a lot more capital off the sidelines and in the game. Coupled with revenue neutrality, which recycles every dollar increase in energy consumers face right back into their wallets - preserving purchasing power, the benefits of clean energy investment will very likely dominate any competitiveness or migration concerns.

Tactical approach (how would it be implemented?): This is the easy and the hard part. The tactical approach is to put a meaningful price on carbon domestically, e.g. pass either a revenue neutral carbon tax or a cap and dividend like policy. As this argument is predicated on such legislation providing net economic growth, no post-legislation approach to addressing leakage would be required per se. This route offers perhaps the most significant room for political compromise. A revenue neutral price on carbon has nearly limitless potential for political compromise. Such a system offers a unique opportunity to negotiate, as tax revenues could be offset in a broad number of areas (from income to labor to capital to a combination) as well as directly via dividends. And because lower income households typically use less energy than average, the dividend approach would ensure a carbon tax is not regressive. The current state of international negotiations does not offer nearly as much room for compromise, as revenues from an international cap and trade system would not be captured as revenue for domestic Treasury to allocate as their country sees fit. The revenues and profits from such a system would accrue largely to firms that are most able to reduce their emissions below the cap and to financial traders and speculators. Seeking a hard cap, to be audited and enforced annually, also dictates a timeframe to participating countries, thereby not allowing them to smooth out their investments in less carbon intensive infrastructure. A revenue neutral tax simply provides a price signal and lets the market determine the allocation of investments over time. This is the primary reason the U.S. Congressional Budget Office recently estimated a carbon tax would be up to 5 times as efficient as a hard cap approach.

The point to emphasize here is that there are endless ways to imagine a political compromise around the idea of revenue neutrality, whereas a cap system without dividends or offsets presents many political barriers. A prime example is the recent U.S. Senate debate of the Lieberman-Warner Climate Security Act, where critics of the Act correctly pointed out that the cap and trade system represents an over \$4 trillion tax increase, as about 50% of the revenues raised over the next 40 years via auctioned permits are kept by the Treasury. Add on a “safety-valve” provision (which would put a price ceiling of about \$12-22 per ton CO₂ via the government releasing (worthless) permits as necessary to maintain the ceiling) there is no clear price signal for firms to manage future high capital energy investments. With a tax shift this potent and effective argument against tackling global climate change disappears overnight.

Strengths and benefits: Perhaps the strengths of this approach were best articulated by economist and Nobel laureate economist Joseph Stiglitz before the Bali United Nations Framework Convention meetings: "Economic efficiency requires that those who generate emissions pay the cost, and the simplest way of forcing them to do so is through a carbon tax. There could be an international agreement that every country would impose a carbon tax at an agreed rate (reflecting the global social cost). Indeed, it makes far more sense to tax bad things, like pollution, than to tax good things like work and savings. Such a tax would increase global efficiency." (<http://www.project-syndicate.org/commentary/stiglitz94>)

The price signal should be expressed as near the producer or investor as possible, to minimize the uncertainties of valuing new investments and lower any price discovery costs. In other words, the price signal should be expressed directly to the economic decision-maker – as an upstream carbon tax would do as directly as possible. The key point here is that reducing taxes on economically productive things, like income or labor or capital, and shifting it onto economically harmful things, like carbon dioxide emissions, results in a more efficient set of incentives for market participants. Because all carbon revenues are offset, there are no increased costs for domestic producers who now have to comply with a price on carbon. In this argument then it is completely unnecessary to seek WTO competitiveness claims to protect domestic economic actors as they will actually be *more* competitive. This was echoed in a recent McKinsey and Company report analyzing the costs of a transition to a clean energy economy. They put these costs in perspective and noted the significant potential for GDP growth: “The macroeconomic costs of this carbon revolution are likely to be

manageable, being in the order of 0.6–1.4 percent of global GDP by 2030. To put this figure in perspective, if one were to view this spending as a form of insurance against potential damage due to climate change; it might be relevant to compare it to global spending on insurance, which was 3.3 percent of GDP in 2005. Borrowing could potentially finance many of the costs, thereby effectively limiting the impact on near-term GDP growth. In fact, depending on how new low-carbon infrastructure is financed, the transition to a low-carbon economy may increase annual GDP growth in many countries.” (McKinsey) Both McKinsey and Stern estimate the transition costs at about 1% of GDP by 2030, below the estimated 5-20% GDP costs over the same period absent significant action to mitigate climate change.

In a 2007 Senate Testimony, noted Silicon Valley venture capitalist Vinod Khosla, who along with Kleiner Perkins and other major firms are investing heavily in next generation clean energies, elaborated on the potential for a carbon price to not just increase economic efficiency, but address fundamental dysfunctions of the market. The longer expectations are built into the market that there will be a carbon price, without legislation or rules clarifying what that price will be or how it will be determined, the more capital will remain on the sidelines as it is impossible to value current energy investments. As Khosla articulated: “Most importantly, the risks associated with these older energy technologies and future carbon emission costs has decreased investment and hurt job creation. One does not need to believe in climate change to support climate change legislation. The uncertainty around such legislation is hurting the US economy and jobs creation and many executives would prefer to deal with known legislation even if unwarranted rather than dealing with the uncertainty of unknown future legislation.” This argument essentially says emissions migration is a non-issue because any costs associated with it will be more than compensated by the benefits of a clear (and currently largely expected, but undefined and uncertain) price on carbon. Unlike the “WTO Route” or “Leader and other will follow Route”, the economic efficiency or indirect subsidization route does not even engage directly on the issue of competitiveness or emissions migration. This could be a profound strength of this approach, as any issues of foreign competitiveness excite strong political views that can dampen the potential for compromise. The mere possibility that the U.S. could lose manufacturing, power and other large producers could motivate a strong coalition against climate legislation on protectionist grounds alone, regardless the potential for cross border adjustments or any other approach.

There is a strong, compelling and growing coalition of economists, investors and business executives who are calling for a carbon price (such as the U.S. Climate Actions Partnership or Global Roundtable on Climate Change) because it would *improve their competitiveness*. This is a promising strategy for dismissing the emissions migration issue as irrelevant to potential climate change legislation altogether. This argument must focus on the need for new domestic infrastructure (from direct current transmission lines to solar thermal plants) and emphasize that these projects require not just more labor and capital, but more per investment (Krupp estimates it to be a multiple of two) than traditional energy infrastructure as well. In other words, clean tech has a higher potential for job creation than traditional energy sources, and the economy that gains a competitive advantage in this sector will commensurately benefit. A price on carbon represents a real opportunity to develop new industry and manufacturing in the growing American “rust belt” and reclaim many jobs that have gone overseas in the last 15 years. This argument could prove a very effective counterpoint to global competitiveness concerns or protectionist sentiments and entirely preclude the need to seek any global legal action.

Weaknesses and risks: Most people don't know what “revenue neutral” means, but they definitely know what “tax” means. In order for this approach to have a realistic chance, the debate must focus on two core arguments in favor of a revenue neutral carbon tax: no new taxes and increased economic efficiency. Numerous times in the Climate Security Act senators dismissed a carbon tax because of the assertion that increased taxes would be harmful to the economy. Senator Lieberman and Senator Boxer both directly dismissed a carbon tax for this reason. This of course gets the facts completely reversed, as a cap with no dividends or offset is a tax increase while a revenue neutral tax is not. This doesn't matter though as long as the public and legislative debate fails to hammer home the ideas of revenue neutrality. To date no politician or group has been able to the popular conception of a carbon tax as simply another government revenue source. As noted earlier in the Financial Times article, this represents a tremendous political opportunity given the right leadership. As Mayor Bloomberg noted in endorsing a green tax shift, the largest challenge representing economic efficiency with solving climate change is political, specifically how to frame the “tax” word. However as Bloomberg powerfully explained this is no justification for inaction: “Both cap-and-trade and pollution pricing present their own challenges — but there is an important difference between the two. The primary flaw of cap-and-trade is economic — price

uncertainty. While the primary flaw of a pollution fee is political, the difficulty of getting it through Congress...If we're going to remain the world's economic superpower, we have to create predictable incentives that will drive technological innovations and allow us to lead the world in developing clean, reliable and affordable energy. We can do it! If we stop saying: "But for the politics!" (Bloomberg) There is a strong and growing consensus that regardless the actions of other economies, the United States can profoundly benefit from a revenue neutral carbon price. But until this is reconciled with the ease of which a new tax can be smeared in Washington and become a reelection liability, the issue will remain a firm second to cap and trade. This has led some commentators to push for rebranding a carbon tax to "tax shift" or "green shift" or even "lower income taxes" as a way to reframe the discussion.

Additional risks of this argument include the growing protectionist sentiment in the U.S., with more Americans currently viewing foreign trade as hurtful rather than advantageous to the economy. (Gallup) Any action which could be perceived to further reduce U.S. global competitiveness will likely encounter stiff public resistance. This places an ever higher premium concerted and honest political leadership on this issue, as exemplified by Mayor Bloomberg. A revenue neutral price also does not allow much room for potentially valuable political horse-trading. Allocating a majority of the revenues from auctioned permits to a broad array of private interests helps to establish a broad political coalition in favor of carbon pricing. Energy firms today extract record rents from carbon intensive sources and have many potentially perverse incentives for supporting a non revenue neutral scheme. Utilities, coal providers, energy traders, waste managers and other energy market participants have a strong incentive to seek a share of the revenues raised from allowance auction, as well as special exemptions. This is particularly the case when the Climate Security Act legislation established broad principles, targets and mechanisms and then creates new regulatory authorities (primarily within the Environmental Protection Agency and Department of Energy) to establish the regulatory legal code for such broad principles. This gives firms willing to seek government funds and offsets ample space for litigation and arbitration. A carbon tax on the other hand is rather suffocating for vested interests as it involves little in the way of new regulations or institutions, it's would require little more than shift in the tax code and a national carbon registry.

Another risk is that initial technical deficiencies of either a permit or tax pricing scheme will be used as proof of the conceptual failure of carbon pricing. For instance, if the initial system exhibits significant price volatility or prices too low to incent clean energy development, many of the potential benefits will be muted. This was the case in the European Union scheme, where the initial baseline of carbon emissions was overestimated and so initial permits had artificially low prices. This is important because there is a clear threshold price (social cost) of carbon dioxide that is necessary to induce widespread clean technology development. Such a price level is far from guaranteed under a cap and trade system, where prices can exhibit significant volatility. Under the Chicago Climate Exchange for example, the largest traded market in the world for greenhouse gas emissions allowances, the price per ton of CO₂ has fluctuated between \$1-7 over the past five years since its founding. This falls \$13 below the lowest recommended level mentioned in the Stern Review on the Economics of Climate Change, Intergovernmental Panel on Climate Change or the Inter-Academy Council of Arts and Sciences reports. Such a low price level per ton does not make clean energies cost-competitive, nor does it provide the necessary incentive to prevent harmful anthropogenic climate change. The average estimates in the Stern, IPCC and Inter-Academy reports for the social cost of carbon dioxide is about \$30 per ton. (Stern, 287) Establishing a price far below this does is neither optimal for mitigating climate change, encouraging large scale new investment or winning the policy debate. It is important to note that the weaknesses and risks associated with this route are almost entirely a matter of the political economy of climate negotiations and public relations. There is a broad and growing consensus among economists and the business and financial communities that a revenue neutral carbon price would foster increased economic efficiency.

Barriers to implementation: The primary barriers to this approach as outlined in the previous section are political. As a prime example there are over half a dozen non revenue neutral cap and trade bills in consideration currently in Congress and no carbon tax bills even in committee. Some of the specific political barriers to this route include: reaching compromise among producers on the level and distribution of carbon credits or prices, building a coalition focused on the merits of a green economy and sustainability as an economy opportunity, preventing smear and filibuster campaigns (as we have seen with every climate change bill in the last 15 years) and effectively framing the debate around economic efficiency and reduced taxes. This route has significant political possibility, but the

overarching challenge remains of balancing existing vested interests and the losers under a carbon pricing scheme (non clean coal and oil) and ensuring revenue neutrality.

Conclusion: The Route We Should Take

The fact is that with a meaningful price on carbon the United States will see huge new economic investment and growth. Jobs and capital will flow to areas like direct current transmission lines, so called "smart grids" that allow consumers to sell clean energy back to utilities via feed-in tariffs, carbon capture retrofitting, and proven renewable energy sources, among many others. These investments will increase U.S. global competitiveness by spurring vast new research and development and driving new job creation. It is estimated for instance that each gigawatt of solar thermal energy will require 3,400 construction jobs and 250 permanent employees, twice the rate as a typical coal or gas plant. (Krupp, 65) The opportunities for the United States are readily apparent.

By returning the revenues of a carbon tax to the private sector, foreign companies that do not yet have to similarly comply will not gain a competitive advantage as domestic tax levels will remain unchanged. Such concerns could also probably be offset with WTO compliant (particularly GATT rules 3, 11 and 20) cross border adjustments (tariffs) for countries that have less stringent standards than the U.S. This however would lead to long and unpleasant arbitration and probably result in retaliation by large U.S. trading partners for years to come.

The global community is currently stuck in a game theoretic stalemate. Developed economies have taken an aggressive posture, demanding guarantees from essentially the entire world community that any domestic action will be quickly replicated globally. As James Connaughton, Chairman of the White House Council on Environmental Quality recently articulated, the U.S. has changed its posture little since Byrd-Hagel: "The president has made clear that we believe a long-term [emissions reduction] goal is useful and necessary. The president has also made clear that it's a goal that must be shared by all countries." Developing economies on the other hand face higher relative transition costs to a clean economy, namely because of lower income levels and significantly lower energy efficiencies. They will therefore not accept bearing these higher risks without the leadership and technological demonstration of richer, more advanced economies. Seeking WTO cross

border wealth adjustments would only widen the gap between these two positions, as outlined in a recent Economic Times article, where the mere mention of an E.U. implemented tariff for CO₂ was interpreted as “a developed country ploy to get major developing countries like China, India and Brazil to agree to some caps on their emissions of carbon dioxide..” (Economic Times) Poorer economies already view more developed nations as the primary driver of climate change and so responsible for a larger share of future emissions abatement. Trade restrictions would be seen as further justification of this position and fan the flames. WTO actions by the United States would be interpreted as another way to shirk responsibility for emissions mitigation by free-riding on the fast growth of developing economies, and would result in a more entrenched bargaining position for developing economies. The only way forward is for the world’s wealthiest economies, the U.S. and E.U., to take a leadership position and provide a clear incentive for developing economies to follow by demonstrating that sustained economic growth and a robust carbon price are complimentary. Aspirational targets or consensus statements will not be enough to break the current stalemate. The leadership route will only work if these targets are adopted as binding and enforced laws in the adopting economies and GDP growth trajectories are largely maintained. For all the reasons outlined in the “route three” section of this paper, this is a viable approach that should be aggressively pursued immediately. So long as the bargaining position of developed economies remains the same, the world will remain without an effective climate change mitigation strategy.

Route 1 runs a high risk of alienating key trading partners and seriously damaging U.S. credibility. It takes a confrontational posture which is likely to be counterproductive. The most effective means of persuasion is not arbitration or trade limiting adjustments, but to lead by example and growing the economy in the process. The single fastest route to bring the whole world on board is for the largest historical emitter and largest economy to stop free-riding and align economic efficiency with our shared global climate system. There is a strong and growing consensus in the U.S. business, financial and political community, including both current presidential candidates, that a revenue neutral price on carbon would create tremendous economic opportunity. The sooner the U.S. can convert this rhetoric into law and prove its own assertions correct, the sooner the challenge of emissions migration will be solved. Currently it appears emissions migration is being used more as an excuse and instrument of delay than as a viable explanation for U.S. inaction. The United States should

pursue routes 2 and 3 simultaneously. The dual tracks of American leadership and an increased tax code will provide the greatest chance that other major economies will integrate a similar carbon price as soon as possible, while mitigating the harmful effects of climate change and incenting a new clean energy fueled economic boom. Once it is apparent that a revenue neutral price on carbon is a win for the economy, the environment and national security, other countries will not be able to jump replicate U.S. policy fast enough. With SO₂, ozone and particulate pollution it was either the EU or U.S. who first led and lesser developed countries, like China and India, who soon followed. The same would happen if the U.S. led by putting a real price on carbon.

References and Credits

“U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law.” Pauwelyn, Joost. Nicholas Institute for Environmental Policy Solutions, Duke University. www.nicholas.duke.edu/institute. 2007.

“The Political Economy of WTO Dispute Settlement: Toward a Synthesis of International Regime Theories.” Griffin, Christopher L. Georgetown University. <http://www.econ.ilstu.edu/uauje/PDF's/CarrolRound/griffinpost.pdf>

“WTO Dispute Settlement 1995–2007 – A Statistical Analysis” Leitner, Kara and Lester, Simon. Journal of International Economic Law. Oxford Journals. <http://jiel.oxfordjournals.org/cgi/content/full/11/1/179>

“Understanding the WTO: Settling Disputes.” World Trade Organization. http://www.wto.org/english/theWTO_e/whatis_e/tif_e/disp2_e.htm

“An Hour with U.S. Senator James Webb.” Charlie Rose. <http://www.charlierose.com/shows/2008/07/21/1/an-hour-with-us-senator-jim-webb>

“Exports to Europe may trip on carbon barrier.” Sen, Amiti. Antony, Anto. The Economic Times. June 23, 2008. <http://economictimes.indiatimes.com/articleshow/3154535.cms>

“Testimony of Michael W. Masters before the Committee on Homeland Security and Governmental Affairs United States Senate.” May 20, 2008. http://hsgac.senate.gov/public/_files/052008Masters.pdf

“Senate Testimony on Employment Opportunities from Green Energy.” Kholsa, Vinod. Khosla Ventures. <http://www.khoslaventures.com/resources.html>

“Green Strategy.” Kholsa, Vinod. Khosla Ventures. <http://www.khoslaventures.com/resources.html>

“A New Agenda for Global Warming.” Stiglitz, Joseph. Economists' Voice. <http://www2.gsb.columbia.edu/faculty/jstiglitz/download/GlobalWarming.pdf>

"Bloomberg calls for tax on carbon emissions." Chan, Sewell. The New York Times. November 2, 2007. <http://cityroom.blogs.nytimes.com/2007/11/02/bloomberg-calls-for-tax-on-carbon-emissions/>

"National Intelligence Assessment on the National Security Implications of Global Climate Change to 2030." Fingar, Thomas. House Permanent Select Committee on Intelligence and House Select Committee on Energy Independence and Global Warming. http://www.dni.gov/testimonies/20080625_testimony.pdf

"Stern Review on the economics of climate change." Stern, Nicholas. HM Treasury. http://www.hmtreasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

"Hot Air Clouds the Energy Debate." Crook, Clive. Financial Times June 22, 2008 http://www.ft.com/cms/s/0/5f9f9f96-4060-11dd-bd48-0000779fd2ac.html?nclick_check=1

"Disapproval of Bush Spans the Issues." Saad, Lydia. Gallup. <http://www.gallup.com/poll/104458/Disapproval-Bush-Spans-Issues.aspx>

"Kyoto Protocol." United Nations Framework Convention on Climate Change. United Nations. http://unfccc.int/kyoto_protocol/items/2830.php

Krupp, Fred and Horn, Miriam. Earth: The Sequel *The Race to Reinvent Energy and Stop Global Warming*. W.W. Norton & Company. New York and London. Copyright 2008 by Environmental Defense Fund.

"The carbon productivity challenge: Curbing climate change and sustaining economic growth." McKinsey & Company. http://www.mckinsey.com/mgi/publications/Carbon_Productivity/index.asp

"VC Investment in Solar: Entrepreneurs, Innovation and Capital 2005-2009." Wesoff, Eric. Greentech Media. <http://www.greentechmedia.com/reports/research-report-intelligence-vc-investment-in-solar.html>

Axelrod, Regina S., Downie, David Leonard., Vig, Norman J. The Global Environment: Institutions, Law, and Policy. Congressional Quarterly Press. 2005.

"Standoff continues on global warming, other issues." Raum, Tom. Associated Press. July 7, 2008. http://news.yahoo.com/s/ap/20080707/ap_on_re_as/bush_g8_51;_ylt=Atlca3gjohkg.9voQDZ4o0NrAlMA

"IPCC Fourth Assessment Report: Climate Change 2007." Intergovernmental Panel on Climate Change. <http://www.ipcc.ch/ipccreports/assessments-reports.htm>

"Lighting the Way: Toward A Sustainable Energy Future." IAC Chairpersons Alberts, Bruce and Yongxiang, Lu. Inter-Academy Council of Arts and Sciences. <http://www.interacademycouncil.net/?id=12161>

"More Americans See Threat, Not Opportunity, in Foreign Trade." Jacobe, Dennis. Gallup. <http://www.gallup.com/poll/17605/More-Americans-See-Threat-Opportunity-Foreign-Trade.aspx>

"California's Global Warming Solution" Doerr, John. Time Magazine. September 3, 2006. <http://www.time.com/time/magazine/article/0,9171,1531324,00.html>

World Energy Outlook 2008. "Global Energy Trends" International Energy Agency. <http://www.worldenergyoutlook.org/>

