

Session 4: Is it possible to apply the same policy instruments to Developing and Developed nations?

Paper 1- Policy Instruments for Developing Countries

M. Asaduzzaman

Nominated Discussion

H. Pitcher

Paper 2- Policy Integration in Developing Countries

T. Jung

Nominated Discussion

S. Mori

Rapporteur's Summary

S. Gaffin

Policy Instruments for Developing Countries

M. Asaduzzaman

POLICY INSTRUMENTS FOR MANAGING CLIMATE CHANGE IN DEVELOPING COUNTRIES

M. Asaduzzaman¹

Bangladesh Institute of Development Studies, E-17 Agargaon,
Sher-e-Bangla Nagar,
Dhaka 1207, BANGLADESH
Tel. : 880-2-818920; Fax : 880-2-813023
E-mail : asad.bids@drik.bgd.toolnet.org

Abstract

Barring a few exceptions, if any, all the Integrated Assessment Models (IAM) analysing policy options and their impact on climate change or factors that influence climate change are based on the data and information from the industrialised West and other developed countries. Even where the developing countries have been taken into consideration, they have generally been lumped together. While data availability and quality had been part of the reason for such a concentration of efforts, the conclusions arising out of such models and analyses may not in general be applicable in the face of the realities of the developing countries, or at least all the developing countries, because of their diversity and differences due to absence or weaknesses of institutions or development priorities. This short paper tries to point to some of these difficulties and argues that while modeling efforts are necessary as a guide to future course of policy actions, these should not turn into fetishes. Further, it is argued that given critical weaknesses of the data and information simpler IAMs possibly are better suited for the purpose than the complex ones which are getting much of the attention at present.

I. INTRODUCTION

Integrated Assessment Models (IAM) are now the rage among many of those trying to understand the interaction between human society and the physical world as these impact upon global climate change on a grand scale over time and space. The literature on IAM is growing quite fast. On the other hand, much of the climate change-related policies in the developed countries of the world are likely to be influenced by the results of these models. For this reason, the Second Assessment Report (SAR) of the IPCC WG III has devoted a full chapter to the IAM. The authors of the chapter, however, cautioned the readers about the strengths and weaknesses of these models. Five types of limitations have been pointed out, one of which referred to the need for representation of the developing country realities in such models. This paper reviews some such relevant differences between the developed and developing countries and tries to argue where and why the policy instruments discussed or implied by the present IAMs may be of limited applicability, at least for the present.

The next section provides a very brief introduction to the IAMs, drawing essentially upon the SAR of the IPCC WG III (Bruce, Lee and Haites : 1996) and their policy implications; followed in Section III by a discussion of some of the broad features pertaining to issues of climate change in developing countries as they differ from or even similar to those in the developed countries. Section IV then combines the policy prescriptions of the IAM and juxtaposes them with the features in Section III to judge the applicability of the policy instruments derived from the IAM or IAM-type models. Finally Section V makes some concluding remarks.

II. THE INTEGRATED ASSESSMENT MODELS

The Integrated Assessment Models basically are of two types, policy optimisation models and policy evaluation models. While each may again be divided into more than one sub-class, the essential difference between the two is that in the former case the attempt is to arrive at the optimal value or level of policy or control variables for achieving certain predetermined policy goals (e.g., stabilisation of emission at a certain level by a certain date or balancing costs and benefits of such stabilisation), while in case of the latter the objective is to find the impacts (of which climate change is only one of several) of putting such policy instruments into practice. Both types of models have their uses. Thus, once one knows the level at which the policy variables are to be set to achieve the climate-related target(s) using the former type of models, the latter may be used to judge the desirability of the policy instrument by focusing not only on their impact on the target variables (related to climate change) but also others within the model so that one can decide whether the latter imposes "costs", political, economic, social or environmental, that are at acceptable levels or beyond. A policy-maker will have to weigh these other implications before finally deciding upon the particular policy instrument.

The IAMs are essentially what economists call general equilibrium models, with the difference that these encompass not simply human activities in the economic sphere but also various natural forces and thus are on a far more grand scale. Given the nature of such models, these more often than not tend to employ high levels of aggregation over variables and space (although some are geographically more explicit than others) as very elaborate models may lead to such clutter that the essential interactions between modules and within modules may get masked by other, possibly non-essential, ones. This applies more to the policy optimisation models. Policy evaluation models, on the other hand, of necessity have to be more elaborate if they are to show the impact on various variables and systems.

There is a diverse array of the IAMs and it is easy to be confused². Some degree of diversity in any academic discourse is, of course, to be expected and not bad in itself. Unfortunately, the modeling here is not just for academic curiosity but also about real life policy-making about an extremely serious matter threatening human life and society, and thus the present diversity may make the policy-maker uncertain particularly as models differ in their findings and explicit or implicit policy prescriptions because of the particular assumptions made in the models. The policy-maker's uneasiness is likely to be more so in the developing countries where the policy actions are constrained by many factors which are either absent or are less important in the developed countries and are thus generally not considered in the models, therefore making their policy-prescriptions less relevant, if not outright inapplicable, in the developing countries. The next section discusses some of these differences between the developed and the developing countries. But more than this, some of the similarities that they share have also been pointed out. Such similarities may make the present debate focusing on the differences somewhat misdirected.

III. DEVELOPED VIS-À-VIS DEVELOPING COUNTRY CONTEXT

The group of countries termed as developing is actually not homogeneous. The differences among these countries is perhaps as great as that between them as a group and the developed countries. With this caveat, let us note the differences and similarities between and within the groups.

First, consider the population level. Many of the developing countries are small in terms of population but many are not either in terms of population size or density (China, India,

Brazil, Bangladesh). In contrast, population in developed countries are in general at most of medium size. More importantly, with a few exceptions, many of the developing countries are experiencing a high rate of growth of population, particularly in Africa and the Middle East (mostly at 3% or more), while in the industrialised West and Japan the rate is very low (with an average rate of 0.7% per annum) (UNDP : 1996). The exceptions include China which is experiencing a rather low rate of growth of population. So interestingly, is, Bangladesh where the last registered inter-censal rate of growth has been 1.8% per annum. In both and similar other cases, however, the base is so large that even with a fall in the rate of growth the absolute addition to population for many years to come will be very large.

Second, compared to their population size, the size of the economies are generally much smaller in the developing countries compared to the developed ones, while the rate of growth of some of the former is very high, particularly in East and South-east Asia. The rate of growth is also picking up in the countries of South Asia. These indicate some interesting cases (like say, China) where a large population size overlaps with a high rate of growth of the economy. In the industrialised West and Japan, the rate of growth of the economy is much smaller while the size of the economies are far larger (with the largest, the USA, in the league)³.

The third difference between the developed and the developing countries relates to the structure of their economies. In the former, the economies have either been transformed or are in the process of transformation into a (relatively speaking) service economy which demands less energy per unit of GDP compared to an economy dominated by material, particularly manufacturing industrial production. The fast growing economies among the developing countries generally fall in this category and may continue to remain in that phase for a quite time long⁴.

Fourth, the nature of energy consumption in many of the developing countries, particularly the low-income ones is radically different from that in the developed countries. Not only it is much higher on a per capita terms in the latter, much or almost all of it is dominated by fossil fuels, coal, oil and natural gas. In the other countries, in contrast, energy consumption is characterised by the predominance of biomass-based fuels, even when some of them are endowed with rich primary sources of fossil fuel (like say Indonesia which has a good reserve of oil but still about 40% of the energy is consumed in the form of biomass or traditional fuels) (WRI : 1996). Bangladesh, similarly, has a fair amount of gas reserve with hopes of further future discovery given the high rate of success in exploration⁵, while biomass fuels account for some 75% of total energy consumption. In India, the proportion is more than 50% (TERI : 1996). Much of this is tree biomass and the rest is animal residues like cow dung.

While the biomass predominates, the demand for fossil fuel and electricity is fast increasing, for example in India at 6% per annum (TERI : 1996). In Bangladesh, according to official estimates, the demand will grow in the future such that between 1995-2020 the total commercial energy use shall rise five-fold while the consumption per unit of GDP shall double. Yet for the foreseeable future the dominance of biomass may continue in many of them as in case of Bangladesh (GOB : 1997).

The fifth difference between the developed and developing countries relate to the historical experience of trend in energy consumption. In the developed countries in general there has been a fall in the energy intensity of GDP⁶. Among these countries, the annual rates of improvement in energy intensity varied between 1.23% (Western Europe) and 1.83% (USA) to 2.22% (Japan). Some of the developing and newly industrialised countries at the same time (over the seventies and eighties) also managed to lower energy intensity. Such countries include China, Taiwan, and Korea but not others like Thailand, Pakistan, India, Malaysia or

Brazil, in which energy intensities of GDP actually increased sometime quite dramatically. A similar situation, as official projections indicate, will also probably be witnessed in the case of Bangladesh.

The sixth difference between the developing countries and the developed ones refers to energy use data. This is not peculiar to energy data as such but is applicable across the board regarding the availability and quality of data and information in other sectors. Be that as it may, it is not a trivial problem as has recently been discovered in Bangladesh (GOB ; 1997). It has been found that the aggregate official data on energy use and the information collected from microlevel consuming units do not match each other, which had been expected. But the degree of mismatch is severe, to the extent of nearly 40%, and for certain sectors like industry - which is expected to account for much of the growth in the consumption of commercial energy in the coming years - the sum of micro level data is twice the official aggregate figure. The situation may not be as bad elsewhere, but one should be careful about using such data for policy-modeling.

The seventh difference between the developed and the developing countries relates to their institutional capacity to manage rapid change. Such lack of capacity is due to shortage of skilled manpower and also finance.

Reference must now be made, before we conclude this section, to one crucial similarity between the developed and the developing countries. The price elasticity of energy consumption is low in both types of countries⁷. Thus while in the industrialized countries the short and long run price elasticities are -0.13 and -0.34, in the developing countries the respective median values are about -0.15 and -0.25. On the other hand while the income elasticities are not that high in the developed countries (0.24 and 0.63, or thereabouts in the short and the long-run) in the other countries these are much higher, either close to or above unity in some cases and for specific fuels.

A similar degree of price and income responsiveness has been observed in Bangladesh (Zaman : 1996). But there have been some curious twists in the tale. While income elasticities are all very high even in the short run (such as about 5 for electricity which very possibly indicate huge unmet demand), the price elasticities in general indicate, if at all, very low price responsiveness. Only kerosene has been found to be price-responsive and, to an extent, domestic gas. One possible reason is that the utilities like power and gas are in the public sector and all are administratively regulated by the government and operate under soft budget constraints (i.e. the government cushions the effect of any price rise). In case of kerosene and domestic gas, the situation is somewhat different. Here the market has a fuller play and the consumers are the very small domestic households without any market-influence.

IV. EFFECTIVENESS OF POLICIES

The question now is whatever the policy-prescriptions of the IAM, may these also hold in case of the developing countries? But even before that we should rather ask the question whether these are applicable to or are operationally valid even in case of the developed countries. It appears that whatever the model results, carbon taxes or similar other measures are not likely to be operationally much effective if other issues are not resolved first.

A carbon tax, after all, is advocated to change the relative prices of different fossil fuels and thus expected to create relatively a higher demand for cleaner fuels like natural gas or renewable energy obtained from wind or solar power. Given the price responsiveness of

fossil fuels as indicated above, it seems hardly likely that consumers will care much, unless they are forced to, whether in the developed or in the developing countries.

One may note that there are many imperfections in the energy market, both in the developed and the developing countries (while it may be more so in the latter). Administered prices may not reflect the true economic cost of supply or may do so only partially (TERI : 1996; personal experience). Subsidies and administered prices are a fact of life in many countries. It has been estimated that removal of these subsidies may play the same role as a carbon tax in terms of these subsidies revenue generation while at the same time freeing the energy market from distortion. Thus, the resources freed may be equivalent to the effect of a \$40 tax per ton of CO₂ (Shah and Larsen : 1994).

There is yet another consideration. The nominal and effective rates of tax may sometime vary widely, as they do in Bangladesh. Thus a nominal tax rate of 4% for petroleum products actually translates into an effective rate of 42% (Chowdhury : 1994). The story is similar in case of electricity and natural gas for the reason that the inputs into their production are also taxed, particularly capital equipments. Whether one would like to impose further taxes in a developing country in such a situation remains debatable.

Consider also that energy is not used directly. Equipments and machines are needed to get the service of energy in a useful form. Unless these equipments and devices are replaced with, or modified to be, more efficient ones, not much is going to change in terms of energy consumption in the long-run. There is in general not much of a lack of commercially proven and technically more efficient technologies. Yet not much happens. One reason is that when energy prices rise people do not immediately discard their old devices and equipments which are still serviceable. They will replace them with the more-efficient ones at the time these are no longer serviceable and if they find them (the more efficient devices) relatively cheaper compared to the old models. Even then whether they shall do so may depend on two factors.

People, when they buy something, look for not one attribute but several. For example, a highly efficient motor car may be bought not simply for its efficiency but also its look and the additional comforts. At least some will put more store in these non-energy characteristics and thus the change in aggregate energy use may come, if at all, only slowly. The whole adoption and diffusion literature bear witness to the importance of these multi-attribute nature of products and practices for these to be used by the people⁸.

A second reason for slow adoption of energy-efficient technology is the observed high rate of discounting (i.e. a desired short pay back period). But even when such a short pay back period is ensured, many may not be willing to invest much. Take the case of Bangladesh industry. In 1986, there was an energy audit in many industries and suggestions were made about certain changes which would have saved substantial amount of energy, but were at the same time shown to be financially very attractive with rather short pay back periods (Arthur D. Little : 1986). Little has happened so far. A probable reason could be that energy is only a small part of the over-all cost or rather declared cost (as many would certainly be in a position to bribe, and do bribe, the metre readers and thus keep their energy costs to a minimum). If one can keep the energy cost low without much inconvenience, why go for costly changes in capital equipments or other measures?

The other critical issue that needs attention in relation to many, if not all, of the developing countries is to track what happens to the use of biomass energy use in the IAMs. These have been given either scant or only an oblique attention through the modeling of land use changes. While a simple increase in efficiency of the cheap cooking stove may drastically cut down the demand for biomass, save the land from much deforestation, and keep carbon

locked in the trees, the issues raised in the IAM become somewhat esoteric for the developing countries.

The developing countries are mostly poor and in many cases populous and they need to raise their living standards fast. A rising population certainly does not help the cause, and concerns have been expressed that population dynamics has not been modeled well in IAMs. But given other things, it is not clear how important population is as a cause of concern if the per capita energy consumption is low, and in many of the major and populous developing countries the trend of population growth is downward. On the other hand, the growth of the economy and its structure in the developing countries is probably more important.

As the developing countries try to grow economically and industrialize, energy consumption will grow fast. Should they be constrained by further tax rises and similar other measures and have a lower standard of living? Some modeling exercises show that such taxes may conflict with these economic and social goals. Boyd and Uri (Boyd and Uri : 1993), for example, have shown for Philippines that elimination of taxes on refined petroleum products would have increased national output by 3.6%, consumption by 13.6% and total utility by 14.3%. Similarly Jayadevappa and Chatre (Jayadevappa and Chatre : 1995) have shown how a carbon tax may lead to a loss of output and income in India because of its impact through rising prices.

What all these mean is that the policy instruments like a carbon tax may not be very suitable for many of the developing countries. They may be so in the context of the developed countries. But, most interestingly, the OECD countries, despite academic discourses, have done little. This is because the worldwide investment in fossil fuel production, distribution and consumption has too much/great a momentum to be slowed down any time soon, as it adversely affects too many powerful players, be it companies or nations. Unless such issues are taken into consideration, the model results may remain just that.

The question now is if anything can be done about these inertia and national imperatives? Probably all sorts of instruments in various degrees, including regulation and standards have to be used. Particularly given the nature of response to various changes as discussed above, regulation and standards will have to play a large role. After all, all these muted responses are nothing but symptoms of market failure due to its inability for one reason or another to internalise all costs borne by the society whether now or in the future. Indeed, the FCCC provisions for obligatory lowering of emission to the level of 1990 by Annex I countries is a pointer to such a failure. Yet, the market should be allowed a full play as far as possible for the sake of efficiency. The issue of tradable permits for emission inside a country, or internationally the mechanism of Joint Implementation (JI) and Activities Implemented Jointly (AIJ), may help in lowering the costs of emission whether or not there is a ceiling to it (as in the case of the Annex I countries).

Tradable permits are theoretically very interesting mechanisms when a country wishes to lower emission and has the administrative and other institutional capabilities for initial apportioning of quotas to various industries or economic activities. Unfortunately this is not the case in developing countries. In any case, these countries do not yet have a quota nationally and thus no need for further dividing it among economic actors.

On AIJ, there are controversies over its operationalisation, particularly regarding the assignment of GHG credits. Furthermore, while it may also be a good cost-cutting mechanism AIJ between developed and developing countries may be only a short run least-cost option. This is so because AIJ investments are likely to be primarily made in case of commercially ready, low-cost, technically proven projects. Furthermore, its additional

provision in terms of investment may result in some puzzling situations and may not lead to really worthwhile investments (from the point of lowering energy consumption and emission). An illustration will help in understanding the matter.

Recently, Bangladesh has prepared a Power Sector Master Plan. Given the availability of natural gas and the present state of technology, the least-cost plan calls for a net generation capacity of 9.7 GW by 2015, relying mainly on combined cycle plants (62% of generation) and less on others like combustion turbines (33%) and the steam turbines (5%). This is also the least emission-intensive as it depends mostly on natural gas. The next best and costlier alternative depends for 55% of generation on imported fuels like oil or coal and is thus much more emission-intensive. The least-cost plan assumes an uninterrupted supply of gas. Now if no more gas field is discovered, over time more of the new plants will have to depend on more carbon-intensive fuels. The additionality of funding here actually should be in terms of the additional investment costs for gas exploration. But then this is traditionally treated separately as part of gas sector development, not as part of power sector development. What then one needs is an integrated, not compartmentalised, assessment of investment options in the energy sector. Unless this is done, the least-cost plan being least-cost will not have any additionality in terms of power sector investments and therefore will not qualify for support in the GHG reduction initiative. The result shall be an additional release of nearly 4 million tons of carbon per year by 2015.

V. CONCLUDING REMARKS

What has been observed here is that while the IAMs may be useful tools in understanding the impact and levels of certain policy instruments, these may have only limited usefulness in the case of developing countries. Their peculiarities in terms of structure of the economy, energy use, inertia of people in changing to new equipments or practices and administrative and institutional factors, limit the effectiveness of the policy tools. On the other hand, the data bases are sometime too weak. Some of these weaknesses have been noted in the SAR review of IAMs. It appears, however, that some of the intended modifications, particularly in the efforts to capture population dynamics, may not be much rewarding as the main driving forces behind future energy use are likely to be in the rates of growth and changes in the structure of the economy. On the other hand, the data problems indicate that simpler, rather than complex, models are called for in analysing the problems in the developing countries.

A second conclusion that one may make relates to the problems of making some of the policy instruments operationally effective even in the developed countries. Low price elasticities for energy consumption, high level of inertia reflected in high discount rates and other such factors, may be responsible for such problems. Furthermore, powerful economic interests may make a speedy move towards a low-emission future less certain.

End notes

¹ Dr. M. Asaduzzaman, an economist by training, is a Senior Research Fellow at the Bangladesh Institute of Development Studies, Dhaka. The views expressed here are his own and are not necessarily shared by his employer Institute.

² As has been commented about the Toulouse Conference : "Everybody played their own jingle and there was little or no consistency". It was thus each to his/her own model. See Heij (1997).

³ The average per capita income in low income (read developing) countries in the early nineties has been \$380 (in cases like Bangladesh much lower) compared to \$24,000 for the industrialised countries. The recently observed rates of growth in the some of the major developing countries, on the other hand, have been China : 9.6%, India : 5.2%, Indonesia : 5.8%, South Korea : 9.1%, Pakistan : 6.0% . In contrast, the mature economies of the industrialised countries experienced growth at 3% or lower. Only, Japan has achieved a higher growth rate of 4%.

⁴ Thus in the low income developing countries services account for 40% or less of total GDP followed by the more semi-industrialised ones where the proportion is generally between 50 and 60%. In contrast, in the developed countries, the service sector accounts for 60-70% or even more (World Bank : 1995).

⁵ The current 17 producing gas fields have been discovered only with 54 drilling wells. Also over the last several months 3 wells, all with possible good reserves, have been discovered, and one of these will begin producing soon.

⁶ See Asaduzzaman (1995) for a reference to the relevant literature.

⁷ For a brief review and reference to the literature see Asaduzzaman (1995).

⁸ Any standard text on sociology of diffusion may be consulted. A major book is by Rogers and Shoemaker (1991).

Selected References

- Arthur D. Little Inc. (1986), Bangladesh Energy Efficiency and Refinery Rehabilitation Project, Energy Efficiency Component, *Executive Summary Report*, Dhaka.
- Asaduzzaman, M. (1995) "Energy savings potentials, issues and constraints", Jepma, Cartinus J. ed. (1995) *The Feasibility of Joint Implementation*, Kluwer Academic Publishers, Dordrecht.
- Bensel, Terence J. And Robert C. Harris (1996), "Energy policy and economic development in the Philippines" *The Journal of Energy and Development*, XX, 187-228.
- Boyd, R. And N. D. Uri (1993) "The economic impact of taxes on refined petroleum products in the Philippines", *Energy*, January 1993, 31-47.
- Bruce, James P., Hoesung Lee and Erik F. Haites, ed., (1996) *Climate Change 1995 : Economic and Social Dimensions of Climate Change*, Cambridge.
- Chowdhury, Omar H. (1994) *Incidence of Indirect Taxation in Bangladesh : 1984/85*, Bangladesh Institute of Development Studies, Dhaka.
- Government of the People's Republic of Bangladesh, GOB (1997) *Bangladesh Climate Change Study : Mitigation Strategy Study* (unpublished Final Report).
- Hassing, Paul *et al* (1997?) "The framework convention on climate change : A convention for sustainable energy development" *Proceedings : International Workshop on Green House Gas Mitigation Technologies and Measures*, Beijing, November 12-15, 1996.
- Heij, B. (1997) "From the editor" *Change*, January.
- Jayadevappa, R. And S. Chhatre (1996) "Carbon emission tax and its impact on a developing country economy- A case study of India", *The Journal of Energy and Development*, XX, 229-246.
- Rogers, E. M. and F.F. Shoemaker (1971) *Communication of Innovations : A Cross Cultural Approach*, Free Press of Glencoe, New York.
- Shah, A. and B. Larsen (1994) "Global warming, carbon taxes and developing countries" *Climate Change: Policy Instruments and Their Implications*, Proceedings of the Tsukuba Workshop of IPCC WG III.
- Tata Energy Research Institute, TERI (1996) *TERI Energy Data Directory and Yearbook*, Tata Energy Research Institute, Delhi.
- UNDP (1996) *Human Development Report*, Oxford University Press, New York.
- World Bank (1995) *World Development Report 1995*, Oxford University Press, New York.
- WRI (1996) *World Resources 1996-97*, Oxford University Press, New York.
- Zaman, B.M. (1996) *Role of Price Policy in Energy Consumption and Conservation in Bangladesh* (unpublished).