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Towards a Global Compact for Managing Climate Change

Ramgopal Agarwala

Research and Information System for Developing Countries
India

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Ramgopal Agarwala
Senior Advisor
Research and Information System for Developing Countries
ragarwala@ris.org.in

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The goal of the Harvard Project on International Climate Agreements is to help identify key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture for global climate change. It draws upon leading thinkers from academia, private industry, government, and non-governmental organizations from around the world to construct a small set of promising policy frameworks and then disseminate and discuss the design elements and frameworks with decision-makers. The Project is co-directed by Robert N. Stavins, Albert Pratt Professor of Business and Government, John F. Kennedy School of Government, Harvard University, and Joseph E. Aldy, Fellow, Resources for the Future. For more information, see the Project's website: <http://belfercenter.ksg.harvard.edu/climate>

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Abstract

Despite an enormous amount of work done to persuade the world of the dangers of climate change and the need for quick corrective action, there is little progress toward a global compact for managing climate change. In fact, there are some basic differences of perspectives on climate change policies between developed and developing countries which may bedevil future global agreements on climate change for quite some time. Among the reasons for these differences are the issues of historical responsibility for carbon emission by the developed countries, the need for lifestyle changes in both the developed and developing countries, suspicion in the developing countries about the motives of developed countries and too much focus of current discussions on the very long-term and global effects of climate change.

This paper presents an approach where the perspectives of the developing and developed countries are sought to be reconciled. A credible global compact for climate change must satisfy five criteria: it must be comprehensive, equitable, realistic, efficient and effective. Based on these criteria, it seems that the target of at least 50% reduction in CO₂ emissions by 2050 is unrealistic. A more realistic target is stabilization of CO₂ emissions at present levels until 2050 and a 50% reduction by 2100. With the target of per capita equality in CO₂ emissions by 2050 and allowing for developmental needs of the developing countries, this approach leads to a target of 5% annual reduction in carbon intensity of GDP for both the developed and developing countries. In terms of overall CO₂ emissions, this leads to a 3% annual decline in developed countries and a 1% annual increase in developing countries. The targets for the developed countries are mandatory in so far as they can be achieved by national action. For developing countries, the targets are conditional on receipt of funding and technology from international sources. The funding issue is crucial for a global agreement and there is no solution in sight on that count. The developed countries seem unwilling to make commitments on massive transfer of resources to developing countries for managing climate change and the latter are unwilling to make any commitments on emissions without such resource transfers. Clearly some innovative ideas are needed, one of which could be the use of seigniorage in global finance for funding the truly global public good of managing climate change.

*Towards a Global Compact for Managing Climate Change*¹

R. Agarwala

I. Introduction

The year 2007 witnessed a major surge in interest in controlling the damage that can be done to the global economy due to the accumulation of greenhouse gases (GHGs) in the atmosphere. The Stern Review (Stern, 2006) published in October 2006 and publicized in 2007 demonstrated how serious the economic consequences could be of the present trends on climate change induced by human activity. In an in-depth cost-benefit analysis (subject to the usual caveats for such analyses), it demonstrated that about 1% of GDP invested in controlling greenhouse gas emissions can save an annuitized loss on a broad measure of consumption (that includes non-market goods and services) equivalent to 5-20% of GDP, due to climate change. In February 2007, the IPCC report (IPCC, 2007) came out presenting the growing consensus among climate scientists about the devastating effects of human-induced climate change, in particular for low income regions and low income people of the world. Al Gore, the former Vice-President of the United States, in his powerful movie, *An Inconvenient Truth*, which won two Oscars, demonstrated in a graphic manner the high costs of climate change for the world including the developed countries. Since then under his leadership the global *Live Earth Concerts* around the globe have been raising consciousness of the global community about the dangers of climate change. On June 7, 2007, the Communiqué issued by G8 Summit (G8, 2007) (which also had inputs from five major emerging economies²) devoted a considerable amount of attention to the issue of climate change and strategies for reducing greenhouse gas emissions. The 2007 Nobel Peace Prize to Al Gore and the IPCC has further raised the public profile on climate change issues.

However, while the year 2007 began with a bang on climate change discussions, it ended with a whimper on climate change agreements. The heated and even tear-inducing debates in Bali Conference in December 2007 only produced a road map for further discussion leading up to Copenhagen Meeting in 2009 and agreement for *consideration* of enhanced national/international action on mitigation, adaptation, technology development and transfer, and provision of technical support and provision of new and additional resources, including official and concessional funding for developing countries. There was no agreement even on broad principles to guide these deliberations. Not surprisingly, the follow-up meetings in Bangkok in April 2008 and Bonn in June, 2008 did not make any real progress towards consensus.

Perhaps the most dramatic demonstration of the differences in perspectives of developed and developing countries³ on climate change came out in the recent (July 2008) summit meetings of G8 and G5 countries in Hokkaido, Japan. The G8 declaration (see G8, 2008) calls for adoption of the goal for achieving at least 50% reduction of global emissions by

¹The paper was prepared by Dr. Ramgopal Agarwala, formerly a Senior Adviser at the World Bank.

² Brazil, China, India, Mexico and South Africa.

³ In this paper, the words, “developed countries” and the North and “developing countries” and the South are used interchangeably.

2050 while emphasizing the need for “contributions from all major economies”, the code words for including major economies such as China and India in the compact. But it does not specify the base from which this reduction is to be achieved. Nor does it specify the targets for developed countries for 2050 or 2020. It also asserts that “all major economies will need to commit to meaningful mitigation actions *to be bound* in the international agreement to be negotiated by the end of 2009” (italics added). The needs for resource transfer to developing countries for adaptation and mitigation and for technology development and dissemination are recognized in broad general terms without any commitment to numerical targets. On the other hand, the G5 declaration (see G5, 2008) states that a shared vision on climate change must be “based on an equitable burden-sharing paradigm that ensures equal sustainable development potential for all citizens of the world and takes into account historical responsibility and respective capabilities as a fair and just approach.” The G5 leaders do not mention a global target for mitigation but call for quantified emission targets for the developed countries under Kyoto Protocol of at least 25-40 percent below 1990 levels by 2020, and by 2050, between 80 and 95 per cent below those levels. They do not call for any commitments on mitigation by developing countries, either in aggregate or in per capita terms or in terms of emission per unit of GDP. They call upon the international community to work towards a strengthened scheme for technology innovation, development, transfer and deployment, and a comprehensive review of intellectual property rights regimes for such technologies in order to strike an adequate balance between rewards for innovators and global public good. They also call upon developed countries to commit clearly to significant additional funding for both mitigation and adaptation in developing countries. The additionality should obtain not only in relation to current programs of ODA but also the financial arrangements under the Kyoto Protocol. They welcome for further exploration the Chinese proposal for setting up a climate financing goal for all developed countries such as 0.5% of GDP (in addition to ODA) for climate action in developing countries.

Clearly, if the Hokkaido G8 Summit is any indication, the developed and developing countries are not on the same page for managing climate change. In this paper we make some proposals to bring them together. In Section II we argue for a frank discussion of the factors that are behind the slow progress in climate change negotiations and present what may be called some “inconvenient truths”. Section III presents five criteria that a global compact must satisfy to reconcile the views of both developed and developing countries and to meet the goals on climate change. Sections IV and V discuss how the Kyoto Protocol and Indian policy paper on climate change fail to meet the necessary criteria proposed in the paper. Section VI presents our proposal of a climate change compact which we believe satisfies the five criteria mentioned in the paper. Section VII takes up the difficult issue of finding resources for financing adaptation and mitigation programs in developing countries and refers to some proposals for restructuring of the global financial architecture which can also generate resources for funding global public goods including climate change. Section VIII makes some concluding remarks.

II. Factors behind Slow Progress in Climate Change Negotiations

In order to make some real progress towards an agreement on climate change, we must be frank about the problems underlying negotiations on climate change. In fact, there are some

“inconvenient truths” that both the developed and developing countries must face up to if there is to be a global compact on climate change.

First, there is the issue of the historical responsibilities for the current stock of GHG and the implications thereof for funding adaptation and mitigation programs. What matters for climate change is not the flow of GHG, but the stock, and according to most calculations, developed countries are responsible for more than 50% of the current stocks of GHGs (see Muller et al, 2007). The concept of carbon debt and the debt servicing responsibility for that debt must be fully accepted. The present value of such debt needs to be quantified and the mechanism for servicing that debt explored. The enormity of the developed country responsibility is indicated by the following calculations. Since pre-Industrial Revolution era, the stock of GHGs has increased from about 280 parts per million (ppm) to about 430 ppm, as the result of emission of over 1 trillion tons of CO₂ equivalent over the period. Estimates of the social cost of carbon emissions today vary from \$3 per ton to \$130 per ton with an average value \$12 per ton in 2005 mentioned by IPCC Working Group II Fourth Assessment (IPCC FA). Even if one uses a low value of the social cost of emissions, the present value of carbon debt will be in trillions of US \$. Any reasonable figure on debt service obligations would indicate payments of hundreds of billions of dollars (a major part of which should come from the developed countries) that should be paid to compensate the present and future generations (a dominant part of which will be in developing countries).

Second, the developed countries must accept that there cannot be an international apartheid in lifestyles. If the western lifestyle is not replicable for the world as a whole, it must be modified in both the developed and developing countries. The emerging middle class in developing countries is by and large trying to replicate the western lifestyle and it must be recognized that this middle class will accept departure from the current western lifestyle only if the west itself is changing its lifestyle to a more sustainable pattern (see Naim, 2008).

Third, there is suspicion in the South that the economic rise of the South is not acceptable to the North because that will end their global dominance and the climate change discussions may be one instrument for slowing down the rise of the South. There must be more research in the South on the impact of climate change on their economies and an internal conviction generated that the effects of climate change will be devastating for the developing countries.

Fourth, the developing countries must stop hiding behind the poor. The burgeoning middle class in the developing countries is set to exceed the population of the developed countries and their lifestyle and per capita GHG emissions are basically similar to those in the developed countries. Unless the carbon emissions of this group are reduced, the developed country efforts to mitigate emissions will go in vain.

Fifth, the present discussions of climate change impacts concentrate too much on very long-term impacts and on impacts on global GDP. It is difficult to be terribly worried about what may happen in a hundred years given all the uncertainties, including those of technological progress. Something more convincing is needed. Among the possibilities are the following:

- i. We need to demonstrate that even though overall global effects may not be large, climate change can wipe out livelihood of millions of people, which could be equivalent to X number of tsunamis. Utter disaster even for 2% of the world

population may involve the livelihood of 100-200 million people, more than the number affected by all the disasters of the twentieth century including the World Wars.

- ii. The effects of global warming work in tandem with other effects which are operational in the short and medium term. For example, the risks of car population explosion come in the form of pollution and congestion in the near-term. Acid rain due to coal burning in China is a problem now. Promoting energy-efficiency is good for energy security now apart from its climate change effects. The discussion of the effects of climate change must put more emphasis on the near-term and associated adverse effects of carbon emissions than is done currently. Or to put it in another way, these discussions must highlight more forcefully the “co-benefits” of mitigation in carbon emissions, as has been done in India’s climate change paper (see Government of India, 2008)
- iii. The nature of catastrophic changes such as changes in monsoon patterns in South Asia or weakening of the Gulf Stream to Europe need to be elaborated by researchers in the affected countries and publicized separately rather than being a footnote in a thick report.

III. Necessary Criteria for a Credible Global Compact

The above discussion may suggest basically irreconcilable positions of developed and developing countries. However in this paper we argue that a compromise solution is possible provided both sides are prepared to show some flexibility. More specifically, we suggest five criteria that have to be satisfied by a credible global compact on climate change:

- First, it has to be comprehensive. What matters for the global climate change is the global stock of emissions and the global increment in that stock. If a compact leaves out major sources of the emissions, it cannot be effective. In this respect, the developing countries have to agree to be part of the emissions compact, though, as we note below, that does not mean “reduction” in CO₂ emissions⁴.
- Second, it has to be equitable. Any hint of a counterpart of the Non-Proliferation Treaty where the past and present high levels of emissions become a basis for future entitlements to high levels of emissions will jeopardize a global compact. It is clear that on ethical grounds, any concept of intra-generational and inter-generational equity will focus on emission rights on a per capita basis. The ethical argument is considerably strengthened by the economic argument that in the 50-100 year horizon relevant for climate change discussions, per capita incomes of major developing countries may converge towards those of the developed countries. India’s per capita income in PPP terms was \$3072 in 2005, an order of magnitude lower than the developed countries’ average of \$29,114. However, if India’s per capita GDP grows only at 5.2% per year between 2005 and 2050, its per capita income in PPP terms in

⁴ In this paper, unless otherwise mentioned, figures on CO₂ emissions as given in World Development Indicators 2007 of the World Bank are used as proxies for all GHG emissions.

2050 will be slightly higher than that of the developed countries in 2005. For China this catching up may take place sooner. In other words, by 2050, per capita emissions of India and China could be expected to be similar to those of the developed countries today, if these countries replicate the current relationship between carbon emission and per capita incomes in developed countries. The reduction that these countries can achieve in CO₂ emissions has to be seen in relation to this potential level rather than the actual level today. On both ethical and economic grounds, equality in per capita emission rights has to be a fundamental principle of a global compact on climate change.

- Third, the targets on emissions have to be realistic. Unless there is a technological breakthrough, the reduction in emissions is going to be a costly and slow process and as noted below, the progress in implementation of Kyoto Protocol does not inspire optimism. Unrealistic targets will reduce the credibility of the compact.
- Fourth, the program has to be efficient. It should minimize the global welfare loss associated with emission reduction and also minimize the risks of corruption in meeting the targets.
- Fifth, the program has to develop an institutional mechanism for effective implementation. Unless there are institutions which can, through incentives and/or disincentives, ensure compliance with global agreements, progress is likely to be limited. For developing countries, international assistance has to be massive but should be made contingent on design and implementation of a credible program for adaptation and mitigation. For developed countries there is a need for clear commitment to mitigation, backed by national legislation.

IV. Limitations of Kyoto Protocol Approach

At present the Kyoto Protocol is the main international mechanism for managing climate change. That mechanism, however, seems to satisfy none of the five criteria mentioned above.

First, the Kyoto Protocol does not provide a comprehensive mechanism for emission control. Annex I countries that agreed to emission targets account for only 30% of the global CO₂ emissions in 2003. If transition economies, which are operating well below their production level in 1990, are left out, then the percentage of emissions in 2003 covered by the Kyoto Protocol is only 20% of the global total.

Second, the Kyoto Protocol does not deal with the issue of equity. The targets it defines in relation to the levels in 1990 seem to be the products of political bargaining. There is no effort to demonstrate how the targets are linked to any principle of equity.

Third, the Kyoto Protocol does little to indicate, even in broad terms, the programs of technological dissemination, incentives, and resources needed for achieving the targets.

Fourth, for efficiency in carbon reduction, Kyoto Protocol uses a cap-and-trade system. This system is rooted in the basic insight that the marginal cost of reduction in emissions beyond the allowable caps may be higher for some entities than that of reducing below the caps for some other entities. In this form it could in principle work within countries and groups of countries with an aggregate cap. However, there are severe problems in practice. First, the allocation of caps to millions of individual units is a complex process subject to political and administrative manipulations. Second, there are major uncertainties about demand and supply of carbon allowances, and the trading prices have shown large fluctuations. These uncertainties do not provide a stable basis for long-term investments in carbon mitigation programs. Moreover, when trading with developing countries where there no limits on carbon emissions, the logic of a cap-and-trade system breaks down completely. A developing country may sell Certified Emission Reductions (CERs) through the Clean Development Mechanism (CDM) with its carbon-saving projects while increasing carbon emissions through other projects. Thus there is no assurance that extra carbon emissions allowed for the emitter in developed countries is being compensated by reduction in overall emissions elsewhere. Thus the system may not achieve overall emission reductions at all. Finally, in the CDM, neither the buyer nor the seller has an incentive to be honest about carbon savings in the project. The certifying agencies thus face temptations of avoiding due diligence in issuing CERs. The loser through falsification of such certificates is the global environment which does not have a seat at the certification table.

Fifth, the Kyoto Protocol does not provide for an effective implementation mechanism. In Kyoto Protocol, the enforcement mechanism for Annex I countries whose targets are supposedly mandatory is weak insofar as the non-complaint party is only asked to make up for the shortfall in future commitments and to submit a compliance action plan. The eligibility of the Party to make transfers under emissions trading is suspended until the Party is reinstated. In addition, the Protocol allows a country to withdraw from the agreement without specifying any penalty.

In view of the limitations of Kyoto Protocol, it is not surprising that the objective of reduction in carbon emissions is not being achieved. Between 1990 and 2003, CO2 emissions (a principal GHG) increased by 18.9% shared almost equally between the developed and developing countries. What is surprising is that carbon intensity of GDP declined more sharply in developing countries (28.5%) than in high income countries (12.6%). Even more surprising is the fact that CO2 emission on a per capita basis, already relatively high in developed countries further increased by 8.5% between 1990 and 2003 while it declined marginally by 1 percent in developing countries. Clearly, despite all the hype about climate change in developed countries, there is a retrogression rather than progress in reducing their carbon footprints in these countries.

Table 1: Trends in CO2 emission, 1990-2003

	1990	2003	% change 1990-2003
1. CO2 emissions (billion tons)			

World	22.50	26.8	18.9%
High income	10.65	12.74	19.59%
Low & middle income	10.66	12.6	18.68%
2. CO2 emissions (kg per 2000 PPP \$ of GDP)			
World	0.628	0.507	-19.24%
High income	0.522	0.456	-12.59%
Low & middle income	0.801	0.572	-28.52%
3.CO2 emissions (metric tons per capita)			
World	4.3	4.3	0
High income	11.79	12.79	8.49%
Low & middle income	2.41	2.39	-0.80%

Source: WDI, World Bank, 2007.

On these trends, the target of reducing CO2 emission between 1990 and 2012 for signatories of Kyoto Protocol is unlikely to be realized. (See, for example, IMF WEO 2007).

The nature of the problems in the international dialogue on climate change is clearly shown by the “National Action Plan on Climate Change” (NAPCC) published in 2008 by a high-level Council chaired by the Prime Minister of India (Government of India, 2008). The paper begins with a clear statement on historical responsibilities of developed countries for the global threat of climate change and calls for transfer new and additional financial resources and climate-friendly technologies to support both adaptation and mitigation in developing countries. At the same time, the report shows great agnosticism so far as the adverse effects of global warming on India is concerned.

The report highlights the need for low carbon growth but avoids any quantification on targets on energy efficiency or carbon efficiency even to the extent that other Government of India documents on energy policy seem to do. There is obviously a concern that any national targets may be seized upon by the international community as national commitments irrespective of the availability of resources and technology to achieve these targets. The only target that is mentioned is that India is determined that its per capita greenhouse gas emissions will at no point exceed that of developed countries. Since that is not a likely outcome for decades, this approach could become an alibi for inaction for the foreseeable future. So far as the global climate change architecture is concerned, the Indian position is that Kyoto Protocol does not expire in 2012; only a new phase of the Kyoto Protocol is to be discussed for the period beyond 2012. Thus the commitments for mitigation will be made by developed countries only and the developing countries will benefit from resources made available under Clean Development Mechanism and funds for adaptation.

The Indian climate policy report is a good example of how the developing countries are not on the same page as the developed countries on post-2012 agreement on climate change.

VI. An Alternative Framework for Managing Climate Change

VI.1 Defining Targets for CO2 Emissions that are Comprehensive and Equitable

As mentioned above, we believe that emission targets that are comprehensive and equitable should be defined on a per capita basis for the world as a whole.

Table 2 works through the implications of the G8 target of emissions by 2050 on a per capita basis. It suggests that, to achieve the target of 50% reduction stated in the G8 communiqué, the developed countries will have to reduce their per capita emissions by 90% from their 2003 level, while the developing countries will have to reduce theirs by 40% from their already low levels. Such targets do not seem to be realistic. Even countries such as the UK that are committed to serious emission reduction efforts do not propose 90% reductions. For developing countries, a 40% reduction in emissions does not seem realistic in technological and political economy terms considering the enormous needs of growth over the next few decades. The target of 50% reduction in carbon emissions by 2050 is gaining currency but that seems to be of questionable validity.⁵

Table 2: CO2 Emissions (billion tons), 2003 and 2050

	2003 total emissions (billion tons)	2003 emissions per capita (tons)	2050 total emissions (billion tons) with:		Population (billion) 2050	CO2 emissions per capita in 2050 with:	
			50% reduction	Stabilization at 2003 level (with equality in per capita emissions).		50% reduction in total emissions from 2003 level	Stabilization in total emissions at 2003 level
High-income countries	12.74	12.79	-	3.44 (-73%)	1.25	1.45	2.75
Developing countries	12.65	2.39	-	21.86(73%)	7.95	1.45	2.75
World	25.39	4.30	12.70	25.39	9.2	1.45	2.75

Note: Figures in parentheses are changes between 2003 and 2050.

Source: WDI, 2007, World Bank, UN Population Projections and author estimates.

⁵ If the base level is 1990 rather than 2003, the task will be even more difficult.

An alternative target could stabilize CO2 emissions at 2003 levels by 2050, with a possible target of 50% reduction by 2100.⁶ This will require reduction in per capita emissions in developed countries by about 80% by 2050, and allow an increase in developing countries' per capita emissions by about 20%. For countries like India, whose per capita emissions in 2003 were only 1.20 tons; this will allow an increase in emission rights by more than 100%. If it is accepted that stabilization of emission levels until 2050 is a more realistic target, it will mean a greater focus on adaptation. In aggregate terms, the approach suggests the following targets:

Between 2003 and 2050, developed countries will reduce CO2 emissions by no less than 73% and developing countries will increase CO2 emissions by no more than 73%.

These targets do not mean that developing countries will not be making efforts to reduce emissions, only that their cuts should be seen in relation to potential emissions after taking into account their growth needs and not from the current levels. So far as reducing carbon intensity of growth is concerned, the developing countries will be making the same degree of effort as the developed countries. In 2003, CO2 emissions per unit of GDP in 2000 international \$ were 0.51 kg for the world, 0.46 for developed countries, 0.57 for developing countries. Assuming 2% annual growth in GDP for the period 2005-2050 for the developed countries and 6% for the developing countries, the above allocation of CO2 emission rights leads to carbon intensity of GDP (in PPP terms) of 0.048 kg per unit of GDP for the developed countries and 0.063 for the developing countries in 2050. It means annual reduction in carbon intensity of GDP by about 5% per year for both developed and developing countries (see Table 3). Thus in this scheme there will be parity between developed and developing countries in terms of efforts to reduce carbon intensity of growth:

Both developed and developing countries will aim at reducing carbon intensity of GDP by 5% per year between 2003 and 2050.

Table 3: Targets on reducing carbon intensity of GDP

	GDP in trillions of 2000 PPP\$		CO2 emission (kg per 2000 PPP\$ of GDP)	
	2005	2050	2003	2050
Developed countries	29.4	71.7 (2%)	0.46	0.048 (-5.0%)
Developing Countries	25.3	348.5 (6%)	0.57	0.063 (-5.0%)
World	54.7	420.2 (4.6%)	0.51	0.060 (-5.0%)

⁶ As per Summary for Policymakers of the Synthesis Report of the IPPCC Fourth Assessment Report (November 2007), this scenario will be in Category III Scenario which has the following characteristics : CO2 concentration at stabilization of 440-485 ppm; peaking year for CO2 emissions during 2010-2030; change in global CO2 emissions in 2050 between -30 to +5 % of 2000 emissions, global average temperature rise above pre-industrial at equilibrium, 2.8-3.2 degree C; global average sea-level rise above pre-industrial level 0.6-1.9 meters.

Note: Figures in parentheses are annual growth rates between 2005/2003 and 2050.

Source: WDI and author calculations.

The targets on carbon intensity of GDP can in turn be divided into targets on reducing energy intensity of GDP and carbon intensity of energy. The former may be cost effective in purely economic terms while the latter will require subsidies to compensate for externalities.

The above approach will imply a clear definition of common but differentiated responsibilities for developed and developing countries. The commonality will obtain in targets for reducing carbon intensity of economies. However, within the efficiency targets, developing countries, which are at early stage of development, will be allowed to maximize their growth performance, while the developed countries, which are at a mature stage of development, will constrain their growth within the allowable carbon emission targets.

Thus for developed countries, with an economic growth rate of 2 percent per year, CO₂ emissions will be reduced by about 3 percent per year, leading to a 73 percent reduction between 2005 and 2050. This target will be mandatory.

For developing countries with 6 percent economic growth rate per year, CO₂ emissions will increase by about 1 percent per year with an increase of 73 percent between 2005 and 2050. For developing countries, these targets will be conditional on receiving transfers of funds and technology from the developed countries, in recognition of limited capabilities of developing countries and the ecological debt owed by the developed countries for their past emissions.

VI.2 Getting Carbon Prices Right for Efficiency

The Kyoto Protocol and the associated programs have been dominated by a planning mindset. Targets are determined by administrative/political process and countries (and production units) are required to fulfill the targets with the option to buy out emissions above the target through trading mechanisms. As noted above, the trends over 1990-2003 do not present an encouraging picture of success in achieving these targets. Perhaps more attention should be given to articulating the instruments, in particular, market-based instruments such as pricing to achieve the goals of emission reductions.

For a generalized impact on carbon use with minimum of bureaucratic intervention, the first step is to get the carbon prices right. This in turn would have two steps.

The first step will be to eliminate (or at least substantially reduce) the subsidies currently given to emitters, which are estimated to be \$250 billion per year by the Stern Review. Whatever else is done, the phasing down of subsidies should be a priority and this should be no more difficult than negotiations on subsidies in the WTO framework. The savings in carbon emissions that such programs can achieve could be substantial. In a study published in 1999 by International Energy Agency (see IEA 1999), it was estimated that for eight countries outside the OECD (China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa and Venezuela), there was on average a subsidy of 20% in energy pricing and removal

of such subsidies could reduce primary energy consumption by 13% and lower CO₂ emissions by 16%. These studies need to be updated to cover major economies in both the developed and developing countries.

The second step will be to explore the mechanism for taxing carbon emitters. The theoretical rationale for such a tax is clear. It is interesting to note that eminent economists such as Jagdish Bhagwati, Joseph Stiglitz, Larry Summers, Jeffrey Sachs, Paul Krugman who have differing views on many development issues all seem to agree that the sources of negative externality should be taxed to compensate for the damage done by greenhouse gas emissions. If one takes a conservative estimate of the average social cost of emissions at \$10 per ton of CO₂, a carbon tax of equivalent to that cost will yield about \$260 billion per year, which can go a long way to meet the costs of mitigation which have been estimated at 1% of GDP by Stern Review.

VI.3 Development and Dissemination of Carbon-saving Technologies

Over the longer term technological breakthroughs will perhaps provide the real solutions to the climate change problem. How can the international community support such activities? What was done in the past for agricultural research activities under the Consultative Group International Agricultural Research (CGIAR),⁷ for example, could provide a model of what international institutions can do for carbon saving technologies.

There are many examples of carbon-saving technologies and practices at the micro- and macro-level around the world. These “success stories” need to be publicized. Perhaps international institutions can create a web page for ready access to such success stories. They could also launch a program for social marketing the importance of carbon emission reductions to the masses. The massive programs popularizing family planning in developing countries, which seem to have made a dent in a very sensitive area, can provide an example of what can be done for climate change.

For widest possible dissemination of existing and new technologies, WTO regimes should be made sensitive to climate change issues. As recommended by the Stern Review, the reduction of tariff and non-tariff barriers for low-carbon goods and services within the Doha Development Round of international trade negotiations could provide further opportunities to accelerate the diffusion of key technologies. Among the non-tariff barriers to technology transfer, intellectual property rights are an important barrier. Although technology transfer is one of the objectives of TRIPS, the progress on this front is inadequate and demands to opt for stronger intellectual property rights in developing countries irrespective of their technological capability hinders transfer of technology. In case of global climate change, the access to Environmentally Sound Technologies (ESTs) should not be withheld on account of weaker intellectual property rights in developing nations.

⁷ <http://www.cgiar.org/index.html>

The Doha Declaration came out with a solution to facilitate access to drugs and pharmaceuticals, particularly in the case of HIV/AIDS. In view of the negative impacts, particularly the health impacts, of global climate change, the parties to the WTO should extend a similar approach to facilitate the transfer of technologies and ensure that intellectual property rights do not become a barrier. The Montreal Protocol provides a successful example where the global community came together to ensure that all countries could get access to technologies to control and eliminate ozone-depleting substances (ODS). It provided for an integrated mechanism to take care of the needs of developing nations to technology and provided incentives for technology transfer. In view of the public goods nature of the global climate and to ensure that developing nations do not suffer from negative impacts of climate change due to lack of technology, it is suggested that the global community formulate a similar mechanism to develop, transfer and use of environmentally sound technologies to mitigate global climate change. This mechanism should complement the various multilateral and bilateral initiatives of technology transfer in the context of global climate change.

The development and transfer of technologies can be stimulated through many measures including patent buy-outs for important technologies, reduction of tariffs on sale and transfer of technologies, a global venture capital fund to commercialize clean energy technologies, transfer of technologies to public domain, licensing schemes with reduced duration of intellectual property rights to enable technology transfer, and flexible mechanisms of climate technology transfer taking into account the need for long-term climate stabilization.

VI.4 A Global Institutional Framework for Effective Implementation

Climate change is now widely recognized as perhaps the greatest market failure in human history and a perfect example of a negative global public good. As mentioned above, the difficulties in making progress in this area should not to be underestimated. Just as provision of national public goods requires national governmental intervention, provision of a global public good may require a breakthrough in a global governance structure. And just as at the national level, the imperatives of provision of national public goods pushed the process of formation of bigger and bigger governance units (in for example the United States and Australia), the imperatives of providing global public goods such as controlling climate change will require more and more public policy interventions at global and regional levels. The theories and practices developed in the context of federal states for allocation of functional responsibly and allocation of fiscal resources for meeting these responsibilities may be increasingly relevant for provision of global public goods such as addressing climate change. The massive task of redistributing resources from the minority who owe most of the carbon debt to the majority who are the victims of climate change will require a global compact and global authority to implement it. And that requires a breakthrough in global governance. Without such breakthrough, effective action just will not happen in this area. TINA (there is no alternative) theme applies here as strongly as anywhere else.

The primary responsibility for helping to meet the challenge of a truly global public good such as coping with climate change should go to global institutions. In this context the UN

system is the appropriate forum for *negotiations and agreements* on a global program for climate change.

However, the implementation of the agreed programs is likely to require substantial financial resources as well as formulation of concrete projects and programs. For that purpose the multilateral financial institutions (MFI) will have to play a crucial role. The Bretton Woods Institutions, which seem to be losing their traditional business, may be restructured to deliver on this new global mission. The traditional tasks of macro-economic stability, balance of payments support, infrastructure development, and poverty reduction, which are more of national or regional public goods than global public goods, could be increasingly left to the regional development banks while the global institutions concentrate on truly global public goods such as emission control. The IMF could be an ideal agency for reviewing the issues of carbon subsidies and carbon taxation at national and global levels and the World Bank could serve as an ideal agency for supporting projects and programs for carbon reduction. The IMF's Article IV Consultation Reports could be restructured to become a vehicle for surveillance on taxes, subsidies, and other carbon reduction programs of both developed and developing countries. The World Bank can build upon its experience of development policy loans to help developing countries design and fund the programs for reducing carbon intensity of these economies.

VI.5 Mobilizing Funding for Carbon Saving

If reducing CO₂ emission by 50% by 2050 is not realistic, global warming of more than 2 degree centigrade may be unavoidable and adaptation to such climate change has to be given a more serious place in global discussions on climate change than has been the case until now. Country-by-country assessments should be made of the resource needs for both mitigation and adaptation. However, the UNFCCC figure of annual bill of \$200 billion per year for activities related to climate change seems a good enough figure to start with. A large part of this expenditure for adaptation and mitigation will have to take place in developing countries which do not have adequate resources of their own. Thus, as part of the historic responsibility of the developed countries for greenhouse gases, they should be willing the transfer resources to developing countries to meet their costs of adaptation and mitigation.

However, while the principle of the global transfer of resources for provision of a global public makes eminent sense, it may not be realistic in the current global atmosphere when the developed countries are facing a resource crunch and are afraid of competition from the developing countries. There is a need to explore an alternative avenue for resource mobilization which is in fact facilitated by the current financial crisis in the United States. Such a proposal has been made in Agarwala (2008), which suggests creation of a global currency to replace the US dollar as the main reserve currency. The seigniorage from global finance that is now accruing to the United States will, in the proposed scheme, accrue to the global community and can be used to fund global public goods such as management of climate change.

VII. Concluding Remarks

Discussions on a post-Kyoto compact on climate change are not going well. This poor performance is not so different from that on several other current multilateral negotiations such as Doha Round on trade, multilateral surveillance on global imbalances and exchange rate, and management of Sovereign Wealth Funds. The basic factor behind this near paralysis in multilateral negotiations is the changing power equation in the global economy. Until recently, the United States was the undisputed leader in these negotiations and under the U.S. leadership, the North basically wrote the rules of the game at multilateral level. But now the South has stood up and is determined to make its voice heard. In climate change discussions, there are some basic differences of perspectives between the North and the South. The North is unwilling to face up to its historical responsibilities for climate change and to admit that its lifestyle is basically not sustainable at global level and must therefore be changed. The South is unwilling to agree that as the center of gravity of the world economy is shifting to the South so is the source of greenhouse gas emissions, and that unless emission per unit of GDP in the South is reduced, all the efforts of the North to reduce emissions will come to naught so far as global warming is concerned. The South is also preoccupied with the technicalities of the UNFCCC agreement reached in a different global economic environment in 1992 and is suspicious of any international commitment on carbon emissions on its part and an effective mechanism to enforce whatever agreement is reached. In view of the serious risks that humanity faces from continued global warming at present pace, a paralysis on agreement on managing climate change will be most unfortunate.

The present paper makes some bold proposals for breaking the current logjam on climate change discussions. It argues that a global compact has to satisfy five criteria: it has to be comprehensive, equitable, realistic, efficient and effective. In a departure from the conventional discussion which puts the UN system at the center stage, the paper proposes that the Bretton Woods Institutions should be utilized as the principal instruments for an effective implementation of a compact on climate change. It also refers to some bold proposals for resource mobilization for managing climate change. These are undoubtedly ambitious ideas; but with the fate of humanity at stake, the world needs nothing less.

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