Development without Carbon as Climate Policy

by

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1. Mitigation, Adaptation, and Poverty Reduction

There was a time when climate policy was strictly about reducing current greenhouse gas emissions. Over the past decade, mitigation has been paired with adaptation to protect against unavoidable damages from climate change, and those twin priorities have dominated international climate negotiations and the academic analyses of climate policy issues. Today, however, a third imperative, the eradication of energy poverty, is elbowing for space in the climate policy agenda. One-fifth of today's global population lacks access to electricity; two-fifths rely on traditional biomass for cooking and heating; and an even larger share has only very limited access to modern energy systems (IEA 2010b). Poverty reduction requires improved access to modern energy. But without a strong and well-funded policy initiative, eliminating energy poverty is very likely to increase greenhouse gas emissions.

Improved energy access for the poor links climate policy with development policy, drawing attention both to opportunities for harmony – economic development can reduce vulnerability to climate damage, and many climate adaptation initiatives have co-benefits that improve living standards in poor communities – and for dissonance. Without policy intervention, economic development and improved energy access are likely to increase carbon dioxide (CO_2) emissions, but abandoning those goals to hold down emissions is neither fair nor politically viable. Thus it is hard to imagine an international climate agreement that does not provide for sustainable low-or-no-carbon development – here referred to, for simplicity, as "development without carbon." Countries that, to date, have emitted very little should not have to choose between economic development and climate protection.

Indeed, the very crux of climate negotiations is the meaning of the term "common but differentiated responsibilities" in the Kyoto Protocol (United Nations 1997) and its implications for rich and poor countries in terms of mitigation and climate finance. Because CO_2, once emitted, persists in the atmosphere for a century or more, many argue that there is a fixed budget for 21st century cumulative emissions – a 100-year global total of emissions that cannot be exceeded while avoiding dangerous climate change (see, for example, German Advisory Council on Global Change 2009). This budget has been estimated at approximately 2,000 Gt CO_2-e (Bowen and Ranger 2009).[1]

Since this budget is far below global business-as-usual emissions, it requires significant changes. Who gets to emit how much? More specifically, how will the economic burden of climate change – mitigation and adaptation costs, together with residual climate damages – be shared among nations? And how will economic growth in developing countries be balanced with global emissions mitigation?

Taking developing countries' right to future emissions as a given (a topic discussed in detail below), economic development in the poorest countries requires more stringent mitigation actions by their richer neighbors, both to reduce industrialized countries' emissions and to provide funding for emissions reduction measures in the developing world. The opposite, of

[1] CO_2-equivalent (CO_2-e) emissions include non-CO_2 greenhouse gases (such as methane) measured in CO_2 equivalents.

course, is also true: Projections of slow economic growth in the developing world would tend to create the expectation that the poorest countries will use up a relatively small share of the global 21st century emissions budget, leaving more "emissions space" for the high and middle-income countries. Assuming that economic development will fail or falter has the effect of weakening the urgent call for rich countries to reduce their emissions.

This article examines the implications of making poverty reduction (including, but not limited to, the alleviation of energy poverty) a central goal of climate policy. The next section reviews recent literature connecting climate, poverty and energy. Section 3 establishes equity's critical role in climate policy, looking at developing countries' right to both a higher standard of living and continued greenhouse gas emissions. Section 4 demonstrates the importance of economic growth assumptions in climate modeling, and the impact that these assumptions have on business-as-usual emission projections and consequent mitigation goals. A final section offers policy recommendations for climate-economics modeling.

2. Climate, poverty, energy

Improved access to modern energy resources is essential to development (CCD 2009; UNEP 2011). The traditional fuels used by the poor can be expensive as a share of their incomes, or require a great deal of labor (e.g. gathering firewood), and they often carry terrible health costs, especially for women and children, as with unimproved biomass cooking and heating fuels (Saghir 2005). Time spent gathering fuel and performing manual labor that could be replaced by mechanical power (food grinding, threshing) also prevents women and girls from engaging in employment and education (UNDP 2005; Keam and McCormick 2008). The co-benefits of improved access to modern energy sources include enormous reductions in indoor air pollution and decreased pressure on ecosystem health (Lambe and Johnson 2009; CCD 2009).

The importance of energy to development, and of development to reducing climate damage vulnerabilities, is well established, but one interconnection has been relatively unexplored until recently. What impact will development have on emissions mitigation efforts? Several recent publications remark on this disconnect, sometimes suggesting that the reputation of biomass as a "carbon neutral" fuel – now debunked as the role of black carbon has become better understood (Gustafsson et al. 2009) – may go part way towards explaining the dearth of analysis (CCD 2009). After all, countries with very low energy use and a well-known reliance on a "green" fuel would hardly be seen as priority targets for the limited emissions mitigation funds available (Sagar 2005).

There is an expanding literature aimed at closing this research gap by exploring the interconnections between increasing energy access, alleviating rural poverty, and mitigating climate change, sometimes called the "energy-poverty-climate" nexus (Casillas and Kammen 2010). A statement by Rajendra Pachauri, chair of the Intergovernmental Panel on Climate Change (IPCC), has been widely cited in this regard: "Providing an adequate supply of energy to the poor should be a key priority. Without it there can be no talk about eliminating poverty in the world."[2] Climate policy is incomplete without a low-carbon solution to energy poverty.

Other recent reports come to this same conclusion from a slightly different vantage point. The Economic Commission for Latin America and the Caribbean's report on the economics of climate change in Latin American and the Caribbean (ECLAC 2010) concludes that a "sustainable, adaptive, low-carbon, socially inclusive development strategy must ... be designed and implemented. This strategy must be based on an awareness that forms of economic growth that do not take into account climate-related phenomena and considerations of equality will carry a high level of risk that is quite likely to prove to be unsustainable in the long run" (p.103). Even in developing countries with relatively strong economic growth, there is a need to balance solutions to energy poverty with emissions mitigation.

In the poorest countries, scarce resources may impose a choice between immediate development needs and the longer-term threat of climate change (IEA 2010a). Climate protection requires near-complete decarbonization worldwide, but it does not require that every country pay for its own emissions mitigation. If the cost of both innovation and implementation necessary to decouple economic growth from emissions growth is not shared — with rich countries assuming the responsibility for a large share of the burden — the viability of global low-emissions trajectories may be called into question. The IPCC's Special Report on Renewable Energy Sources and Climate Change Mitigation (Chapter 9, Sathaye et al. 2011) asserts that investment in renewable energy can decouple the correlation between rising incomes and rising greenhouse gases, while improving energy access for the poor. Lambe and Johnson (2009), in contrast, question whether any country has ever truly decoupled economic expansion from growth in energy consumption without outsourcing its most polluting industries. The relationship between perceived decoupling and the importation of goods and services containing embedded energy and emissions is under-explored.

Key questions that emerge from this literature are: How can developing countries achieve economic growth without increasing emissions? What national and global policies can effectively link development and climate policies? And how can secure, affordable, sufficient, low-carbon energy sources be assured? If we assume that developing countries will achieve significant economic growth over the next century, the emissions intensity (kg of CO_2-e released per dollar of gross domestic product (GDP)) of this growth becomes critical to the success of global mitigation policies. If China were to maintain its current emissions intensity through a few more decades of rapid growth, its per capita emissions would come to resemble those of the highest (per capita) emitters today: Bahrain, Kuwait, and the United Arab Emirates (Stanton 2011; see also Olivier et al. 2011). If, on the other hand, China — together with all of the low and middle-income countries — is able, through its own efforts and financial support from the high-income countries, to lower its emissions intensity even as its economy grows, climate policy has a chance for success.

[2] "Vienna Energy Conference calls for shift to low-carbon green industries," United Nations Industrial Development Organization, June 22, 2009. Available at http://www.unido.org/index.php?id=7881&tx_ttnews[tt_news]=360&cHash=b32ae1b88f.

3. What is fair?

There are two normative principles at work in the discussion of development without carbon: equity requires development; and equity requires common but differentiated responsibilities. (A third principle, that equity is a social good and an appropriate goal for public policy is here taken as a given.) The principle that equity requires development is enshrined in the Millennium Declaration, adopted by the General Assembly in the United Nations in 2000, which asserts a set of commonly held objectives for development and poverty eradication, stating: "We are committed to making the right to development a reality for everyone and to freeing the entire human race from want."

The United Nations, together with the Organization for Economic Cooperation and Development (OECD), the World Bank, and the International Monetary Fund, went on to establish a set of eight Millennium Development Goals (MDGs)[3] that incorporate measurable indicators for progress. The MDGs include the eradication of extreme poverty, a substantial reduction in child mortality, and the objective that environmental sustainability be integrated with development; many of the MDGs targets — officially set in 2000 — are meant to be achieved by 2015. According to the 2011 MDG progress report (United Nations 2011), the world is on target to meet some of the goals, while on others, it is lagging behind. For the poorest of the poor, obstacles to development have proved intractable, and the MDGs will remain aspirations long after 2015 has come and gone.

The importance that a clean and healthy environment has in achieving development goals is a key thread in the MDG literature. Rockström et al. (2005) argue that environmental sustainability has an important role in the achievement of all the MDGs, and the IPCC's Special Report on Renewable Energy Sources and Climate Change Mitigation (Chapter 9, Sathaye et al. 2011) describes numerous synergies between renewable energy and sustainable development. Moreover, development is widely seen as a way to reduce vulnerability to climate change (see UNDP n.d.; Davidson 2003) — a premise that explains the coincidence of so many climate adaptation goals with development goals.

Development without carbon starts with development, best described as progress towards MDG targets or measured in terms of human development (UNDP 2011), but very often summed up in terms of the growth of per capita income in PPP terms.[4] Critiques of per capita GDP as a summary measure of development abound, but have failed to dethrone it, at least in the field of economics. (See Sen 1999; UNEP 2011, among many other important works, for a more nuanced discussion.) Economic development is necessary — but not sufficient — to improving the quality of life in poor communities. If development is a right, then so too is economic growth up to some threshold.

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[3] To learn more about the MDGs, go to http://www.un.org/millenniumgoals.

[4] A country's per capita income in PPP terms is the cost of buying the country's current standard of living at U.S. prices – which are often higher than developing country prices for locally produced goods and services. For a more detailed definition, see the World Bank Development Education Program glossary: http://www.worldbank.org/depweb/english/beyond/global/glossary.html.

A second normative principle upholds the development without carbon approach: Equity requires common but differentiated responsibilities in climate policy. This principle was first articulated in the 1992 Rio Declaration on Environment and Development, which stated: "In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command." (United Nations 1992) The Kyoto Protocol to the United Nations Framework Convention on Climate Change (United Nations 1997) echoed this language, renewing this principle in the specific context of climate change.

These assertions are based on a long-run view that acknowledges that not every person, or every country, has had an equal responsibility for causing the climate problem. The high-income countries emitted 62 percent of cumulative global emissions in the period from 1980 to 2007; the middle-income countries, 35 percent; and the low-income countries just 2 percent.[5] (In 2005, these groups accounted for 18, 67, and 15 percent of the global population, respectively (UN-DESA 2011).) In 2005, CO_2-e emissions per person ranged from 70.5 tons in Qatar to 0.4 tons in Burundi and Rwanda. If anyone has a right to continued greenhouse gas emissions, surely it is the group that has emitted the least to date.

An equitable climate policy cannot make the same requirements of developing countries that it does of industrialized countries (Modi et al. 2005). The 2009 Copenhagen Accord reaffirmed this basic principle, and established the Green Climate Fund as a financial mechanism to support mitigation and adaptation in developing countries (for documents on the design of the Green Climate Fund, see UNFCCC 2011).

Though the MDGs do not include a direct mandate to reduce energy poverty, a subsequent literature following on the MDGs has made this relationship clear (Rockström et al. 2005). The United Nations' own Millennium Project has called for energy services to be placed on a par with other MDGs, noting that lack of access to energy services impedes the eight original MDGs (Modi et al. 2005). More recently, the Commission on Climate Change and Development (CCD 2009) has drawn out the connections between emissions mitigation and the eradication of energy poverty in detail, concluding that "developing countries and especially [less developed countries] have the right to use their emission space in any future climate agreement for significant increases in energy consumption while industrial countries rapidly decrease their emissions." (CCD 2009, 63)

There can be no single, definitive answer to what is right or fair in climate policy, and much has been written about the equitable allocation of future emissions (Saran 2010). One of the

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[5] Countries were assigned to their income categories according to the divisions between income groups for the World Bank's income-level classifications (http://data.worldbank.org/about/country-classifications/country-and-lending-groups); this categorization differs from that reported by the World Bank, which is based on incomes for an earlier year. One revision was made to the World Bank classification system: The upper bound for incomes in the low-income group was raised from $1,005 to $2,000. Note that here, and throughout the original socio-economic projections presented in this report, 2005 world totals are slightly lower than in the original data. A small number of countries have been removed from the dataset due to missing underlying data for GDP, population, or emissions. The dataset used here includes 176 countries. Emissions data are for total greenhouse gas emissions – including non-CO_2 gases (World Resources Institute's Climate Analysis Indicators Tool. CAIT 8.0. http://cait.wri.org/).

simplest, most transparent approaches to climate equity allocates emissions on an equal per capita basis, where each country's emission budget is the sum of its residents' individual emission rights (Agarwal and Narain 1991; Narain and Riddle 2007). Some proposals assert developing countries' right to emit up to the current average per capita emissions in industrialized countries, agreeing to lower the former in step with the latter (Singh 2008). Others stress the importance of basing policy on individual, rather than average national emissions, excusing individuals with emissions lower than the per capita target from engaging in any mitigation activities (Chakravarty et al. 2009), or emphasize the need to base allocations on historic, and not merely current, emissions contributions (Müller, Höhne, and Ellermann 2009).[6]

Prominent among emission allocation proposals is the Greenhouse Development Rights (GDRs) framework (Baer et al. 2008), which sets a global emissions budget and then distributes the abatement costs necessary to staying within that budget on the basis of two factors: a country's ability to pay — taking income distribution within countries into consideration — and its responsibility for past and current emissions. When all global mitigation measures are viewed as joint, collective responsibilities, the question of where in the world emissions (or emissions reductions) will take place becomes secondary to the question of how much each country will contribute to the common pool of funding.

Using the GDRs approach, emissions reductions will begin wherever the costs of abatement are especially low, with the cheapest abatement measures, anywhere in the world, addressed first and the most expensive last.[7] Low-income countries have little or no responsibility to pay into the abatement funding pool because any contribution is unaffordable to the portion of their populations living in poverty, and because their historical greenhouse gas emissions have been infinitesimal. As countries develop, so does their contribution, but in proportion to the share of their population with incomes above a minimum acceptable standard of living.

The Climate and Regional Economic Development (CRED) model (Ackerman, Stanton, and Bueno 2011b; 2011a) takes a similar approach, paying abatement costs out of a common pool and assigning contributions to that pool based on average per capita consumption in a country or region. CRED is a welfare-optimizing integrated assessment model that allows for cross-regional investment between rich and poor countries. Following the mainstream economic principle of diminishing marginal returns, increasing incomes in poor countries does a lot more to raise social welfare than does increasing incomes in rich countries. In CRED's optimal climate policy, therefore, high-income regions contribute the bulk of funds in the common abatement pool and simultaneously invest in poverty reduction in low-income regions.

All of these emissions allocation systems share a few common principles:

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[6] For contrasting viewpoints on the best way to achieve emissions reductions see Hare et al. (2010) and Rayner (2010).

[7] See Vogt-Schilb and Hallegatte (2011) for a discussion of exceptions to this "marginal abatement cost curve" approach.

- The allocation of future emissions should follow some normative, rule-based standard for equity.
- Poorer countries have a special right to future emissions.
- Richer countries have a special responsibility for paying for mitigation.

Future allocations will have to balance these standards for equity with the need to keep cumulative emissions low. The next section discusses the available emissions budget consistent with avoiding dangerous climate change, and the importance of projections of economic growth in predicting the likely scale of future emissions, both with and without policy intervention.

4. A finite emissions space

Goals for greenhouse gas emission reduction are set in relation to expected future emissions in the absence of climate policy, often called business-as-usual emissions. The lower, or more optimistic, the business-as-usual forecast of future emissions, the less urgency there is for mitigation policy, and the more lax emission reduction goals can be. (Put another way, the smaller we think that future emissions will be without climate policy, the smaller our policy actions need to be to reduce those emissions – wishful thinking leads to poor planning.) The pace of economic growth in the developing world is a critical, but little discussed, element in determining the overall scale of 21st century cumulative emissions. And cumulative emissions are one of the most important indicators of the likelihood of limiting the increase in global average temperatures to 2°C, a well-established climate policy goal.[8]

Business-as-usual emission projections are based on expected economic growth and expected changes to emissions intensity. Projections of emissions under a given mitigation scenario begin with the business-as-usual trajectory, then show the effect of slowing economic growth and accelerating emissions intensity reductions. The higher the business-as-usual emissions, the more ambitious climate policy must be to provide a good chance of avoiding dangerous climate change.

Bowen and Ranger (2009) estimate that the emissions budget for keeping global average temperature increases below 2°C is about 2,000 Gt CO_2-e emitted cumulatively during the 21st century, including both CO_2 and other non-CO_2 greenhouse gases such as methane and nitrous oxide.[9] Given such a budget, country-level emissions can be viewed as a “zero-sum game.” In other words, the more that any one country emits, the less that remains for other countries. If the poorest economies don’t grow very much, they won’t use up much of the remaining budget – leaving more for today’s industrialized global North and the newly industrializing countries in the global South. The assumption of slow economic growth in

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[8] See Allison et al. (2009) and German Advisory Council on Global Change (2009).

[9] Estimates in Bowen and Ranger (2009) range from 1,908 to 2,684 Gt CO_2-e. See also Allan et al. (2009), Anderson and Bows (2011), Gohar and Lowe (2009), Lowe et al. (2011), and Meinshausen et al. (2009). For a meta-analysis of allocation approaches used in stabilization scenarios see Den Elzen and Höhne (2010).

the poorest countries has the effect of lowering expectations for emissions reductions in the rest of the world. An example will help to illustrate this concept.

Imagine if – out of an illustrative 10 Gt budget – the lowest income countries' economies were expected to grow so quickly that their emissions would total 9 Gt during the 21st century, leaving just 1 Gt for richer countries to emit – a very small budget that would require extremely steep emissions reductions. If, on the other hand, the least developed countries were expected to have slow economic growth, they might emit only 1 Gt, leaving a 9 Gt budget for richer countries. In this second scenario, there would be much less pressure on richer countries to lower their emissions, and their target level of annual emissions could be much higher. What we anticipate about developing countries economic growth and future emissions affects how big of an emissions budget richer countries can claim for themselves. (Of course, this assumes that developing countries have a right to a certain amount of emissions.)

Assuming slow economic growth in the poorest countries would mean a larger emissions budget – and weaker targets for emissions reductions – for the rest of the world. What do actual climate-economics models assume about economic development? The twelve integrated assessment models of climate and economy compared by the Energy Modeling Forum's (2009) portray a rapid pace of economic growth in China and India: on average across these models, mean 21st century annual growth of GDP per capita is 3.7 percent for China and 3.1 percent for India.[10] But for the rest the developing world, these models have a very different expectation; average annual 21st century income growth (averaged across the EMF models) is 1.7 percent for the world as a whole and 1.8 percent for the world excluding China, India, the European Union, and the United States.

With the exceptions of China and India, climate-economics models expect tepid growth in the developing world over the next century. Today, U.S. average income is 9.0 times higher than that of the world excluding China, India, the European Union, and the United States. By 2100, these models expect the United States to be only 4.9 times higher; incomes move in the direction of greater equity, but that convergence is limited and pessimistic. If instead China's expected growth rate were ascribed to the rest of the developing world, their average income per capita would surpass that of the United States by the end of the century. Using India's expected growth rate, the ratio would be 1.1-to-1 in 2100 – very near to parity.

Climate-economics analyses model limited income convergence, not sufficient to raise the poorest countries out of poverty. Whether or not the rest of the developing world can match China and India's growth is not known, but certainly the potential exists for the least developed countries to grow more quickly than currently assumed. Low-growth expectations for poor countries translate into low business-as-usual emissions projections in

[10] China's 21st century annual growth of GDP per capita ranges from 2.7 to 4.4 percent across EMF models; India's growth ranges from 2.7 to 3.4 percent. EMF model inputs in 2005 US$ MER terms. Models compared are: ETSAP-TIAM; FUND; GTEM; IMAGE; MERGE Optimistic; MERGE Pessimistic; MESSAGE; MiniCAM-BASE; MiniCAM-LoTech; POLES; SGM; and WITCH. EMF input data available at http://emf.stanford.edu/events/emf_briefing_on_climate_policy_scenarios_us_domestic_and_international_policy_architectures. See also Gurney et al. (2009).

climate-economics models. With less (assumed) competition for future emissions space, rich countries can loosen their belts, expecting to receive a bigger piece of the pie.

5. Discussion and policy recommendations

Is there a path forward that balances climate and development (where development includes an end to energy poverty)? At present, most climate-economics models skirt this issue by implicitly treating the economic development of the poorest countries as if it were doomed to fail. This approach is overly simplistic and short-sighted: it either consigns the poor to remain poor for the next few generations at a minimum, or assures a failure of climate policy by failing to anticipate economic development.

Here are a few questions that the next generation of economic analyses should be asking and attempting to answer:

Can development derail climate policy? It is possible that, either on their own or with financial support from the international community, the poorest countries could follow India and China on a path to prosperity? Without targeted funding to support emissions intensity reduction while simultaneously alleviating energy poverty, this optimistic economic development scenario seems very likely to result in higher developing-country emissions. Meanwhile, if rich countries set weak mitigation targets for themselves, based on bad economic advice that assumes a pessimistic growth scenario for developing countries, the 21st century emissions budget is sure to be busted. In this manner, successful development (in combination with poor foresight) could indeed derail climate policy.

Can climate policy derail development? A global climate policy powerful enough to force developing countries to slow growth is hard to imagine, given the mood and track record of the international negotiations process. In theory, strongly enforced per country or per person emissions caps, enacted without supporting policy to aid reductions in emissions intensity, could slow or even stop economic growth in poor countries. In practice, this outcome is of most use as a counterfactual – a description of a world no one wants or expects. To make strong climate policy and strong economic development compatible will require significant investment in measures to support income-driven reductions to emission intensity.

A recent Center for Global Development working paper (Wheeler 2011) finds that developing countries accounted for 47 percent of the global increase in low-carbon energy generation from 1996 to 2002, and 68 percent of the increase from 2002 to 2008. The study concludes that developing countries are already full participants in emission mitigation, and bear a fair share of emission reduction expenditures, and goes on to issue this challenge to rich countries on behalf of poor countries: “We are willing to assume our fair share of the mitigation expenditure burden, as we have in the past. If you invest more aggressively in low-carbon energy, we will match you and maintain our fair share of the global expenditure burden. But you can scarcely expect us to pay a greater share of our incomes than you do, particularly since you have created more than your fair share of the problem” (p.8). This would serve as a good summation of the dynamic between the poor and the rich in climate policy negotiations, if only the “poor” were exemplified by China and India.

In 2010, China contributed the greatest share of global investment in renewable energy, followed by Germany and the United States. New investments in renewables in China and India represented a 28- and 29-percent increase over 2009, respectively (UNEP 2011). China and India's expected economic growth through 2020 is 8.3 percent per year, compared to 3.3-percent growth for non-OECD countries excluding China and India. The burdens and aspirations of China and India are not the burdens and aspirations of the rest of the developing world. In 2005, more than half (54 percent) of the low- and middle-income countries' populations did not live in China and India; in 2105, this share is expected to have grown to 71 percent.

For much of the rest of the developing world (and for the many very poor citizens of China and India), a fair interpretation of common but differentiated responsibilities is this: They have every right to continued economic growth, very little history of past emissions, and somewhere between very little and no responsibility to pay for future emissions mitigation. Taking such a pro-development stance seriously in climate-economics modeling requires an examination of the impacts of faster economic growth in developing countries.

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