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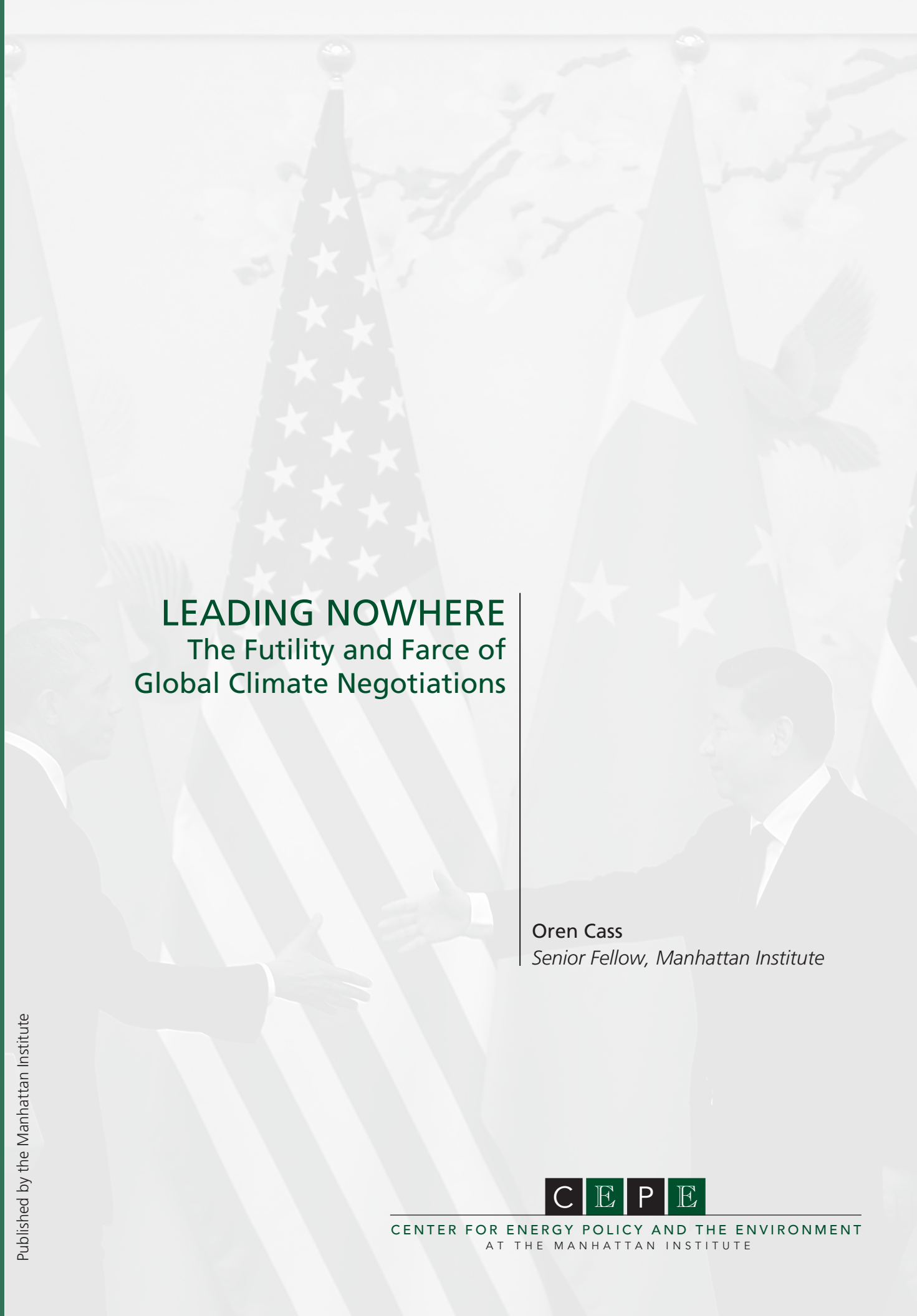

LEADING NOWHERE
The Futility and Farce of Global Climate Negotiations

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Conference of the Parties (COP) 21, the international climate negotiations that will be held in Paris, November 30–December 11, 2015, will conclude the twenty-first round of talks under the United Nations Framework Convention on Climate Change (UNFCCC). There is "no plan B—nothing to follow," declared Miguel Cañete, the EU's commissioner for climate action. "This is not just ongoing U.N. discussions. Paris is final."[1]

In keeping with the demands of environmental activists, President Obama has committed the United States to showing international leadership by taking aggressive domestic action to reduce carbon dioxide (CO_2) emissions. The ultimate objective is, purportedly, a successful international agreement by which all countries commit to substantially reducing emissions.

Stipulating that climate forecasts of the UN Intergovernmental Panel on Climate Change (IPCC) are accurate and its goals for limiting emissions necessary, this paper examines the likelihood that the present framework for international negotiations can succeed. To do so, it examines three strategic paths that might hypothetically lead to an agreement:

1. **Collective action.** All parties agree to take costly action (emissions reductions) to achieve a goal that purportedly offers a net benefit (less climate change) to each.
2. **Compensation.** Some parties transfer wealth to other parties to secure their agreement to the necessary action.
3. **Coercion.** Some parties threaten to impose costs on other parties to secure their agreement to the necessary action.

Fundamental economic and political challenges suggest that there is no plausible path to an agreement premised on collective action or compensation: developing nations that must bear the brunt of emissions reductions in any successful scenario cannot achieve those reductions while pursuing rapid economic growth; developed nations cannot sufficiently compensate developing ones for forgoing such growth. Evidence from recent negotiations, as well as preparations for the next round of talks, reinforces this conclusion.

The third path to an agreement—coercion—has received little attention. No group of nations appears prepared to employ the approach and risk subsequent conflict. But with limited prospects for constructive negotiation, only two outcomes appear realistic: a coercive agreement to restrict growth in the developing world; or no substantive agreement and only the hope that future technological innovation someday makes action palatable to developing nations.

Whatever ineffectual "deal" may emerge from the Paris talks will only underscore what has been true all along: no negotiated agreement will significantly reduce global emissions of CO_2. The U.S. Congress should pass a resolution preemptively rejecting any agreement that omits enforceable developing-nation commitments to emissions reductions or that transfers substantial wealth to the developing world. Constraining the options in Paris to either a genuine and enforceable agreement, or no agreement, will have a valuable, clarifying effect on the future of international climate policy.

About the Author

OREN CASS is a senior fellow at the Manhattan Institute, where he focuses on energy, the environment, and antipoverty policy. He was domestic policy director of Mitt Romney's presidential campaign in 2011–12. In that role, Cass shaped campaign policy and communication on issues from health care to energy to trade. He spoke regularly on behalf of the campaign, including in debates at Harvard University on health care policy and at MIT on energy and environmental policy. Since then, Cass has outlined conservative policy approaches on poverty, climate change, environmental regulation, and international trade. His essays and columns have been published in the *Wall Street Journal*, *New York Times*, *Washington Post*, *National Affairs*, *City Journal*, *National Review*, *Investor's Business Daily*, and *Washington Examiner*. Cass has briefed members of Congress and congressional staff, and his work formed the basis of the antipoverty reforms proposed in 2014 by Senator Marco Rubio.

Prior to joining MI, Cass was a management consultant for Bain & Company in the firm's Boston and New Delhi offices, where he advised global companies across a range of industries on implementing growth strategies and performance-improvement programs. He holds a B.A. in political economy from Williams College and a J.D. from Harvard University, where he was an editor and vice president of volume 125 of the *Harvard Law Review*.

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The Futility and Farce of Global Climate Negotiations

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INTRODUCTION

The UNFCCC, which has governed international climate negotiations for more than two decades,[2] explicitly states its objective: "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[3] A negotiated agreement to achieve the goal would presumably require that each country make some commitment to reduce future emissions, in return for commitments that others do the same.

This starting point should be axiomatic, yet climate analyses frequently ignore it. One optimistic school of thought holds that emissions reductions "pay for themselves"[4]—but if the required actions were already in each party's self-interest, negotiation would be unnecessary.

Another school of thought puts great faith in half-measures that "demonstrate leadership" and "build confidence" while producing no quantifiable or enforceable commitments[5]—but how can a collective-action problem be solved through a mechanism that leaves action voluntary? Genuine negotiation must grapple with costly adherence to a limited "carbon budget," as well as contentious commitment mechanisms to ensure that each country remains within its agreed-upon share.

The Carbon Budget

Once emitted, CO_2 remains in the atmosphere for hundreds of years.[6] It is thus the total stock of CO_2 ever emitted, not the rate of flow at which new emissions occur, that computer models indicate will drive changes in global temperatures: the *when* of emissions matters relatively little; the *how much* matters quite a lot, and can be expressed as a simple sum over time.

In its Fifth Assessment Report (2014), the IPCC converted its estimates for dangerous atmospheric concentrations of CO_2 into estimates of how much CO_2 human civilization could safely emit in total.[7] To have at least a 66 percent chance of holding total warming below the internationally agreed threshold of 2 degrees Celsius,[8] the IPCC report estimates that total human emissions cannot exceed 2,900 gigatons (Gt) of CO_2. From the beginning of industrialization through 2011, humans emitted 1,890 Gt, leaving a remaining budget of 1,010 Gt.[9]

Rather than treat climate negotiations as a complex fight over the year by which each country's emissions will be some percentage lower than in some baseline year, the carbon budget focuses on a much simpler question: How much of the 1,010 remaining Gt (or any other budget that governments might agree to) should each country be allowed to emit? The difference between emissions expected in a business-as-usual scenario and emissions allocated under the carbon budget represents the concession that each country must make.

The IPCC has developed a series of scenarios that model how economic growth and energy consumption will lead to emissions over time. The "A1B" baseline provides a helpful business-as-usual reference point for understanding the trajectory of global emissions, absent significant mitigation efforts (see box, "SRES A1B").[10]

Between 2000 and 2100, in the A1B scenario, per-capita income will increase fivefold in developed nations and *60*-fold in developing nations. Whereas in 2000 the developing world's per-capita income was only 5 percent that of the developed world, by 2100 it will exceed 60 percent (and, remarkably, will more than double the current level of prosperity in the developed world). Global GDP will grow by a factor of 20.[11] Clearly, fueling the growth of a world where the rich continue to get richer and the poor become rich will require enormous supplies of energy.

SRES A1B

In 2000, the IPCC produced the Special Report on Emissions Scenarios (SRES), which provides the building blocks for modeling the future trajectory of economic output, energy consumption, and CO_2 emissions.[12] The SRES A1B scenario is still commonly used[13] as a moderate baseline that assumes "a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies," ultimately employing a balance of fossil and nonfossil energy sources.[14]

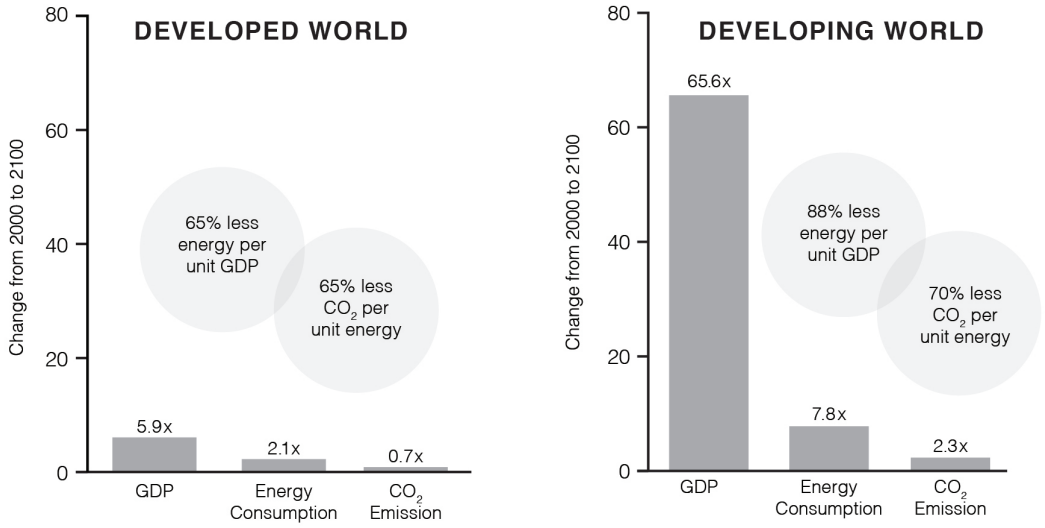
The A1B emissions trajectory is, by no means, a "worst-case scenario"; rather, it is somewhat more optimistic than the median baseline scenario among those considered by the IPCC's Fifth Assessment Report.[15] As of 2010, actual emissions tracked closely to the A1B assumptions: CO_2 emissions from fossil fuels had risen by 36 percent over 2000 levels, compared with an A1B estimate of 40 percent; developing-world emissions represented 66 percent of the 2010 total, compared with an A1B estimate of 65 percent.[16]

SRES scenarios divide the world into one OECD90 category that includes all members of the OECD as of 1990, counted here as "developed"; and three categories for non-OECD countries—Eastern Europe and the former Soviet Union; Africa, Latin America, and the Middle East; and Asia—collectively counted here as "developing."[17]

The A1B scenario makes fairly aggressive assumptions for technological innovation to allow a "decoupling" between increasing economic output and decreasing CO_2 emissions. It assumes that developed economies become three times more efficient in their use of energy per dollar of GDP and that developing economies become eight times more efficient. It also assumes that renewable sources generate 40 percent–50 percent of energy in both the developed and developing worlds by 2100 and that CO_2 emissions, per unit of nonrenewable energy, decline by at least one-third.[18]

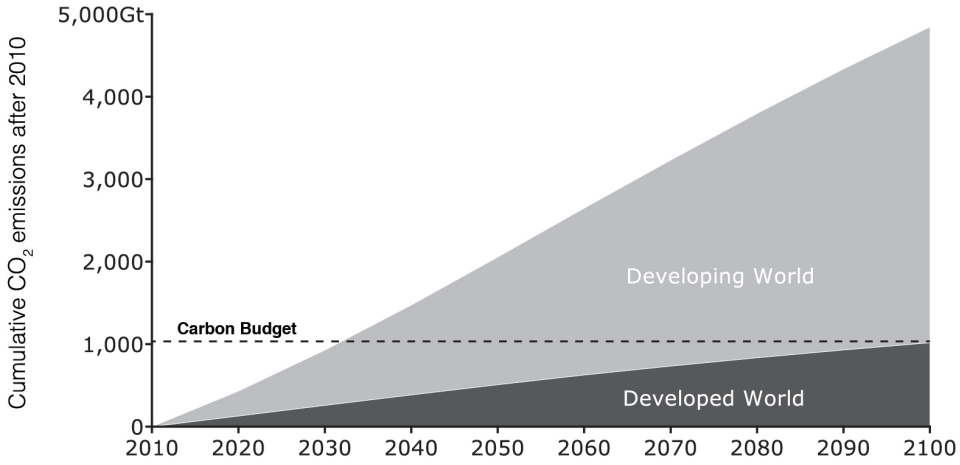
Still, the thirst for energy expands emissions far faster than the quest for efficiency contracts them. The A1B assumptions lead to a 69 percent increase in annual emissions during the twenty-first century: developed-nation emissions decline by 28 percent, but developing-nation emissions increase by 134 percent and, eventually, constitute more than 80 percent of the total (**Figure 1**). Emissions from 2010 through 2100 are projected to total 4,846 $GtCO_2$—nearly five times the allowable budget[19] (**Figure 2**).

Figure 1. Efficiency Is Not Enough



Source: IPCC, SRES A1B Scenario

Figure 2. Budget Busted



Source: IPCC, SRES A1B Scenario

Significantly, 79 percent of the projected total—and thus four times the world's allowable budget—comes from the developing world. This is not to suggest that developed nations should not reduce their emissions under an agreement; but it does demonstrate that substantial developing-nation reductions must be any effort's centerpiece.

If developed-world CO_2 emissions ceased tomorrow, the developing world would still need to instantly slash its emissions by more than half—and hold at that level indefinitely—to remain within the carbon budget until 2100. Conversely, if the developing world zeroed out its emissions tomorrow, the developed world could stay within budget through century's end while making no emissions-reduction efforts at all.[20] The central challenge of climate negotiations is to place developing nations on a credible path to substantial emissions reductions.

Negotiation Models

Popular discussion of climate negotiations often envisions a scenario where all nations come together and agree to each reduce their emissions by a required amount, contingent on everyone doing the same. This is a collective-action model of negotiation and requires that all parties receive a benefit from the collective action that exceeds the cost of their own action. Trade agreements take this form, with all countries reducing tariffs and making their markets more hospitable to imports from the other respective countries. Arms-control agreements typically take this form, too.

Second, climate negotiations could follow a compensatory model, in which some countries pay other countries to reduce emissions. Richer countries might so strongly desire emissions reductions that they will reduce emissions *and* transfer wealth to poorer countries in return for the latter reducing their own emissions. The Montreal Protocol on Substances That Deplete the Ozone Layer, which the UN calls "the world's most successful environmental agreement," took this form.[21] Through a Multilateral Fund for the Implementation of the Montreal Protocol, developed nations provided developing nations with a total of $2.4 billion in assistance over 20 years.[22]

Third, climate negotiations could follow a coercive model, in which one set of countries threatens economic or physical force against other countries *unless* the latter reduce emissions. The world's embargo of South Africa sought to end apartheid this way. This tactic also secures surrenders at the end of wars. Proponents of the recent Joint Comprehensive Plan of Action for Iran's nuclear program argue that economic sanctions helped produce Iran's concessions.

Economic or international relations theory might place these models on a single continuum, where compensation and the ceasing of coercion are merely among the range of actions that each party might take in return for actions by the other (coercion is negative compensation; collective action is zero compensation). Nevertheless, these three models have dramatically different political implications for the form that a negotiation will take and its likelihood of success—as previous climate negotiations make clear.

Is there any realistic prospect that nations will agree on how to allocate a global carbon budget? That the rich will transfer wealth to the poor in return for such an agreement? Or that the rich will impose such an agreement by force? There is not.

I. THE DEVELOPING WORLD WILL NOT VOLUNTARILY REDUCE EMISSIONS

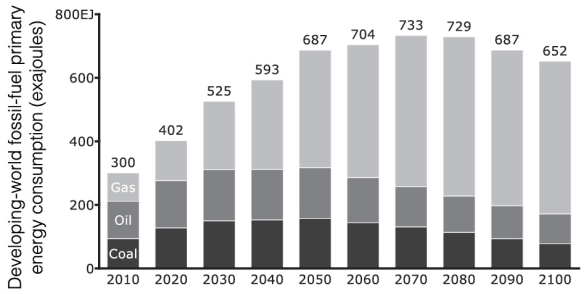
Framing climate change as a collective-action problem presumes that the only obstacle to developing nations reducing emissions is coordination—the need to ensure compliance by all nations. This assumption is mistaken: the inability of current low-carbon energy technologies to support the developing world's need for economic growth makes a developing-world commitment to significant emissions reductions implausible, regardless of what commitments developed nations make.

Exploding Energy Demand

The critical investment decisions that will determine the world's emissions trajectory will occur in the next 30 years. By 2050, in the A1B scenario, fossil-fuel energy production in the developing world will

already have completed its expansion. During 2010–50, annual energy use from fossil fuels will more than double; by contrast, during 2050–2100, it will decline by 5 percent[23] (**Figure 3**). Future technology might allow fossil-fuel infrastructure to come more rapidly offline later in the century, or perhaps even to take greenhouse gases back out of the atmosphere.[24] But for purposes of negotiation over emissions trajectories, the question is what happens in this century's first half.

Figure 3. The Time Is Now



Source: IPCC, SRES A1B Scenario

Developing nations have little flexibility to reduce emissions below an A1B-like trajectory without substantially slowing economic growth and/or incurring enormous costs. The sheer scale of energy capacity that must come online, as well as the timeline in which it must do so, precludes the predominant deployment of low-carbon sources. Once infrastructure is built and deployed, the economic case rarely exists for deactivating it before the end of its useful life.[25]

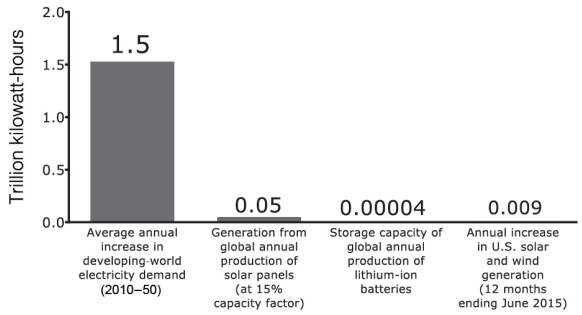
Here, it is helpful to focus specifically on electricity, which is responsible for the greatest CO_2 emissions and requires the most extensive infrastructure development. Even if transportation infrastructure could transition away from fossil-fuel consumption more rapidly, it would likely do so by relying on electricity. Any assumption of faster decarbonization for transportation only heightens an emphasis on the electric grid's fuel sources. In the A1B scenario, developing-world electricity consumption will jump from 11.3 trillion kilowatt-hours (kWh) in 2010 to 72.5 trillion kWh in 2050.[26] (The U.S. generated 4.1 trillion kWh in 2014,[27] which means that the developing world must add the equivalent of another U.S. power grid every three years for 40 years.) The challenge is therefore threefold:

1. Fossil-Fuel Baseload. In many regions of the world, deployment of renewable energy as a marginal source of electricity makes economic sense. But intermittent sources of renewable energy, such as wind and solar, typically become uneconomical as they exceed approximately one-third of a grid's supply[28] or, at most, one-half of supply.[29] In the developed world, these constraints are relatively more manageable because utilities and property owners add small marginal increments of renewable power to enormous fossil-fuel and/or nuclear baseloads.[30] But the developing world is only beginning to build its baseload—the jump from 11.3 to 72.5 trillion kWh means that 84 percent of the electric generation to be consumed in 2050 was not online in 2010.

2. Installation Capacity. Were a grid capable of handling a much higher share of renewables, the required build-out would be without precedent. In the U.S., solar and wind power generation increased by 0.009 trillion kWh for the 12 months ending June 2015 over the prior 12 months.[31] To meet even half its anticipated demand increase, the developing world would need annual expansions of renewable capacity 84 times faster than that, every year, for four decades—while building an accompanying smart-grid and storage infrastructure far beyond anything attempted in the developed world. Indeed, an entire year of the world's current solar-panel production could fulfill one-fifteenth of that annual increase;[32] an entire year of the world's 2013 lithium-ion battery production capacity could store one minute's worth of the developing world's 2020 demand[33] (**Figure 4**).

3. Cost. The economic cost of such a build-out would be, as Bill Gates told the *Financial Times* in a June 2015 interview, "beyond astronomical."[34] This conclusion aligns with the findings of a project conducted by engineers at Google, RE<C ("Renewable Energy

Figure 4. A Problem of Scale



Source: IPCC, SRES A1B Scenario;
U.S. Energy Information Administration; Tesla Motors

Cheaper than Coal"). Google launched the project in 2007 but shuttered it in 2011, after concluding that existing technological approaches were incapable of meeting the challenge.[35] Germany provides a useful reference point: its environment minister estimated that his country's own *Energiewende* ("energy revolution") would cost up to a trillion euros over 20 years,[36] for a population less than 2 percent of the developing world's.[37]

Existing technology thus cannot support the low-emissions grid that developing nations would need to commit to; existing capacity cannot produce such a grid; and existing resources cannot fund it.

Coal's Renaissance

Ongoing fossil-fuel investment in the developing world belies optimistic claims that progress in wind and solar technologies will smooth the path to low-carbon economic growth. True, countries are deploying renewable technology where it makes economic sense, and growth looks impressive, in percentage terms, from a small base.[38] But the leading source of energy, and fastest-growing in absolute terms, remains coal.[39]

Global energy markets reflect this reality. A June 2015 article ("Drivers for the Renaissance of Coal") in the *Proceedings of the National Academy of Sciences* states: "In summary, in recent years non-OECD countries have relied increasingly on coal to meet their energy needs. The poorer a country is and the higher its rate of economic growth, the stronger is this effect. Both effects become more pronounced over time, suggesting that increasing coal use is a general trend among poor, fast-growing countries and is not restricted to a few specific countries."[40]

The rate of coal use is not only increasing in developing nations; the expansion of coal-fired generating capacity is accelerating, too.[41] India, which aims to double coal production in the next five years,[42] is expanding coal-power-plant capacity 2.5 times faster than the U.S. is closing its own.[43] Worldwide, the Sierra Club and CoalSwarm report that there are 2,177 new coal plants in various stages of development, including 557 under construction.[44] Even if only half the plants not yet under construction are ever built, the total capacity addition of 817 GW would exceed the OECD's entire existing coal-plant capacity and match China's.[45]

No Commitments

The outcomes of recent negotiations confirm that developing nations will not offer emissions reductions. During the drafting of the 1997 Kyoto Protocol, developed nations made the fateful decision to accept a framework under which only they were required to make emissions reductions[46]—even though, by that time, developing nations already represented the majority of global annual emissions.[47]

Developing nations continue to insist on this approach and resist demands that the negotiating framework shift to one in which all nations reduce emissions. For instance, in September 2015, Indian prime minister Narendra Modi declared: "While the developed countries should have targets for emission cuts, developing countries should work on targets of encouragement."[48]

At COP20, in Lima, Peru, in December 2014, negotiators laid the groundwork for COP21 through an accord that secured no actual emissions commitments. Rather, all countries "agreed to agree," promising to submit their own nonbinding commitments by March 31, 2015, in preparation for the December 2015 meeting in Paris.[49] A requirement that commitments at least take a common format to facilitate comparison was stricken, at the behest of developing nations.[50] Most countries then failed to follow through even on that commitment-to-commit-to-anything.

Of 169 expected Intended Nationally Determined Contribution (INDC) submissions, only the United States, the European Union, and three other countries met the March 31, 2015, deadline. From then until mid-September 2015, an additional 23 countries made submissions. During September 15–October 1, at a time too late for significant pre-Paris discussion or analysis, 81 more countries made submissions. Of the world's seven most populous developing nations, China was the only one to submit a commitment by the end of June. India, Brazil, Indonesia, and Bangladesh made submissions at the end of September. As of October 1, neither Pakistan nor Nigeria had made a submission.[51]

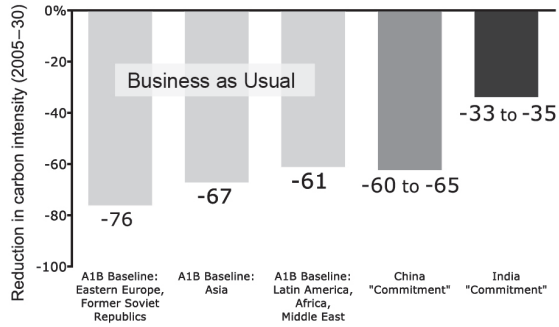
Each of these developing-nation submissions is unserious in its own way and fails to depart significantly from a business-as-usual scenario. In 2014, China and the U.S. reached a "historic"[52] agreement in which China committed to reaching peak emissions by "around 2030," while establishing no limits in the interim, no level at which the peak must occur, and no trajectory of decline thereafter. China's proposed peak also aligned with a 2011 estimate, from the Lawrence Berkeley National Laboratory, for when its emissions would have peaked naturally.[53]

China's INDC submission supplements that 2030 commitment with a targeted reduction in carbon intensity[54] of 60 percent–65 percent, from 2005 levels, by 2030.[55] A Bloomberg New Energy Finance analysis subsequently calculated that this target is actually *less* aggressive than simply remaining on China's business-as-usual trajectory.[56] Indeed, the initial A1B scenario had always envisioned that developing Asia would reduce its carbon intensity by 67 percent during 2005–30, with GDP growing sixfold while CO_2 emissions only doubled.[57]

India made no commitment with respect to emissions at all, offering only a 33 percent–35 percent reduction in carbon intensity in 2030 from 2005 (**Figure 5**).[58] This compares unfavorably not only with the baseline of a 67 percent reduction in the A1B scenario but also with the 2.7 percent annual reduction in energy intensity that India reportedly experienced during 2005–12. Assuming no change in carbon intensity (when, in fact, increasing use of renewables should provide additional gains), the energy-efficiency gains alone brought India halfway to its 2030 target by 2012 and left it needing only 1.2 percent annual efficiency gains from 2012 to 2030.[59] Bangladesh, meanwhile, proposed to reduce its emissions 5 percent by 2030 from its self-defined business-as-usual trajectory, meaning that its emissions would climb from 2011 by 247 percent instead of 264 percent.[60]

Brazil and Indonesia are both outliers because their emissions have historically been driven by deforestation rather than fossil-fuel consumption.

Figure 5. A Lack of Ambition



Source: IPCC, SRES A1B Scenario; China and India INDCs

Brazil's emissions fell by 41 percent during 2005–12, thanks to reductions in deforestation.[61] Thus, its commitment to reduce emissions by 43 percent below 2005 levels by 2030 is, per the Brookings Institution, "seeking credit for work done," and "the new targets mean only tepid steps forward."[62] Indonesia attributes only 19 percent of its emissions to fossil-fuel consumption, and its INDC[63] is so vague that the World Resource Institute found it impossible to assess, concluding that the plan "does not allow for any accountability."[64]

As of the September 2015 negotiations in Bonn—intended to prepare an agreement for final negotiations in Paris—negotiators had made no progress on nation-specific emissions or a timeline for phasing out fossil fuels.[65] Shortly after the Bonn negotiations concluded, 13 "Like-Minded Developing Countries," including India and China, issued a statement asserting that "the Paris Agreement

should not be mitigation-centric" and rejecting "any obligatory review mechanism for increasing individual efforts of developing countries."[66]

In short, no evidence—distant or more recent—indicates any willingness by developing nations to make even nonbinding pledges to slow the growth of CO_2 emissions, let alone accept the dramatic reductions required to substantially alter the trajectory of atmospheric concentrations.

II. DEVELOPING NATIONS CANNOT BE INDUCED TO ACT THROUGH "CLIMATE FINANCE"

If developing nations will not join in collective action, can they be paid to act? Much discussion in the lead-up to COP21 has focused on "climate finance," the transfer of wealth from developed to developing nations. In theory, this path might move toward an agreement in which the developed world either funds the costly construction of low-carbon infrastructure for the developing world or compensates developing nations for accepting higher energy costs and lower growth. In practice, this path is equally unpromising.

On the one hand, developing nations demand climate finance as compensation for past developed-world emissions and expect to receive it regardless of whether they act to reduce their emissions. On the other hand, developed nations would not pay for reduced emissions even were such an offer on the table, and certainly will not pay for reduced emissions on top of so-called climate reparations. Again, there is no possible scope for a meaningful agreement.

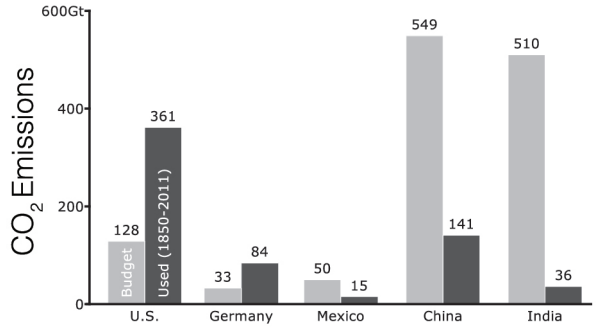
"Climate Justice"

The negotiating position of the developing world emphasizes the developed world's disproportionate share of historical emissions. This view took root during the Kyoto negotiations, when Brazil first introduced the idea that historical emissions were critical to defining each country's fair share of future emissions[67] (part of the basis for Kyoto's counterproductive developed-nations-only emphasis). Thus, it is not the remaining carbon budget that must be allocated among countries but rather the entire budget, including parts already used.

Such analyses typically use an allocation proportional to each country's population. Of the entire 2,900 $GtCO_2$ budget established by the IPCC, the U.S. would receive a total allocation of 128 Gt; the entire developed world would receive 406 Gt.[68] CO_2 emissions during 1850–2011, for the U.S. and entire developed world, were 361 Gt and 734 Gt, respectively[69]—they are, in other words, deeply in "ecological debt." India, by contrast, has used only 7 percent of a 510 Gt budget (**Figure 6**).

These figures change, based on which forms of emissions are included (CO_2 from fossil fuels, all CO_2, all greenhouse gases, further effects from deforestation, etc.), the start date from which debits

Figure 6. Deeply In Debt



Source: IPCC, Fifth Assessment Report; World Bank; CAIT Climate Data Explorer

and credits accrue, and the total budget allocated. A 2015 study in *Nature Climate Change* estimated a U.S. debt of 100 $GtCO_2$, based on a 1990 start date, or 203 $GtCO_2$, for a 1960 start date—three times the debt of any other nation.[70] A related 2015 study in *Environmental Research Letters* also found the U.S. debt to exceed 100 $GtCO_2$ and noted that monetizing it, based on the U.S. government's own estimate of damage per ton of CO_2, would suggest that America owes $1 trillion–$10 trillion-plus.[71]

China has adopted this ecological-debt position: the vice president of its Academy of Science has argued that while the U.S. exceeded its budget in 1936, China will not reach its own budget until 2047; and India, not until after 2050. He calls international negotiation against this backdrop "an almost

impossible task" and suggests that the developed world must pay cash compensation.[72]

India's Modi recently argued that "discourse must shift focus from climate change to climate justice";[73] India's INDC submission is titled "Working Toward Climate Justice." Pope Francis endorsed the concept of ecological debt in *Laudato Si'*, his encyclical on the environment, in which he wrote that developed nations "ought to help pay this debt by significantly limiting their consumption of nonrenewable energy and by assisting poorer countries" and advocated "mechanisms and subsidies which allow developing countries access to technology transfer, technical assistance and financial resources."[74]

Developing nations also argue that they are entitled to compensation for the costs of adapting to climate change created by historical developed-world emissions. In 2013, they walked out, en masse, from UN negotiations when developed nations balked at the idea and, upon return, declared it a "red line." Developing nations have proposed, for instance, establishing a new international institution that would automatically trigger compensation when natural disasters occur.[75] Again, developing nations expect payment of "reparations"[76] independently of any commitment to emissions reductions.

Compensation Won't Work

Developed nations will not pay the compensation demanded by the developing world for "climate justice." The demand is rightly rejected, on the philosophical ground that treating nations as moral agents in this context makes little sense;[77] on the practical ground that it ignores the countervailing support that developing nations receive from developed-nation technology and institutions as they pursue economic growth;[78] and on the political ground that voters in the developed world's democracies would never accept such a transfer of wealth.

Further, the path is plainly inadequate, if not irrelevant, with respect to reducing global emissions. Most obviously, it does not achieve any of the needed emissions reductions in the developing world—developing nations neither make emissions commitments nor take any meaningful and concrete steps away from carbon-intensive development. Rather, the developed world is essentially asked to purchase an agreement that it can hold up to demonstrate the achievement of progress, though the agreement itself would be the only real progress achieved. India's INDC, for instance, makes no commitments to emissions reductions but then highlights that the country will likely need $1–$2.5 trillion in climate finance by 2030.[79]

Even if developed nations could offer sufficient funding to not only assuage concerns of climate justice but also induce developing-nation commitments, no implementation mechanism would exist to translate such an agreement into effective action. For developing nations, improvements in living standards demand increases in energy consumption. If the developed world cannot pay for developing nations to produce that energy while holding down emissions, there will be no deal.

But current technology, as discussed, cannot meaningfully shift the course of development at manageable cost. The cost, as well as ambition, of even beginning to develop the necessary infrastructure is unfathomable: trillions of dollars directed at an electrical grid far more complex than the existing model—itself described, by the U.S. National Academy of Engineering, as the twentieth century's greatest engineering feat.[80]

The history of foreign development aid shows the considerable challenge of deploying even modest amounts of capital in pursuit of modest development initiatives; no institutions exist in developing nations capable of effectively utilizing financing on the aforementioned scale for an unprecedented, decades-long deployment of advanced, often unproven, technologies.

No Funds Available

The last high-profile round of UNFCCC negotiations, the 2009 Copenhagen talks, pursued an agreement built on both emissions reductions and climate finance. That event descended into mayhem as developing nations refused to make emissions commitments and the Sudanese delegation led a

walkout over the inadequacy of developed-nation financial offers.[81] Some of the poorest nations also insisted that the target for acceptable warming be lowered, from 2 degrees to 1.5 degrees Celsius[82] (a seemingly senseless demand, unless one remembers that a lower target means a smaller carbon budget and thus, a larger ecological debt owed by the developed world).

In the end, a small group of countries hammered out a final agreement[83] that was not adopted by all parties, contained no emissions commitments, and promised to fill a "Green Climate Fund" with $100 billion annually for developing nations by 2020, with no explanation of how the money would be raised or spent.[84] Then–secretary of state Hillary Clinton, announcing the deal, insisted that funding would be provided only if nations like China and India made binding commitments to reduce emissions.[85] While developing nations subsequently scooped up the pledge, such conditions fell by the wayside.

Developed nations have since come under growing criticism for failing to raise the funds—by mid-2015, pledges total less than $10 billion, with lower amounts delivered.[86] French president François Hollande has declared that the Green Climate Fund commitment "was a promise that already has not been kept. It is now a requirement. Without 100 billion, there will be no deal in Paris."[87] UN secretary-general Ban Ki-moon has insisted that "credible climate financing is essential" to an agreement in Paris.[88]

Developing nations continue to raise the stakes. A joint statement issued by China, India, Brazil, and South Africa at a UN meeting in June expressed "disappointment over the continued lack of any clear road map to provide $100bn per year by 2020, as well as on substantially scaling up financial support after 2020."[89] EU commissioner Cañete preemptively acceded to this demand, promising not only a clear demonstration of meeting the annual $100 billion by 2020 but also an agreement in Paris for increasing wealth transfers thereafter.[90]

This extraordinary scale of "financing" needs further perspective. The Montreal Protocol's global phaseout of chlorofluorocarbons to protect the ozone layer is sometimes highlighted by environmentalists as a case study in successful coordination. Yet on an annual basis, that agreement's $2.4 billion in assistance to developing countries over 20 years[91] represents approximately one one-thousandth of the rate of support so far contemplated in the climate context. Or consider existing foreign-aid programs: all official development assistance from the developed world totaled $135 billion in 2014, on par with amounts now contemplated for climate finance alone.[92]

In Bonn, developing nations appeared to soften their demand that a formal mechanism be established to compensate them for natural disasters, proposing text that read "the governing body to this agreement shall ensure that adequate support is available to the international mechanism to address loss and damage."[93] But this sign of "progress" only underscored that a developing-nation commitment to take action in return for financing was not on the table at all. No evidence indicates that such an agreement could be accepted or implemented by either side.

III. A MEASURE OF SERIOUSNESS

For two decades, international climate negotiations have proceeded from an assumption that nations pursuing their self-interest might act collectively to substantially reduce CO_2 emissions, with transfers of wealth perhaps incorporated to ensure fairness and implementation. In the U.S., the claim that "leadership" would spur the world to action has been central to the justification for unilateral action. In August 2015, President Barack Obama announced the implementation of his "Clean Power Plan," with four different references to America "leading the way."[94]

But the reality of climate negotiations, in which the nations whose behavior matters most are exempt from commitments while other nations are beseeched to offer funds that will never be paid, bears little resemblance to this vision. Developing nations, facing the costliest action, plainly do not perceive it in their self-interest to change. Developed nations, desperate to demonstrate continued progress, make whatever concessions are necessary to ensure that more "agreements" are signed, even as the core

issues remain unaddressed. A meaningful climate agreement will not emerge from the parties' current positions and interests.

If negotiations will not lead developing nations to substantially alter their emissions trajectories, two dramatically different paths remain. The first is to support innovation and hope that new technologies emerge with the capacity to replace fossil fuels affordably and at scale. With sufficient technological progress, developing nations would find it within their interest to join in collective action—perhaps with realistic financing from developed nations. Government policy can encourage innovation, but this path is ultimately one of wait-and-see. For those who consider this path inadequate, the only viable alternative is coercion.

Is Conflict Inevitable?

Developed nations need not offer the developing world anything to change its behavior; developed nations could instead threaten sanctions for failure to comply. Some prominent economists have, in fact, moved down this path, proposing the use of tariffs to force intransigent nations to adopt a global carbon tax.[95] But such a tariff regime is difficult to enforce and more likely to produce a trade war than the desired action, in which case, the threat of further action—more aggressive sanctions or even military action—to prevent excess emissions would be required.

Only by credibly threatening real harm to developing nations are they likely to change course. Such a tactic may sound radical—it is—but in a world where a cooperative global agreement is unattainable, activists who describe the threat of climate change in equally radical terms (see box "Is Climate Change Like the Holocaust?") need to describe how far they would go.

IS CLIMATE CHANGE LIKE THE HOLOCAUST?

Archbishop Desmond Tutu has compared climate change to apartheid: "Just as we argued in the 1980s that those who conducted business with apartheid South Africa were aiding and abetting an immoral system, we can say that nobody should profit from the rising temperatures, seas and human suffering caused by the burning of fossil fuels."[96] Climate scientists Michael Mann and Daniel Kammen have likened the threat of climate change to the "gathering storm" of World War II;[97] climate scientist James Hansen has extended the analogy to the Holocaust: "the trains carrying coal to power plants are death trains. Coal-fired power plants are factories of death."[98]

In September 2015, the *New York Times* published a remarkable op-ed by Yale historian Timothy Snyder titled "The Next Genocide," comparing climate change to the Holocaust and climate "deniers" to Hitler: "Hitler spread ecological panic by claiming that only land would bring Germany security and by denying the science that promised alternatives to war. By polluting the atmosphere with greenhouse gases, the United States has done more than any other nation to bring about the next ecological panic, yet it is the only country where climate science is still resisted by certain political and business elites. These deniers tend to present the empirical findings of scientists as a conspiracy and question the validity of science—an intellectual stance that is uncomfortably close to Hitler's."[99]

Anyone who truly views the threat of climate change in terms of world war or genocide must be prepared to threaten dramatic coercive action in pursuit of an agreement—and take that action if negotiations fail. Instead, the standard activist policy package consists of aggressive unilateral emissions reductions in the developed world, coupled with an international agreement to be named later. But without the prospect of an agreement, the package makes little sense: aggressive unilateral action must be complemented with something concrete, something else.

Removing the nonexistent option of a cooperative agreement can clarify the climate-change stakes by forcing scientists, activists, and policymakers to calibrate the severity of risk to the severity of reaction. A view that equates CO_2 emissions with the Holocaust is plainly incompatible with one that accepts the structure of current, futile negotiations. The aggressiveness of one's chosen something else helps establish how dire one believes the risk of climate change to be.

CONCLUSION

The U.S. plays an outsize role in shaping the direction of international climate negotiations and bears significant responsibility for allowing them to move unproductively forward for so long. This should stop.

A bipartisan American consensus holds that developed-nation emissions commitments must be paired with developing-nation commitments. In 1997, in response to the Kyoto agreement's requirement that only developed nations reduce emissions, the Senate passed, by a vote of 95–0, the Byrd-Hagel resolution, rejecting any agreement that did not "also mandate . . . new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties."[100] Even at Copenhagen in 2009, Secretary Clinton asserted that any climate finance should be contingent on developing-nation emissions commitments.

A great risk of the Paris talks is that an American delegation looking to cement its president's legacy will spearhead an "agreement" that the American people and their Congress will not support. Such an outcome would give political cover to the developing nations that stand as primary obstacles to any real agreement and leave the U.S. vulnerable to blame when it failed to follow through on, for instance, significant "climate finance" contributions.

The U.S. Congress should pass a resolution, in advance of Paris, reiterating the position that any agreement must include enforceable commitments from developing nations to significantly alter their future emissions trajectories. It should also reject the idea of large wealth transfers from developed to developing nations, and of any climate finance not tied directly to enforceable commitments. While such a resolution might appear an obstacle to an agreement in Paris, it would only be an obstacle to useless, unenforceable agreements. The real effect of such a resolution would be to call the bluff of developing nations and leave the world the choice of a real agreement or no agreement at all.

The most likely outcome in Paris—as it has been at all previous climate negotiations—is no agreement to meaningfully reduce emissions. Such an outcome will be valuable if it helps policymakers and activists abandon fruitless negotiations and focus instead on the realistic option of promoting innovation and preparing for any future adaptation that may be necessary.

ENDNOTES

[1] See Fiona Harvey, "No Plan B if Paris Climate Summit Ends in Failure, Says EU Climate Chief," *Guardian* (UK), July 6, 2015, http://www.theguardian.com/environment/2015/jul/06/no-plan-b-if-paris-climate-summit-ends-in-failure-says-eu-climate-chief.

[2] See "Background on the UNFCCC: The International Response to Climate Change," UN Framework Convention on Climate Change, accessed October 8, 2015, http://unfccc.int/essential_background/items/6031.php.

[3] "United Nations Framework Convention on Climate Change," UN, May 9, 1992, http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf.

[4] See, e.g., Ian Parry, Chandara Veung, and Dirk Heine, "How Much Carbon Pricing Is in Countries' Own Interests? The Critical Role of Co-Benefits," IMF working paper, September 2014, https://www.imf.org/external/pubs/ft/wp/2014/wp14174.pdf; James Hamblin, "If You Have Asthma, Talk to Your Doctor About Cap-and-Trade," *The Atlantic*, August 26, 2014, http://www.theatlantic.com/health/archive/2014/08/asthma-and-climate-policy/379119.

[5] See, e.g., Coral Davenport, "A Climate Accord Based on Global Peer Pressure," *New York Times*, December 14, 2014, http://www.nytimes.com/2014/12/15/world/americas/lima-climate-deal.html.

[6] See "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013," U.S. Environmental Protection Agency, April 15, 2015, http://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Main-Text.pdf.

[7] See IPCC, Fifth Assessment Report, Working Group 1, Summary for Policymakers, http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf.

[8] See "Background on the UNFCCC," accessed October 2, 2015.

[9] See IPCC, Fifth Assessment Report, Working Group 1, Summary for Policymakers. Note that these figures assume the continued emission of other greenhouse gases besides CO_2. Other analyses have produced independent estimates of the carbon budget; however, they are generally similar in magnitude. See, e.g., Fred Pearce, "What Is the Carbon Limit? That Depends Who You Ask," Yale Environment 360, November 6, 2014, http://e360.yale.edu/feature/what_is_the_carbon_limit_that_depends_who_you_ask/2825.

[10] See IPCC, SRES A1 (A1B) Illustrative Marker Scenario with Model AIM, version 1.1, July 2000, http://sres.ciesin.org/final_data.html. All emissions data in the scenario are reported in units of carbon. They are reported here in units of CO_2, converted at 1 unit carbon = 3.664 units CO_2.

[11] See IPCC, SRES A1B.

[12] See "Emissions Scenarios," UN Intergovernmental Panel on Climate Change, 2000, http://www.ipcc.ch/ipccreports/sres/emission/index.htm.

[13] See, e.g., "Climate Change Impacts in the United States: The Third National Climate Assessment," 2014, http://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0.

[14] See "SRES Emissions Scenarios," IPCC Data Distribution Centre, May 1, 2014, http://sedac.ciesin.columbia.edu/ddc/sres.

[15] See IPCC, Fifth Assessment Report, Working Group 3, Chapter 6: Assessing Transformation Pathways, http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter6.pdf. Figure 6.4 shows median of baseline scenarios producing higher emissions in both developed and developing worlds than estimated by the A1B scenario. Figure 6.7 shows an emissions trajectory for RCP 6.0 similar to the A1B scenario and ending at the very low end of the baseline range. The U.S. government also describes the A1B scenario as comparable with RCP 6.0. "Climate Change Impacts in the United States," appendix C.

[16] See IPCC, SRES A1B; "Global Carbon Project," Carbon Dioxide Information Analysis Center (U.S. Dept. of Energy), May 2015, http://cdiac.ornl.gov/GCP (2014 Budget v1.1).

[17] See "Emissions Scenarios," appendix III. The "REF" region incorporating Eastern Europe and former Soviet states is treated here as part of the developing world because its projected per-capita economic growth and emissions trajectory more closely mirror those of other developing regions. Further, the negotiating position of its largest member, Russia, has more closely resembled that of a developing nation.

[18] See IPCC, SRES A1B.

[19] See ibid. Global annual CO_2 emissions increase from 29.2 Gt in 2000 to 49.4 Gt in 2100. The OECD decrease is from 11.7 to 8.5; the non-OECD increase is from 17.5 to 40.9.

[20] See ibid. OECD CO_2 emissions from 2010 to 2100 total 1,016.8 Gt; non-OECD emissions total 3,828.8 Gt. If non-OECD nations limited CO_2 emissions to half of their 2010 level from 2010 through 2100, total emissions would be 13.6 * 90 = 1,224 Gt.

[21] See Danielle Fest Grabiel, "Crucial Crossroads," Our Planet (UN Environment Programme), September 2007, http://www.unep.org/PDF/OurPlanet/2007/sept/EN/ARTICLE7.pdf.

[22] See "The Deepest Cuts," *The Economist*, September 20, 2014, http://www.economist.com/news/briefing/21618680-our-guide-actions-have-done-most-slow-global-warming-deepest-cuts.

[23] See IPCC, SRES A1B.

[24] As of the Fifth Assessment Report, the IPCC began assuming negative-emissions technologies in many of its scenarios. See IPCC, Fifth Assessment Report, Working Group 3, Summary for Policymakers, http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf.

[25] Analyses highlighting the potential for cost-competitive renewable energy typically compare the full cost of building and operating a renewable energy facility with building and operating a fossil-fuel plant. If the fossil-fuel plant is already built, operating it is almost always significantly cheaper than retiring it early and building something new. See, e.g., "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2015," U.S. Energy Information Administration (EIA), June 3, 2015, http://www.eia.gov/forecasts/aeo/electricity_generation.cfm. For a useful analysis of emissions "committed" through investments in infrastructure, see Steven J. Davis and Robert H. Socolow, "Commitment Accounting for CO_2 Emissions," Environmental Research Letters, August 26, 2014, http://iopscience.iop.org/1748-9326/9/8/084018.

[26] See IPCC, SRES A1B. All energy data in the scenario are reported in exajoules. Exajoules of electricity are converted here to kilowatt-hours at 3.6 EJ = 1 trillion kWh. See "Energy Units," American Physical Society, accessed October 2, 2015, http://www.aps.org/policy/reports/popa-reports/energy/units.cfm.

[27] See "Monthly Energy Review," U.S. EIA, September 2015, http://www.eia.gov/totalenergy/data/monthly/pdf/sec7_5.pdf, table 7.2a.

[28] See Jaquelin Cochran et al., "Grid Integration and the Carrying Capacity of the U.S. Grid to Incorporate Variable Renewable Energy," National Renewable Energy Laboratory, April 2015, http://www.nrel.gov/docs/fy15osti/62607.pdf.

[29] See Jesse Jenkins and Alex Trembath, "Is There an Upper Limit to Variable Renewables?," The Energy Collective, May 28, 2015, http://www.theenergycollective.com/jessejenkins/2233311/look-wind-and-solar-part-2-there-upper-limit-intermittent-renewables.

[30] In the U.S. in 2014, wind and solar combined to generate less than 5 percent of all electricity. Solar represented less than half of 1 percent. See "Monthly Energy Review," U.S. EIA, September 2015, table 7.2a.

[31] See ibid.

[32] In 2013, global solar photovoltaic production totaled 40 gigawatts, having increased only 4 percent annually over the prior two years. See "Global Photovoltaic Manufacturing Production Slows in Recent Years," U.S. EIA, September 14, 2015, http://www.eia.gov/todayinenergy/detail.cfm?id=22912. Capacity factors in the developing world are generally on the order of 15 percent. See "Electric Generator Capacity Factors Vary Widely Across the World," U.S. EIA, September 8, 2015, http://www.eia.gov/todayinenergy/detail.cfm?id=22832. Forty GW of capacity at an average 15 percent capacity factor would produce 0.053 trillion kWh of electricity per year.

[33] See IPCC, SRES A1B. Annual non-OECD electricity demand of 17.8 trillion kWh in 2020 implies daily demand of 49 billion kWh or demand each minute of 33.9 million kWh. Tesla Motors estimates 2013 global battery capacity at less than 35 million kWh; its "gigafactory" under construction in Nevada would double that total. See "Tesla Gigafactory," Tesla Motors, accessed October 2, 2015, http://www.teslamotors.com/gigafactory.

[34] See Christopher Adams and John Thornhill, "Gates to Double Investment in Renewable Energy Projects," *Financial Times*, June 25, 2015, http://www.ft.com/intl/cms/s/2/4f66ff5c-1a47-11e5-a130-2e7db721f996.html.

[35] See Ross Koningstein and David Fork, "What It Would Really Take to Reverse Climate Change," IEEE Spectrum, November 18, 2014, http://spectrum.ieee.org/energy/renewables/what-it-would-really-take-to-reverse-climate-change.

[36] See "German 'Green Revolution' May Cost 1 Trillion Euros—Minister," *Reuters*, February 20, 2013, http://www.reuters.com/article/2013/02/20/us-germany-energy-idUSBRE91J0AV20130220. The estimate was widely criticized as a gross total investment rather than the net incremental cost above using conventional energy sources, but that gross total is the correct starting point for estimating the total investment required for building the required developing-world grid.

[37] See World Bank Development Indicators (Population, total), http://data.worldbank.org/indicator/SP.POP.TOTL, accessed October 2, 2015.

[38] See, e.g., Tom Jackson, "Africa's New Breed of Solar Energy Entrepreneurs," BBC News, January 27, 2015, http://www.bbc.com/news/business-30805419; Justin Doom, "Poor Countries Tap Renewables at Twice the Pace of Rich," *Bloomberg Business*, October 28, 2014, http://www.bloomberg.com/news/articles/2014-10-28/cost-competitive-clean-energy-installs-surge-in-emerging-nations.

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[41] See Davis and Socolow, "Commitment Accounting for CO_2 Emissions."

[42] See Saurabh Chaturvedi, "India: Faster Environmental Clearances to Double Coal Production in 5 Years," *Wall Street Journal*, December 1, 2014, http://www.wsj.com/articles/india-faster-environmental-clearances-to-double-coal-production-in-5-years-1417438707.

[43] See Eric Roston, "The Grim Promise of India's Coal-Powered Future," *Bloomberg Business*, May 21, 2015, http://www.bloomberg.com/news/articles/2015-05-21/the-grim-promise-of-india-s-coal-powered-future.

[44] See Christine Shearer et al., "Boom and Bust: Tracking the Global Coal Plant Pipeline," Sierra Club /CoalSwarm, March 2015, http://endcoal.org/2015/03/the-worldwide-coal-boom-goes-bust.

[45] See "International Energy Outlook 2013: World Installed Coal-Fired Generating Capacity by Region and Country, Reference Case," U.S. EIA, accessed October 2, 2015, http://www.eia.gov/oiaf/aeo/tablebrowser/#release=IEO2013&subject=7-IEO2013&table=19-IEO2013&region=0-0&cases=Reference-d041117.

[46] See "Kyoto Protocol to the United Nations Framework Convention on Climate Change," 1998, http://unfccc.int/resource/docs/convkp/kpeng.pdf.

[47] See IPCC, SRES A1B. Even in 1990, emissions of non-OECD countries were 51 percent higher than OECD emissions. The Kyoto Protocol did cover some countries outside the OECD—Russia, in particular—that made its applicability somewhat broader.

[48] See "Developing Countries Are Not Enemies of Environment: Modi," *Times of India*, September 16, 2015, http://timesofindia.indiatimes.com/home/environment/developmental-issues/Developing-countries-are-not-enemies-of-environment-Modi/articleshow/48979690.cms.

[49] See Davenport, "A Climate Accord Based on Global Peer Pressure."

[50] See ibid.

[51] See "INDCs as Communicated by Parties," UN Framework Convention on Climate Change, accessed October 2, 2015, http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx.

[52] See remarks by President Barack Obama, Beijing, November 12, 2014, https://www.whitehouse.gov/the-press-office/2014/11/12/remarks-president-obama-and-president-xi-jinping-joint-press-conference.

[53] See Nan Zhou et al., "China's Energy and Carbon Outlook to 2050," Lawrence Berkeley National Laboratory, April 2011, https://china.lbl.gov/sites/all/files/lbl-4472e-energy-2050april-2011.pdf.

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[57] See IPCC, SRES A1B.

[58] See "Intended Nationally Determined Contribution of India," UN Framework Convention on Climate Change, October 1, 2015, http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf.

[59] In its INDC, India reports that its energy intensity decreased from 18.16 grams of oil-equivalent per rupee of GDP in 2005 to 15.02 in 2012. Assuming that India's energy mix did not become more carbon-intensive over the period, carbon intensity declined at least as fast and was already at least 17 percent below the 2005 level in 2012.

[60] See "Intended Nationally Determined Contribution of Bangladesh," UN Framework Convention on Climate Change, September 25, 2015, http://www4.unfccc.int/submissions/INDC/Published%20Documents/Bangladesh/1/INDC_2015_of_Bangladesh.pdf.

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[62] See Guy Edwards and Timothy Roberts, "Despite Its Heavyweight Status, Brazil's Climate Plan Punches Below Its Weight," PlanetPolicy (Brookings Institution), September 30, 2015, http://www.brookings.edu/blogs/planetpolicy/posts/2015/09/30-brazil-climate-plan-edwards-roberts.

[63] See "Intended Nationally Determined Contribution of Indonesia," UN Framework Convention on Climate Change, September 24, 2015, http://www4.unfccc.int/submissions/INDC/Published%20Documents/Indonesia/1/INDC_REPUBLIC%20OF%20INDONESIA.pdf.

[64] See Suzanne Goldenberg, "Indonesia to Cut Carbon Emissions by 29% by 2030," *Guardian* (UK), September 24, 2015, http://www.theguardian.com/environment/2015/sep/21/indonesia-promises-to-cut-carbon-emissions-by-29-by-2030.

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[69] See CAIT Climate Data Explorer, World Resources Institute, 2015, http://cait.wri.org (total historical CO_2 emissions). This example does not charge or credit countries for emissions associated with land-use change.

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