

A Way Forward Working Paper #1

Advancing Development Goals in a Sustainable Manner:

Options and Implications for Post-2012 International Climate Change Efforts

November 2007

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Abbreviation and Acronyms

| | |
|---------------------|--|
| AAU | Assigned amount units |
| AR4 | Fourth assessment report |
| ASEAN | Association of Southeast Asian Nations |
| BRICSAM | Brazil, India, China, South Africa and Mexico |
| CDM | Clean development mechanism |
| CER | Certified emission reductions |
| CIS | Commonwealth of Independent States |
| CO ₂ | Carbon dioxide |
| CO ₂ -eq | Carbon dioxide equivalency |
| COP | Conference of the Parties |
| EUA | European Union Allowance |
| ERU | Emission reduction unit |
| G8 | Group of Eight |
| GDP | Gross domestic product |
| GEF | Global Environment Facility |
| GHG | Greenhouse gas |
| HFC | Hydrofluorocarbon |
| IEA | International Energy Agency |
| IISD | International Institute for Sustainable Development |
| IMF | International Monetary Fund |
| IPCC | Intergovernmental Panel on Climate Change |
| LDC | Least developed country |
| MDB | Multilateral Development Bank |
| MDG | Millennium Development Goal |
| Mt | Megatonne |
| N ₂ O | Nitrous oxide |
| ODA | Official development assistance |
| OECD | Organization for Economic Co-operation and Development |
| PDD | Project design document |
| PNG | Papua New Guinea |
| ppmv | parts per million by volume |
| SD-PAM | Sustainable development policies and measures |
| SO _x | Sulphur oxide |
| UNDP | United Nations Development Programme |
| UNFPA | United Nations Population Fund |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WSSD | World Summit on Sustainable Development |

1.0 Introduction

At the 11th Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in Montreal, 2005, Parties agreed to initiate a dialogue on long-term cooperative action by enhancing implementation of the Convention (UNFCCC 2007b). That dialogue, while undertaken without prejudice to any future negotiations, commitments, process, framework or mandate under the Convention, was widely understood as a first official step in thinking about what sort of climate change regime might succeed our current efforts. It centered on four themes, corresponding to the chapters of the present volume:

- advancing development goals in a sustainable way;
- addressing action on adaptation;
- realizing the full potential of technology; and
- realizing the full potential of market-based mechanisms.

This paper will focus on the first of these themes: advancing development goals in a sustainable way. In doing so it will first frame the terms of discussion, something which has not yet happened at the international level (though there has been broad agreement among participants at the Dialogue's first two meetings on the theme's critical importance). The paper will then suggest a number of elements that might feature in an international approach to climate change that focused on advancing development goals in a sustainable way, and will note what sort of regimes are implied by each. It will end by outlining Canada's interests in the various elements and regimes, and how each would fit with Canada's domestic and international policy objectives.

2.0 Background

The notion that advancing development goals in a sustainable manner should feature as part of an international response to climate change is rooted in the understanding of the fundamental links between climate change and development. The line of reasoning that encompasses those links goes as follows:

- climate change is taking place; action to address it is imperative;
- poverty and inequity exist in unacceptable measure; development that addresses them is imperative;
- economic growth is a means to development—one that will continue to be used in the foreseeable future;
- there are a number of potential conflicts between economic growth and action on climate change;
- but there are synergies between climate change action and *development* actions aimed at both adaptation and mitigation that can contribute to development;
- unchecked climate change will undermine development goals *and* economic growth;
- thus advancing development goals in a sustainable way should be a central part of efforts to address climate change in all countries; and
- therefore there are a number of reasons why the international community should focus in particular on helping achieve this in developing and least-developed countries.

These points will be fleshed out in greater detail in the remainder of this section, in an effort to give some conceptual grounding to the international discussions. To date, there has not been much effort

to explicitly frame the discussions or define objectives, and the resulting talks—while valuable—have been extremely wide-ranging.¹ Such an open-ended dialogue may have been exactly the right starting point from a political perspective, but there will eventually be a need to agree on at least the basis for discussion. The argument that follows aims to contribute to such an agreement.

It is important to note at the outset that when we talk about development goals we are not only talking about development in so-called developing countries. Development as used in this paper means increases in human well-being, and as such it is clearly a key priority of all governments, no matter what their state of industrialization.

2.1 *Climate change is taking place; action to address it is imperative*

The Intergovernmental Panel on Climate Change’s (IPCC) fourth assessment report (AR4) in 2007 effectively put to rest many of the debates surrounding the science of climate change, rendering evidence solid enough to impel action. It found that warming of the climate system was “unequivocal,” and that a number of attendant effects were already observable, including:

- an increase in global average surface temperature over the last 100 years of 0.74 degrees C;
- a decrease in the average extent of mountain glaciers and snow cover in both hemispheres;
- an acceleration in the annual rate of sea level rise from 1.8 mm over 1961 to 2003 to 3.1 mm over 1993 to 2003; and
- more intense and longer droughts over wider areas (IPCC 2007).

Moreover, relative to its 2001 assessment the report expressed increased confidence about the causes of the observed warming, concluding that “most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely*” due to anthropogenic greenhouse gas (GHG) emissions (IPCC 2007: 10).

The International Scientific Steering Committee (2005) meeting in Exeter in 2005 explored the temperature thresholds that could trigger irreversible catastrophic events such as the melting of the Greenland icecap (leading to an eventual seven-metre sea level rise) and the shutdown of the Atlantic thermohaline circulation that warms the North Atlantic countries. They cautioned that temperature rise above 3° C would likely have “serious risk of large scale, irreversible system disruption.”

In the same vein, others have found that such a temperature rise would lead to serious feedback effects, not sufficiently accounted for in most models, such as:

- the thawing of permafrost and drying of peat and wetlands, releasing stores of trapped methane in volumes estimated as equivalent to *twice* the world’s cumulative GHG emissions from fossil fuel burning; and
- reduced ability of the world’s forests to act as carbon sinks, as water scarcity, fires and disease reduce forest area and productivity (Stern 2006: chapter 1, esp. Box 1.3).

Yet a temperature rise of 3° C is squarely within the realm of the possible. The AR4 ran projections across six of the standard scenarios in use since the IPCC’s 2000 report on emission scenarios

¹ There have been some notable exceptions. See Sokona (2006) for an excellent “foundation” discussion.

(IPCC 2000a).² Table 1 shows that for all but the most upbeat scenario a 3° C temperature increase is within the likely range by the end of this century.³

Table 1: IPCC Temperature Change Projections

| Scenario | Temperature Change (C at 2090-2099 relative to 1980-1999) | |
|-------------|--|--------------|
| | Best Estimate | Likely Range |
| B1 | 1.8 | 1.1 - 2.9 |
| A1T | 2.4 | 1.4 - 3.8 |
| B2 | 2.4 | 1.4 - 3.8 |
| A1B | 2.8 | 1.7 - 4.4 |
| A2 | 3.4 | 2.0 - 5.4 |
| A1F1 | 4 | 2.4 - 6.4 |

Source: IPCC (2007: Table SPM-3)

The growing body of scientific evidence has fostered clear international consensus that action is needed. The UNFCCC commits Parties to address climate change, by stabilizing GHG concentrations so as to “prevent dangerous anthropogenic interference with the climate system.” Since the Convention was ratified, the international community has repeatedly affirmed its intention to rise to the challenge at the national and international levels:

- The G8 (2005) (with Brazil, China, India, Mexico and South Africa attending), meeting in Gleneagles in 2005, reaffirmed their commitment to the UNFCCC and its ultimate objective, calling climate change “a serious and long-term challenge that has the potential to affect every part of the globe.” Meeting in 2007, the G8 leaders agreed that in light of current evidence “greenhouse gas emissions must stop rising, followed by substantial global emission reductions” (G8 2007).
- The heads of state of Australia, China, India, Japan, Korea, New Zealand and the ASEAN nations, gathered in Cebu, Philippines in January 2007 recognized “the urgent need to address global warming and climate change,” and committed to “Mitigat[ing] greenhouse gas emission through effective policies and measures, thus contributing to global climate change abatement” (ASEAN *et al.* 2007).
- The Assembly of the African Union, meeting in Addis Ababa in January 2007 expressed its “grave concern on the vulnerability of Africa’s socio-economic and productive systems to climate change and variability and to the continent’s low mitigation and response capacities,” and committed, among other things, “to integrate climate change and climate change adaptation strategies into national and sub-regional development policies, programmes and activities” (African Union 2007).

Commitment to action in most contexts refers to both mitigation of climate change and adaptation to avoid or diminish the impacts of climate change. Throughout this text, reference to climate change actions and objectives should be understood to cover both spheres.

² For a summary of the scenarios used in AR4, see IPCC (2007:18).

³ The likely range of the most optimistic scenario—B1—misses the 3° mark by one tenth of a degree Centigrade.

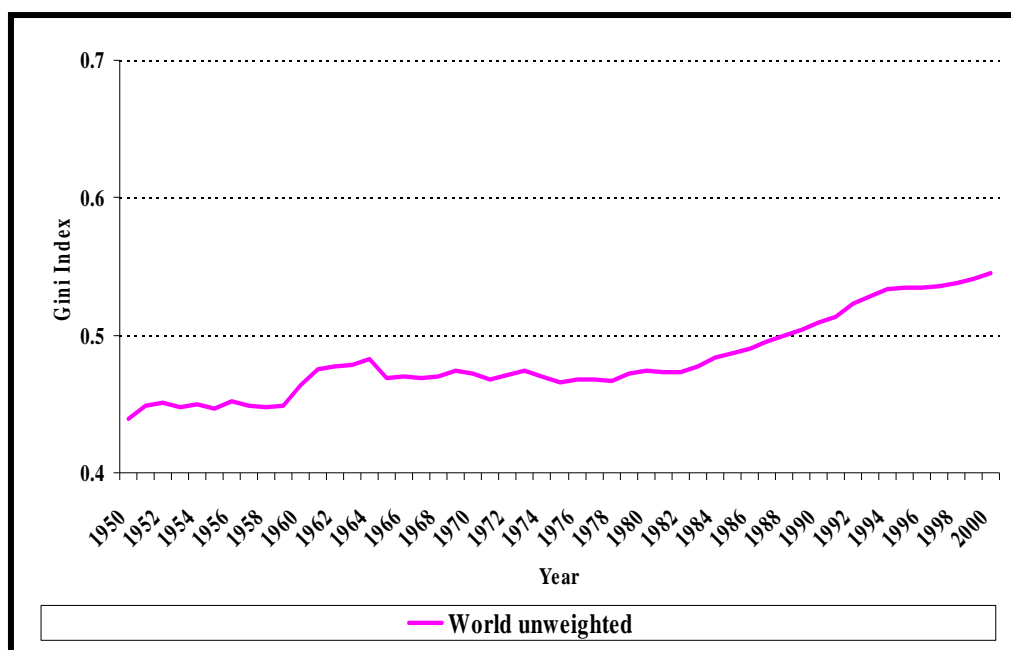
2.2 Poverty and inequity exist in unacceptable measure; development that addresses them is imperative

While strong economic growth in China and India, in particular, has lifted unprecedented numbers of people out of poverty in the last two decades, the World Bank (2006a) still estimates that almost half of the world's population survives on less than \$2 a day.

Poverty and inequity go hand in hand. In dollar terms, the richest five per cent of the world's population controls almost one half of world income, earning in 15 hours what the poorest five per cent make in a year (Milanovic 2005). Access to piped-in water for the richest fifth of world population is at 85 per cent, while for the poorest fifth it stands at 20 per cent (UNDP 2006a). In Sub-Saharan Africa and South Asia 77 per cent and 59 per cent of the population, respectively, do not have home access to electricity—in total over 1.3 billion people (World Bank 2006b).

Neither do the trends in equity give much hope for near-term improvement. Figure 1 shows a clear trend: per capita income differentials between countries have steadily risen over the last half century.

Figure 1: Increasing Global Inequity



Note: The Gini co-efficient is a standard measure of inequity that ranges from a score of zero (complete equity) to 1 (complete inequity). Source: Milanovic (2005).

As with the efforts to combat climate change, there is clear international consensus on the need to address the crisis in development. In 2001, global leaders agreed on a set of goals that defined a way forward: the Millennium Development Goals (MDG), to be achieved by 2015. These went far beyond focusing on income poverty to identify development as including such goals as education, health, gender equality, literacy and environmental sustainability. In launching the global effort, the UN General Assembly (2000: paras. 11 and 12) declared:

“We will spare no effort to free our fellow men, women and children from the abject and dehumanizing conditions of extreme poverty, to which more than a billion of them are currently subjected. ... We resolve therefore to create an environment—at the national and global levels alike—which is conducive to development and to the elimination of poverty.”

2.3 Economic growth is a means to development—one that will continue to be used in the foreseeable future

It was noted above that development goes beyond simply alleviating income poverty. There have been a number of measures of well-being proposed that try to encompass a broader approach, the United Nations Development Programme’s (UNDP) Human Development Index being but one of these.⁴ The MDGs may be the clearest international statement to the effect that development goes well beyond economic growth. Much current thinking follows Nobel Laureate Amartya Sen (1999) in defining poverty as a lack of freedom to pursue life ambitions, and conversely defines development as a process of fostering such freedom.

Yet nevertheless, none of these approaches goes so far as to deny the critical role of economic growth and increased incomes in the development process. In fact the MDGs have addressed income poverty as the first goal. Even Sen allows for the major enabling role of income as a determinant (albeit one of many) of one’s capabilities throughout his work.⁵

So economic growth is important even for development more broadly cast. Moreover, economic growth continues to be of primary importance to national governments, whether in developing or developed countries.⁶ It is still the metric by which progress is conventionally measured. And as much as policy makers might look for growth with a human face, at the end of the day any growth will often be considered better than no growth.

Further, economic growth of one kind or another will continue, at least for the foreseeable future and will persevere as a key element of national development efforts. The International Monetary Fund (IMF 2006) foresees global growth over the next two years at an impressive 4.7 per cent—a rate which would imply a doubling of global gross domestic product (GDP) in 15 years. It is driven by continued surging growth in 2007 in China (9 per cent), India (7 per cent), ASEAN-4 (5.7 per cent) and the CIS (6 per cent). Section 3 will talk at greater length about the details of that growth and its drivers, but the clear message is that it will probably continue to occur, even if possibly not at the dizzying pace seen over the last few years.⁷

2.4 There are a number of potential conflicts between economic growth and action on climate change

This seems to be a fairly straightforward proposition: as the economy grows, so too will GHG emissions. The equation appears simplest for carbon emissions associated with increased use of energy in industrial, residential/commercial (lighting, heating and appliances) and transportation

⁴ Others include, for example, the Human Wellbeing Index (Prescott-Allen, 2001) and the Genuine Progress Indicator (Venetoulis and Cobb, 2004). For a survey of such indicators, see Boarini, Johansson and Mira d’Ercole (2006).

⁵ See Cosby (2005: Section 3.2)

⁶ In countries plagued by poverty and inequity, growth of the pie may be seen as a much easier alternative to more equitably dividing the pie.

⁷ IMF (2006) warns that its projections are subject to risks posed by so-called global imbalances, largely meaning an overvalued U.S. dollar and undervalued currencies in parts of Asia and the Middle East.

sectors. All of these tend to increase with income, other things being equal (Shafik and Banyopadhyay 1992). As such, for example, the International Energy Agency's (IEA's) World Energy Model, used to derive its authoritative projections of energy demand, is based on projected economic growth (along with demographics, fossil fuel prices and technological development) as a key exogenous assumption. The massive reductions in GHG emissions from economies in transition since 1990 have been driven almost entirely by economic crisis involving negative growth rates.

The reality of the impacts of growth is a little more complex. Copeland and Taylor (1994) developed a seminal model that can be used to break down the environmental effects of economic growth into three effects; scale, composition and technique effects:⁸

- As the economy grows, if all technology and production patterns are held constant, we get a sheer increase in scale of production—the *scale effect*. This will always have a negative effect on the environment.
- If growth is accompanied by an improvement of techniques of production, such as increased energy efficiency, then the *technique effect*—which is almost always a positive influence on the environment—comes into play. Drivers include economic incentives and government policies.
- The *composition effect* occurs when growth is accompanied by a shifting of the patterns of production. For example, a given economy may evolve to produce relatively less of a good that is highly polluting, and relatively more of a relatively cleaner good. This effect is not so relevant at the international level, though it can occur in limited ways.⁹

Thus, the final impact of any economic growth is, *ex ante*, indeterminate. It will often boil down to a contest between the scale and technique effects—a contest, however, that is almost always won by the power of scale. That is, the rate of development and dissemination of new technology does not normally keep pace with the rate of growth in scale. For example, the Chinese government's current five-year plan involves a 20 per cent reduction in the energy intensity of its economy—a level of ambition with few international precedents. But over those five years at current rates of growth, China's GDP will be almost 60 per cent larger.¹⁰ Barring any composition effects (and of course assuming the targets can be met), this means an overall increase in energy use of 27 per cent over this period.

The same dynamic can be seen repeatedly over time; for example, the increasing efficiency of automobiles is routinely swamped by increased miles driven.¹¹ In part this is due to an effect known in the ecological economics literature as the “rebound” effect—a derivative of the original “Jevons’ Paradox,” whereby increasingly efficient technology for coal use actually increased the use of coal.¹²

⁸ Their model was originally used to describe the impacts of trade liberalization, but it is also applicable to economic growth.

⁹ The composition effect is usually a response to shifts in comparative advantage among nations—that is, it simply involves shifting to a different division of the same bundle of production among countries.

¹⁰ Assumes an annual rate of growth of 9.625 per cent—the average of 2004 and 2005 (actual) and 2006 and 2007 (projection) figures from IMF² (2006). Copeland and Taylor's conception of the technique and scale effects covered only productive activities (efficiency and scale of production), but the concept here has been extended to cover end-use efficiency as well.

¹¹ For an illustration of this effect in China see IISD (2004: 119 – 122).

¹² For a summary of the modern literature on this subject, see Alcott (2005).

Increased efficiency effectively lowers the price of the associated goods and services, and as the price of any normal good decreases, we consume more of it.

The Organisation for Economic Co-operation and Development (OECD) (1994) notes another type of environmental effect—the regulatory effect.¹³ Economic growth can enrich citizens who will demand better environmental regulations, and can provide governments with the financial resources to propound and enforce them. This is clearly an important consideration in the context of international climate change efforts.

In summary, the overall effects of economic growth will often—but not always—conflict with climate change objectives. This holds true for energy-associated carbon emissions, as argued above. It is also probably true in the context of non-CO₂ GHG emissions, most of which are associated with goods for which demand increases as income rises. Air conditioner ownership in urban China, for example, more than tripled between 2000 and 2007, and with it the production of the GHG HFC-22.¹⁴

2.5 But there are synergies between climate change goals and development

While it may be true that economic growth often conflicts with climate change objectives, this is not necessarily the case for development (which is, in the end, the *object* of growth).¹⁵ In fact there are important synergies between development and climate change objectives.

There are, for example, a number of ways in which development efforts can lead to mitigation:

- Efforts to restore forest cover or avoid deforestation/land degradation, for example, can have significant development payoffs, including reduced time spent collecting fuelwood, reduced indoor air pollution from inefficient biomass use, and flood control in watersheds (Stern 2006: chapter 25). In the process, such efforts also address a source of some 20 per cent of total anthropogenic emissions, reducing GHGs emitted and increasing carbon sink capacity (Baumert *et al.* 2005).
- Efforts to provide energy to the poor constitute development in their own right.¹⁶ If that energy is in the form of renewables (e.g., biogas digesters, micro hydro, solar cookers, photovoltaic (PV) panels), then those efforts will count toward mitigating emissions, compared to a baseline of conventional new energy provision.¹⁷
- Fuel switching efforts may be aimed at reducing the burden of import costs, improving balance of payments and generating domestic employment.¹⁸ At the firm level they may

¹³ Like the framework used by Copeland and Taylor, the OECD framework is meant to describe the effects of trade, but can also serve to describe the effects of economic growth.

¹⁴ See Bradsher (2007). Ownership went from 24.4 per 100 urban households to 87.2. Rural ownership between 1995 and 2005 increased 35-fold.

¹⁵ Development is hereinafter used to mean an increase in human wellbeing.

¹⁶ See WSSD (2002: para. 9); World Bank (2006b); IEA (2004: chapter 10); van Geel (2005); UNDP (2005).

¹⁷ This sort of mitigation *relative to a hypothetical baseline of new energy provision* has in fact been accepted as additional by the Methodology Panel and Executive Board of the CDM. See the important work done by SouthSouthNorth on the theoretical basis and actual calculation of “suppressed demand” baselines (Winkler and Thorne 2002).

¹⁸ Bradley and Baumert (2005) note that Brazil’s ethanol program, replacing petroleum as automobile fuel, has reduced Brazil’s external debt by \$100 billion from the baseline case and created hundreds of thousands of jobs among the rural population. It is also, incidentally, offsetting some 26 million tonnes of CO₂ annually.

simply be about improving efficiency and/or saving on fuel costs. But they can also yield significant emissions reductions.¹⁹

There are also a number of ways in which efforts to mitigate GHG emissions can contribute to development:

- Efforts to achieve energy efficiency have enormous potential to reduce GHG emissions.²⁰ Household energy efficiency programmes can also reduce expenditures on heating and lighting (yielding particularly strong development benefits when targeted at the poor).²¹ And overall energy efficiency, other things being equal, leads to a stronger more competitive economy, with significant economic benefits for all.
- Efforts to avoid the emissions associated with deforestation, as in the provision of improved cookstoves or solar cookers to fuelwood users, can yield significant development benefits as well, including reduced indoor air pollution (Malhotra and Rehman 2004). As noted above, avoided deforestation itself yields a number of development benefits.
- Efforts to capture methane emissions from landfills and livestock operations contribute powerfully to GHG emission reductions.²² Such efforts also reduce odours, and often the containment technologies used significantly lower the risk of leaching and containment spills—a benefit to local populations.

As well as the links to mitigation efforts, development objectives have strong links to adaptation. This stands to reason; the key objective of adaptation measures is to reduce vulnerability to the immiserating impacts of climate change, so any successful adaptation efforts will, by definition, constitute development.

But it is also possible for appropriately designed development efforts to strengthen adaptive capacity while simultaneously achieving their primary objectives.²³ OECD (2005:21) notes that in many cases this does not involve new plans, but rather involves the successful implementation of *existing* plans in areas such as “water or energy conservation, forest protection and afforestation, flood control, building of coastal embankments, dredging to improve river flow and protection of mangroves.” As such, a number of aid agencies are now making efforts to “climate-proof” their programming.²⁴

Just as development has linkages to active climate policies, it also has linkages to the *failure* of climate policies. Many of these are simply the obverse of the links discussed above. For example, as noted

¹⁹ Note the results of the Brazilian ethanol program cited in Bradley and Baumert (2005). UNEP-Risø’s CDM pipeline of projects (www.cd4cdm.org) as of February 1, 2007 showed potential mitigation of 117 million tons of CO₂ equivalent to 2012 from 62 firm-level fuel switching projects.

²⁰ The IEA’s World Alternative Policy Scenario—a scenario of projected policy activism to address energy security and environmental concerns—derives almost 60 per cent of its projected reduction in CO₂ emissions from energy efficiency measures (IEA 2004).

²¹ Cosbey *et al.* (2006), in assessing the development dividend from CDM projects, found that household energy efficiency projects scored higher than all other project types.

²² UNEP-Risø’s CDM pipeline of projects (www.cd4cdm.org) as of October 1, 2007 showed potential mitigation of 258 million tonnes of CO₂ equivalent to 2012 from 354 such projects.

²³ Of course, successful adaptation being development as noted above, there is often no bright line to easily distinguish adaptation objectives from development objectives.

²⁴ See, for example, Danish Ministry of Foreign Affairs (2005). Kjørven (2006) estimates that 27-40 per cent of current donor-funded activities are “climate-exposed.” See also www.iisd.org/security/es/resilience/climate_phase_2.asp on the development of the CRiSTAL tool to screen development interventions for climate change concerns.

above, successful adaptation policies constitute development; it is conversely true that a lack of adaptation policies will lead to mal-development—a decrease in human wellbeing.²⁵

But there are also linkages that are novel. A failure of successful mitigation efforts, for example, will have a number of important development impacts, most of them which also threaten to undermine the basis for economic growth. Kjørven (2006) makes the case that climate change unchecked will seriously undermine the achievement of the MDGs. The scenarios of this type are countless, but a few key examples include:

- Patterns of agricultural production will be disrupted, as producers (who constitute some 40 per cent of the population in developing countries as a whole, and over 80 per cent in some (ILO 2004: chapter 3)) are forced to cope with increased variability and uncertainty of weather patterns. Poor dryland farmers will be heavily affected, and the final effects will directly increase malnutrition and poverty in poor countries (Hadley Centre 2006; Stern 2006: chapter 4; Magrath 2006). Impacts will also be significant for developed country producers.²⁶
- Droughts, floods and extreme weather events will become more frequent and more severe, taking a human and economic toll (IPCC 2007).
- Risk of immiserating vector-borne diseases such as malaria, and diseases based on a lack of potable water, may increase for tens of millions of people (van Lieshout *et al.* 2004).
- Sea level rise will threaten populations and infrastructure in coastal communities worldwide (IPCC 2007).²⁷ The effects of an abrupt disruption—a disaster scenario such as the melting of the Greenland ice sheet—would imply incalculable damage, eventually raising sea levels by up to seven metres (Baer 2007).
- Glacial recession will significantly reduce flows of rivers critical to the well-being of huge swaths of the population in developing countries (Rai 2005; Barnett *et al.* 2005; Chevalier *et al.* 2005).

The failure of adaptation efforts will have effects that amount to intensified vulnerability to the sorts of impacts described above.

2.6 Thus advancing development goals in a sustainable way should be a central part of efforts to address climate change in all countries

There are a number of important elements that should feature in any national and international approaches to address climate change, including a focus on adaptation, the engagement of the private sector and the lowering of costs through the inclusion of market mechanisms, and a focus on development and dissemination of new technologies. These elements are all discussed in the papers that follow this one. The foregoing analysis argues strongly that advancing development goals in a sustainable way should also be central.²⁸

²⁵ See OECD (2005) for case studies of this linkage in action.

²⁶ See Natural Resources Canada (*forthcoming*) for an assessment of the implications for Canadian producers.

²⁷ Also see Dasgupta *et al.* (2007), who calculate conservatively that 56 million people in developing countries would be impacted by a 1-metre sea level rise.

²⁸ In fact, as noted below, there is a great deal of overlap between advancing development goals sustainably and the other elements listed here.

The argument starts with the urgent need for, and the international commitments to, action on both climate change and development. It notes that governments worldwide are pursuing strategies to increase economic growth, which often has inherent conflicts with climate change objectives.

Appropriate development strategies can deal with all of these priorities simultaneously. They achieve the ends for which economic growth is a key means (and potentially alleviate the pressure for such growth). In the process they address climate change objectives by means of the many positive linkages between such development and mitigation. And where development strategies relate to adaptation, they will by definition advance both development and climate change-related goals.

The key is the emphasis on win-win policies that can simultaneously achieve development and climate change objectives. Win-win opportunities will not by themselves take us as far as we need to go in addressing either climate change or development needs,²⁹ but from the perspective of climate change policy they are an obvious starting point.

2.7 The international community should focus on advancing development goals sustainably in developing and least-developed countries

The line of argument laid out in the previous sections holds true for developed countries as well as developing. Economic growth and development are key priorities for policy makers the world over, and climate change impacts will likewise be felt everywhere. In all countries there needs to be a focus on the types of win-win solutions that advance development goals and simultaneously achieve climate change objectives.

That said, as the international community addresses climate change there are a number of reasons why it should focus in particular on advancing development goals in developing and least developed countries (LDCs). First, while it is true that economic growth and development are priorities in all countries, the needs in developing countries and LDCs are on a different scale altogether than that in the developed world. Section 2.2 illustrates the stark nature of poverty as it exists today in the South. Thus, even declarations with global application such as the Millennium Declaration and the Monterrey Consensus on Financing for Development are strongly focused on actions to assist developing and least developed countries (UN General Assembly 2000; United Nations 2002).

Second, current development paths indicate the greatest need for investment to alter energy paths is in developing countries. IEA's (2006) baseline projections predict that between 2005 and 2030 developing countries will account for more than half of the world's increase in primary energy demand and more than 70 per cent of the global increase in GHG emissions.

Third, developing and least developed countries are particularly vulnerable to climate change impacts.³⁰ Many are more exposed to climate change impacts because of their tropical geography. Further, developing countries, and particularly their poorest populations, are generally more sensitive to any climate change impacts, given a high dependence on agriculture, strong reliance on ecosystem services, rapid growth and concentration of population, and relatively poor health. And developing countries generally have less capacity to adapt to climate change impacts, having

²⁹ Michaelowa and Michaelowa (2005) caution, in particular, that much development-related climate change spending might not necessarily mesh with the highest development priorities of the recipient countries.

³⁰ This discussion is based on Stern (2006: 93-99).

inadequate infrastructure (particularly in water supply and management), meager household income and savings, and limited supporting public services.

Fourth, the very countries that are most vulnerable are, for the most part, those that have contributed least to the current atmospheric concentrations of GHGs.³¹ It can be argued that there is therefore a responsibility among the largest historic contributors to assist them in achieving development goals in ways that contribute to adaptation and mitigation goals.³²

Finally, if developing and least developed countries are to contribute meaningfully to efforts toward mitigation of climate change impacts, they will need the strengthened capacity that comes with development. The UNFCCC (Article 3.4) rightly holds, among its principles, that “economic development is essential for adopting measures to address climate change.” That is, countries that experience development are more likely to be able to play a meaningful role addressing the international challenge that is climate change.

3.0 Situating the discussion

When the Kyoto Protocol was negotiated in the late 1990s, the world was a very different place. Those differences have an important bearing on both the prospects for sustainable development globally and for the shape of international efforts to address climate change.

In 1997 India and China were listed among the World Bank’s low-income developing countries, China’s GDP per capita being less than Cameroon’s or Albania’s, and India’s falling below Lao PDR and Benin (World Bank 1997). Brazil’s maternal mortality rate was nearly twice that of Vietnam, at 200 per 100,000 live births, and in South Africa only 46 per cent of the population had access to sanitation.

Figures 2, 3 and 4 show the phenomenal rise of the BRICSAM (Brazil, India, China, South Africa and Mexico) countries into a class of their own as emerging world leaders. Matching their powerful economic growth is a rise in aggregate GHG emissions. China is reported to have surpassed the U.S. in total emissions in 2006 (Netherlands Environmental Assessment Agency 2007). As a whole the five BRICSAM countries in 2003 had CO₂ emissions equivalent to over 70 per cent of the top five Annex I emitters (see Table 1).³³ By 2012, if current trends continue, developing countries as a whole will overtake the OECD as global emitters of CO₂, with China and India contributing the lion’s share; China alone is projected to be responsible for almost 40 per cent of global increases in emissions between 2004 and 2030 IEA (2007: 81).

Of course, compared with many Annex I Parties, the BRICSAM countries are still developing, with significantly lower economic indicators and commensurately lower GHG emissions per capita (see Table 1). And much of the rest of the developing world is still in the same position in relation to the OECD countries as they were when Kyoto was negotiated.

³¹ Baumert *et al.* (2005) estimate cumulative historic contributions (1850-2002) to climate change at over 75 per cent for developed countries, with the United States and EU-25 alone constituting 56 per cent.

³² The principle of responsibility for action based on historical responsibility for emissions was at the heart of the Brazilian Proposal (see UNFCCC 1997 among others).

³³ Annex I data based on UNFCCC CO₂ emissions data (without LULUCF). BRICSAM data based on World Bank’s World Development Indicators.

Table 1: BRICSAM and Annex I's five biggest CO₂ emitters

| Country | CO ₂ emissions (kilotonnes) | CO ₂ emissions (tonnes per capita) | GDP per capita (current USD) |
|----------------|--|---|------------------------------|
| China | 4,148,648 | 3.2 | 1,742 |
| India | 1,277,279 | 1.2 | 757 |
| Mexico | 416,206 | 4.1 | 7,599 |
| South Africa | 363,958 | 7.9 | 5,281 |
| Brazil | 297,509 | 1.6 | 4,865 |
| United States | 5,877,677 | 19.9 | 41,890 |
| Japan | 1,284,376 | 9.6 | 35,484 |
| Germany | 892,545 | 9.8 | 33,890 |
| Canada | 593,063 | 17.9 | 34,484 |
| United Kingdom | 558,938 | 9.4 | 36,555 |

Notes: CO₂ emissions data is for 2003. Annex I data from UNFCCC; non-Annex I data from World Bank's World Development Indicators. GDP and population data is for 2005, using current US dollars, from World Development Indicators.

Figure 2: GDP per capita

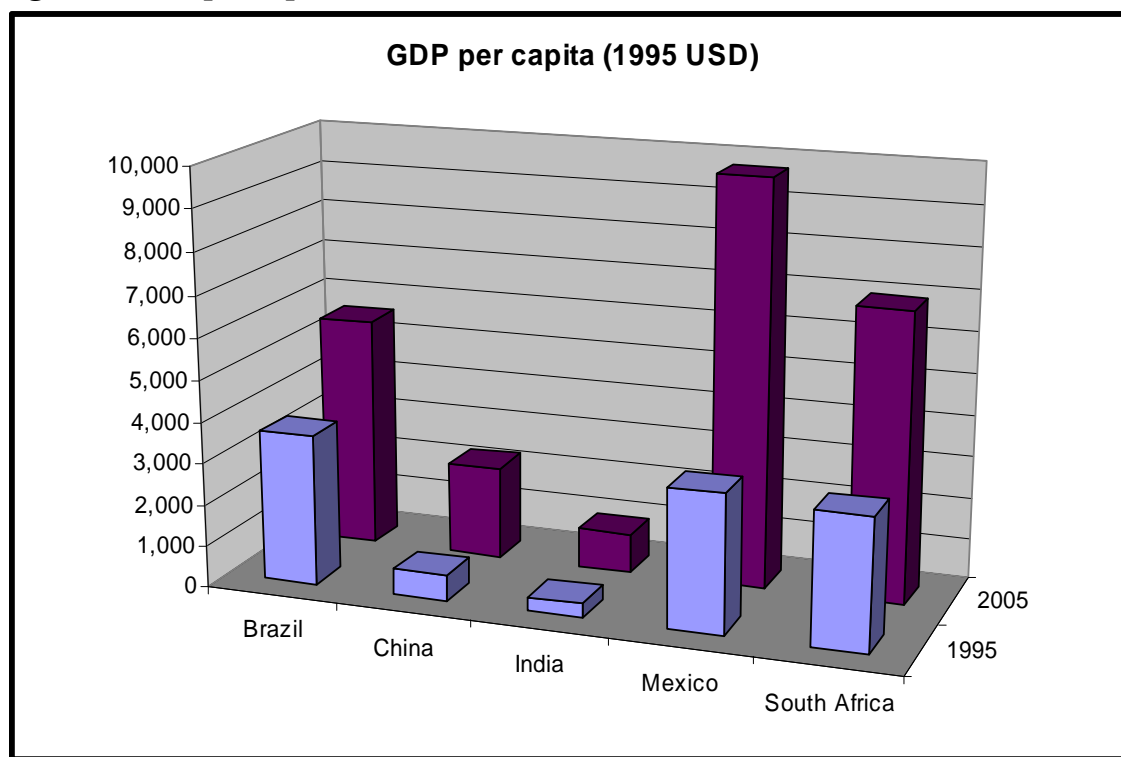


Figure 3: Kg of oil equivalent consumed per capita

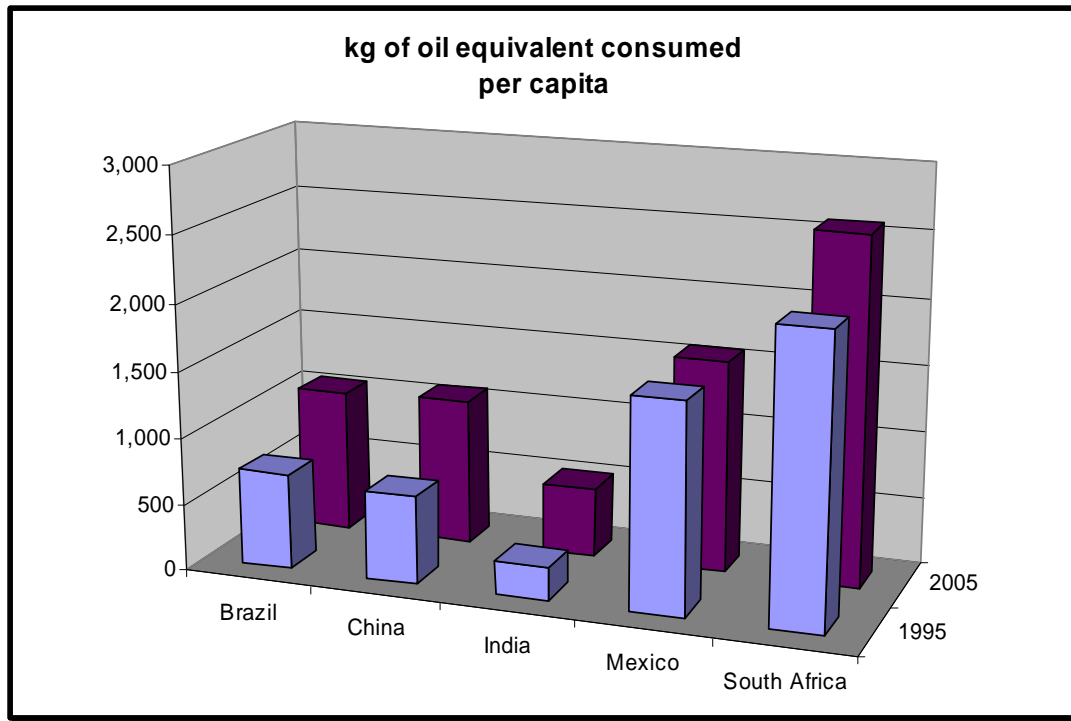
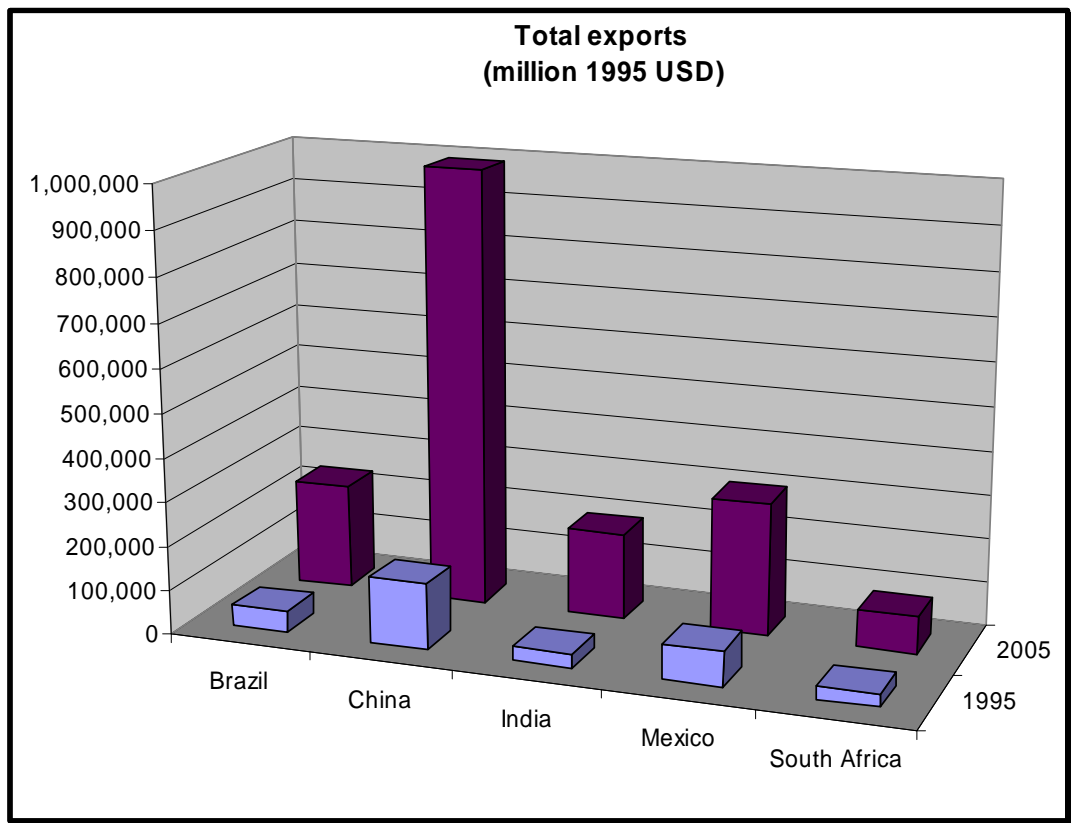


Figure 4: Total exports



Source, Figures 2 – 4: World Bank: World Development Indicators.

But the meteoric rise of the major developing countries has at least two important implications for any climate regime post-2012.

1. The emissions of developing countries must be taken into account in any post-2012 effort to address climate change. Although they are small on a per capita basis, they are critically important on an aggregate basis. Whether the result is a more severe contraction of Annex I emissions, or a more stringent set of obligations for non-Annex I countries, somehow the rising emissions of the BRICSAM countries in particular will have to be accounted for if the world is to avoid dangerous climate change.
2. The major developing countries are increasingly competitive with OECD countries on a range of products and services. Regardless of their levels of development or low per-capita emissions, this will heighten concerns about competitiveness and leakage in any post-2012 negotiations. There will be pressure for the BRICSAM countries and other major developing countries to take actions commensurate with their capacity, even if at levels below those taken by Annex I countries, and Kyoto's simple two-tiered system may not be sufficiently flexible to serve.

The key message of this section is that the world is much different than it was in 1997, and will be much different again in 2012, after five more years of the kind of growth predicted in Section 2.3. For a post-2012 regime to be effective in addressing climate change, it will have to take account of those differences. There will certainly be some need for developing country involvement, or at least the involvement of the major economic powers among them, in a more meaningful way than was negotiated in the first commitment period.

4.0 Elements of an international approach

Section 2, above, made a detailed case for addressing climate change by advancing development goals sustainably. It noted that this involved searching for strategies that support both the goals of addressing climate change (mitigation and adaptation) and the goals of development, particularly in developing and least developed countries. At its heart, this approach involves understanding and exploiting the nexus of environment and development, with particular focus on that subset of linkages involving climate change.

Enough is known about the strength of the various linkages, and about the implications for climate change, to define at least the major elements that should be part of any approach to addressing climate change by achieving development goals sustainably. Among these are:

- avoiding and reversing deforestation;
- clean energy production and use for developing countries;
- clean transportation options; and
- adaptation, with particular focus on links to mitigation.

Each of these elements is discussed in greater detail below. For each it is asked why it is important for a post-2012 regime to address it, and in what manner it might do so. It is then asked what sort of regime structure might be implied by the need to address each.

4.1 *Avoiding and reversing deforestation*

Emissions and removals of carbon from land use change are a significant part of human contributions to the global carbon cycle. IPCC (2000b) calculates total annual carbon emissions from land use change between 1989 and 1995 at 1.6 gigatonnes per year, or 20 per cent of global anthropogenic emissions.³⁴

The elements that make up land-use change figures are deforestation for cultivation or pasture, deforestation for forest products or fuelwood, abandonment of cultivation or pasture activities (and subsequent re-growth), and shifting cultivation (slash and burn). Deforestation for cultivation or pasture, mostly centred in developing countries, dwarfs the other elements of this mix, amounting to just over 100 per cent of net emissions (Baumert *et al.* 2005). To put this in perspective, at these levels predicted CO₂ emissions from this type of deforestation *every year* during the first commitment period would amount to roughly double the reduction all Annex I Parties combined had achieved in their annual GHG emissions between 1990 and 2004.³⁵

As such, avoiding and reversing tropical deforestation is an obvious focal point for international efforts aimed at mitigation. Enkvist *et al.* (2007) argue that forestry has the highest potential of any sector to contribute to low-cost mitigation between now and 2030. Moreover, a number of studies have suggested that sequestering carbon in forests is likely to be much less costly than other approaches to reducing atmospheric CO₂ (Stavins and Richards 2005).³⁶ However, the only manner in which developing countries can participate in achieving the Kyoto Protocol's reduction commitments is through the Clean Development Mechanism (CDM), where deforestation is not covered (having been negotiated out largely due to concerns over methodology and leakage).

As well as being key to mitigation efforts, deforestation is also strongly linked to development. Clearing of land in developing countries is primarily for agriculture; subsistence farming in Africa, cattle ranching and soy plantations in South America, palm oil and coffee plantations and timber products in South East Asia.³⁷ Deforestation negatively impacts those—most directly, the poor—who rely on the affected ecosystems for fuel, food and flood prevention among other things. And widespread low-efficiency fuelwood use generates significant air pollution and health problems. Given the strength of these linkages there is a host of development projects dedicated to avoiding deforestation and land degradation via improved natural resource management, increased fuelwood efficiency and improved agricultural practices.³⁸

How might a post-2012 regime address deforestation? Stern (2006: 540) puts it succinctly;

³⁴ Table 2. This figure has an error limit of 0.8 gigatonnes at a 90 per cent confidence interval.

³⁵ Calculations of emissions reductions taken from UNFCCC (2006), based on total aggregate emissions without LULUCF, where a reduction of 0.7 gigatonnes CO₂ equivalent was achieved. (The corresponding figure for reductions with LULUCF is 0.8 gigatonnes.) Calculations for emissions from deforestation based on IPCC (2000b:13), where annual net stock change from all LULUCF over 2008-2012 is predicted to be between 1.6 and 1.2 Mt.

³⁶ See, though, Enkvist *et al.* (2007) for a contrary view, holding that a wide range of other policies and measures would be more cost effective.

³⁷ Stern (2006: chapter 25). According to FAO (2005), between 2000 and 2005 Brazil (3.1 million ha) and Indonesia (1.9 million ha) accounted for 1.5 times the forest loss of the other top eight countries put together.

³⁸ As of February 9 2007, the Asian Development Bank's global database of development projects that address environment and poverty contained 25 entries in this area (some comprising a number of projects), making up over 30 per cent of all entries. See www.povertyenvironment.net.

“Effective action to protect existing forests and encourage afforestation and reforestation requires changes to the structure of economic incentives that lead to unsustainable logging and to the conversion of forestland to agriculture.”

In other words, deforestation is fundamentally an economic phenomenon. Addressing it will call for measures that alter the basic economics of deforestation. Efforts to this end can be made at the domestic level; Costa Rica and Mexico already pay landowners to be stewards of forested land (Stern 2006:544). But at the international level there are at least four ways in which such efforts could be undertaken.

The Papua New Guinea/Costa Rica proposal. In the lead up to the 11th Conference of the Parties (COP 11), Papua New Guinea (PNG) and Costa Rica proposed that the international community “consider appropriate expansion of the Marrakesh Accords,” in order to allow the CDM to credit projects that reduce emissions from tropical deforestation (PNG/Costa Rica 2005). The concept is not elaborated in the PNG/Costa Rica paper, but presumably the idea would be to allow the CDM to use existing rates of deforestation as a baseline in determining the impacts of a project or program in reducing GHG emissions. This would involve an amendment of the Marrakesh Accords in the first commitment period or, more relevant to the present analysis, agreement that in any post-2012 regime that there be scope for such crediting.

It would also, however, involve some difficult methodological considerations with respect to verification and monitoring. IPCC (2000b) makes it clear that there are no easy definitions of what constitutes deforestation, or even what constitutes a forest for that matter. While the principle behind this proposal is simple enough, putting it into practice would be challenging.

Brazil’s proposal for reducing emissions from deforestation. In a submission to the *Dialogue on Long-Term Cooperative Action* (specifically in the context of advancing development goals in a sustainable way) Brazil elaborated on earlier proposals to propose a new agreement, under the auspices of the UNFCCC, to compensate developing countries for avoided emissions from deforestation.³⁹

Unlike the PNG/Costa Rica proposal, this proposal does not envision the reduced emissions from avoided deforestation being used by Annex I countries to count towards their obligations; these reductions would be additional to any such obligations. It would presumably involve establishment of a funding mechanism with contributions from developed country Parties. Financial incentives would be awarded to countries that lowered their rates of deforestation below an established baseline rate. No penalty would apply to those countries that exceeded their baseline rate, but for the purposes of calculating financial incentives due from the fund, such failure would count against any future reductions.

The financial incentives would be in the form of new and additional payments, in the form of technology transfer, and/or in the form of capacity building. The latter might be particularly important. Avoiding deforestation involves significant domestic-level challenges that typically require, at a minimum, strengthening legal and regulatory systems (particularly involving property rights and enforcement) and natural resource management capacity.

³⁹ The PNG/Costa Rica proposal also mentions the idea of a separate agreement as one option for addressing tropical deforestation, but does not elaborate any further.

Sustainable Development Policies and Measures (SD-PAMs). In its fundamentals, as applied to deforestation, this idea is similar to the Brazilian proposal. It has been proposed that one way to engage developing countries in a post-2012 regime without actually embarking on the politically difficult course of setting quantitative targets is to allow them to pledge to undertake sustainable development policies and measures that will reduce GHG emissions (Bradley and Baumert 2005). Such pledges would be voluntary, and would be designed primarily to serve domestic policy needs not related to climate change objectives. They would, if successfully carried out, be rewarded with funding, either by agreement through existing channels (e.g., Official Development Assistance (ODA), the Global Environment Facility (GEF), multilateral development banks) or through some expressly designed international mechanism.

If a post-2012 regime chose to involve developing countries in this fashion, it could allow for pledges to curb deforestation, thus directing financial support toward efforts to do so.

Developing country commitments post-2012. A final possible regime design is to assign quantitative targets to developing countries, and to allow avoided deforestation to count toward fulfillment of those obligations. If the regime allowed for emissions trading along the lines of the present regime, this would allow countries such as Brazil and Indonesia to generate large quantities of AAU-like credits, generating significant revenues that could be devoted to forest protection. There is strong opposition among developing countries to the idea of such targets in a post-2012 regime—opposition that would hardly be overcome by designing a system that would benefit only a sub-set of countries (those with major deforestation problems). If the regime allowed afforestation and reforestation to count toward commitments with a high cap, or no cap, it might broaden the group of benefiting countries somewhat, certainly including China, for example.⁴⁰

Stern (2006: 540) cites estimates of the opportunity cost to forested countries of stopping forest land conversion and of completely eliminating forestry, expressing the results in terms of the cost per tonne of avoided CO₂ emissions. The former are estimated at less than \$5 per tonne, while complete elimination of deforestation would drive the costs up to \$30 per tonne. While it is not argued here that either of these scenarios is either desirable or likely, it is instructive to note that these figures are not outside the reasonably expected range of prices for carbon in a post-2012 world.⁴¹

4.2 Clean energy production and use for developing countries

Energy in developing countries is a critically important focus for a strategy that advances development goals as a way to address climate change. Energy is the biggest part of the battle for effective mitigation. Moreover, energy is fundamentally linked to development:

“Without access to modern energy services, the poor are deprived of opportunities for economic development and improved living standards. Modern energy services provide lighting, cooking, heating, refrigeration, transportation, motive power and electronic communications that are indispensable to increasing productivity, creating enterprises,

⁴⁰ China reported an annual net gain in forest area from 2000-2005 of over 4 million ha. This was almost four times the gain of the next nine leading nations combined (FAO 2005: table.2.6).

⁴¹ Enkvist *et al.* (2007) estimate a price per tonne of CO₂e of €40 in 2030, assuming the need to limit atmospheric concentrations of CO₂e to 450 ppm. For reference, since the EU ETS came into force in 2005, prices for carbon allowances under that scheme have ranged from €1.50 to just under €30 per tonne.

employment and incomes, and accessing safe water and sanitation, as well as health and education” (World Bank 2006b: 1).

From the development perspective, the challenge is the immense need for new energy supplies in the coming decades. For many in developing countries the issue is basic needs. Traditional biomass is still being used for cooking and heating for 2.4 billion people, and 1.6 million women and children die each year from exposure to the resulting indoor air pollution (World Bank 2006b:1). Over 1.6 billion people worldwide have no access to network electricity (mostly in Sub-Saharan Africa and South Asia), and 80 per cent of those are the rural poor of developing countries (IEA 2006: 157).

Energy needed to feed projected economic growth is also significant. IEA (2006) cites a need for \$20 trillion dollars in new energy investment between 2005 and 2030, with more than half of that in developing countries. By 2030 the result would be more than a 50 per cent increase in global energy use, with developing countries accounting for more than 70 per cent of that total. China alone in 2005 added more than 70 GW of new capacity to its grid—equivalent to adding two 650 MW generating stations per week or adding, over the year, the entirety of the UK’s installed generating capacity (Green 2006).

For all intents and purposes there are two separate challenges here: the challenge of providing basic energy needs to the rural poor, most of whom are not connected to any grid, and the challenge of supplying new capacity to urban centres to facilitate the growth of industry and accommodate rising household demand. The two challenges are, in fact, simply two ends of a continuous spectrum—providing clean energy for development. But the context, the scale and the implementing strategies differ markedly between the two.

In the rural context the challenge is to provide cleaner energy than current sources used for cooking, heating and lighting (or to increase the efficiency of current use), and to provide new energy for appliances. This sort of effort has high payoffs in terms of development, many of which are discussed above, and is the subject of a large number of ongoing development programs.⁴² It may not, however, have such high payoffs in terms of carbon mitigation.

By contrast, in the urban context the stakes for mitigation efforts are huge. The rush of investment needed over the next several decades in developing country energy infrastructure will lock in technologies for up to half a century thereafter. But these decisions are being made by private investors with few, if any, incentives to consider environmental externalities. Sun (2005) describes the tide of new coal generating stations being built in China as far from best available technology; until recently sub-critical units dominated, but now roughly half of new orders are super-critical. Only a clutch of ultra-supercritical units are in the works. China will not have its first integrated gasification combined cycle plant for at least four years.

The differences matter. A single 600 MW ultra-supercritical unit (recall that China adds more than the equivalent capacity of two of these per week), compared to a supercritical unit, will reduce CO₂ emissions by nearly four million tonnes over a 30-year lifetime.⁴³ If Chinese power plants were at the average efficiency of Japanese plants, China would consume 20 per cent less coal (World Bank 2007). This would conserve over 180 million tonnes of coal a year, avoiding 486 megatonnes of CO₂

⁴² See, for example, World Bank Group (2006).

⁴³ AEP (undated). The contrast to subcritical units would, of course, be even more stark.

emitted.⁴⁴ The attendant benefits for the economy of this kind of increased efficiency, and the environmental benefits of reducing pollutants such as SO_x and resulting acid rain, are self evident.

While improving the efficiency of production is key, perhaps just as important is improving end-use efficiency. There is enormous potential to avoid GHG emissions through the use of efficiency standards and labeling, mandating the use of low-energy appliances such as air conditioners, refrigerators and light bulbs, and requiring efficient design in new buildings.⁴⁵ The timing of such efforts is important; replacing or retrofitting an existing capital stock is much more difficult than mandating efficiency in the early stages of demand growth for such goods, as found in such countries as India and, to a lesser extent, China.

A post-2012 regime that advances development goals sustainably must find a way to help provide the energy needed for development. But it must also find a way to help ensure that the energy in question does not lock us into decades of high-emission technologies.

How might a post-2012 regime address the need for clean energy in developing countries? The mechanisms will vary, particularly depending whether they are designed to address what were referred to above as the rural or urban energy challenges. There are at least two possible broad thrusts toward an effective approach to energy in a post-2012 regime, and they are discussed below. Within them there are many possible variations and synergies, but presenting them as two “options” seems to cover all the necessary discussion related to these possibilities.

Support programs and policies for poverty-alleviating clean energy in developing countries.

There are two main avenues that might simultaneously achieve the goals of development as it relates to the energy-poor and of addressing climate change. The first is some market-based mechanism for bringing clean energy to the poor, along the lines of the current CDM. The idea here is to somehow provide a premium to investors for their investments in bringing to the energy-poor such energy technologies as micro-hydro, solar PV, solar thermal and wind power. Such a mechanism should also reward dissemination of technologies that allow more efficient use of, or replacement of, existing energy appliances, such as wood-burning stoves (see discussion above on avoided deforestation), light bulbs and water heaters.

The current CDM does this by awarding carbon credits to the investor. But it might be improved in a number of ways to better serve the goal of development for the poor and/or energy-poor. One obvious way is the approval of new methodologies for programs of activities. Previously the CDM was more or less restricted to project-level activities, which limited its usefulness in reaching numerous dispersed individuals in need of identical small-scale interventions (e.g., converting from incandescent to compact fluorescent light bulbs). To register each small intervention as a project would be prohibitively expensive. But the current roster contains several registered projects with programmatic characteristics (see Box 1). And the CDM’s Executive Board has recently approved and set guidelines for programs of activities under the CDM, including those that would implement

⁴⁴ IEA statistics for 2004 cite China’s electricity plant consumption of coal at 919,616 kilotonnes of coking coal and other bituminous coal. Not included in this total are gas works gas and coke oven gas. Tonnes of CO₂ emissions avoided are calculated using the average carbon content of coal power in China (0.736 tCO₂/tce) times 44/12, as cited in the China windpower CDM project CERUPT (2004: Annex 3).

⁴⁵ The Government of Ghana projected over 3 MtCO₂e emissions reductions from its proposed air conditioner efficiency standard, submitted as a 7-year cycle CDM project (NM0159-rev – rejected by the EB).

a government-issued policy, such as an efficiency standard.⁴⁶ This should make such activities much more prevalent in the evolving CDM roster, and any iteration of the CDM in a post-2012 world will almost certainly involve a strong component of such programmatic and policy-based CDM.

The other option for pursuing more clean energy investment for the poor and/or energy poor involves policy alone, and does not involve the private sector explicitly, nor crediting for Annex I countries of the involved reductions. It was noted above that the SD-PAMs approach has been promoted as a way of supporting developing country governments in their voluntary pledges to pursue their own development goals in ways that also reduced GHG emissions. Either in this context or by means of some other dedicated funding/support mechanism the international community might support developing country

government policies that seek to promote development through provide clean energy and energy efficiency. The discussion above on SD-PAMs and, separately, on energy, should make it clear that the UNFCCC would not be the only, or probably even the primary, player in such an arena. There are numerous ongoing and planned development agency and Multilateral Development Bank (MDB) projects focusing on just such support.

Technology cooperation. The chapter in this book on technology makes an argument for broadening the concept of technology transfer to think about technology *cooperation*. The latter would include a number of supporting elements that go beyond the simple transfer of a given technology, to the “soft” elements of technology transfer that work to ensure successful adoption of the hard elements; a focus on absorption and capacity, on best practice in public policy and regulation, on effective diffusion and so on. In the UNFCCC (2006b) context, much of the discussion on these issues has been around enabling environments and capacity building for technology transfer.

The technology chapter goes into much greater depth on this subject and specifically on its applicability to an energy focus in a post-2012 context. As such, it will simply be noted here that a key element in addressing what was called the ‘urban’ challenge above—providing energy to developing countries for expanding industries and to meet growing residential demand—must be a focus on technology cooperation. Specifically, any efforts to promote climate change objectives through advancing sustainable development goals will involve support for developing countries in fundamentally altering their energy paths, such as:

Box 1: CDM with Programmatic Characteristics

The CDM’s roster of registered projects includes the following:

- distributing solar cookers in Aceh, Indonesia;
- retrofitting public buildings in Moldova with high efficiency biomass heating systems;
- installing household-level biogas digesters in India and Nepal;
- distributing photovoltaic kits to rural households in Morocco; and
- retrofitting low-income housing with insulation, compact fluorescent bulbs and solar water heaters in South Africa.

⁴⁶ See CDM Executive Board (2006). Mollet (2005) argues for the enormous potential of standards and labeling to mitigate GHG emissions, calculating that S&L for four products (including refrigerators and air conditioners) could reduce global emissions by more than 500 MtCO_{2e} by 2020.

- subsidies for private energy infrastructure investors, altering incentives such that low-carbon technologies are attractive;
- subsidizing developing country acquisition of intellectual property in the area of clean energy;⁴⁷
- capacity building for regulatory infrastructure to promote clean energy development (including, for example, regulatory initiatives in support of demand-side management); and
- financial support for developing country adoption and implementation of high energy efficiency standards, and for labeling programs.

Effective cooperation in this area, whether under the architecture of the UNFCCC or via dedicated stand-alone agreements, is the only hope to ensure that the world can meet the needs of energy for development, while at the same time encouraging the wide uptake of low-carbon technologies.

4.3 *Clean transportation options*

An approach to climate change that advances development goals needs to focus on transportation in developing countries—in particular on providing clean transportation options for the increasingly affluent growing population of large urban centres.

United Nations Population Fund (UNFPA) (2004) notes that by 2007, for the first time in history, over half of the human population will live in urban centres. By 2030 the figure will be 60 per cent, or some 5 billion people. Almost all of the world's growth between now and that time will take place in developing country cities.

Increasing prosperity in those cities (particularly in the fast-growing economies of Asia), and falling prices for private automobiles due to trade and investment liberalization mean that increasing numbers are choosing private transport as their mode of choice (IISD 2004). In China, national car sales grew by an astonishing 75 per cent between 2002 and 2003, and domestic production increased by 177 per cent between 1999 and 2004 (Bradley and Baumert 2005). In Santiago, Chile, private vehicle use doubled between 1991 and 2001 from 15 per cent of trips to 30 per cent, accompanied by a 50 per cent increase in vehicle ownership (Barías *et al.* 2005). These general trends are expected to continue; car ownership in China, for example, is still very low by international standards at 9 per 1,000 population. By way of comparison, the corresponding figure for the United States in 2004 was 700, and for middle income economies like Mexico, Brazil and Korea, 150–200 (Bradley and Baumert 2005).

This trend represents a critical challenge for development and for climate change. The development implications of increased automobile use in urban developing country centres are well-documented. While increased personal mobility is a definite benefit for those that can afford it, the social costs are considerable, and include:

- increased air pollution (carbon monoxide, nitrogen dioxide, volatile organic compounds, particulates), and the health effects that accompany it;⁴⁸
- increased traffic fatalities;⁴⁹

⁴⁷ See the proposals for a *Multilateral Technology Acquisition Fund* in South African Government Department of Environmental Affairs and Tourism (2006) and UNFCCC (2006c).

⁴⁸ IISD (2004) notes that even China's strict new emission standards will be easily swamped by the scale of increased automobile use.

- loss of arable land (highway construction); and⁵⁰
- increased congestion.

Energy security and balance of payments concerns are also important. China in 1993 went from being a major oil exporter to a net importer, and today is the second-largest importer in the world. IEA (2006:86) projects that by 2030 China's imports of oil will have increased 230 per cent over 2005 levels, equaling Europe's total imports, with most of that being used for transport. The same analysis worries that "rising oil and gas demand, if unchecked, would accentuate the consuming countries' vulnerability to a severe supply disruption and resulting price shock" (IEA 2006: 38).

Transportation choices are also a matter of concern from a climate change perspective. Some 18 per cent of global CO₂ emissions come from transportation, with road transport constituting 72 per cent of that total (Baumert *et al.* 2005). If the urban planners of fast-growing developing countries do not plan today for clean transportation solutions, the resulting GHG emissions growth will be significant. IEA's baseline case projects increases in road transport-related CO₂ emissions of over 55 per cent between 2004 and 2030 (IEA 2006: 80).

But many developing countries will exceed that. Baumert *et al.* (2006: 64) predict increases in China of 143 per cent, in India of 67 per cent, in Indonesia of 122 per cent, in Mexico of 71 per cent and in the Middle East of 68 per cent by 2020.⁵¹

There are three types of solutions to these challenges. First, developing countries can set efficiency standards for vehicles, and requirements for fuels, at stringent levels. China, for example, has upgraded auto emission standards to the EURO III level, with plans to increase them to EURO IV levels by 2010.⁵² Most countries by now have phased out leaded gasoline.

A second tack, which may be more effective overall, is to reduce the number of vehicles on the road, by providing attractive alternatives. Box 2 describes such an effort in Bogotá, Colombia. Mass rapid transit efforts of this type, if successful,

**Box 2: Transmilenio:
Rapid Mass Transit in Bogotá**

The *Transmilenio* project, begun in 2000 and running through to 2012, is designed to make public transit more attractive to riders in Bogotá, Colombia:

- by 2012, 130km of dedicated bus lanes and new stations;
- larger capacity EURO III buses with smaller feeders to main stations;
- elevated bus stations, pre-ticketing and free transfers; and
- centralized system management.

Two years into the project, the results were impressive:

- travel time cut by 32%;
- traffic accidents cut by 80%;
- noise pollution cut by 30%;
- SO₂ levels cut by 43%; and
- NO₂ and particulate levels cut by 18%.

Sources: IISD (2004); Grütter Consulting (2006).

⁴⁹ See Tiwari (2003) on the case of Delhi.

⁵⁰ See Bradley and Baumert (2005) on the case of China.

⁵¹ These projections are calculated based on IEA (2004).

⁵² EURO III standards were in effect in the EU from 1999 – 2005; EURO IV standards are now in effect, until 2008.

can speed transit, lower congestion, lower accident rates and pollution, and cut GHG emissions.⁵³ While options include rail, light rail and subway, the most cost-effective efforts in developing country urban centres are typically bus right-of-way efforts (Fouracre *et al.* 2003; Grütter Consulting 2006: sec. 3b).

A third strategy is to avoid the need for transport through appropriate urban planning. Situating residences close to their work and other destinations is probably the most effective policy option, though it has limited applicability for those urban areas that have already been built.

How might a post-2012 regime focus on supporting these types of efforts? There are at least two ways in which it might do so.

CDM-like mechanism. The Transmilenio project described above has actually been registered as a CDM project. There is another project like it in the process of gaining methodology approval—a bus transit corridor project in Mexico.⁵⁴ The Transmilenio project in its project design document (PDD) made a strong case (which was eventually accepted by the Executive Board and Methodology Panel) that the main obstacle to implementing the project was financial. As such, it argued, the revenues from Certified Emissions Reductions (CERs) were essential to allowing the project to proceed.

A market mechanism like the CDM, allowing and providing carbon finance for such projects, would be one manner in which to focus on transportation. Again, it is worth noting that such projects are in fact more like a program of activities, explicit approval for which has recently been given by the CDM's Executive Board. As the methodological questions surrounding such projects are answered and the way is cleared for others to follow, there will certainly be more of them in the roster, building up a potential foundation for a similar mechanism post-2012.

SD-PAMs. Another possibility would be to support developing country voluntary pledges to reduce GHG emissions in the transportation sector, through projects like Transmilenio. As in the SD-PAMs proposal described above, the funding and support could come through any number of sources, from a dedicated sectoral fund under the UNFCCC to diverse sources of development assistance. It might complicate matters that SD-PAMs type pledges would presumably come from national governments, while mass rapid transit projects are typically conceived and implemented at the municipal level, but this would not be an insurmountable obstacle.

Technology cooperation. The first type of action discussed above to address transport-related concerns was a technological solution: more efficient private vehicles and cleaner blends of fuel. This is clearly an area suitable for technology cooperation. In fact, however, the opportunities for government action might be limited, given the fierce competition that prevails in the automobile sector as it rushes to develop proprietary technology for cleaner vehicles.

In terms of “soft” technology, there should be scope for sharing the lessons learned in developing country projects like Transmilenio, assisted by a post-2012 commitment to support this type of South-South cooperation.

⁵³ The Transmilenio Project's phases II – IV are registered as a CDM project with projected emission reductions of over 1.7MT CO₂e by 2012.

⁵⁴ Mexico City Insurgentes Avenue Bus Rapid Transit Pilot Project (NM 158).

4.4 *Adaptation*

It was argued above that successful adaptation measures are, by definition, also development measures in that they increase human well-being. As such, any post-2012 regime that chooses to address climate change by advancing development goals will necessarily have a major adaptation component. This case is argued later in this book, in the chapter specifically devoted to adaptation. In that chapter the various scenarios for addressing adaptation are discussed, and the implications for Canada are highlighted. As such, though it is central to the scope of this chapter, more in-depth discussion of adaptation will be left to the chapter to come.

5.0 *Canada's interests*

The previous section explored the essential elements of any post-2012 regime that seeks to address climate change objectives by advancing development goals sustainably. Each of those elements has implications for the shape of an international regime. This section explores those implications, asking what they mean for Canada, taking into account Canadian interests and objectives. It does not consider the implications of a focus on adaptation as an element of the post-2012 effort, nor does it consider technology cooperation in detail, these being dealt with in much greater depth in the chapters that follow.⁵⁵

In the discussions below, two major objectives of Canadian policy are simply assumed. First, Canada has an interest in an effective regime—one that will in fact achieve the objectives of the UNFCCC and stabilize GHG concentrations below the levels at which they would cause dangerous anthropogenic interference with the climate system. To the extent that the elements discussed above actually contribute to that end, they will be desirable. A major consideration in that regard is the need to meaningfully engage developing countries in any post-2012 regime, given the realities described in Section 3. An approach that combats climate change by addressing the overriding priorities of those countries for development will have definite attraction from that perspective.

Second, among Canada's foreign policy objectives is a desire to see development in developing countries. Canada has signed on to the MDGs, the World Summit on Sustainable Development (WSSD) Plan of Implementation and the Monterrey Consensus on Financing for Development, *inter alia*. And Canada as much as any country has an interest in international development, both for the benefits it brings to those in need and for the ancillary benefits that fostering stable prosperous nation states can bring to the global community. As such, the approach of advancing development goals sustainably has some appeal from the wider perspective of Canadian foreign policy objectives.⁵⁶

There are three elements from the preceding discussion that merit further consideration here:

- a market mechanism for developing country initiatives;
- SD-PAMs approach; and
- developing country targets.

⁵⁵ The next draft of the paper will bring some of the discussion from subsequent chapters to this current chapter. As well, reference will be in those chapters to this chapter.

⁵⁶ For a more complete discussion of the complementarities between foreign policy and climate change objectives, see Murphy *et al.* (2007).

5.1 *A market mechanism for developing country initiatives*

Each of the elements discussed above posited a regime that contained a market mechanism, similar to the CDM, which allowed developing countries to help finance their efforts to simultaneously reduce GHG emissions and to foster sustainable development. In the context of deforestation, this was mooted in the PNG/CR proposal and implied as a possibility in the Brazilian proposal. It is already in use to various degrees in the context of energy and transport, though it could certainly be given a greater role in both.

The chapter in this volume that discusses market mechanisms goes into greater depth on the types of regimes that could support such a market,⁵⁷ but in brief the need for such a mechanism also probably implies a need for quantitative targets, and a need for a segregation of the type that now separates Annex B and non-Annex B Parties. The targets are necessary to grant some value to carbon; without them there is no market for the products of a CDM-like mechanism. The segregation is a prerequisite for a CDM-like structure where emission reductions in countries without quantitative targets can be traded to countries (or firms in countries) that do have such targets.

It is possible that such a mechanism could survive in a regime structure that involved linking of various regional/national cap-and-trade schemes, as opposed to a multilateral approach like the CDM. But its functioning would be greatly complicated in such a setting, perhaps to the point where the necessary administrative burden would make it unfeasible. There would need to be a harmonization across various schemes of the methodologies for crediting projects in countries outside their jurisdictions, similar to that now used in the CDM setting. Moreover, in the context of deforestation the methodologies used would be entirely new, since no such methodologies would have been developed under the CDM (assuming no amendment of the Marrakesh Accords).

As for the implications for the CDM itself (assuming that the CDM would survive into a post-2012 regime structure), the elements noted here seem to imply an evolution. In the case of afforestation, reforestation and avoided deforestation it would involve large amounts of credits for areas that are now disallowed or limited. In the areas of energy and transport it was noted that the most effective approach seemed to involve an evolution of the CDM from a project-based mechanism to one that also covers policies and programs—a more “top-down” structure. In either case, the result would probably be a significantly greater number of CERs supplied at any given price. A projected emission of 40 gigatonnes from tropical deforestation over the first commitment period compares with estimated shortfalls from Annex I countries in meeting their commitments of some five gigatonnes over that same time.⁵⁸ Even a moderately successful effort at avoided deforestation would have major market impacts under this scenario.

Canada’s major interest in regards to this regime element is enunciated in Article 12.2 of the Kyoto Protocol; one of the two stated objectives of the CDM is to “assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments.” Canada, under any conceivable future regime, will face some difficulties in complying with its international obligations by means of domestic actions alone. Current reports have Canadian emissions running at some 35 per cent above its Kyoto target levels (Environment Canada 2006).

⁵⁷ For a deeper discussion of these issues see also Cosby and Murphy (2007).

⁵⁸ Projected emissions from deforestation from Baumert *et al.* (2005). Estimate of compliance gap from UNDP (2006b).

As such, any regime elements that facilitate compliance at low cost would be welcome from a Canadian perspective. The evolution of the CDM discussed above fits this bill, potentially significantly augmenting the available credits from CDM. Given the domestic opposition to buying “hot air” on the international market, it may be that a distinction could be argued between Assigned Amount Unit (AAUs) and Certified Emissions Reductions (CERs)/Emission Removal Units (ERUs), positioning the latter as more credible and desirable, particularly if that argument could be couched in the terms that frame this chapter: advancing development goals sustainably.

It should be noted, however, that over-supply is not an unblemished good. If the level of demand is seriously out of synch with supply (for example, due to unambitious targets, highly effective domestic action or, more significant for this discussion, a flood of new sources of credits) the market will force prices to a level where quality small-scale CDM projects are unviable and the only credits available will be from large top-down programs, or from large-scale low-cost end-of-pipe projects such as industrial HFC and N₂O capture. This would both tarnish the image of the CDM and thwart the objectives of the instrument. As such, a market analysis is probably necessary as a foundation for final Canadian policy on this regime option.

5.2 SD-PAMs approach

The SD-PAMs approach is also featured as a possible element in all the discussions above. This approach would see developing countries supported financially, and in other ways, in their voluntary pledges to undertake development actions that would also reduce GHG emissions. Presumably this would cover areas such as avoided deforestation, clean energy, clean transportation and adaptation.

This approach as enunciated by its major proponents does not contribute to the market for compliance credits, the GHG reductions being additional to those to which Annex I Parties are committed. It would of course assume, like the market mechanism approach discussed above, that there are Parties that do not have quantified emissions reductions obligations, though whether *any* Parties have such obligations does not affect its viability. That is, it is possible to imagine an SD-PAMs approach as a part of an orchestra of treaties that does not involve Kyoto-style targets.

If the post-2012 regime indeed looks this way, lacking specified national targets for action, then there is some attraction to the SD-PAMs approach from a Canadian perspective. It contributes to the effectiveness of international efforts to address climate change, and aligns well with Canada’s development goals. It could provide a ready channel for additional ODA, either bilateral or through existing intermediaries (GEF, World Bank). The budget implications of such a plan would have to be considered, but if it were truly a multilateral effort then the Canadian share would probably not be onerous. As such, a multilateral approach should clearly be sought under this scenario.

If, on the other hand, the post-2012 international efforts to address climate change do involve specific targets, then the SD-PAMs approach loses much of its attraction from a Canadian perspective. In a sense the SD-PAMs approach acts as a sort of alternative to an evolved CDM that covers policies and programs. The major difference between these two would be the fact that the SD-PAMs approach does not produce tradable emission reduction credits that might be used by those Parties with commitments. In light of Canada’s ready need for such credits as argued above, the Canadian preference would probably be for a regime that involved something more like an evolved CDM than an SD-PAMs approach.

5.3 *Developing country targets*

One of the options discussed for addressing deforestation was a regime that assigned specific targets to developing countries, but also allowed them to meet those targets by means of avoided deforestation. This is not one of the suggested methods for addressing deforestation, it should be noted; the Brazilian and PNG/CR proposals assume that developing countries will not have quantitative targets under a post-2012 regime. It is possible that the Brazilian approach could countenance targets for developing countries (either at the outset or through some form of graduation) without having them cover deforestation. But it seems highly unlikely that the international community would negotiate targets for developing countries and leave the matter of avoided deforestation (the largest single source of developing country emissions) out of those targets, to be addressed under a separate, incentive-based mechanism.

It is, of course, also possible that a developing country targets regime could encompass efforts to make good policies in the area of energy and transportation as well. The focus here is on deforestation because it is the single largest developing country contributor to GHG emissions by some margin, and if developing countries are to take on targets—contrary to their current positions—it will likely be as a result of major incentives like the inclusion of avoided deforestation.⁵⁹

Canada does have a keen domestic interest in seeing the concept of sinks expanded in a post-2012 regime, in the areas of both forests and agriculture. Any allowance granted to developing countries to confer credit for good policies would likely provide an opportunity to pursue Canadian interests as well. By that reasoning, such a regime has attractions for Canada. Such a regime would almost certainly imply a raising of current caps on contributions via afforestation and reforestation above what is available under the current regime.

Further, it is possible that under such a regime there would be a large quantity of forest-related AAU-like units available for trade. It was noted above that emissions from deforestation are significant relative to current Annex I shortfalls. Even moderate success in avoiding deforestation under such a scheme could conceivably produce a large quantity of tradable credits from developing countries that had exceeded their reduction obligations. By the same logic that the CDM would be in Canada's interests, a market with an ample quantity of AAU-like credits might also be desirable. Note, however, that relative to the CDM option this scenario loses some of its ability to distinguish the “hot air” that is tainted in public opinion from the sorts of purchases Canada would make on the international market. Note also the caveat expressed above about the need to ensure that supply does not significantly outpace demand for compliance units.

⁵⁹ It was noted in the discussion on deforestation that this sort of incentive would not be uniformly attractive to all developing countries. In fact, depending on how it was elaborated, it might hold major attraction for only Brazil, Indonesia and China.

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