GAP ANALYSIS WITH PARIS PLEDGES

By Michael Wolosin and Maria Belenky*

Introduction and Motivation

The parties of the United Nations Framework Convention on Climate Change (UNFCCC) are working toward a global climate agreement, to be concluded at the 21st Conference of the Parties (COP) in Paris in December 2015. In advance of the Paris COP, nations have agreed to put forward pledges of action—commonly called intended nationally determined contributions—as a signal of their climate ambition. The pledges, which are set to go into effect in 2020, are collectively aiming to close the "ambition gap"—the remaining distance between action pledged or taken to date and that required to keep average global warming below 2°C.

The international pledging process began in earnest this fall as the European Union, United States and China announced their minimum ambition targets. Together, these three represent just under 50% of global emissions in 2011. These and other UNFCCC parties "that are ready to do so" are encouraged to submit their pledges to the UNFCCC during the first quarter of 2015. While some may miss that deadline, all major economies are expected to put forward their pledges before Paris. We set reasonable bounds on the likely Paris pledges from the rest of the world to examine whether the collective pledging levels are on the right path, and to assess the need for additional ambition well in advance of Paris in order to make sure that the first round of national announcements are aiming as high as possible.

Pledges to date have been focused on unconditional targets for domestic emissions—in other words, the emission reductions countries commit to achieve at home that do not depend on either additional actions or additional financial support from other countries. The wealthier countries are likely to continue this pattern of first pledging self-financed mitigation targets, while some developing countries will likely pledge both self-financed mitigation and additional mitigation that would be conditional on the provision of international support and finance.

***We focus this analysis only on unconditional pledges of self-financed domestic mitigation*.** This is not intended to suggest that any particular level of self-financed mitigation is appropriate or equitable for any given country. Nor is it because conditional pledges are unimportant. Quite the opposite, in fact, the critical role of international mitigation partnerships is masked if conditional pledges are grouped with other types of pledges and considered "existing ambition" before they are matched by financing pledges. To date, no country has made a post-2020 pledge to finance mitigation in developing countries. Only when it is perfectly clear how much mitigation is likely to be pledged in Paris through individual country action can we fully see how important it is to also seek collective action.

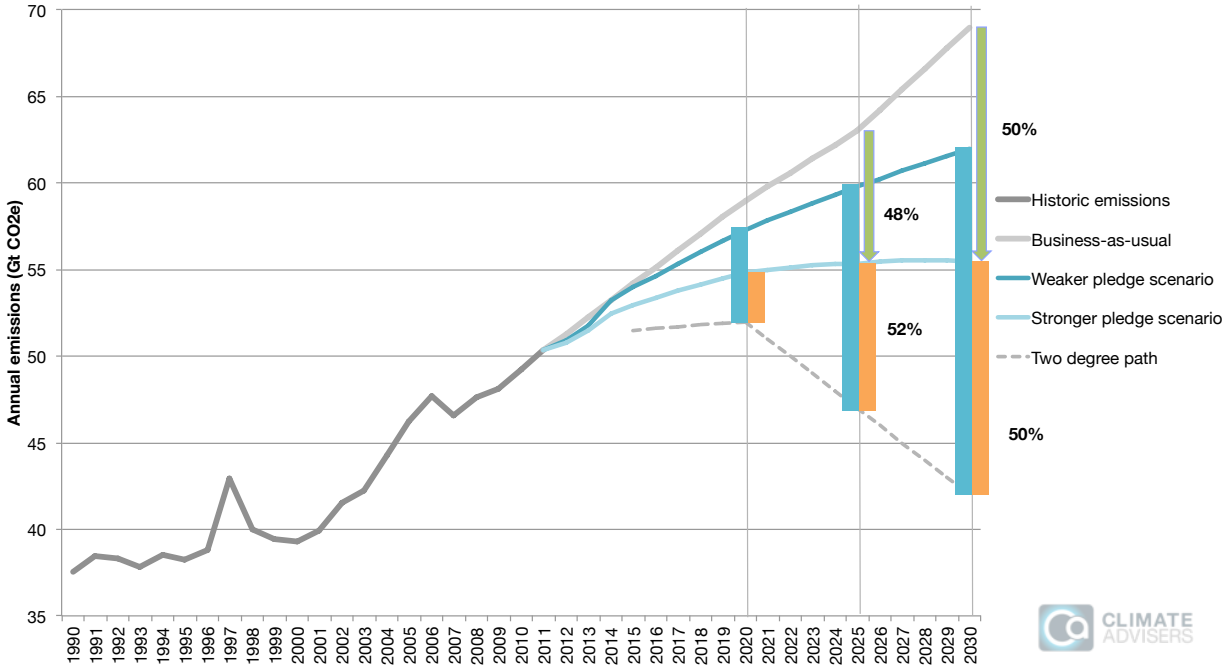
The following sections show the emissions mitigation that would be achieved by current (E.U., U.S., and China) mitigation pledges, if the rest of the world comes forward in 2015 at the stronger or weaker end of their likely unconditional mitigation targets. In both cases, we estimate the gap between expected emissions and emissions likely to limit warming to 2°C or less by the end of the century. Through these scenarios, we take a very early pulse of Paris ambition and hope to set the stage for a year of intense and well-directed effort at increasing that ambition.

* Michael Wolosin is a Managing Director of Research and Policy and Maria Belenky a Senior Associate, both at Climate Advisers.
This analysis was conceived of by Nigel Purvis, with additional input from Andreas Dahl-Joergensen, Joel Finkelstein, Claire Langley, and Rebecca Lefton. Please address comments and suggestions to wolosin@climateadvisers.com.

Global Results

Finding 1: Based on known and anticipated domestic pledges, the Paris agreement could achieve up to half (48-50%) of the emissions reductions necessary to reach 2°C.

Figure 1. Impact of Known and Anticipated Domestic Pledges



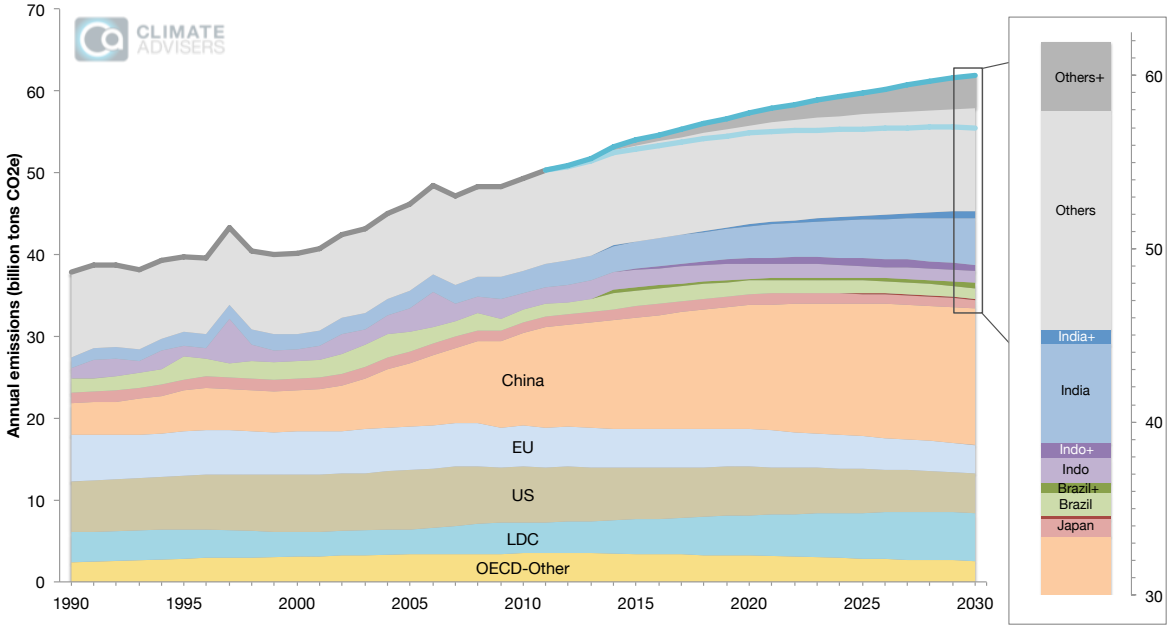
Our analysis shows that a strong set of pledges on top of the current commitments made by the United States, China, and the European Union would deliver 48-50% of the emission reductions needed for a likely chance of limiting warming to 2°C—the amount science says is necessary to avoid the most dangerous impacts of climate change (Figure 1). In this stronger pledge scenario, global GHGs reach 55.3 Gt CO_2e in 2025 and 55.5 Gt CO_2e in 2030, essentially flattening out by the last half of the decade. This compares to an emissions growth rate of about 1 Gt CO_2e per year (2.3%) for the last decade. In this scenario, slowing emissions growth in the first half of the decade, which results from declining emissions in the OECD countries and in the world's two largest tropical forest countries, is more than balanced out by increasing emissions from the rest of the developing world. This is the case even with slowing emissions growth in China and improving emissions intensity in India. In the second half-decade through 2030, emissions continue to decline in the OECD countries and emissions growth slows in China and other middle-income countries; Brazil and Indonesia achieve their deforestation reduction commitments; and emissions growth continues in India and in the least developed countries.

Finding 2: Cutting emissions in half is possible only if countries that have not yet announced their plans put forward strong pledges.

Weaker pledges would result in only a small reduction from Business-as-Usual (BAU). In the weaker pledge scenario, global GHGs reach 59.8 Gt CO_2e in 2025 and 62.0 Gt CO_2e in 2030. These weak pledges would suggest continued emissions growth from today averaging 610 Mt (1.1%) per year through 2030, with some slowing of the growth rate over the period. If not substantially exceeded, a weak set of pledges would achieve only a fourth of the reductions needed for a likely chance of limiting warming to 2°C.

The biggest difference between this weaker pledge scenario and the stronger pledge scenario is the level of self-financed ambition exhibited by the "Others" group: non-LDC, non-OECD countries (Figure 2). The group includes the former Soviet Republics, South Africa, and middle-income countries in Asia (e.g. Thailand, Malaysia, Taiwan), the Middle East (e.g. Iran, Saudi Arabia) and South America (e.g. Argentina, Venezuela). This group represents almost one-fourth of 2011 emissions, and the difference between our stronger and weaker pledge scenario for this group of countries is almost 4 Gt CO_2e in 2030, or 14% of the reductions needed from BAU to 2°C. India's pledge will also have a significant impact, with about 1 Gt CO_2e separating our stronger and weaker scenarios in 2030. The rest of the difference is based on the extent to which Indonesia and Brazil pledge self-financed emissions reductions by halting deforestation—about 1.5 Gt CO_2e in 2030 separates the stronger and weaker pledge scenarios from these forest nations.

Figure 2. Middle Income Countries and Forests Make the Difference Between Strong and Weak Scenarios



Note: This figure represents the historic emissions (through 2011) and pledge pathways for each country and country group in our analysis. A single pledge scenario is used to represent the OECD-Other and LDC group; current pledges are used for the U.S., E.U., and China. For Japan, Brazil, Indonesia, India, and the "Others" group, two scenarios are represented – a stronger pledge scenario (lighter shade) and a weaker pledge scenario (with additional emissions beyond the strong scenario represented by a darker shade and the "+").

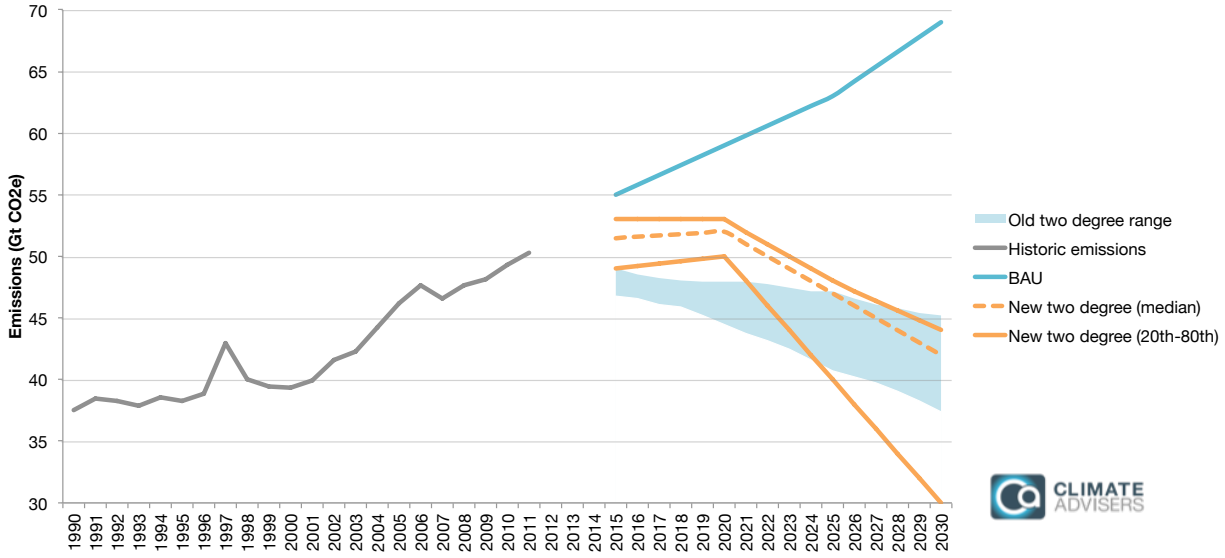
Methodology and Country Pledge Scenarios

To estimate the size of the emissions gap between a 2°C pathway and the potential Paris pledges, we create specific pledge scenarios for 7 of the top emitting countries individually, together accounting for approximately 60% of global emissions today.[1] For the countries that have already put pledges on the table, we define a "current pledge" scenario, which represents projected emissions given existing pledges. For all other countries, we define a "stronger pledge" and a "weaker pledge" scenario. The "stronger pledge" scenario suggests pledges at the high end of what could be expected with strong political will and leadership within the current political constraints of various countries; it does not assume any dramatic shifts in these constraints between now and Paris. In other words, "stronger pledges" does not imply sufficient ambition to deliver a 2°C pathway.

We combine the remaining countries into three groups: the OECD member states not included in the individual country assessments (OECD-Other); the Least Developed Countries (LDC), which include countries that exhibit the lowest indicators of socioeconomic development according to existing UN classifications; and everyone else (Others). For each group, we base our projections on a set of common assumptions regarding potential emissions pathways and economic growth rates.

Current Emissions, 2°C Pathways and Business as Usual

Figure 3. Historical Emissions, 2°C Pathways and Business as Usual



Current and Past Emissions

There is extensive uncertainty in both current and past climate emissions. For example, estimates of global 2010 GHG emissions range from approximately 47 to 58 Gt according to the IPCC (IPCC, 2014, Figure 1.6 in AR5 Synthesis Report). We follow UNEP's convention of using the Emission Database for Global Atmospheric Research (EDGAR), which comprises total emissions of CO_2 (including from land-use change and forestry) and of all anthropogenic sources of CH_4, N_2O, and F-gases (HFCs, PFCs and SF_6) (JRC/PBL, 2010). The EDGAR 2010 emissions excluding international aviation and shipping of 49 Gt used as an anchor point, with different data sources and projections normalized to this 2010 value.

[1] Russia is also one of the world's top emitters. It is excluded from the individual country analysis because their actions in Paris are extremely uncertain. We have, accounted for some of this uncertainty in the "other" category.

Historic data for each country or group of countries' emissions (excluding Brazil and the United States) is obtained from EDGAR. Historic data on Brazil's emissions are obtained from the System for the Estimation of Greenhouse Gas Emissions (SEEG, 2014), and the United States' historic emissions are obtained from EPA's 2014 emissions inventory (EPA, 2014). These gross emissions estimates do not subtract land-based carbon sinks, which offset significant proportions of anthropogenic emissions for a few countries and which total approximately 4-6 Gt per year globally in the last two decades (IPCC WGIII AR5 Figure 11.8).

2°C and Business-as-Usual Pathways

We adopt 2°C and business-as-usual emissions pathways from UNEP's 2014 Emissions Gap Report. UNEP's 2°C emissions range is adapted from a subset of 18 scenarios included in the IIASA AR5 Scenario Database. This subset includes scenarios that extend current climate policies through 2020 and assume least-cost pathways after 2020 with a likely chance (greater than 66%) of limiting temperature increases to 2°C or less during the 20th century.[2] UNEP represents the 2°C pathway as a range of emissions from the 20th percentile to the 80th percentile of all Kyoto gas emissions from these eighteen scenarios. Given the small number of scenarios in this category, we follow UNEP's lead in using the median to calculate the gap, as the median is more robust for small samples; the range should be considered indicative.

It is important to note that this 2°C pathway differs from that used in previous publications, notably the IPCC Second and Third Assessment Reports, as well as the 2010-2013 UNEP Gap Reports (Figure 3). The new pathway reflects the consensus that a least cost emissions reduction path from 2010 emissions until stabilization of emissions around 450 ppm is not feasible. Instead, significant reductions in GHG emissions are expected to be delayed until 2020 and beyond. All emissions pathways that delay action until 2020 are expected to "overshoot" the maximum radiative forcing levels consistent with long-term (2100 and beyond) stabilization, and require some level of net negative emissions later in the century.[3]

The global Business-as-Usual (BAU) scenario is primarily illustrative, although it does enter into calculations in terms of how much of the required global emissions reductions are represented by various pledge scenarios.[4] We adopt the UNEP 2014 Emissions Gap Report's BAU range and median.[5] The BAU range is estimated from the 20th percentile, median, and 80th percentile of the AR5 baseline (P0) scenarios, normalized to a common 2010 emissions level of 49 Gt.

[2] Data are from The Emissions Gap Report 2014, Table 2.2 for 2020, 2025, and 2030. We estimate a 2015 range from the IAASA AR5 database using a similar set of scenarios as UNEP, and make a correction to be consistent with the UNEP estimates in later years. Interim years are interpolated.
[3] See Figure ES.1 in the UNEP 2014 Gap Report for an illustration.
[4] We use country-specific BAUs for countries expected to define their pledges off of BAU baselines.
[5] The BAU range estimates vary slightly between Chapter 2 and Chapter 3 of the report. We use the 2020 values from Chapter 2, which hews more closely to the IPCC AR5 scenarios; and the 2025 and 2030 values from Chapter 3.

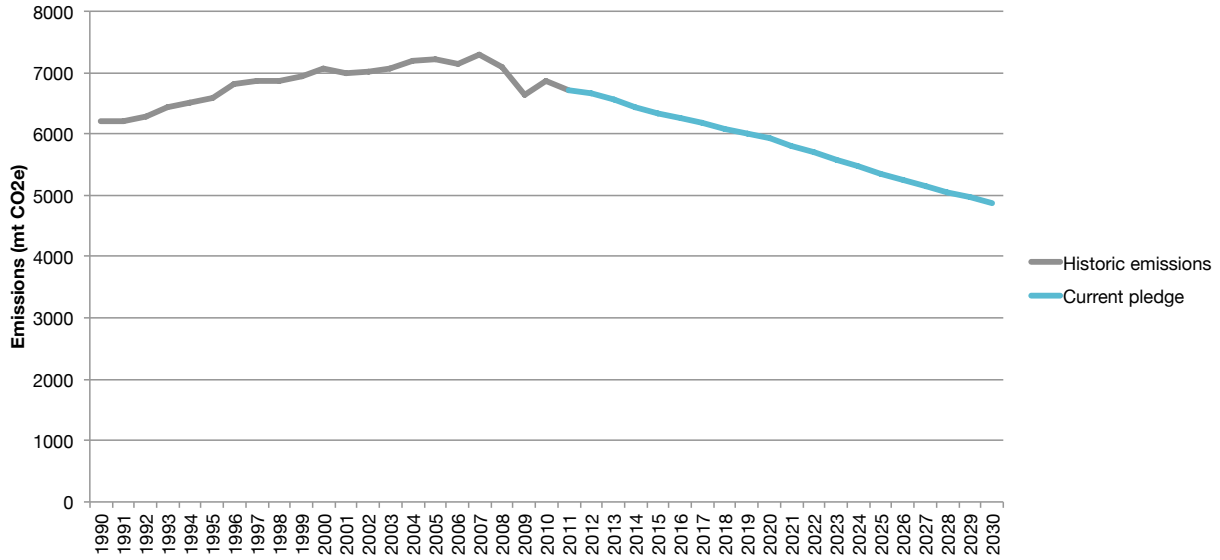
United States

Assumptions:

		2020	2025	2030*
Copenhagen	Change in emissions below base year	-17%		
Current pledge	Change in emissions below base year	Meet 2020 target	-26%	-34%
	Base year	2005	2005	2005

**Because the United States is not announcing a 2030 pledge, the 2030 target is developed for the purpose of consistency with other pledges and to facilitate the overall gap analysis.*

Figure 4. United States Emissions and Current Pledge



In Copenhagen, the United States pledged to lower greenhouse gas emissions by 17% below 2005 levels by 2020.[6] For this analysis, we assume that the Copenhagen target is met by the end of the decade in both scenarios. We base the U.S. current pledge on the recently announced 2025 target: that the U.S. will strive to achieve a 26-28% reduction in emissions below 2005 levels by 2025 (White House, 2014). Because this scenario represents the floor of potential climate ambition, we use the lower 26% emissions reduction target.

Although the United States is not likely set a 2030 target, we include an assumption about the 2026-2030 period in the current pledge scenario, set at 34% below 2005 levels. This pathway is consistent with President Obama's stated goals of reducing GHG emissions from 2005 levels by 17% in 2020 and 83% by 2050. To facilitate calculations, we assume linear emissions reductions for each half-decade.

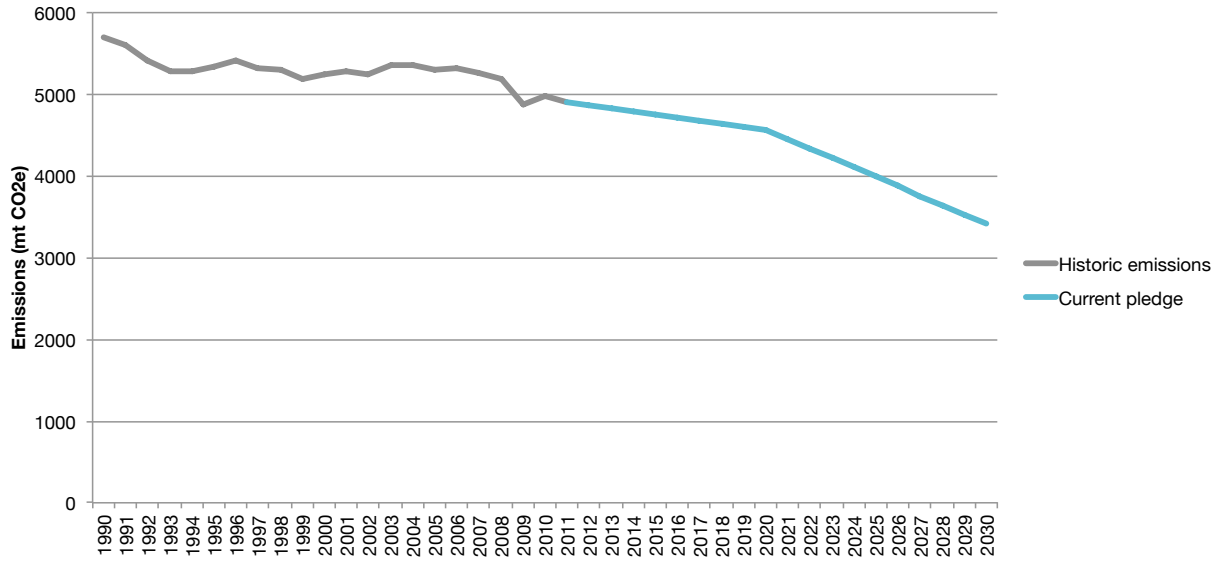
[6] Note that we interpret all US pledges as percent reductions from 2005 net emissions levels, which are about a gigaton lower than gross emissions due to a strong land sink.

European Union

Assumptions:

		2020	2030
Copenhagen	Change in emissions below base year	-20%	
Current pledge	Change in emissions below base year	Meet 2020 target	40%
	Base year	1990	1990

Figure 5. European Union Emissions and Current Pledge:



In Copenhagen, the European Union pledged to lower greenhouse gas emissions by 20% below 1990 levels by 2020. Current projections suggest that the E.U. will outperform this target slightly with current policies (European Environment Agency, 2013); however, the difference is slight, so we assume that E.U. emissions reach the Copenhagen pledge level in 2020.

In October 2014, E.U. leaders pledged to reduce greenhouse gas emissions by at least 40% by 2030 compared to 1990 levels (European Commission, 2014). We set Europe's pledged pathway as a linear trend from the 2020 Copenhagen pledge level to the 40% 2030 target.

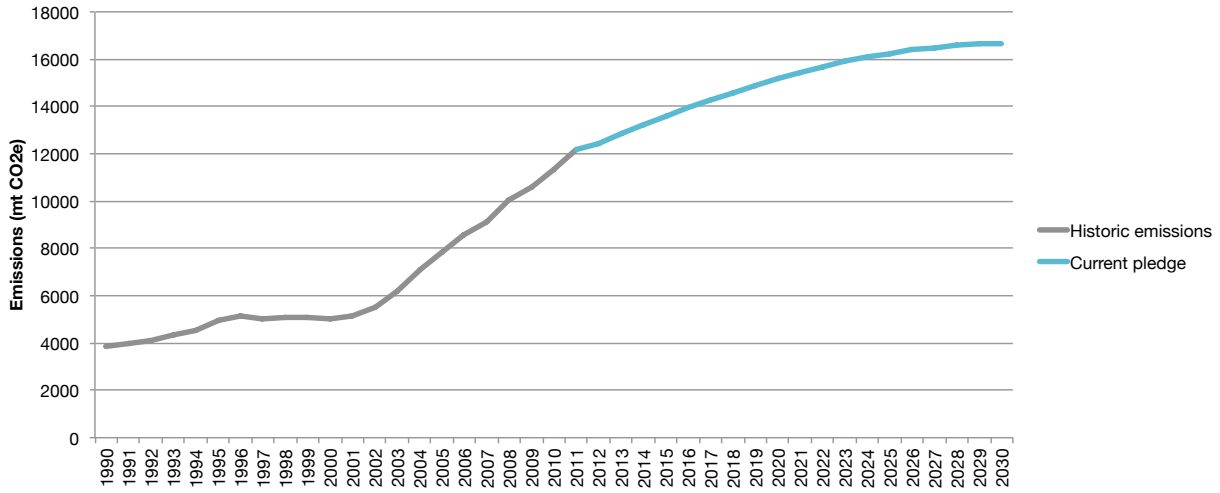
China

Assumptions:

		2020	2021-2030
Copenhagen	Carbon intensity below base year*	-40% to -45%	
Current pledge	Carbon intensity below base year	Meet -40% target; non-CO_2 emissions continue upward linear trend	
	GDP growth	7%/yr	
	Peak year		2030
	Base year	2005	2005

**China's target applies only to their carbon emissions, not other GHGs.*

Figure 6. China Emissions and Current Pledge:



In Copenhagen, China committed to reducing the carbon dioxide intensity of its GDP (measured as tons of CO_2 per 2005 US$ GDP) by 40-45% below 2005 levels by 2020. We assume that the country meets the lower end of the target. We also assume an annual 7% GDP growth rate through 2020, which is consistent with the rate noted in China's Second National Communication on Climate Change (China's National Communication, 2014) as well as the rate used in IEA's 2014 World Energy Outlook (WEO) (IEA, 2014). Finally, we assume that non-CO_2 emissions continue to increase linearly based on the current trend.

Based on China's recently announced target of a 2030 peak year (White House, 2014), starting in 2021 we begin to decline emissions growth linearly to hit zero emissions growth in the peak year. It is important to note that we do not analyze the impact of China's recent announcement to peak its coal use by 2020. However, given that CO_2 emissions from coal account for approximately half of the country's total greenhouse gas emissions (based on calculation using EIA data for total GHG emissions and EIA data for CO_2 emissions from coal), it is likely that this commitment will help China peak its total emissions before 2030.

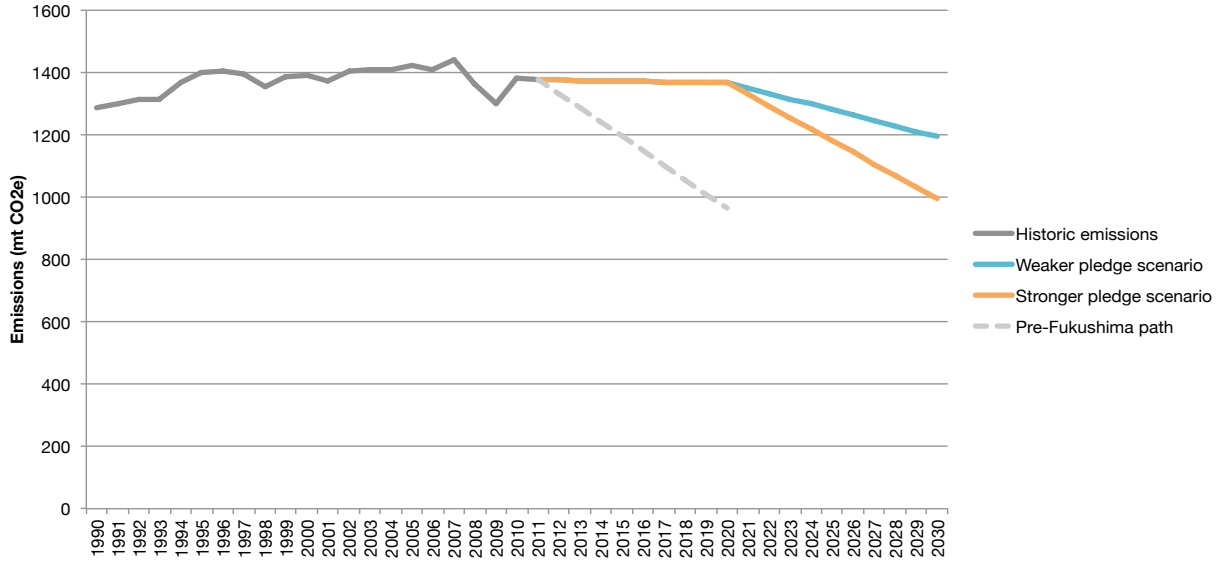
Japan

Assumptions:

		2020	2030
Copenhagen (revised)*	Change in emissions below base year	-3.8%	
Weaker pledge scenario	Change in emissions below base year	Meet revised 2020 target	-16%
Stronger pledge scenario	Change in emissions below base year	Meet revised 2020 target	-30%
	Base year	2005	2005

**The Copenhagen pledge was to cut emissions by 25% below 1990 by 2020; this was lowered in 2013 to a 3.8% cut from 2005 by 2020.*

Figure 7. Japan Emissions and Potential Pledges:



Unlike the U.S. and E.U., which have made clear public statements about their intended targets, Japan has not made a public statement on its intended target—and has recently experienced dramatic shifts in potential climate ambition. Japan's potential pledge thus requires more detailed analysis.

Japan's energy policy has been heavily influenced by the 2011 Fukushima accident and subsequent shutdown of the country's entire nuclear fleet. In Copenhagen, when nuclear power comprised nearly 30% of the country's electricity generation, Japan pledged to reduce its emission by 25% below 1990s by 2020. This target became infeasible once nuclear, which has no associated greenhouse gas emissions, was no longer a near-term component of the country's energy mix. In 2013, the Copenhagen target was lowered to a 3.8% reduction from 2005 levels by 2020. In our analysis, we assume that the country meets this lower target in both the stronger and weaker pledge scenarios, as it appears likely to do with the restart of a few of the nuclear plants (The Guardian, 2014).

Japan's pledge for the Paris agreement will depend almost entirely on the proportion of Japan's energy that is expected to be generated from nuclear power by 2030. In other words, the number of nuclear plants that come back online over the next 15 years will substantially influence the country's climate ambition. The best perspective on Japan's emissions reduction potential given varying degrees of nuclear capacity is provided in "Options for Energy and the Environment" issued by Japan's Energy and Environment Council during the administration of former Prime Minister Yoshihiko Noda in 2012. This publication outlines a "zero nuclear energy" scenario—no portion of electricity generation comes from

nuclear—associated with a 16% decline in emissions compared to 1990 levels, a “15% nuclear” scenario, associated with a 23% decline compared to 1990, and a “20-25% nuclear” scenario, which is which translates into a 25% cut in emissions below 1990 levels. For the purpose of this analysis, we use the “zero nuclear” as the weaker pledge scenario and “20-25% nuclear” as the stronger pledge target. As a reference, prior to Fukushima, approximately 26% of Japan’s power generation came from nuclear (EIA, 2014). Because 2005, rather than 1990, is likely to be the baseline year for Japan’s Paris pledge, we adjust these targets based on the relative 1990/2005 emissions ratio. The amended targets would therefore become 21% below 2005 baseline and 30% below baseline in the weaker and stronger pledge scenarios, respectively, if based entirely on this source.

However, in addition to adjusting both targets to a 2005 baseline, we also adjust the weaker pledge scenario to reflect recent changes in growth and renewable energy policies of the current government. First, the scenarios proposed in "Options for Energy and the Environment" were calculated using lower projected economic growth rates: 1.1% per year until 2019 and 0.8% per year through the 2020s. The new government, however, is targeting higher GDP growth rates (Kaneko & Kajimoto, 2013). If achieved, faster growth could potentially result in additional energy consumption and therefore greater emissions. Moreover, Japan’s current government may be reconsidering its aggressive renewable energy policy in order to reduce the economic burden associated with the current system of feed-in tariffs (Japan Unlimited, 2014). If implemented, this policy shift will slow the rate of introduction of renewable energy and therefore decrease the range of achievable emissions reductions through 2030. Although it is difficult to predict exactly what effect these two policy shifts—higher targeted GDP growth and less rapid adoption of renewables—will have on emissions, we assume a modest 5 percentage point decrease from the targets proposed in the 2012 report. This leads our final “weaker pledge” target to equal 16% below 2005 levels by 2030.

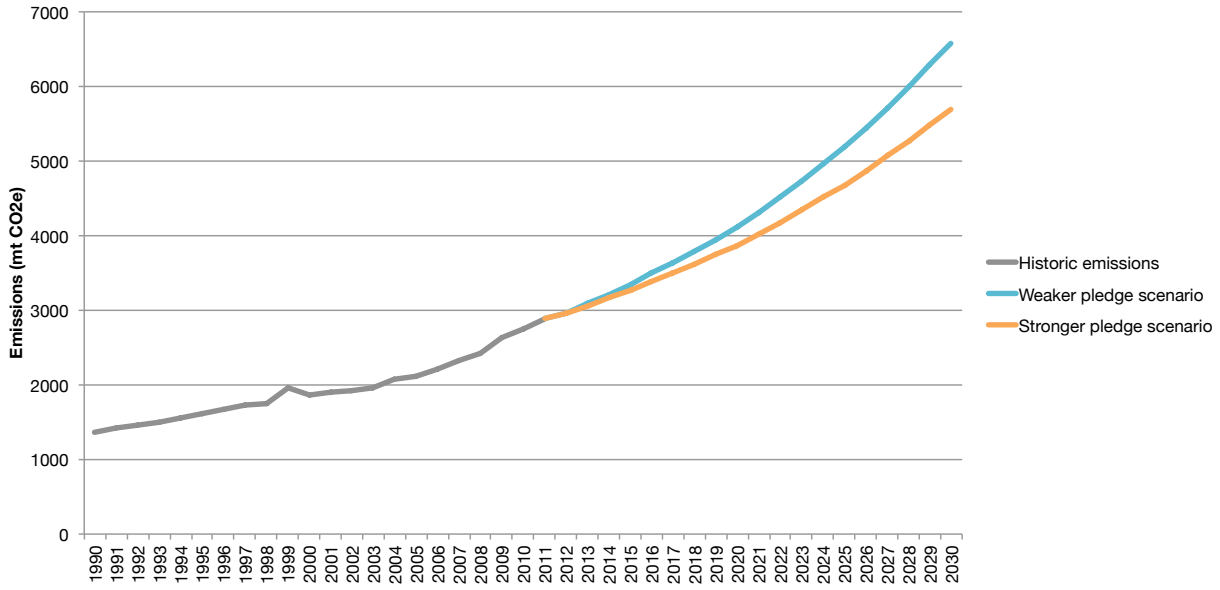
India

Assumptions:

		2020	2025	2030
Copenhagen	Emissions intensity below base year GDP growth	-20% to -25%* 6%/yr		
Weaker pledge scenario	Emissions intensity below base year GDP growth	Meet -20% target	-25% 6.6%/yr	-30% 6.6%/yr
Stronger pledge scenario	Emissions intensity below base year GDP growth	Meet -25% target	-33% 6.6%/yr	-40% 6.6%/yr
	Base year	2005	2005	2005

**This target excludes emissions from the agricultural sector.*

Figure 8. India Emissions and Potential Pledges:



In Copenhagen, India pledged to reduce the emissions intensity of its GDP by 20-25% below 2005 levels by 2020, excluding emissions from the agricultural sector. We assume that the country meets the lower end of the 2020 target in the weaker pledge scenario and the upper end of the target in the stronger pledge scenario. Because emissions intensity is dependent on GDP, we must assume a particular level of annual GDP growth. We use a rate of 6% through 2020. This is based on IEA's 2014 WEO and is lower than the 8-9% growth rate assumed by the country in setting the Copenhagen target in 2009.

It is unclear whether India will put forward a 2025 or 2030 target as part of its Paris pledge. Therefore, we evaluate the potential pledges for both half-decades. Because the country's Copenhagen pledge was based on emissions intensity, and taking into account prevailing concerns about restricting growth, we assume that any target put forward in Paris will also be based on emissions intensity rather than percent of absolute emissions. (Of course, the intensity target translates into an absolute number using our economic growth assumptions, which is used to assess the global mitigation gap.) In the weaker pledge scenario, we assume that India will propose a 25% reduction in emissions intensity from 2005 baseline by 2025—the upper bound of its Copenhagen pledge—and a 30% reduction by 2030. In the stronger pledge scenario, we propose a 33% and 40% reduction in emissions intensity by 2025 and 2030, respectively. Annual average GDP growth for the entire period (2021-2030) for both scenarios is assumed to be 6.6% (IEA, 2014).

Brazil

Assumptions:

	2010–2020 Path*	2025 Pledge	2030 Pledge
	General assumptions: 1) Brazil's unconditional pledges are likely to reflect *higher* than current emissions levels because the country is now and will continue to seek international support for its dramatic cuts in recent years, as well as continued emissions levels well below the historical average. 2) Brazil's ambition for unconditional versus supported LUCF emissions reductions is based on the country's proposed Reference Emissions Level (REL) approach. RELs are set at a constant level for five years, based on the previous ten-year historic average.		
Weaker pledge scenario	Forest emissions climb steadily reaching 2006-2008 average in 2025; other emissions continue linear trend	LUCF emissions in 2025 based on 10-year REL corresponding to increasing forest loss in 2011-2020; other emissions follow linear upward trend	LUCF emissions in 2030 based on REL for 2016-2025 corresponding to increasing forest loss through 2020; other emissions follow linear upward trend
Stronger pledge scenario	Forest emissions begin linear decline in 2015 from 2011-2013 average reaching zero in 2025; other emissions continue linear trend	LUCF emissions based on 5-year REL for 2021-2025 corresponding to declining forest loss; other emissions begin to slow, peaking in 2030	LUCF emissions based on 5-year REL for 2026-2030 corresponding to declining forest loss; other emissions begin to slow, peaking in 2030

**Brazil's Copenhagen pledge of 36-39% reduction from BAU was conditional on international finance and is not included.*

Figure 9. Brazil Emissions and Potential Pledges:

Land use change and forestry have an outsized influence on Brazil's climate emissions profile, both because of large emissions from this sector and a high share of renewable (hydro) power generation. Until two years after deforestation peaked in 2004, LUCF was more than half of Brazil's total GHG emissions – and in peak deforestation years reached as high as 66% (2004) and 75% (1995). While deforestation emissions have dropped dramatically in the last decade, other emissions have climbed slowly and steadily upward, at a rate of increase of 2% per year. These very different patterns—significant year-to-year variability on top of a massive 75-80% decline since 2004 in the case of LUCF emissions, and a slow and steady climb upward for other emissions—require separate analyses.

We set weaker and stronger targets for what Brazil might pledge as its self-financed, non-conditional climate actions. This is different in form than the country's previous pledges. For example, in Copenhagen, Brazil pledged to reduce its emissions by 36.1% to 38.9% in 2020 compared to BAU emissions, *conditional* on appropriate levels of international financing. It planned to achieve these reductions largely by reducing Amazon deforestation by 80%, and by reducing clearing of savannah forests (the *Cerrado*) by 40%. Brazil is largely on track to meet these targets, even without significant international climate finance support. However, this previous level of ambition does not provide much of a guide for our purposes, as it was conditional and based on a BAU that at the time projected continuing increases in deforestation emissions on top of the very high 1995-2005 average. In contrast, Brazil's 2012 emissions of about 1.2 Gt were already 54% below the expected 2012 emissions levels based on the type of BAU pathway discussed at the time—and 67% below the 2020 BAU value.

Brazil's Reference Emissions Level (REL) for the Amazon Fund and its proposed REL approach for REDD+ more broadly in its submission to the UNFCCC (UNFCCC, 2014) give the best indication of how the nation might approach a split between own-action and internationally-supported reductions. These REL's are set at a constant level for five years, based on the previous ten-year historic average. For example, the REL for 2021-2025 would be set at the 2010-2020 average. By assuming a range of potential pathways of LUCF emissions through 2025, REL's for 2025 and 2030 can be calculated using this approach.

We set the LUCF component of a weaker pledge scenario for 2025 and 2030 by assuming that 2012 was the nadir of actual LUCF emissions, with 2013 and 2014 the beginning of a steady rise in actual LUCF emission back up to 2007-2008 average levels in 2025. Using these assumptions, we calculate the corresponding REL for 2021-2025 and 2026-2030. For the stronger pledge scenario, we assume that the recent uptick in deforestation rates are temporary, that 2014 actual LUCF emissions are at the average level for 2011-2013, and that there will be a linear decrease in actual LUCF emissions thereafter reaching zero net in 2025.[7] We depart from the tradition REL methodology for the stronger pledge scenario, assuming that Brazil will be using a five-year rather than a ten-year historic average – which is equivalent to assuming that Brazil self-finances a larger portion of a given level of forest emissions reductions.

While there is less of an indication of how Brazil might approach climate ambition outside the LUCF sector, the uncertainties and possible ranges are smaller outside the LUCF sector. We thus set weaker and stronger pledge scenarios at two different levels. First, we suppose that Brazil would not pledge any self-financed emissions reductions below BAU in non-LUCF sectors through 2030,relying on the forest sector for all of its pledged reductions. For this weaker pledge scenario, we model continued linear growth. We model the stronger pledge scenario as a self-financed pledge to slow the rate of increase in non-LUCF emissions after 2020, reaching a peak in 2030.

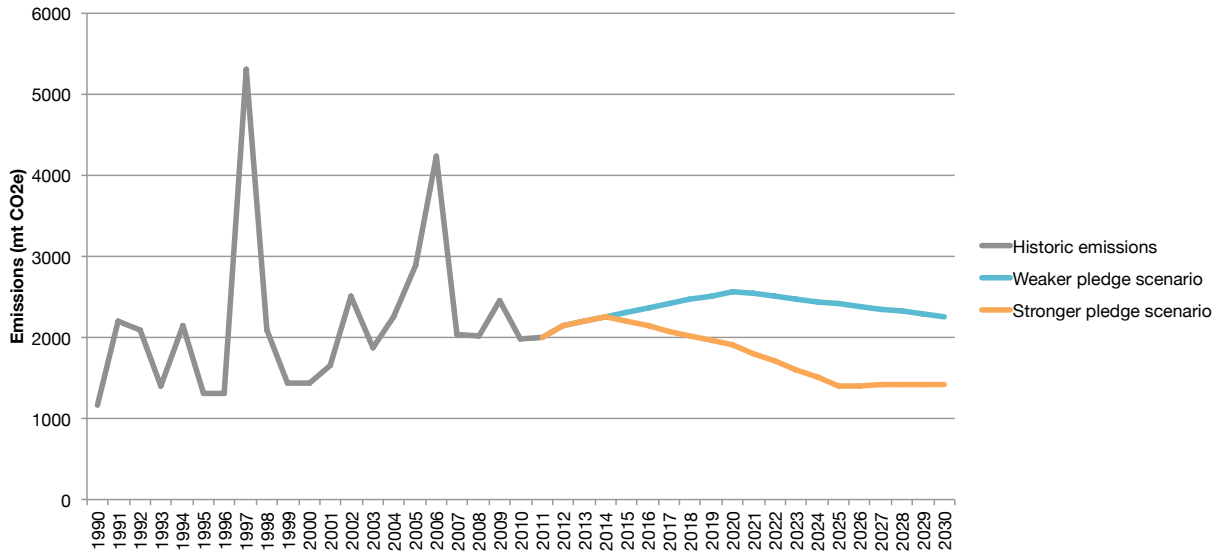
[7] We follow the convention used by SEEG of focusing on the land use emissions as calculated from changes in forest area. This figure is net of carbon sequestration from forest area gains, but does not subtract the anthropogenic land sink calculated by the Government of Brazil as a fixed multiple of all indigenous and protected areas, as allowed by the IPCC land use accounting guidelines.

Indonesia

Assumptions:

	2020	2021-2030
Copenhagen	Cut emissions by 26% by 2020 from BAU levels	
Weaker pledge scenario	Fail to meet 2020 target of 26% reductions from BAU; All emissions increase according to linear trend	- BAU: LUCF flat at 2020 level, current trend for "other"; - With-Action scenario: LUCF cut in half from BAU by 2030, current trend for "other"; - Pledge: Self finance 63% of difference between expected BAU and "with action" scenario (same ratio as Copenhagen pledge)
Stronger pledge scenario	Meet or exceed 2020 own action target of 26%	- BAU: LUCF flat at Copenhagen 2020 own-action target (-26%); other emissions level off in 2030; - With-Action scenario: LUCF cut to zero in 2025; other emissions level off in 2030 - Pledge: Self finance 63% (26/41) of difference between low emissions BAU "with action" scenario

Figure 10. Indonesia Emissions and Potential Pledges:



Note: The extreme variability in Indonesia's historic emissions is the result of years with high deforestation accompanied by large-scale peat fires.

In Copenhagen, Indonesia pledged to cut its emissions by 26% below BAU levels by 2020, with the largest portion of the overall decrease coming from reduced deforestation. It is important to note that this figure represents Indonesia's *unconditional* pledge and comprises only the emissions reductions that the country would achieve on its own. In 2009, Indonesia also proposed to cut emissions by 41% below BAU by 2020 *conditional* on the availability of international support. For the 2020 target, BAU is defined as a linear upward trend based on historic emissions levels for both LUCF and non-LUCF sectors. We use Indonesia's unconditional Copenhagen pledge as the basis for the 2030 analysis.

To form our weaker and stronger pledge projections for 2030, we build on three analytical components: 1) the BAU scenario, 2) the "with action" scenario—a potential emissions pathway achieved both through its own action and with international support, and 3) the "pledge" scenario—Indonesia's

unconditional emissions reductions target. The latter assumes that the country will self-finance a portion of the ideal "with action" scenario, a share that we assume to be 63%.[8]

In the weaker pledge scenario, we assume that Indonesia anticipates that emissions will fail to meet the 26% emissions target by 2020. Instead, they anticipate that without additional action, LUCF and non-LUCF emissions will increase linearly based on current trends through 2020. In the following decade, we assume that the pledge would be based on BAU LUCF emissions that remain flat at the 2020 level, while BAU non-LUCF emissions would be assumed to continue their linear increase. The weaker "with action" scenario considers a plan by the government to cut LUCF emissions in half by 2030 while non-LUCF emissions would be allowed to continue their linear upward trend. Indonesia's weaker pledge is therefore calculated to be 63% of the difference between this potential anticipated high emissions BAU and the potential anticipated "with (less) action" scenario.

In the stronger pledge scenario, we assume that the country will stand by the 26% emissions reduction target for 2020, and will set their post-2020 pledge assuming it will be met. For the following decade, we assume the country would treat BAU LUCF as flat at the 2020 emissions figure; non-LUCF emissions would be treated as leveling off in 2030 in the BAU. The more ambitious "with action" scenario assumes that Indonesia will plan to cut LUCF emissions to net zero by 2025 (with some international support); the target for other emissions will be to level off in 2030. As above, Indonesia's self-financed pledge scenario is calculated to be 63% of the difference between this lower emissions BAU and the more aggressive "with action" case.

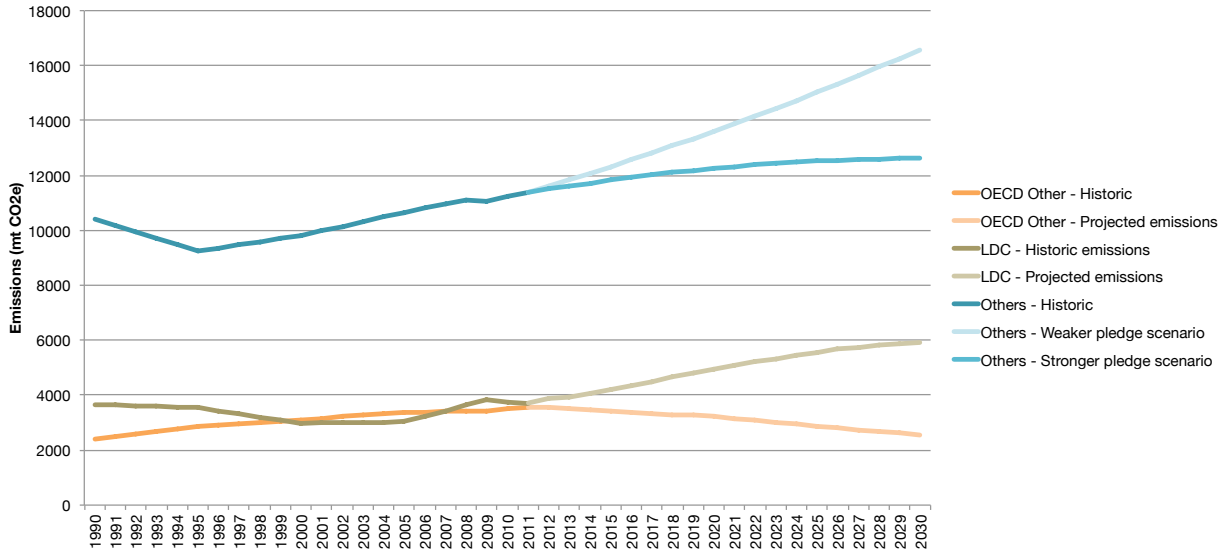
[8] This figure is based on the ratio of the country's unconditional and conditional Copenhagen pledges (26%/41%=63%).

Rest of World

Assumptions:

	Weaker pledge scenario (present-2030)	Stronger pledge scenario (present-2030)
OECD-Other	Average annual % emissions change between U.S. and E.U. in weaker pledge scenario	
LDC	Emissions increase based on a 7% annual average GDP growth and declining emissions intensity according to last 5-year trend	
Others	Emissions grow steadily at 2%	Linear decline in emissions growth to meet 2030 peak

Figure 11. Rest of World Projected Emissions:



For the purpose of this analysis, we divide the rest of the world into three distinct groups: the OECD countries not included in the individual analysis above (OECD-Other), Least Developed Countries (LDC), and the rest of the world (Others).

For the rest of the OECD—countries that are not individually analyzed in this exercise—we assume that the annual change in emissions will approximate the average of the United States and the European Union in the current pledge scenario. Although we have chosen to use the conservative weaker pledge scenario average to project emissions for the rest of the OECD through 2030, it is worth noting that the difference between using the weaker and stronger pledge average is relatively small: approximately 190 $mtCO_2e$ in 2030. Because this difference is so small compared to global total emissions, we only include one scenario for this group.

For the LDC group, we assume accelerating economic growth and therefore rising emissions through 2030. Projections begin in 2012, the first year for which composite historic emissions data is not available, and are based on an assumed GDP growth rate and emissions intensity. For annual average GDP growth rate, we adopt a relatively high 7% through 2030. This is consistent with the goal of the Istanbul Programme of Action for LDCs, which strive to achieve economic growth in LDCs of least 7% annually by the end of this decade (UN-OHRLLS, 2011). The emissions intensity of GDP is assumed to decrease based on the linear trend of the past five-year period. Because LDCs should not be constrained by significant self-financed emission reductions pledges, we have modeled just a single pledge scenario for them as a group.

The "Others" category is perhaps the toughest for which to make projections because it includes a wide variety of nations with diverse economic circumstances and climate ambitions. The group includes most of Latin America, as well as the former Soviet Republics and countries within the Middle East/North Africa. The top emitters in this group are Russia (21.5% of group emissions), Iran (4.5%), Saudi Arabia (4.3%), and South Africa (3.6%). Unlike our analysis of potential OECD and LDC emissions pathways, which are more homogenous, this group is so large and so diverse we propose a weaker and stronger pledge scenario to account for the wide range of possible emissions paths. Because the group includes only low and middle-income countries, we assume that emissions will either increase (weaker pledge scenario) or plateau in 2030 (stronger pledge scenario). In the former, we assume an average 2% annual emissions growth rate. This figure is somewhat *above* the 2000-2011 historic average (1.4%) and is meant to account for potential increasing economic growth. In the latter, we propose a plateauing of emissions after 2030. This represents the potential that some of the larger emitters—Russia, for example, which accounts for about 20% of this group's total emissions, and potentially other former Soviet Republics—might make serious pledges in Paris to decrease their emissions after 2020.

Note that many other potential pathways lie between these two extremes. For example, if emissions followed a faster growth rate through 2020, but these countries all pledged a 2030 peak emissions year, the 2030 emission level would fall between the current weaker and stronger pledge scenarios.

Summary Table

		2020	2025	2030
BAU		59,000	63,000	69,000
Median Two Degree Scenario		52,000	47,000	42,000
Gap between BAU and 2DS		7,000	16,000	27,000
World	**Weaker pledges**	**57,317**	**59,779**	**61,951**
World	**Stronger pledges**	**54,848**	**55,335**	**55,471**
US	Current pledge	5,921	5,350	4,871
EU	Current pledge	4,557	3,987	3,418
China	Current pledge	15,180	16,245	16,665
Japan	Weaker pledge	1,367	1,281	1,194
Japan	Stronger pledge	1,367	1,181	995
India	Weaker pledge	4,107	5,200	6,582
India	Stronger pledge	3,872	4,682	5,691
Brazil	Weaker pledge	1,845	1,837	1,919
Brazil	Stronger pledge	1,633	1,527	1,326
Indonesia	Weaker pledge	2,570	2,414	2,258
Indonesia	Stronger pledge	1,902	1,398	1,421
OECD-Other	Single pledge scenario	3,224	2,873	2,550
LDC	Single pledge scenario	4,939	5,569	5,907
Others	Weaker pledge	13,607	15,023	16,587
Others	Stronger pledge	12,253	12,523	12,626

Notes: All data in $MtCO_2e$. These figures represent "expected domestic pledge emissions equivalents"—the level of gross emissions from each country or country group that is equivalent to the domestic action pledge scenarios in our model, combined with assumptions about economic growth rates and pre-2020 emissions pathways. This analysis does not project actual future emissions, as it includes only unconditional, or self-financed, domestic action pledges. It does not take into account the mitigation potential of international partnerships, which is significant.

References

China, 2012. *The Second National Communication of the People's Republic of China*. Available at: http://unfccc.int/resource/docs/natc/chnnc2e.pdf

EPA, 2014. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. Available at: http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html

Energy and Environment Council of Japan, 2012. "Options for Energy and the Environment." Available at: http://www.cas.go.jp/jp/seisaku/npu/policy09/pdf/20120629/shiryo1.pdf. [Translation available at: http://www.cas.go.jp/jp/seisaku/npu/policy09/sentakushi/pdf/Report_English.pdf]

European Commission, Joint Research Centre/Netherlands Environmental Assessment Agency (JRC/PBL). Emission Database for Global Atmospheric Research (EDGAR), release version 4.2 FT2010. Available at: http://edgar.jrc.ec.europe.eu, 2011.

European Commission, 2014. 2030 framework for climate and energy policies. Available at: http://ec.europa.eu/clima/policies/2030/index_en.htm.

European Environment Agency, 2013. Trends and projections in Europe 2013: Tracking progress towards Europe's climate and energy targets until 2020. Available at: http://www.eea.europa.eu/publications/trends-and-projections-2013/full-report-ghg-trends-and-1.

International Institute of Applied System Analysis (IIASA), 2014. AR5 Scenario Database. Available at: https://secure.iiasa.ac.at/web-apps/ene/AR5DB/dsd?Action=htmlpage&page=welcome

IPCC, 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Meyer, L. (eds.)].

Japan Unlimited, 2014. "Japan's renewable energy policy: victim of its own success." Available at: http://www.japan-unlimited.nl/2014/07/04/japans-renewable-energy-policy-victim-of-its-own-success.

Joint Research Centre of the European Commission & Netherlands Environmental Assessment Agency (JRC/PBL). (2012). Emission Database for Global Atmospheric Research (EDGAR), release version 4.2. Available at: http://edgar.jrc.ec.europa.eu.

Kaneko, K. & Kajimoto, T. "Japan's Abe targets income gains in growth strategy." *Reuters.* June 5, 2013. Available at: http://www.reuters.com/article/2013/06/05/us-japan-economy-arrow-idUSBRE95400R20130605.

Observatorio do Clima, Sistema de Estimativa de Emissões de Gases de Efeito Estufa (SEEG), 2014. Available at: http://seeg.herokuapp.com/tabela-geral-de-emissoes.

OECD, 2014. *OECD.Stat*. (Database). Available at: http://stats.oecd.org.

The Guardian, 2014. "Japan to restart nuclear reactors." Available at: http://www.theguardian.com/world/2014/sep/10/japan-restart-nuclear-reactors-fukushima.

System for the Estimation of Greenhouse Gas Emissions (SEEG) of Brazil, 2014. Available at: http://seeg.herokuapp.com/

UN-OHRLLS, 2011. Istanbul Declaration and Programme of Action. United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and the Small Island Developing States (UN-OHRLLS). Available at: http://unohrlls.org/about-ldcs/istanbul-programme-of-action.

UNEP, 2013 The Emissions Gap Report 2013. United Nations Environment Program (UNEP).

UNEP, 2014 The Emissions Gap Report 2014. United Nations Environment Program (UNEP).

UNFCCC, 2014. Brazil's submission of a forest reference emission level for deforestation in the Amazonia biome for results-based payments for REDD+ under the UNFCCC. Available at: http://unfccc.int/files/methods/redd/application/pdf/20140606_submission_frel_brazil.pdf.

White House, 2014. "U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation." Available at: http://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c.

World Bank, 2014. Development Indicator Database. Available at: data.worldbank.org.

WRI, CAIT 2.0. 2014. Climate Analysis Indicators Tool: WRI's Climate Data Explorer. Washington, DC: World Resources Institute. Available at: http://cait2.wri.org.