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Co-benefit as an approach to align climate change concerns with national development objectives: solid waste management

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Abstract Impinging local environmental problems on the one hand and constantly persuasive climate change concerns on the other put developing Asian cities in a dilemma as to which direction they should channel their efforts. While local matters are their immediate mandate, increasing awareness of climate change vulnerabilities adds weight to global problems. In this context, the concepts of co-benefits and ancillary benefits play an important role in aligning climate change concerns into sector-specific developmental goals. This article presents the conceptual aspects of co-benefits and the integration of climate concerns into sustainable development goals. The possible synergies between these two different but very important strategic pathways are examined along with possible ways to align them. The bottlenecks that can occur during such integration are also highlighted.

Key words Climate change · Co-benefits · Solid waste management · Sustainable development

Introduction

Counting from Kyoto, climate change negotiations have been proceeding for over a decade, and now it is time to speed up the trickle-down process in order to establish local actions. Although climate regimes are set up on the international stage, local regimes, which are usually sector specific, get all the attention of national planning and implementation. States, at the national level, set their development objectives and all the planning and development efforts center around those targets. Co-benefits (derived

from the concepts of environmental externalities) present the much needed interface for these two most important regimes, which receive different levels of priority both from national and local policy makers. Co-benefits provide the necessary bridge for the alignment of climate change concerns with national development objectives. Co-benefits are contextually substantive as we look at climate change and sustainable development in a holistic framework in the light of the ongoing post-2012 negotiations. In this article such efforts at the sector level are analyzed with particular emphasis on municipal solid waste management in Asian cities.

Waste management issues – why are they unique in developing Asian cities?

At different stages of economic growth, cities face different kinds of environmental problems.^{1–4} For instance, cities with less development face a problem of lack of sanitation facilities resulting in unhygienic conditions and the spread of infectious diseases. With increasing economic growth, such problems disappear, slowly giving rise to different problems such as industrial wastewater and air pollution. As economic growth proceeds, environmental problems transform into rich lifestyle problems such as higher energy use, increased waste generation, and related problems.^{4,5} Many developed cities in Asia have undergone these stages and are facing different kinds of environmental problems according to their respective levels of economic growth.² Figures 1 and 2 depict the dynamic nature of such environmental problems.

According to this model, the problem of waste handling gains significance only after cities reach the stage of consumption-related problems, which in itself is an indicator of having reached the economically developed stage. At this stage, the waste handling problem stems from the quantity of waste to be handled, rather than from the quality of waste management. As cities go through the economic development process, they acquire the necessary infrastruc-

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Fig. 1. Types of environmental problems faced at different times and different stages of development (from Yedla^{3,4})

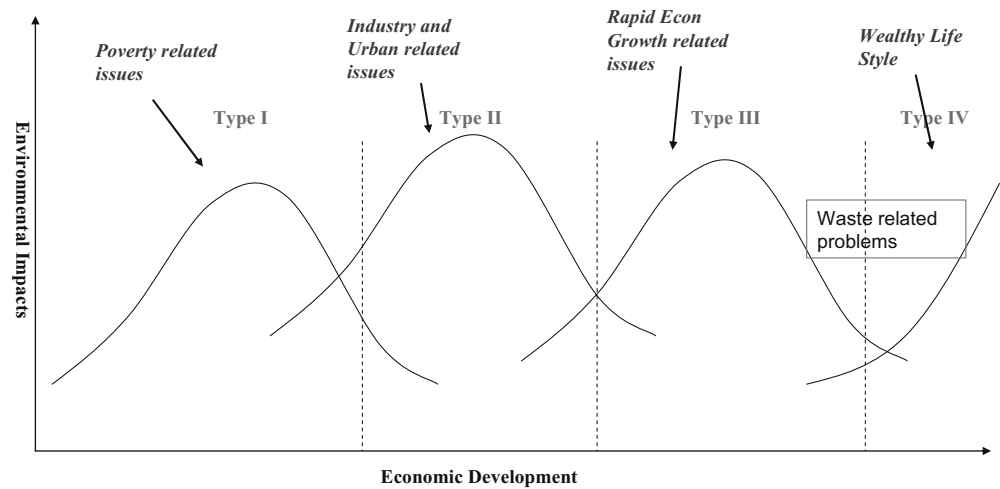
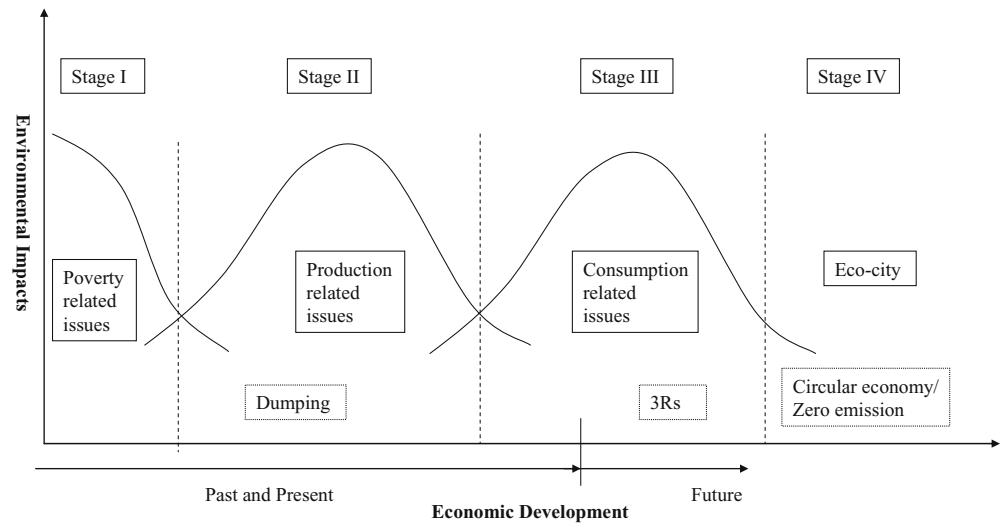


Fig. 2. Stage model that explains the evolution of environmental problems vis-à-vis economic development (extracted from Bai¹ and Yedla³)



ture to handle the waste generated. Cities at the developed stage usually have a lower organic content in their municipal solid waste (MSW) and have formal recycling systems in place, and it would be relatively easy to handle the waste if it were not for the quantity.

Developing Asian cities, due to the increased contribution of the services sector to GDP, have started experiencing increasing per capita income and hence additional waste generation. The influence of Western throwaway culture has only added to the otherwise increasing waste generation. Because the cities have not reached the desired economic levels, according to the conventional stage model, they fail to augment their infrastructure to handle the increasing piles of garbage. Even before the growth in infrastructure and necessary awareness of waste handling at the household level, the volume of waste has started to increase, resulting in:

- uncontrolled littering
- a higher degree of moisture in MSW (indicative of a poor economy) and also dumped reusables/recyclables (due to the increasing throwaway culture)

- uncollected waste on the streets
- mounting open dumps
- lack of funds to handle the waste.^{6,7}

This peculiar situation has left cities with huge quantities of garbage coupled with high organic content. With poor awareness levels and participation from the public, which could be linked to the economic development status of the city and the high organic content of the waste, it has become a Herculean task for the municipalities to handle the garbage in terms of both quality and quantity.^{8,9}

Solid waste management scenario in developing Asian cities

As explained in the previous section, waste management in developing Asian cities is a peculiar problem and hence models from the West may not prove effective in the Asian and the Pacific region. The solid waste management system in developing Asian cities is typically characterized by:

- no segregation at source/lack of participation
- insufficient collection
- inadequate final disposal.¹⁰

Most cities in this region do not collect all the wastes generated, with their waste collection efficiencies ranging between 50% and 70%.^{10,11} Uncollected waste is often thrown into the streets, vacant lots, and bodies of water. Open burning of waste is a common sight and it adds to severe air pollution problems.^{9,12-15}

Open dumping is the most common waste disposal method employed in most of the cities in the region.¹¹ Although sanitary landfills have been attempted in a few cities, they remain episodic. Open dumping pollutes the air, water, and land. It poses serious health threats for slum dwellers in the vicinity and also for scavengers who spend most of their time on these open dump sites picking out waste with some economic value.^{6,12,13,16} Rag picking activity is predominant in this region, and millions of rag pickers make their living from scavenging.¹⁷

MSW in this region has a very high organic content. Table 1 shows the high organic content in MSW, which poses problems as well as opportunities. Decomposed organic waste in open dumps and landfills contributes to climate change (via methane emissions) due to the prevailing anaerobic conditions beneath the top layers of the garbage.¹⁸ Landfills account for about 11% of anthropogenic greenhouse gas (GHG) emissions, and this source is slowing growing as one of the major GHG contributors in the region. At the same time, the high organic content could

Table 1. Fraction of organic waste in municipal solid waste in Asian cities

City	Fraction of compostable (organic) waste
Jakarta	74%
Indian cities	75%
Katmandu	80%
Dhaka	84%

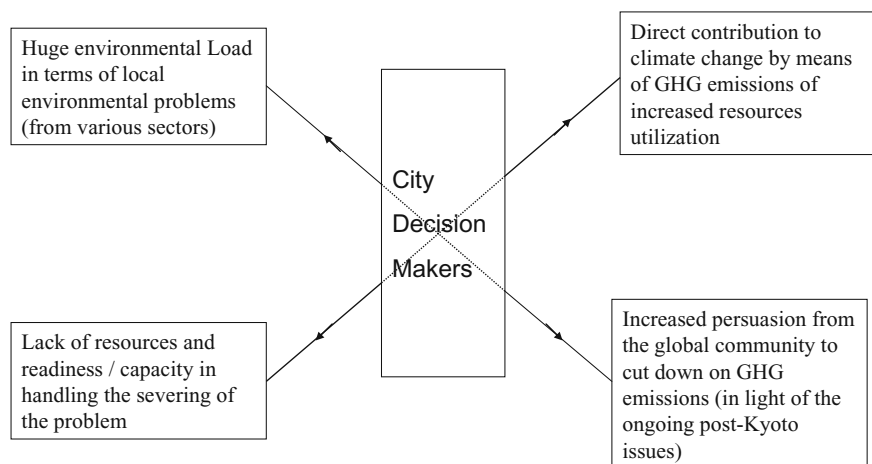
serve as an advantage, allowing the conversion of MSW into organic manure by means of aerobic composting, vermi-composting, or even pig cultivation.

Policy makers at a crossroads: local priorities vis-à-vis global concerns, which way to go?

Developing countries, with poor waste management efficiency and high organic content in their wastes, coupled with increasing populations, are set to face a major challenge in managing their waste in a sustainable way. The high organic content not only poses handling problems but further worsens the situation by contributing to GHG emissions.^{8,16} Cities in developing countries suffer from serious financial restrictions, and efficient management of their wastes is a Herculean task. On the other hand, concerns about climate change are gaining momentum, and developing countries such as India and China are being constantly persuaded to join hands in fighting climate change. With the post-Kyoto mechanisms being discussed, cities are to take active part in the execution of these efforts to fight climate change.^{10,11} But developing Asian cities are struggling to handle the local and highest priority problems such as MSW management and control of air pollution from automobiles, let alone attending to climate change mitigation. With impinging local priorities and increasing persuasion to adopt climate-friendly measures, Asian cities, which are in financially difficult situations simply delivering their civic services, are in a great dilemma regarding which way to go: to continue to augment the civic services and take care of local environmental problems (thus risking climate vulnerabilities) or to attempt to respond to the call for climate protection and risk jeopardizing local environmental priorities.⁹ Figure 3 presents a graphical representation of this situation.

With a higher level of certainty on climate change than ever before, and with increasing awareness around the world, sooner or later every country has to play its role in

Fig. 3. Asian policy makers at a crossroads. GHG, greenhouse gas



Policy makers at cross-roads

fighting this global environmental problem. While local environmental and ecological problems are addressed by national policies, national planning, local regulations, and various developmental goals (such as national development goals and millennium development goals), climate change issues are addressed only at the international and national levels. Such policies do not trickle down to the city level. Setting ourselves toward the post-Kyoto regime and the problems of ecologically overloaded urban agglomerations, it is time to make city administrations participate in climate change mitigation measures.

However, dealing with climate change explicitly could be expensive for Asian cities and is expected to cost several trillion dollars over this century.^{19,20} Given this fact, addressing both these important aspects of the environment, i.e., local priority environmental issues and climate change, presents a daunting task to both policy makers and researchers. Applying the concepts of co-benefits could be a potential approach to address these two distinct strategies converging toward a common goal of sustainable development.^{20,21}

Co-benefits approach: the basic constructs

Co-benefits are derived from externality concepts where an externality is defined as an unintended and uncompensated side effect of someone’s action on another person.²² There are three types of externalities: positive, negative, and pecuniary.^{22,23} While positive externalities are called external benefits (co-benefits), negative externalities are termed as external costs (co-damages). Further, co-benefits can be of two types: intended co-benefits, which are also called ancillary benefits, and unintended co-benefits.²⁰

Policy-induced emission changes work through the environmental system and eventually feed back into the economic system. Depending on institutions such as markets and taxes, they may transform into environmental externalities or nonenvironmental externalities.²⁰ Therefore, in order to derive the complete benefits of the system, all these costs and benefits, both intended and unintended, need to be accounted for.^{12,24}

Any policy, in addition to the intended benefits, will have a set of co-benefits and ancillary benefits. However, such benefits vary from policy to policy. Figures 4 and 5 present such a stream of benefits resulting from policies to protect the local environment and policies to mitigate climate change, respectively.

In conventional accounting, only the targeted outputs are considered and other benefits resulting from the same policy initiative are ignored. For instance, while implementing policies to control local pollution, the benefits of greenhouse gas mitigation, improved health, and economic and social benefits (e.g., employment generation and improved living standards) are not accounted for, thus leaving the net benefits of the policy measure understated. Such inclusive assessment provides a much-needed bridge between climate concerns and local priorities and can help align them for sustainable development.

Why should development and climate concerns be aligned?

Applying conventional perspectives, development is seen as a threat to the climate, and climate change is treated as a barrier to development.^{19,25} However, with increasing understanding of the problem and with awareness among the

Fig. 4. Policies to control environmental pollution and the resulting co-benefits and ancillary benefits (developed by authors based on OECD²⁰)

Environmental Policies and the Co-benefits

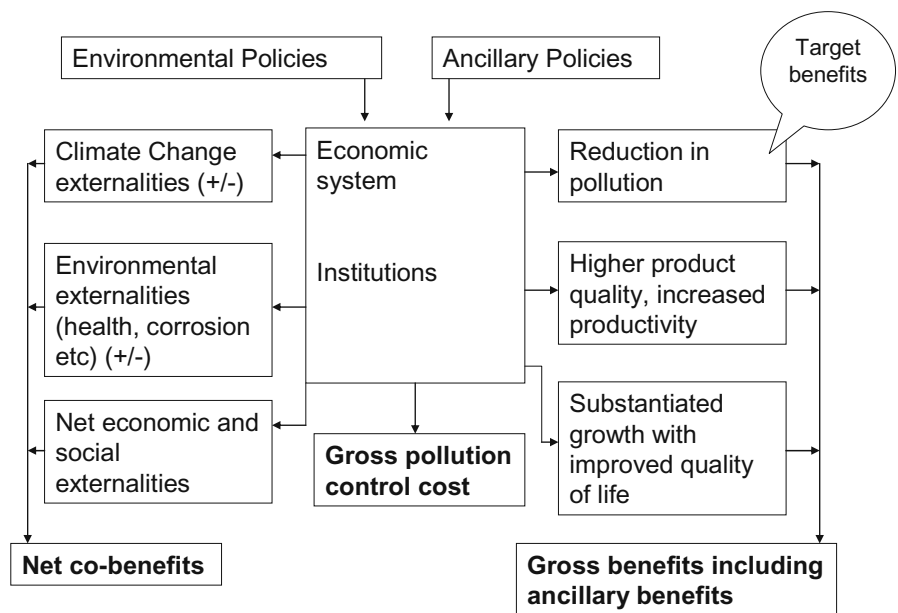
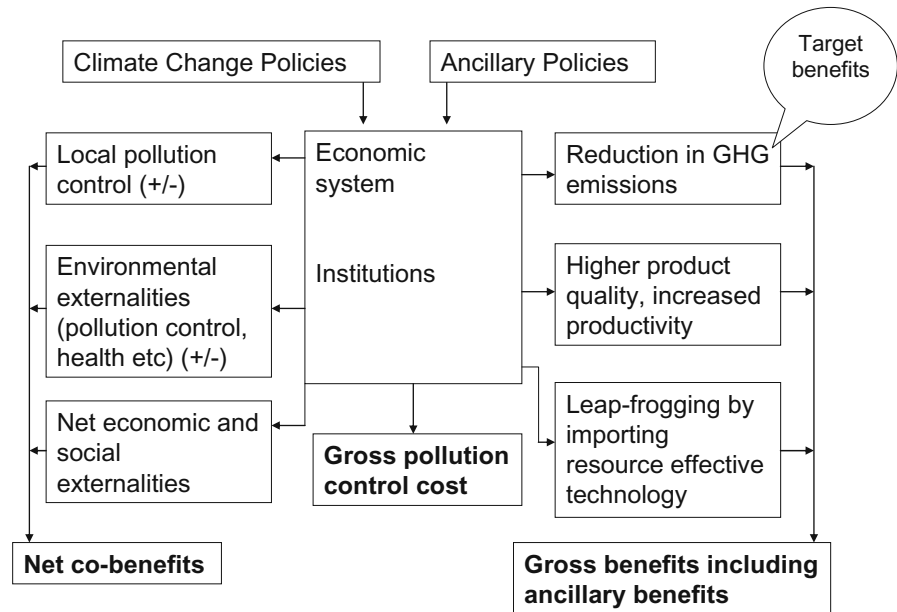


Fig. 5. Policies to mitigate climate change and the resulting co-benefits and ancillary benefits

Climate Change Policies and the Co-benefits



various actors involved, the conception of the interaction between development and climate change is changing rapidly. Under the development and climate perspectives, the pathways to achieve sustainable development goals are found to be climate friendly.²⁵

Many policies targeting sector-specific issues have proven to be climate friendly.²⁶ For instance, Indian MSW management rules issued by the Government of India in 2000 require all waste management bodies (municipalities) to dispose of their organic waste in properly designed landfills (sanitary) with mandatory gas flaring. This national policy target to improve waste management also controls GHG emissions, which is a co-benefit. In another study by the authors, it was observed that CO₂ mitigation strategies have resulted in similar co-benefits (control of local pollutants) as that of strategies to control particulates and hydrocarbons (with CO₂ control as a co-benefit).²⁷ China has been employing a waste-reduction approach (i.e., reduce, reuse, recycle, the 3Rs) as a part of its waste management strategies, which in turn have helped in controlling GHG emissions (a co-benefit).

Therefore, strategies for sustainable development and climate change have many common elements, and aligning these would reduce costs and *minimize welfare losses*. As shown in Fig. 6, such streamlining of climate change policies and environmental and development policies would result in comprehensive benefits at much lower incremental costs.

A recent study in India suggested that a joint mitigation strategy for CO₂ and SO₂ would be able to save \$400 million over a period of 30 years.²⁵ In another similar study by the author, it was reported that the mitigation cost of carbon from the urban transport sector (marginal abatement cost) is comparable between CO₂ mitigation strategies and par-

ticulate and hydrocarbon (local pollution) control strategies. Thus, aligning climate concerns with sustainable development pathways would result in integrated and socially optimal solutions.^{22,23} However, as a first step, one needs to identify the synergies between these two distinct but connected strategies.

Synergies between climate change concerns and sustainable development goals

National development objectives are set by the planning commission of the respective countries and they are augmented by local regulations. Development goals set by international bodies such as UN Millennium Development Goals (MDGs) are in general alignment with national developmental goals of the respective countries. However, despite increasing awareness of climate change issues, no mechanisms are in place to transform the national-level climate change mitigation policies into city-level action plans.

Implementation of national development plans result in certain climate change benefits (in terms of co-benefits). Further, integrating climate change concerns into development goals by means of identifying synergies between them would help align climate concerns and development strategies, leading to sustainable development. This section explains such synergies by taking up Indian development objectives vis-à-vis UN MDGs and their synergies with climate change mitigation. Table 2 presents various policy measures and goals developed as a part of national development and environmental protection strategies and their interface with climate change.

Fig. 6. Integrated policies to control local pollution and greenhouse gas emissions and the resulting co-benefits and ancillary benefits

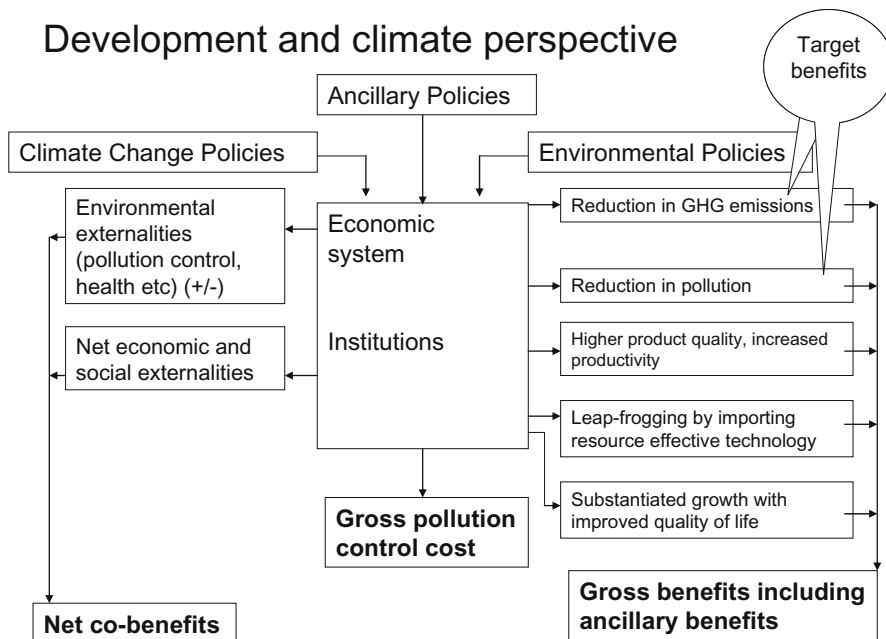


Table 2. Developmental and environmental plans and their interface with climate change

Millennium development goals	India's national plan targets	Climate change synergies
Goal 1: Eradicate extreme poverty and hunger Targets: halve, between 1990 and 2015, the proportion of people with income below \$1 a day and those who suffer from hunger	Double the per capita income by 2012 Reduce poverty ratio by 15% by 2012 Contain population growth to 16.2% between 2001 and 2011	Income effect would enhance choices for cleaner fuels and adaptive capacity Reduce greenhouse gas (GHG) emissions due to lower population
Goal 7: Ensure environmental sustainability Targets: Integrate sustainable development principles in country policies/programs to reverse loss of environmental resources Target: Halve by 2015 the proportion of people without sustainable access to safe drinking water	Increase forest cover to 25% by 2007 and 33% by 2012 (from 23% in 2001) Sustained access to potable drinking water for all villages by 2007 Electrify 80000 additional villages by 2012 via decentralized sources Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012	Enhanced sink capacity, reduced GHG and local emissions; lower fossil imports; reduced pressure on land, resources, and ecosystems Higher adaptive capacity from enhanced supply of water, health, and education in rural areas

National transportation policy highlighted the need to adopt alternative fuels such as biodiesel as a strategy to achieve energy security. Such policies, although targeted in terms of development would essentially contribute significantly to mitigate climate change. Thus, from the viewpoint of developing countries such as India, it is more important to adopt “sustainability” in their development pathways because it has tremendous potential to control climate change. However, such co-benefits need to be accounted for.

Against the argument that climate protection measures are expensive and affect developmental pathways negatively, particularly in the context of developing countries, identifying synergies and integrating the co-benefits into sustainable development pathways would certainly take us much closer to climate protection, with all countries participating actively.

Sustainable development pathways are, more often than not, climate friendly. However, integration of climate con-

cerns into development objectives depends on “assessing” such tangible co-benefits from different sectors. For instance, a decentralized community-based composting model in Dhaka, the aim of which was to achieve better waste management in the city, is estimated to reduce CO₂ emissions by 90 000 tons/year by reducing the waste reaching landfill. It has the potential to generate a thousand jobs as well.⁹ High-end waste and resources management approaches such as the development of eco-towns and eco-industrial parks (EIPs) could result in substantial GHG savings along with reduced waste generation and energy consumption.²⁸⁻³⁰ Such attempts can be further merited by accounting for other co-benefits such as waste reduction and cost savings from the use of methane as energy, a reduction in fuel for transportation of waste, and savings in land. However, measuring such co-benefits provides a major challenge to the city administrators in this region.

Barriers to the promotion of co-benefits and conclusions

Promoting the co-benefits approach suffers from various barriers:²⁶

- lack of awareness of the co-benefits
- lack of capacity to quantify co-benefits
- differences in priority/interest of the sector.

Developing a framework for mainstreaming climate change in national development strategies may provide a solution to these barriers. It is essential to set up new institutions to facilitate the integration of climate concerns into national- and state-level policy making. A more important aspect is to improve awareness among various actors and also to make efforts to achieve inclusive valuation of various policies.

While local matters are the immediate mandate of local- and city-level policy makers, increasing awareness of climate change vulnerabilities adds weight to global problems. Thus, the concepts of co-benefits and ancillary benefits, where synergies between these two competing aspects are highlighted, play an important role in aligning climate change concerns with sector-specific developmental goals.

Co-benefits as an approach to mainstream climate concerns in sector development objectives, especially in transportation, agriculture, and waste management, with emphasis on energy use and conservation measures, have the potential to play a major role in the post-2012 negotiations.

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