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Clean Investment Budgets Reward Developing Countries for Early Action

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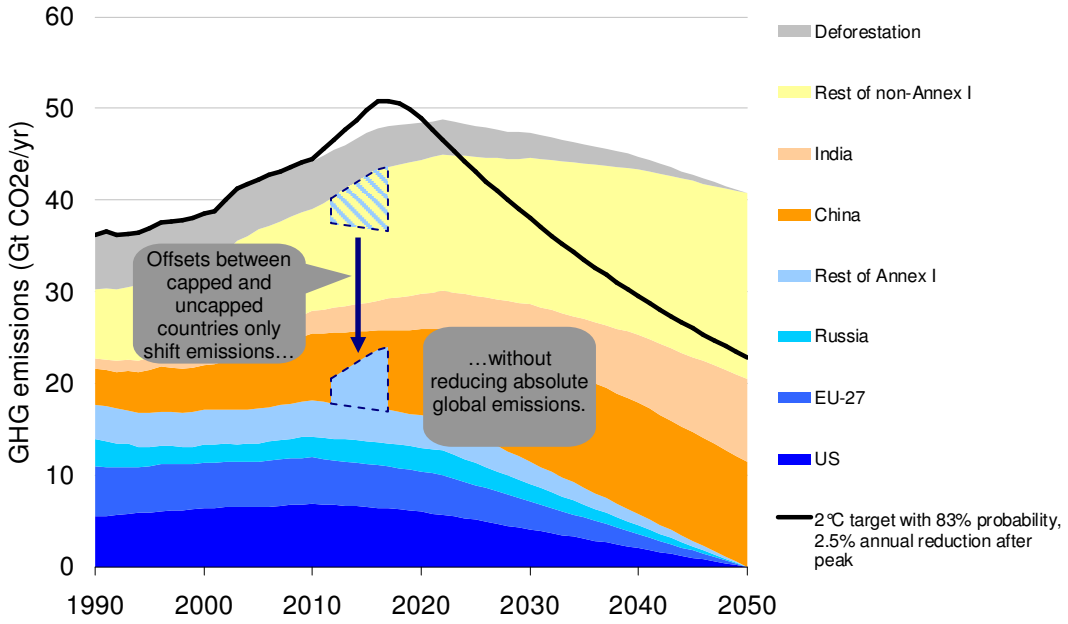
Designed correctly,[ii] a global carbon market is the most efficient way for all major greenhouse gas (GHG) emitters to create the necessary capital, incentives, and investment signals to reorient their economies towards a low-carbon future. However, it will be impossible to avoid 2°C of warming if the only mechanism for major emitting developing countries to participate is through offsets – i.e., issuing credits for reductions in uncapped countries below what would have otherwise occurred ("business as usual," or BAU) and transferring those credits so industrialized countries can increase their emissions by the same amount. Such transfers only shift emissions from developing to industrialized countries; they do not reduce absolute global emissions. Even if emissions from industrialized countries and deforestation were reduced to zero by 2050, unless major emitting developing countries also reduce their absolute emissions significantly, the world will not be able to prevent 2°C of global average warming.[iii]

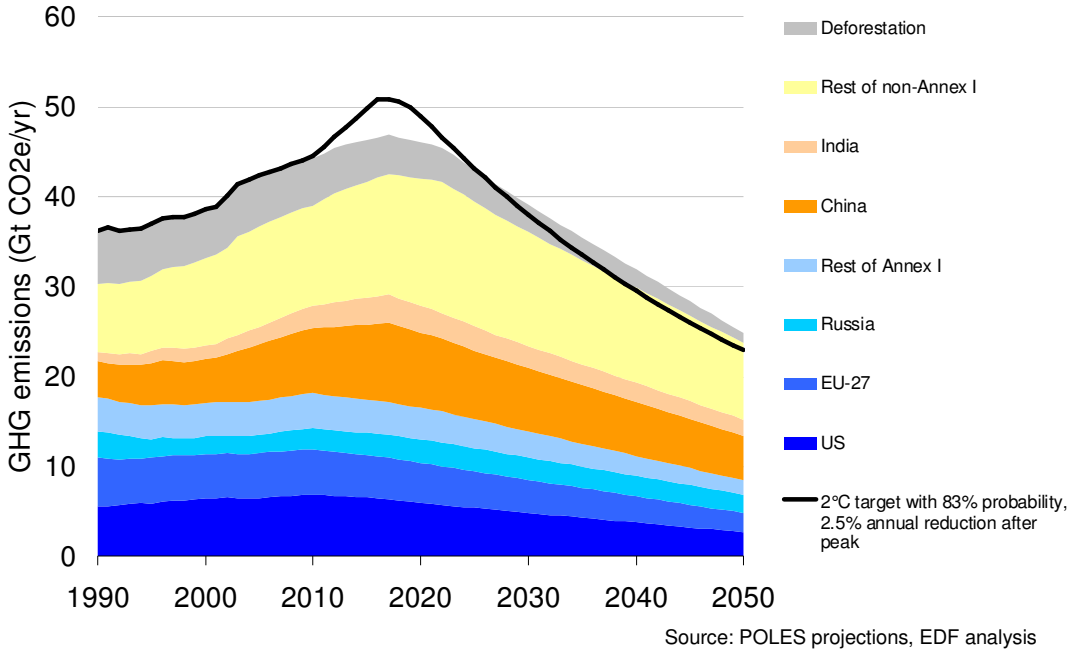
Figure 1: Two degrees out of reach without significant reductions by major emitting developing countries, even if emissions from industrialized countries and deforestation are reduced to zero



Source: POLES projections, EDF analysis

Fund-based or project-based approaches like the Clean Development Mechanism alone cannot generate the scale of investment or capital necessary for developing countries to sufficiently transform their economies in the necessary timeframe. The good news is that, consistent with the principle of common but differentiated responsibility,[iv] it is still possible to avoid 2° of warming even if developing countries' emissions grow through around 2020, *as long as industrialized countries meet strong proposed emissions targets and all major developing country emitters put emission caps in place by 2020, at the latest.* (See Figure 2 for an illustrative scenario.[v])

Figure 2: Global emissions reduction paths to avoid >2°C



Source: POLES projections, EDF analysis

Consequently, it is essential that the post-2012 framework give developing nations with significant emissions strong incentives to join the global carbon market and reduce their GHG emissions as soon as possible. One such approach is that of "**clean investment budgets,**" a simple idea with powerful implications.[vi]

Clean investment budgets can pay for investments in low-carbon pathways

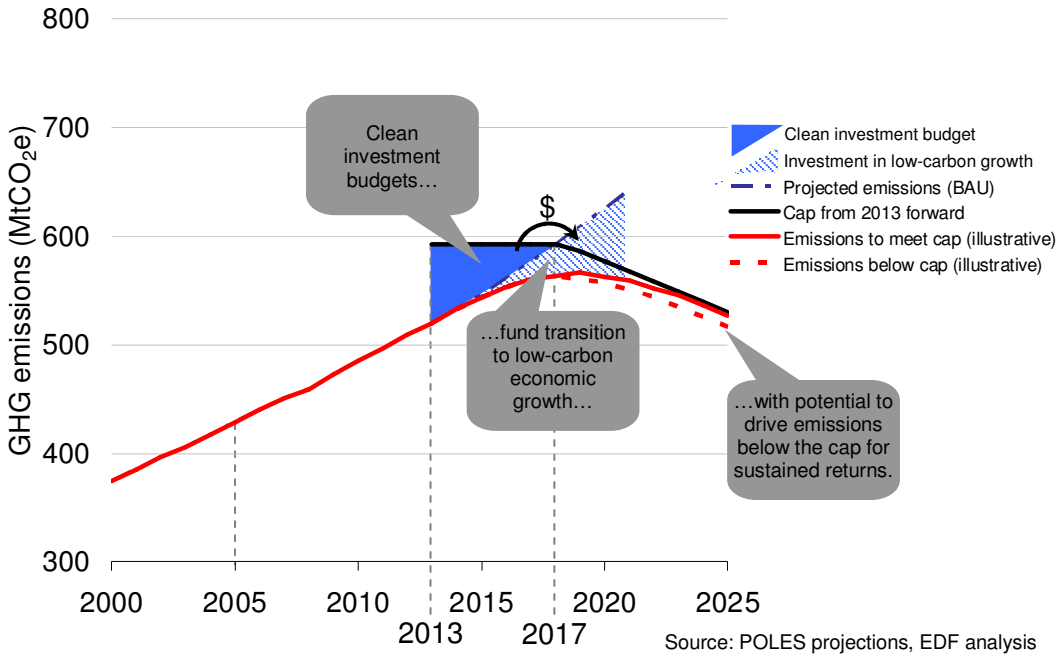
Clean investment budgets (CIBs) provide a measurable, reportable, and verifiable mechanism that rewards any developing country that takes a firm emissions cap early. Using CIBs, an emerging economy voluntarily sets a firm cap at a level *higher* than its current emissions but within the constraints entailed by a global 2°C goal. The resulting surplus allowances can, in part, be banked for future domestic use or sold on the global carbon market to generate revenue. Oversight and compliance are crucial to ensure that the revenue is used to finance investments in low-carbon pathways, allowing economy-wide transformations.

Developing nations need to move swiftly to claim their CIBs. If not, the atmospheric space for those budgets will disappear – taken by other countries as early as 2013 or gone completely by 2025 if no developing country limits emissions.[vii]

Take some simple numeric examples for Turkey, the Republic of Korea and Mexico. Suppose Turkey were to adopt a CIB for the five year period 2013-2017 set at 38% above its 2005 actual emissions (roughly 14% above its expected 2013 level).[viii] This cap would equal 595 $MtCO_2e$ per year. Set in 2013, and considering business-as-usual projections, Turkey would, thus, gain an

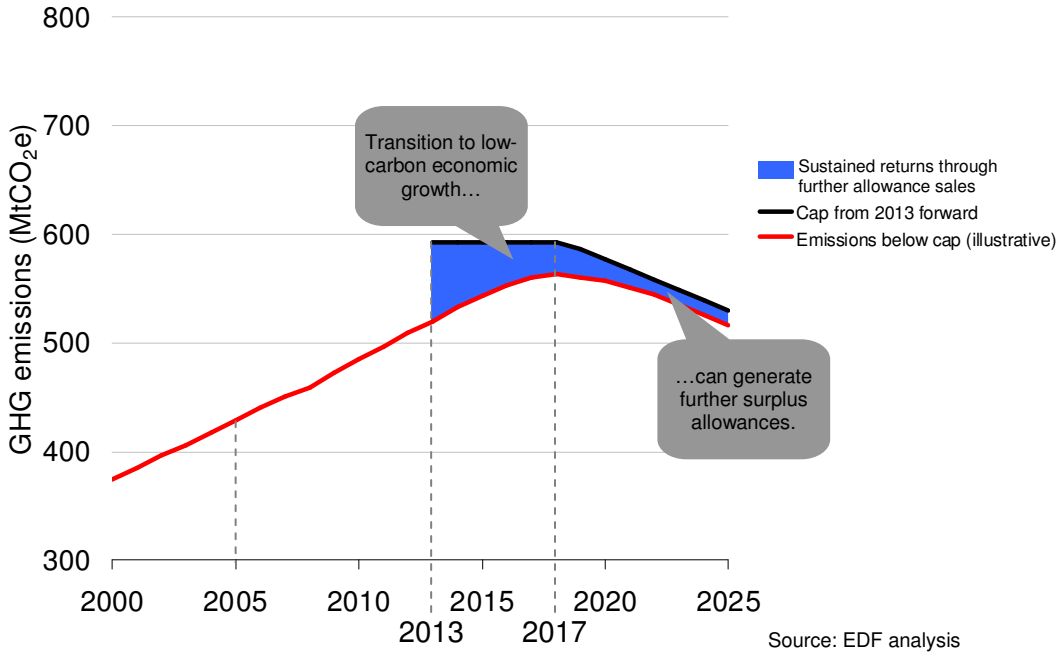
additional set of emission allowances of 227 $MtCO_2e$ (blue triangle in Figure 3 below). At a price of \$30/tCO_2e, this clean investment budget is worth \$6.8 billion.

Figure 3: Clean investment budgets reward early action; illustrative example of Turkey



Investing the surplus allowances in clean development could enable Turkey to continue to reduce emissions below its cap, generating further surplus allowances – a "gift that keeps on giving."

Figure 4: CIBs can help drive emissions below cap for sustained returns; illustrative example of Turkey



Other countries could follow a similar model. South Korea's CIB, for example, could be around 309 $MtCO_2e$ if it adopted a cap, starting in 2013, set 42% above its 2005-levels. At $\$30/tCO_2e$, this budget would be worth $9.3 billion. Mexico's expected monetary transfers could be even larger. Its CIB from 2013 through 2017 for a cap of 37% above 2005 levels could be 344 $MtCO_2e$ or $10.3 billion at $\$30/tCO_2e$.[ix]

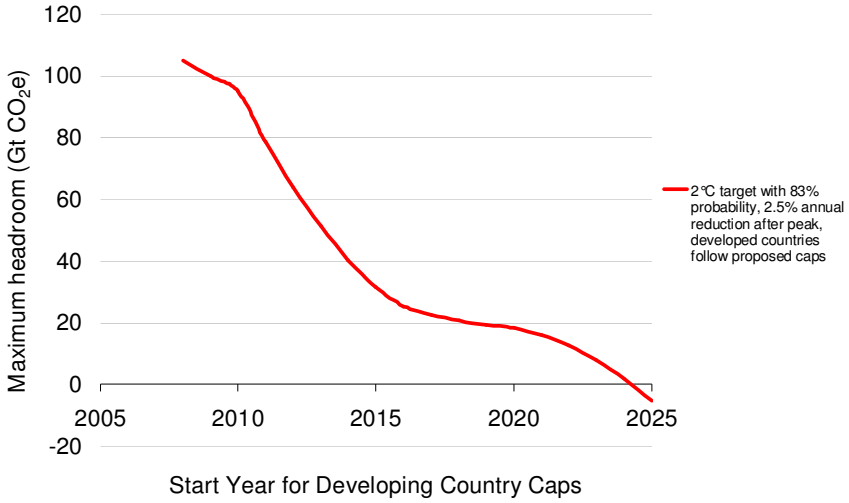
Crucially, none of this revenue stream is based on an immediate alteration of the emissions trajectory. The cap is set significantly higher than current emissions, in these examples between 37 and 42% above 2005 levels, 13 to 14% above business-as-usual projections for 2013. The surplus allowances can either be sold immediately into the carbon market to generate revenue for clean development, or banked for future compliance or sale.

But this is not the only way early action pays. There is only a finite amount of global headroom, or remaining emissions under a pathway that avoids dangerous climate change. What one country takes, others cannot. Early actors would be able to set higher domestic caps, and thus receive larger CIBs. By not acting, some countries could miss this opportunity. The exact level of the caps would be negotiated internationally, subject to the constraint of available headroom. Additional mechanisms would still be needed to provide funding for investments in less developed countries that are currently emitting little.

Sufficient headroom even for larger emitters to take a clean investment budget

There is sufficient headroom to give out CIBs even to larger emitters, while still ensuring the integrity of a global cap. Working backwards from a goal of avoiding >2ºC of warming and assuming that industrialized countries adhere to their proposed targets, the cap allows for enough headroom to give out CIBs through 2024. Headroom here is defined as the cumulative allowable emissions above emissions in a given start year. It corresponds to the sum of available CIBs.

Figure 5: Maximum available atmospheric headroom for developing countries



Source: POLES projections, EDF analysis

Global atmospheric headroom amounts to over 90 Gt CO_2e in 2010 and over 50 Gt in 2013. Initially, headroom is large enough to accommodate CIBs for even the largest developing country emitters, but it is rapidly shrinking. By 2015, only 32 Gt will be left. In 2020 the number is down to 18, shrinking further to zero by 2025.

Early action is crucial. The finite amount of atmospheric headroom available under a global constraint vanishes over time. The earlier a country signs on to a global carbon market, the larger its potential CIB and ensuing financial flows.

A sound clean investment budgets approach generates "development air"

Several reasons ensure that a CIBs approach would not simply result in the trading of "hot air" that either has no beneficial effect on the climate or causes emissions to grow faster than they otherwise would. Quite the opposite: sound implementation of CIBs would be an important way to achieve global climate goals within the limited timeframes available for securing a safe climate.

First, based on the notion of "common but differentiated responsibilities," developing countries arguably ought to be given extra emissions allowances to generate development revenue, considering their lower per capita income and smaller contribution to historical pollution. Hence, these CIBs could most closely be described as "development air," where the CIB allows further carbon-intensive growth in the near term, while freeing up resources to decouple the link between continuing growth and carbon emissions.

Second, any international framework needs to be based on credible oversight and compliance. CIBs are no different. Regardless of the specific compliance mechanism or institution, any international framework will need to ensure that funds made available as development revenue are invested in reducing emissions in developing nations. CIBs offer an advantage in this regard: Entities that must tender emissions allowances for compliance in nations with mandatory caps on emissions, will be seeking to invest preferentially in nations that offer transparent opportunities for reducing emissions while boosting development. That is exactly what CIBs offer – "development air" that can be used most crucially for investing in reducing domestic emissions. Some nations might further wish to voluntarily submit their CIBs to international oversight as a further means of ensuring transparency. International oversight bodies might also provide supporting roles when it comes to technical assistance for abatement technologies and play decidedly positive roles with regard to compliance.

A third safeguard is the necessary global constraint on emissions to achieve climate goals. Finite headroom necessitates a limited amount of CIBs. Establishing a scientific oversight board with a clear directive to observe and report on the progress of meeting the goals of the UNFCCC would ensure no nation is awarded a clean investment budget that exceeds emission constraints needed to avert 2°C of warming. Furthermore, countries that take a CIB may be required to simultaneously accept a second and even third commitment period with a lower cap. National

caps will need to decline over time to be consistent with a global trajectory that avoids dangerous climate change.

Finally, it is important to note that there is probably no danger of a lack of demand for emissions allowances offered for sale by countries with CIBs. The United States will likely adopt a domestic cap-and-trade system, which alone would more than double the current carbon market (now driven by the EU ETS). In addition, the countries that have taken mandatory reductions under Kyoto are expected to take even more stringent targets under the post-Kyoto treaty. Any international trading allowed by the US or EU would come with provisions to ensure real emission limits.

Clean investment budgets can help drive the transition to a low-carbon future

CIBs can drive investments in cleaner technologies and cleaner development more effectively than a CDM-style project-based approach. Oversight and compliance here are crucial issues as they are in any international climate treaty. Various safeguards can ensure that revenues generated through CIBs are indeed applied to clean development. First and foremost, the existence of monetary flows can aid compliance. Investors will be searching for "high quality" emission reductions because those are what will be accepted for compliance in nations with mandatory caps on emissions. Some nations might, as a matter of their domestic implementation of their mandatory caps, might adopt minimum standards for foreign allowances that can be tendered for compliance in their cap and trade markets.

Sellers can also play a crucial role in compliance. If a country accepts multiple commitment periods, domestic oversight may suffice to ensure the integrity of the system. In that case, sellers of allowances alone could be responsible for their own oversight, assuming the existence of multilaterally agreed-upon mechanisms such as penalties for non-compliance in subsequent commitment periods. If a country only accepts a single commitment period, the case for international oversight is much stronger. The exact form of oversight merits further discussion. Some options for managing CIBs could include:

- *Country Management with Assurances of Transparency:* Nations adopting CIBs might choose to establish programs that meet internationally-agreed standards for transparency of investment in the economic transition to a low-carbon future.

- *Country Management with International Oversight*: Nations adopting CIBs might choose to manage their CIB revenues with oversight from an independent third party, potentially under the aegis of the secretariat of the post-2012 framework. The independent third party would conduct periodic assessments of the program's compliance with internationally-agreed standards.

- *International Clean Investment Executive Board*: Nations adopting CIBs might choose to participate via a Clean Investment Executive Board, similar to the CDM Executive

Board, that would monitor and evaluate the use of CIBs for clean development for each country. For example, the Board would work with each country to review its investment plans for clean technologies and energy efficiency improvements and its measurement metrics and indicators to track success.

- *Management by an international entity*: Revenue from CIBs could be placed in a fund that would be managed by an international financial institution, either already existing or newly created for this purpose.

Regardless of which form of oversight the international community agrees to, monitoring and verification represent a key element of the CIB approach – one that can ultimately open up substantial funds for technology transfer and domestic measures to help move developing countries towards a low-carbon future.

Clean investment budgets can generate financing for technology transfer

It is clear that scaling up financing for technology transfer will be imperative as the world moves forward. A variety of tools and sources of funding will be necessary to finance technology transfer to developing countries of all income levels, including, but clearly not limited to, bilateral agreements, market mechanisms, and direct funding from the international community. Industrialized nations must also find a way to ensure that funds are measureable, reportable, and verifiable.

CIBs could provide a portion of such funding. Using their CIB revenues, countries could apply these funds either to underwrite technology transfer or other mitigation activities according to their needs. The revenue generated from CIBs would be significantly higher than direct assistance from industrialized countries has been in the past.

Four key elements of clean investment budgets

1. Countries voluntarily accept binding emission caps, set above current levels
2. Sum of CIBs must lie within globally available headroom
3. Emissions must be monitored and verified
4. Payment for surplus allowances is contingent on investment of funds in low-carbon technologies and future tightening of caps

Moving from illustrative examples to country-level analyses

This paper analyses CIBs using illustrative examples of Turkey, South Korea and Mexico. The next step will be to expand this analysis to other developing countries and then integrate national

marginal abatement cost curves to estimate actual emissions based on expected domestic abatement and international financial flows. Estimates of international financial flows will also enable a second level of analysis centered on projections of expected domestic banking of and international demand for CIB allowances. Lastly, we welcome any feedback on designing mechanisms for oversight and compliance.

In the final analysis, however, the verdict is already clear: Clean investment budgets increase the chances of avoiding dangerous climate change by rewarding countries that adopt caps. The earlier they take a cap, the greater rewards they will receive and the more competitive they can be in the global market.

Appendix

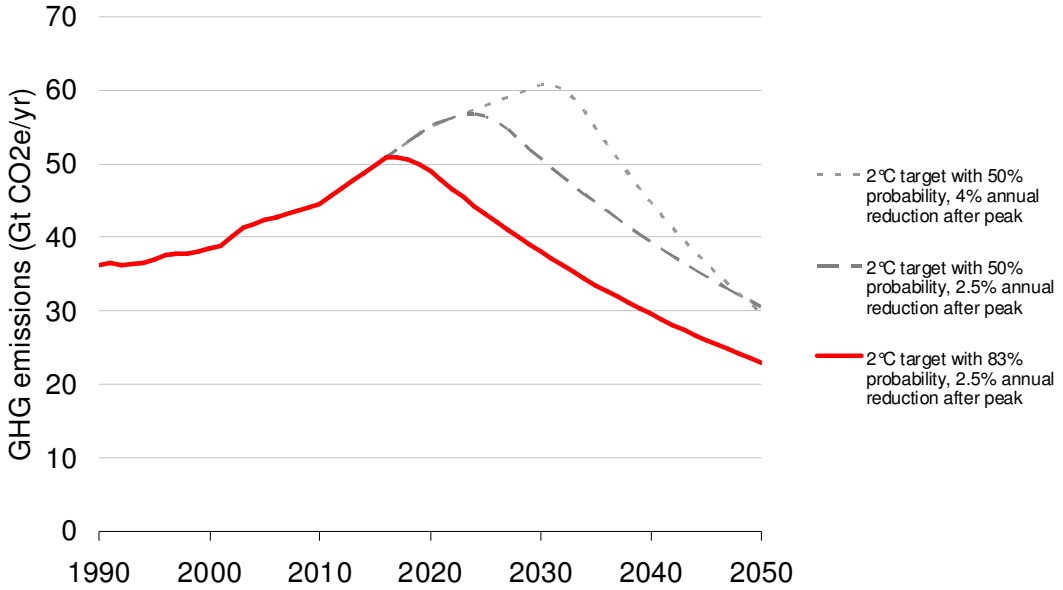
Our analysis follows Wang *et al.* (2007) and Meng *et al* (2007). We determined global emission reduction pathways using the MAGICC model of greenhouse gases and climate (Wigley and Raper, 2002; Wigley et al., 2002; Wigley, 1993), assuming the range of climate sensitivities recommended in the IPCC Fourth Assessment Report. The emissions in this paper include the six Kyoto gases (CO_2, methane, nitrous oxide, HFCs, PFCs, and SF_6) and are aggregated into units of CO_2 equivalent (CO_2e) using global warming potential values from the IPCC Second Assessment Report. Emissions of other climatically important gases, including SO_2 and tropospheric ozone precursors, are assumed to follow the median of the IPCC SRES scenarios. Through additional simulations, we found that concurrent abatement of these other gases under a global emission reduction pathway would have only a small effect on temperature, as reductions in tropospheric ozone, a greenhouse gas, offset reductions in SO2, a climate cooler.

The global emission reduction pathway considered in this paper avoids 2 degrees Celsius of warming with a probability of 83% and a maximum annual emissions reduction rate of 2.5% after the peak. Various authors, including O'Neill and Oppenheimer (2002) and Oppenheimer and Petsonk (2005), have identified a warming of approximately 2˚C above pre-industrial as a threshold beyond which the risk of dangerous climate change increases significantly. The pathway transitions from a peak to the maximum rate of reduction over a period of five years and corresponds to a total budget of 2337 $GtCO_2e$ between 1990 and 2050, with 1638 $GtCO_2e$ remaining from 2008 onwards.

Note that we focus on concentration peaking pathways, rather than concentration stabilization pathways, in this analysis, similar to Wang *et al.* (2007) and Meng *et al* (2007). Although stabilization pathways have been more commonly discussed in the scientific and policy arenas, there is no physical basis for ignoring the multitude of other possible pathways that avoid dangerous levels of warming. Frame et al. (2006) have pointed out that concentration stabilization pathways are somewhat artificial and that it would in practice be difficult to maintain a steady concentration level indefinitely. Peaking pathways have the additional benefit of allowing the possibility to bring concentrations, and eventually temperature, back down to or below today's level. Peaking pathways have been suggested recently by den Elzen and van Vuuren (2007) as a more cost-effective alternative to stabilization pathways. However, care should be taken to avoid an excessively high *rate* of warming in the near-term from a peaking pathway that may be acceptable in terms of the long-term *total* warming. Note that the main pathway we consider in this paper, which gives an 83% likelihood of avoiding 2 degrees of warming, entails a level of emissions reduction by 2050 equal to about 35% below 1990 levels globally. This is comparable to a concentration stabilization pathway that gives a roughly 50% likelihood of avoiding 2 degrees of warming (M. Meinshausen's 450 ppm CO_2e pathway that overshoots to 500 ppm, available at www.simcap.org).

The graph below also shows sensitivities around the probabilities of achieving 2 degrees Celsius (shifts in the downward-sloping path) and maximum annual reduction rates after the peak (changes in the slope)

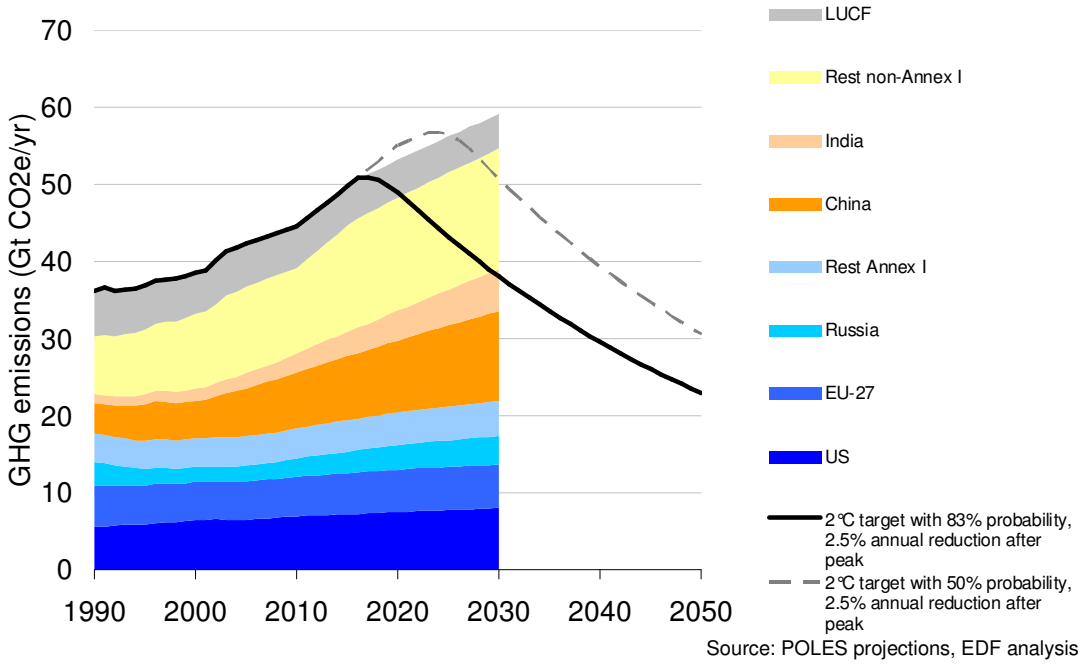
Figure 6: Global emissions reduction pathways



Source: POLES projections, EDF analysis

We estimated historical emissions through 2000 with emission data from the World Resource Institute's CAIT database, supplemented by newly available land use change and forestry (LUCF) data by Houghton (2008). CO_2 emissions data from 2000 through 2030 come from POLES estimates via WRI's CAIT database, supplemented by EPA data for non-CO_2 gases. We take Houghton (2008)'s LUCF through 2005 and then extrapolate linearly through 2030 using the last year's rate of change. The following graph displays the resulting business-as-usual calculations for large emitting countries and LUCF.

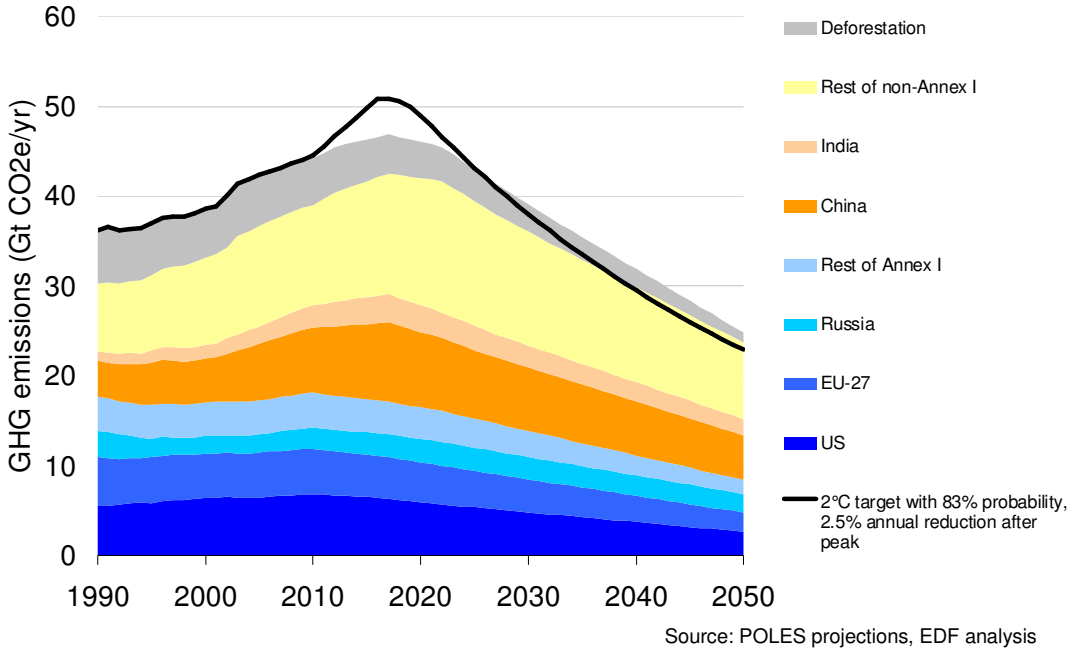
Figure 7: Global emissions at BAU



Source: POLES projections, EDF analysis

We then estimate emission paths under the global pathway in line with assumptions by Meng *et al* (2007). The assumed national emission reduction pathways result in cumulative emissions of 2348 $GtCO_2e$, close to the global cap of 2337 to result in no more than 2°C of warming.

Figure 8: Global emissions reduction paths to avoid >2°C



Source: POLES projections, EDF analysis

We base CIB calculations for Turkey, South Korea and Mexico in the text on business-as-usual POLES projections through 2017 and a price of $30/$tCO_2e$.

The sooner countries limit their emissions, the more likely it is that the world will stay on a path to avoiding catastrophic climate change.

EDF (1998) first proposed the idea of clean investment budgets in all but name. Oppenheimer and Petsonk (2004), among others, further developed the concept.

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[i] The authors are, respectively, an economist and an atmospheric scientist at Environmental Defense Fund in New York. The document was written with invaluable support from Jennifer Haverkamp, Annie Petsonk, Clare Sierawski, all at Environmental Defense Fund, and Kyle Meng, Columbia University. The authors wish to recognize Dr. Daniel Dudek, who first proposed the concepts on which this paper is based. Contact: gwagner@edf.org and jwang@edf.org.

[ii] Five key elements for emissions trading markets to operate with environmental and economic integrity: 1. Measurement (quantifying emissions accurately), 2. Transparency (publicly available program, including tracking of emissions and transactions), 3. Accountability (holding participants accountable for meeting their goals), 4. Fungibility (exchangeability, i.e., one ton of absolute reductions below a cap is fully tradable with another such ton, with minimal constraints on the transaction) and 5. Consistency (governments establish durable programs and refrain from changing parameters except in accordance with previously announced rules). See EDF (1998).

[iii] This assumes a middle-of-the-road IPCC SRES projection (B2 MESSAGE scenario) for non-Annex I countries after year 2030 and a POLES projection before 2030. Please see the appendix for more details on our analysis.

[iv] See *Framework Convention on Climate Change*, *supra* note 1, preamble and articles 3-4, 31 I.L.M. at 851-56.

[v] Note that what is critical for achieving the 2°C limit is the cumulative budget through 2050 (the area under the black curve) rather than the exact shape of the curve.

[vi] Clean investment budgets are sometimes also referred to as "premium emissions" or "growth" budgets.

[vii] See analysis in section on "Sufficient headroom even for larger emitters to take a clean investment budget" below.

[viii] The exact percentage increase over current levels would need to be negotiated. For simplicity, we set it at 38% above 2005, corresponding to POLES projections for 2018 at which point the cap would start to decline.

[ix] Both percentage increases for South Korea and Mexico are again set here at levels corresponding to 2018 POLES business-as-usual projections. The exact percentage increase would need to be negotiated.