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# SETTING THRESHOLDS FOR COUNTRY PARTICIPATION: A NEW APPROACH TO DEVELOPING COUNTRY COMMITMENTS IN THE GLOBAL CLIMATE CHANGE REGIME

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This paper proposes a new framework for addressing the responsibility of developing countries to limit greenhouse gas emissions in the context of the international regime on climate change. Following the commitment of developed countries to greenhouse gas emissions limits under the 1997 Kyoto Protocol, significant attention has focused on whether or not to establish similar commitments for developing countries. This paper argues that the conventional debate over setting specific emissions targets for developing countries should be replaced by a focus on determining the appropriate emissions thresholds for developing country action. The paper explores the application of similar thresholds in other international agreements, describes relevant proposals for determining developing country responsibility for greenhouse gas emissions, and explores a series of interactive formulas for setting developing country thresholds. Finally, the paper proposes a three-part threshold standard that would provide for appropriate developing country participation.

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## A New Approach to Developing Country Commitments

Over the past several years, following the multilateral agreement establishing the Kyoto Protocol in 1997, the issue of developing country commitments has become a significant concern in international negotiations on global climate change. To a large extent, the issue of developing countries' responsibilities emerged in direct response to the commitments that the Protocol defines for developed countries. Under the terms of the Protocol, industrialized nations and nations with transitional economies are required to achieve specified targets limiting their emissions of greenhouse gases. For most of these countries, the targets require reductions in absolute terms between the base year of 1990 and the first commitment period of 2008–2012. The Protocol did not, however, require developing countries to adopt such emissions limits, and whether these countries should also adopt some type of reduction or avoidance targets during the 2008–2012 period has since become a contentious issue. Taking their cue directly from the framework established for industrialized countries, negotiators have, for the most part, explored the type of emissions targets that would be appropriate for developing countries. Discussion of these issues has become trapped in a polarized debate, however, and a very limited set of options has taken center stage.

Unfortunately, that debate leaves other critical matters unaddressed. While negotiators have generally focused their attention on what type of targets would be appropriate, they have not devoted equal attention to which among the developing countries should be responsible, and when. Explicitly addressing these other critical issues—who and when—has the potential to move the negotiating process forward in productive ways that the current debate cannot. Developing countries have repeatedly stated their firm opposition to binding reduction or avoidance targets—including, for most developing countries, voluntary targets—in the near term (Personal communication 1999).[1] However, developing country diplomats also recognize that they will likely be required to adopt reduction targets at some point in the future, perhaps during the second or third commitment periods for emissions reduction (Personal communication 1999). Thus, multilateral diplomacy might achieve greater success by formally clarifying the thresholds for developing country graduation into the regime of emission targets.

Multilateral negotiations therefore ought to focus on the adoption of an amendment to the Kyoto Protocol that would stipulate the threshold criteria for the application of emissions targets to developing countries.

Such an amendment would thereby establish a set of explicit, quantified commitments concerning the date and circumstances under which developing countries will take action. The threshold criteria most likely should apply beginning in the expected second commitment period for the Kyoto Protocol—presumably the period of 2013–2018. If the participation threshold instead applied instead during the first commitment period, then the amendment itself would likely also need to specify the reduction or avoidance targets for that time frame. However, as noted already, such an agreement on actual emissions limits for developing countries has been the central diplomatic obstacle. Indeed, if an agreement concerning first period binding targets could be reached now, then the diplomatic approach proposed here might well be unnecessary.

The threshold commitment approach is also reasonable and appropriate for more than diplomatic reasons. The establishment of criteria for developing country participation is in many ways a logical consequence of the principle enunciated in the 1992 UN Framework Convention on Climate Change that parties have "common but differentiated responsibilities" in addressing climate change. Not only can developing countries commitments be distinguished from those that apply to industrialized nations, but it should also be possible to differentiate among developing countries according to their level of responsibility for emissions or their ability to take action. The approach proposed here would immediately provide certainty about the intention of developing countries to undertake serious mitigation action, while also providing for reasonable distinctions among them and an appropriate period of time for them to develop their capacity for emissions reduction or avoidance.

In addition, the threshold approach would enable industrialized countries to demonstrate that those countries most able to do so can in fact achieve reduction or avoidance targets under the Kyoto Protocol. Following an amendment to the Protocol and prior to the first commitment period of 2008–2012, negotiations could be held to address the type of emissions targets that would apply during the second period to developing countries that cross the agreed threshold. It should be noted that delaying such negotiations past 2008 would leave developing countries with limited time to actually implement any emissions limitation policies before the second commitment period. Thus, with an extended timeline for negotiations on targets, critical lessons from industrialized country reduction efforts could be applied to the establishment of developing country target requirements.

The adoption of a multilateral agreement focused on threshold com-

mitments for developing countries will, in part, require a significant shift in diplomatic priorities. However, international negotiations will also need to shift attention to the difficult matter of setting the threshold criteria themselves. This paper will therefore discuss examples of existing international agreements in which thresholds for developing country participation have been used, and it will then examine several proposals concerning criteria for developing country responsibility in the climate change context. The paper will go on to propose the use of interactive formulas involving multiple criteria as a new and potentially useful model for determining thresholds. From here, the paper propose a standard that a set of thresholds be adopted that require a developing country to accept binding targets in the second commitment period if: 1) its emissions exceed 1.0 metric tons of carbon emissions per capita; 2) its carbon intensity when weighted by per capita GDP exceeds the calculated level of 0.12; or 3) its emissions exceed 5 percent of total world emissions.

## Possible Approaches for Determining Threshold Criteria

Both the Framework Convention on Climate Change—the initial, broad international agreement on responses to climate change—and the more specific and ambitious Kyoto Protocol already make a number of clear distinctions among the different types of countries that are parties to the agreements. In the Convention, varying degrees and types of responsibilities are assigned to developed countries, developing countries, and transition economy countries (i.e. those transitioning from state-controlled economies to market economies). Overlapping some of these categories are the Convention's Annex I country list, which includes both the OECD member countries at the time the Convention was negotiated and a number of transition economies, and the Annex II country list, which includes the Annex I parties minus the transition economies. In addition to these categories, the Convention makes mention of the special needs that the least developed countries have in the area of technology transfer. With several minor exceptions and additions, the Convention's Annex I parties are included in the Protocol's Annex B list of parties to which binding reduction targets apply. The responsibilities of these Annex I parties are thus distinguished from those of the non-Annex I parties—essentially the developing countries—to which reduction targets do not apply.

Despite the distinctions among the parties that the Convention and Protocol establish, however, nowhere are the criteria for these differentia-

tions elaborated. In essence, international climate change negotiations have relied on an ad hoc process for determining the appropriate levels of responsibility—based substantially on internationally understood, but somewhat undefined, distinctions between developed and developing countries. The difficulty with an ad hoc process such as this is that there may not be a procedure for adjusting a country's status under the relevant international agreements even when the country's actual circumstances change. Such has been the case with Mexico and South Korea. Both of these countries have joined the OECD since the signing of the Framework Convention but have so far resisted inclusion on the Annex I list of countries. A more carefully defined set of criteria for determining a country's status might therefore be helpful to the long-term clarity and transparency of the climate change regime. This paper thus aims to establish a more defined set of criteria for distinguishing between those countries with binding emission targets and those without.

## International Agreements with Developing Country Thresholds

Multilateral agreements in issue areas other than climate change provide important precedents for distinguishing among countries—including among developing countries—through the use of various types of thresholds. The Montreal Protocol and international trade agreements provide the most useful examples of such threshold approaches.

The Montreal Protocol on Ozone-Depleting Substances is clearly the most relevant of the international agreements that can serve as a model for establishing threshold criteria in the climate change regime. The agreement, negotiated in 1987 and ratified soon thereafter, requires substantial reductions by member parties in the use of chemicals that deplete the ozone layer. While developed countries were obligated by the Protocol and later revisions to reduce and eventually eliminate these chemicals within ten years, developing countries were granted a longer time frame for acting to reduce their emissions. Under the original terms of the Protocol, developing countries with consumption of less than 0.3 kilograms per capita of the relevant ozone-depleting chemicals are granted a 10-year grace period until they are required to implement the necessary reductions. The threshold of 0.3 kilograms set in 1987 compared to a consumption level in the U.S. and European Community of about 0.85 kilograms, and, among developing countries, China consumed 0.02 kilograms and Mexico 0.07 kilograms in 1987 (Tripp 1988).

The 1990 London revisions to the Protocol made more stringent the

Protocol's standards, including agreement to completely eliminate ozone-depleting chemicals. In addition, the threshold for the developing country exemption was set at 0.2 kilograms per capita for newly added substances. Most important, the London revisions retain the 10-year grace period for developing countries, however, once the grace period expires, they are required to follow the developed countries' time frame for elimination (Benedick 1998). The basic structure of the Protocol—and its usefulness as a model for climate change negotiations—was thus retained with the revisions. In sum, the Montreal Protocol provides two key models: a per capita usage level below which the agreement is not applied to developing countries, and a grace period for developing country participation (during which the usage threshold applies).

Differentiated treatment for developing countries has also been widely used in the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO). Within the trade context, the principle of "special and differential treatment" has been granted to developing countries in various ways since 1965. Most significantly, in 1979 GATT officially adopted the Generalized System of Preferences, under which developing countries have been granted tariff preferences by industrialized countries without a requirement that the developing countries reciprocate (as would usually be required under GATT rules). In the 1994 agreements creating the World Trade Organization, special provisions for developing countries—including a lower level of obligations, more flexible implementation timetables, and more favorable treatment by industrialized countries—were added in a number of trade areas. In many instances, further distinctions were drawn between developing countries as a broad group and the least developed countries (LDCs) in particular. For example, the Agreement on Trade Related Aspects of Intellectual Property Rights grants developed countries a five year extension and least developed countries an eleven year extension to implement their obligations (World Trade Organization 1994).

Distinctions between countries are drawn in several ways in the WTO. In general under the WTO, since no definition of the broader category of developing countries has ever been agreed to, countries are recognized as such through self-designation (Hoekman and Kostecki 1995). In the case of least developed countries, the UN designation has generally been used to distinguish between these and other developing countries. Under the UN's guidelines, inclusion on the list of LDCs is based on four criteria: per capita GDP of $765 or less (set at the World Bank level for low-income countries); level on the augmented physical quality of life index (based on

life expectancy, the calorie supply, the level of adult literacy, and the school enrollment ratio); level on the economic diversification index (based on a manufacturing level measured by the percentage share of the labor force in industry, electricity consumption, and export ratio); and a population of less than 75 million (United Nations 1997). For the WTO, the criteria and analysis of the UN thus serve as a proxy for differentiating the status of LDCs in the trade regime.

In the case of the Agreement on Subsidies and Countervailing Measures, however, the WTO devised its own set of explicit graduation thresholds for developing countries. In general, developing countries are exempt from the Agreement's prohibition on export subsidies. If a developing country attains a global market share of 3.5 percent of a product, however, it is no longer exempt. In addition, any country that reaches a per capita GDP greater than $1,000 can have countervailing duties applied to it for any use of inappropriate subsidies (World Trade Organization 1994). Thus, while the WTO agreements rely in part on country self-designation and UN standards, they also provide an important precedent regarding the use of quantitative thresholds.

## Proposals Regarding Criteria for Country Responsibility

While international agreements provide important models for a system in which developing countries are subject to threshold criteria, suggestive proposals have also been made in the specific context of climate change. In a report on issues of equity in the global climate change regime, the Pew Center on Global Climate Change devised a broad framework for considering the question of who should take action to limit emissions. This analysis, published in 1998, draws on much of the analytical literature of the past decade in proposing standards for country responsibility. The report proposes that a country be required to take action based on three major factors: responsibility for emissions, standard of living, and opportunity to limit emissions (Claussen and McNeilly, 1998).

In the Pew framework, responsibility for emissions is based on a country's cumulative carbon emissions since 1950, its present emissions level, and its likely future emissions based on current growth levels. The report analyzes emissions responsibility for all three time frames in terms of both total carbon emissions levels and per capita emissions. Once emissions responsibility has been assessed, the report suggests that a country's ability to take action should be viewed on the basis of its standard of living as determined by the country's per capita GDP. Under this

formulation, richer countries are deemed to have grown economically to a point where it is reasonable to ask them to act in ways that may constrain their further growth. Finally, a nation's opportunity to limit emissions should be calculated according to its level of carbon emissions per unit of GDP. In this case, the report argues that a country has a greater opportunity to reduce its emissions when it uses a relatively greater quantity of energy—and hence emits more greenhouse gases—for a particular level of economic output.

Using these three basic prongs for setting responsibility, the Pew report divides countries into three categories: those who must act now to limit emissions, those who should act now but in a different way from the first group, and those who could act now. The "must act now" set of countries are mainly the industrialized nations who are already Annex I parties; the "should act now but differently" category is comprised mainly of developing and transition countries who have crossed what Pew views as a critical threshold for taking some kind of action; and the "could act now" countries are those developing countries for which emissions limitations are not yet appropriate.

For the purposes of this paper, the central question is the standard used for determining which are the "should act now" countries, since these include the developing countries that have crossed the participation threshold. The report places in that category any country that falls in the "middle" set of countries in at least two of the three basic criteria. In the case of the standard of living criterion, a country fits into the middle range of countries if its GDP per capita falls between the median and average world GDP per capita. For the carbon intensity criterion, a country also falls into the middle set of countries if its use of energy per unit of GDP is between median and average. The standard for emissions level is somewhat more complicated. The report essentially creates an index that averages the standing—high, middle, and low—of countries in cumulative emissions, total current emissions, current emissions per capita, and expected emissions growth; those countries with a certain index are then classified as middle range. In sum, the Pew report relies on a range of factors to determine whether a developing country ought to participate.

Another framework for threshold criteria is suggested in a 1993 article by Smith, Swisher and Ahuja examining the appropriate payment levels for contributions to a proposed global climate change fund. The authors propose that a country's payment obligation should be set according to a weighted average of a country's responsibility, based on emissions, and its ability to pay, based on GNP. They suggest that the responsibility level

should be determined according to a country's cumulative emissions since 1950, minus a base amount of emissions necessary to achieve a "reasonable" level on the Physical Quality of Life Index (PQLI).[2] The authors thus set a minimal level of total cumulative emissions necessary for a country to achieve adequate conditions. Beyond this threshold, which countries are assessed responsibility. The authors calculate a country's ability to pay in a similar fashion, based on GNP per capita, minus a base level of GDP that is the average income level for countries with an adequate PQLI.

The calculation of a country's payment obligation is then carried out in several stages. The "ability to pay" and the "responsibility" indices are set by taking the adjusted levels of GDP and emissions and then calculating them as a percentage of the world's total. Finally, to provide a figure representing a country's actual obligation to pay, the percentage levels of the two indices are averaged. As noted above, the authors subtract base amounts of emissions and GDP to reflect basic energy and income needs, and many developing countries thus have a zero level in both indices. When the average of their index levels is calculated, these countries therefore have no obligation for payment. Hence, only those developing countries with cumulative emissions and income above a certain level will have any an obligation to pay. In essence, by establishing a minimum adequate base for emissions and income, these authors provide a model for the establishment of threshold criteria in emissions and income.

Finally, it is worth noting proposals that have been made in the context of the international climate change negotiations themselves. In preparations for negotiations following the Berlin Mandate agreement of 1995, countries proposed a number of criteria for determining responsibility to limit emissions. These criteria were suggested mainly in order to provide for differentiation among binding commitments to be taken on by Annex I parties (UN Framework Convention on Climate Change 1996). In addition to the basic standards already discussed here, the proposed criteria included: a country's emissions as a share of global emissions, emissions per area of territory (e.g. per square kilometer), and a country's marginal costs of abatement per unit of emissions reduction. In 1997, in preparation for the 3rd Conference of the Parties to the Framework Convention on Climate Change, which resulted in the Kyoto Protocol, the Australian government proposed a differentiation scheme based on the types of industry for which a country uses carbon-based energy (UN Framework Convention on Climate Change 1997). The Australian framework suggested that consideration should be given to the fact that the predominant industries in some countries are substantially more

energy intensive than is the case in other countries. Although the various differentiation proposals made in the course of negotiations leading to the Kyoto Protocol were not aimed at identifying thresholds for developing country participation, they are nonetheless helpful in exploring such criteria.

## Proposed Interactive Forumals for Setting Threshold Criteria

The approaches to establishing threshold standards that we have examined in this paper tend to view the various criteria as independent of each other. Typically, the threshold is based on an individual metric or a set of alternative metrics, each of which can stand alone. It may prove useful, however, to evaluate the criteria according to an interactive framework using measurements that involve some interplay among the standards chosen. One way in which to attempt such an interactive approach would be through simple multiplicative formulas that account for more than one criterion. This paper therefore explores a series of such formulas that may prove useful in developing a threshold for developing country participation in an emissions limitation regime.

### Underlying Criteria for Interactive Formulas

In order to develop the interactive formulas, a set of initial criteria must be chosen. Thus, using some of the earlier discussion concerning thresholds as a starting point, this paper uses the following basic criteria for use in an interactive framework:

#### *Carbon Emissions Per Capita*

This criterion was chosen to represent a country's usage fairly, without bias against highly populated countries that may have high total emissions levels but low emissions levels for each of its residents. It is worth noting that per capita formulas may provide a perverse incentive to countries to increase their population as a way to decrease their calculated emissions level. However, the uncertainties present in determining the extent of such incentives makes it difficult to adjust the per capita standard appropriately. Hence, this paper uses an unadjusted per capita emissions level. Another consideration is that different geographic regions or socio-economic classes in a country may differ greatly in their per capita usage. An entire country's per capita level of emissions may thus fail to fairly reflect the relative emissions when comparing the usage of particular residents with that of residents in another country. However, so long as international politics continues to be built around the sovereignty of

national governments, a sub-national approach is unlikely to emerge in multilateral agreements.

### *Proportion of World Carbon Emissions*

While per capita emissions is appropriate for fairly calculating the emissions caused by the individual residents of a country, it does not account for the significant impact that the national governments of countries with high emissions levels may have on worldwide climate change. Thus, rather than basing a threshold standard on a country's absolute total emissions, this paper uses a country's proportion of world emissions as the relevant criterion. This is done in order to reflect the relative impact of a particular country and its national government on global emissions.

### *Carbon Intensity Per Unit of Economic Output*

By analyzing the energy efficiency with which a country's economy operates, this criterion introduces the principle that emissions tend to be correlated with an economy's size but that countries also have substantial control over the manner in which they use carbon-based energy. The use of this criterion for determining a threshold is complicated, particularly given that some developing countries will reduce their carbon intensity, while others will increase it over the coming decades (Baumert, Bhandari and Kete 1999). In an interactive formula, however, countries will be held responsible for their level of carbon intensity only in interaction with other factors. Thus, a country that is not energy efficient but does not otherwise have a high level of carbon emissions will not be overly penalized for its high carbon intensity. Another concern is that, as the Australian government has noted, carbon intensity does not account for differences among countries' industrial structures or available energy sources. Some countries may have levels of carbon-based energy usage that are more difficult to reduce. Again, by including this criterion in an interactive formula, the criterion's significance- and thus the impact of particular industrial structures- will be mitigated.

### *GDP Per Capita*

As discussed earlier, this criterion is meant to provide a measure of a country's ability to limit its emissions and thereby perhaps forego some of its potential economic growth. For poorer countries, limiting emissions will especially be onerous as they attempt to achieve industrial growth. In addition, richer countries have more resources available with which they can develop emissions limitation technologies. In this paper, a country's

economic standing will be calculated in terms of the ratio between the country's GDP per capita and the world's GDP per capita, thus reflecting the relationship between the country's economic level and the world average.

In order to determine interactive criteria, the individual criteria chosen will be entered into several multiplicative formulas. However, this paper does not suggest where the appropriate thresholds should be set for developing country participation in a regime of emission targets. Rather, it will examine whether the metrics created with the formulas can be used for determining appropriate scales for developing country action. In many cases, the introduction of exponential functions might be appropriate in order to distinguish the weight of the individual criteria and thus provide more sophisticated and appropriate metrics. However, given the political and process limitations of international climate change negotiations, this paper will only explore relatively simple formulas that might have a reasonable chance of adoption in the multilateral context. All of the calculations in this paper are based on actual data for 1990 and 1996 and reference case projections for 2010 and 2015 in the International Energy Outlook 1999 published by the Energy Information Administration of the U.S. Department of Energy (Energy Information Administration 1999). The GDP data are adjusted for 1997 dollars and are not PPP adjusted.

## Formula 1: Per Capita Carbon Emissions and Per Capita GDP

The first formula multiplies a country's annual per capita carbon emissions level by the ratio of its per capita GDP to world per capita GDP. The

**Table 1**

| Metric Tons CO2/Capita X Ratio of Country GDP/Capita to World GDP/Capita | | | |
|---|---|---|---|
| **Country** | **1996** | **2010** | **2015** |
| African Countries | 0.02 | 0.02 | 0.02 |
| Brazil | 0.45 | 0.77 | 0.97 |
| China | 0.10 | 0.27 | 0.38 |
| India | 0.02 | 0.04 | 0.05 |
| Japan | 16.04 | 15.79 | 17.39 |
| Mexico | 0.79 | 1.30 | 1.44 |
| South Korea | 4.84 | 8.76 | 11.93 |
| Turkey | 0.43 | 0.70 | 0.77 |
| United States | 34.20 | 38.43 | 37.85 |
| World | 1.1 | 1.2 | 1.3 |

intent of this formula is to create a metric that includes both a country's emissions responsibility for each resident and its economic ability to undertake action to limit emissions. Under this framework, a developing

country that has lower per capita emissions than another developing country, but that also has relatively higher GDP per capita, might have the same metric outcome and thus the same level of responsibility to limit emissions. However, the formula also creates a scale that magnifies many of the differences between countries. For instance, note the substantial gap indicated in Table 1 between the United States and developing countries such as China and India. Any differences between these countries in carbon emissions and GDP become enhanced. Thus, while this metric may be helpful in balancing the criteria of emissions and economic level, it fails to provide a broadly useful comparison of countries.

### Formula 2: Per Capita Carbon Emissions and Carbon Intensity

This formula multiplies a country' per capita carbon emissions level by its carbon intensity level measured in terms of emissions per unit of GDP.

**Table 2**

| Metric Tons CO2/Capita X Metric Tons CO2/GDP | | | |
|---|---|---|---|
| **Country** | **1996** | **2010** | **2015** |
| African Countries | 0.20 | 0.18 | 0.16 |
| Brazil | 0.04 | 0.06 | 0.08 |
| China | 0.62 | 0.69 | 0.71 |
| India | 0.15 | 0.18 | 0.17 |
| Japan | 0.16 | 0.17 | 0.16 |
| Mexico | 0.21 | 0.21 | 0.20 |
| South Korea | 0.68 | 0.74 | 0.78 |
| Turkey | 0.17 | 0.18 | 0.17 |
| United States | 1.04 | 1.01 | 0.99 |
| World | 0.23 | 0.24 | 0.24 |

Because carbon intensity varies among countries at similar levels of economic development, the formula takes into account a country's efforts to address energy efficiency in its economy, while still considering the basic issue of emissions responsibility for each resident. Additionally, there is the important issue of distinguishing among developing countries. For almost all of these countries, emissions per capita will grow—to varying degrees—as they experience economic growth. However, in the case of carbon intensity there is evidence that some developing countries will reduce their intensity level as they develop economically while others will increase theirs as they grow (Baumert, Bhandari and Kete 1999). Hence, it is important to create a metric that provides a balance between the per capita and GDP-weighted emissions measures. Further, the combined metric provides a potentially useful way to compare the responsibility of countries at different levels of economic development, given that some

countries with low emissions levels per capita may nonetheless be extremely energy inefficient (and vice-versa).

As can be seen from the data presented in table 2, this formula does produce some interesting results for key countries. In particular, the United States, at around 1.00, and China, at around 0.70, fall into a relatively close range with one another. The metric may thus provide more useful comparisons between these countries than is otherwise the case. However, the usefulness of the formula may be questioned when viewing the discrepancy between developed countries, such as the United States and Japan, that already fall within the group of countries with binding emissions targets. Similarly, the relative proximity of Japan's metric with that of the African countries with very low emissions levels casts doubt on the formula's usefulness. In sum, while the formula provides some helpful comparisons, it ultimately does not offer a metric that can be used for setting developing country thresholds.

## Formula 3: Per Capita Carbon Emissions and Share of World Carbon Emissions

This formula multiplies per capita carbon emissions by the square root of a country's share of world carbon emissions. The intent of this formula is

**Table 3**

| Metric Tons $CO_2$/Capita X Square root of [Country $CO_2$ Divided by World $CO_2$] | | | |
|---|---|---|---|
| **Country** | **1996** | **2010** | **2015** |
| African Countries | 0.05 | 0.05 | 0.05 |
| Brazil | 0.05 | 0.08 | 0.10 |
| China | 0.24 | 0.44 | 0.53 |
| India | 0.05 | 0.08 | 0.08 |
| Japan | 0.51 | 0.51 | 0.53 |
| Mexico | 0.11 | 0.15 | 0.16 |
| South Korea | 0.35 | 0.50 | 0.60 |
| Turkey | 0.06 | 0.08 | 0.09 |
| United States | 2.75 | 2.95 | 2.93 |
| World | 1.1 | 1.2 | 1.3 |

to provide an interactive measurement of a country's responsibility for each resident and its responsibility as a proportion of world total emissions. Under this framework, a country with relatively low per capita emissions but with a large population is held responsible, to some degree, both for population growth that increases its share of world emissions and for the impact that the national government can have on emission levels. By using the square root of a country's share of world emissions, the

formula reduces the range among countries. This is done because a country's share is due in many cases to the somewhat uncontrollable factor of population size. As can be seen from the data in Table 3, this metric does provide a fairly narrow range of measurement, with the notable exception of the United States. In fact, the formula may be extremely useful in establishing distinctions among developing countries. However, the significant discrepancy between most other countries and the United States under this metric might make political acceptance of the formula difficult. In sum, the formula provides some extremely helpful comparisons, but it may not ultimately be useful in a multilateral negotiating context.

## Formula 4: Carbon Intensity and Per Capita GDP

The final formula multiplies a country's carbon intensity by the ratio of its per capita GDP to world per capita GDP. In part, the purpose of this formula is to provide a fair assessment of a country's carbon intensity in terms of its impact on global emissions. The usual measurement of carbon intensity (emissions per unit of economic output) does not account for the fact that a country with a high carbon intensity level but a low GDP per capita may have a quite limited impact on worldwide emissions. Given this, it may prove difficult to find political acceptance for this traditional metric while also trying to establish a participation threshold. However, the formula proposed here, which weights carbon intensity according to a country's per capita GDP, may be more politically viable in a multilateral context. In addition, the formula permits a balance between carbon intensity and economic level. This can be a reasonable aim if one considers that more economically developed countries should have greater resources with which to reduce their energy inefficiency.

**Table 4**

| Metric Tons CO2/GDP X Ratio of Country GDP/Capita to World GDP/Capita | | | |
|---|---|---|---|
| **Country** | **1996** | **2010** | **2015** |
| African Countries | 0.06 | 0.05 | 0.04 |
| Brazil | 0.09 | 0.11 | 0.12 |
| China | 0.14 | 0.17 | 0.18 |
| India | 0.05 | 0.06 | 0.06 |
| Japan | 0.48 | 0.41 | 0.40 |
| Mexico | 0.19 | 0.19 | 0.18 |
| South Korea | 0.52 | 0.55 | 0.59 |
| Turkey | 0.15 | 0.15 | 0.14 |
| United States | 1.15 | 1.00 | 0.94 |
| World | 0.22 | 0.20 | 0.19 |

As can be seen from the data in Table 4, the formula does present a

somewhat more balanced view of countries' carbon intensity levels, and it provides a helpful comparison among developing countries. In addition, the metric provides a useful scale for comparing the United States with other countries. While still substantial, the degree of discrepancy is less than would be the case with the other proposed formulas. The GDP-weighted carbon intensity formula may thus provide a useful metric for establishing a participation threshold, as will be discussed below.

## A Proposal for Developing Country Threshold Criteria

The adoption of threshold criteria may be critical if emissions limitation targets are eventually to be negotiated for developing countries. As some already existing multilateral agreements demonstrate, delayed and conditional action by these countries is an internationally accepted approach to their participation. In setting such a threshold in the climate change context, a number of possible models and criteria are available, including those examined in this paper. However, given the political and process constraints of international climate change negotiations, a focus on relatively simple and straightforward criteria may be the most viable approach to establishing such a threshold. With the exception of the last formula above, the interactive formulas proposed here would require substantial additional complexity for them to provide a proportionate and useful metric. Such complexity would probably be beyond the scope of the negotiable in an international forum. Similarly, the Pew report's approach, while perhaps workable, most likely is weakened by the fact that it relies on too many criteria to be viable in multilateral negotiations. This paper will therefore propose somewhat more simple criteria as thresholds for the developing countries.

Before proposing specific threshold criteria, it is worth noting that the standards proposed in this paper are based on carbon emissions levels. That is the case because there is limited data in the form of future projections for other key factors such as methane emissions and land-use changes that contribute to climate change. In fact, the proposals presented here might be strengthened significantly if they were developed in terms of these other critical factors as well. Given the data constraints, however, this paper proposes that the threshold criteria initially be based on the following standards:

A developing country would be required to adopt binding emissions limitation in the second commitment period (2013-2018) at the point that it exceeds one of the following limits (based on a rolling average for each criterion over the previous five years):

### •A Level of 1.0 Metric Tons of Carbon Emissions Per Capita

This level is approximately equivalent to the average worldwide per capita emissions level of 1.09 in 1990.[3] That date is the baseline year in the Kyoto Protocol for calculating the emissions limits that Annex I countries must achieve. Hence, 1990 represents the internationally accepted date at which the world became responsible to address climate change-related emissions. Once a country crosses the threshold of the average world per capita emissions at that critical juncture in global action, the country should therefore become responsible to take on binding emissions limits in some form. As can be seen in Table 5, China, Mexico, and Turkey will likely cross the threshold in the latter part of the second commitment period. South Korea will have crossed the level substantially earlier.[4] Brazil will be near to crossing the threshold by 2015, but if land-use changes are subsequently added to the framework, it will likely cross the threshold at an earlier date.

**Table 5**

| Per Capita CO2 | | | |
|---|---|---|---|
| **Country** | **1996** | **2010** | **2015** |
| African Countries | 0.3 | 0.3 | 0.3 |
| Brazil | 0.4 | 0.7 | 0.8 |
| China | 0.7 | 1.1 | 1.2 |
| India | 0.2 | 0.4 | 0.4 |
| Japan | 2.3 | 2.5 | 2.7 |
| Mexico | 0.9 | 1.2 | 1.2 |
| South Korea | 2.5 | 3.4 | 4.0 |
| Turkey | 0.7 | 0.9 | 1.0 |
| United States | 5.6 | 6.2 | 6.3 |
| World | 1.1 | 1.2 | 1.3 |

### •A Level of 0.12 in the Measure of Carbon Intensity Weighted by Per Capita GDP

This criterion would be based on Formula 4 proposed above, in which carbon emissions per unit of GDP is multiplied by the ratio of a country's per capita GDP to world per capita GDP. The threshold of 0.12 would be at the level of approximately half the worldwide average carbon intensity per unit of GDP in the year 1990.[5] The intent of choosing a threshold at this level would be to reinforce the intent of the Framework Convention and the Kyoto Protocol to reduce inefficiency over time in carbon-based energy usage. Otherwise, if acceptable emissions levels were tied too closely to economic growth rates, international climate change agreements would have an extremely limited impact on emissions reduction. Under this framework, China, Mexico, Turkey and Brazil will likely have crossed

the threshold at or near the beginning of the second commitment period. As with the criterion of per capita emissions, South Korea will have crossed the threshold much earlier.

### •A Level of 5 Percent of Total Worldwide Emissions

As noted earlier, a country's responsibility must depend in part on the impact that its national government can have on climate change-related emissions. When a country emits more than 5 percent of total worldwide emissions, its national policies can exert substantial influence on the global course of climate change and its responsibility for emissions should therefore be addressed. Under this criterion, China and possibly India will have crossed the threshold by the beginning of the second commitment period, as can be seen in Table 6.

**Table 6**

| Share of World Carbon Emissions (as %) | | | |
|---|---|---|---|
| **Country** | **1996** | **2010** | **2015** |
| African Countries | 3.3 | 3.4 | 3.3 |
| Brazil | 1.2 | 1.5 | 1.7 |
| China | 13.5 | 17.4 | 18.9 |
| India | 3.8 | 4.8 | 4.9 |
| Japan | 4.9 | 4.0 | 3.9 |
| Mexico | 1.4 | 1.6 | 1.6 |
| South Korea | 1.9 | 2.1 | 2.2 |
| Turkey | 0.7 | 0.8 | 0.8 |
| United States | 24.5 | 22.3 | 21.4 |
| World | 100.0 | 100.0 | 100.0 |

## CONCLUSION

A substantial diplomatic gap persists between developing countries and those developed countries that seek to define increased developing country participation, particularly through emissions targets, in the international climate change regime. The aim of this paper has been to suggest possible approaches that could lead to a breakthrough in the current stalemate over such commitments. The standards proposed here are meant as initial proposals for developing country thresholds that could be negotiated as an amendment to the Kyoto Protocol. Other criteria might prove either politically or technically more advantageous, and they should be explored. Regardless of the particular model adopted, however, the central point remains: negotiations can be more productive if they focus on a set of thresholds that would answer the key questions of which countries and when, rather than continuing polarized discussions about actual emissions

targets for developing countries. If such alternative approaches are not explored, coordinated international action to prevent catastrophic levels of climate change may become impossible.

## Notes

1 Argentina, of course, is an exception to the list of developing countries opposed to voluntary commitments, as it has indicated its desire to take on an emissions target and enter into emissions trading during the first commitment period.

2 The PQLI is based on life expectancy, infant mortality, and literacy. The authors view a measurement of 80-90 on the index as "reasonable."

3 The world per capita emissions level of 1.09 is based on world carbon emissions of 5,786 million metric tons and population of 5.282 billion people.

4 While South Korea and Mexico have joined the OECD, and Turkey is a member of the European Union, these countries have not yet been fully included in the binding emissions limitation regime. Turkey was included in Annex I in the negotiated Framework Convention, but it has since declined to accept its status in the accord. Given their current unclear status, these countries offer an important measure of the impact of any threshold criteria.

5 The worldwide carbon intensity level in 1990 was O.24, based on carbon emissions of 5,786 million metric tons and GDP of $24,253 billion.

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