Greenhouse Gas Reduction Strategies in Asia

Background paper

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Contents

Introduction

By the year 2025, the Asian region is expected to emit CO_2 (carbon dioxide) in the range of 3.79 GtC (gigatonnes of carbon) per year—the highest emissions in the world. This will reflect the region's economic growth, which will then be about 35% of the world GDP (gross domestic product). This calls for the Asian countries to balance their pursuit of economic growth with the implementation of abatement policies. As of now, most Asian countries do not have extensive abatement plans, and meaningful regional policy action seems unlikely in the near future. Since the ALGAS (Asia Least-cost Greenhouse Gas Abatement Strategy) project, however, there has been a streamlining of policy measures and, if the decisions taken by respective governments thus far are any indication, there seems to be substantial scope for no-regrets policy actions. The ALGAS project is the study by 12 Asian countries of their national emissions of GHGs (greenhouse gases) in 1990, projections of GHG emissions to 2020, and an analysis of mitigation options in different economic sectors (ADB–GEF–UNDP 1998a). Decisions taken at the COPs (Conference of the Parties to the UN FCCC [United Nations Convention on Climate Change]) have also driven policies in the region. Since most of these countries are members of the Group of 77+China, most actions have highlighted the social and economic aspects under climate change mechanisms (Sanderson J and Islam M N. 2000).

The growth in the Asian region will be driven by spiraling demands on energy. Hence the recommendation of the ALGAS study are very important because it incorporated the inputs from local institutes and experts. Most of the abatement strategies are important because they provide opportunities for collaboration under AIJ/CDM. The Clean Development Mechanism (CDM) is a concept that has been made popular by Kyoto Protocol. In article 12 it states, the purpose of CDM is to assist developing countries (DCs) achieve sustainable development goals in collaboration with industrialized countries (ICs). For developing countries financial, technological and participatory benefits through projects as host countries. Whereas for ICs the carbon credits from the projects would help comply with their quantified emission reduction commitments (please refer to a more detailed description on CDM in the later part of the paper). One of the drivers of the Climate Change is Asia web site is to provide relevant information that would facilitate CDM projects in Asia. The Climate Change in Asia web site will report on activities and options available for 10 Asian countries, which forms its core. This paper examines energy, agriculture, and forestry – sectors that have great potential for GHG abatement – and then highlights individual country initiatives and options. Establishing GHG abatement strategies help identify GHG abatement initiatives, establish baseline scenarios, and prepare the ground for extensive national inventories.

GHG mitigation strategies in the energy sector

Energy sector overview

All countries in Asia face problems in the energy sector. Asia has 63% of the world's recoverable reserves of coal, a high GHG energy source**,** and coal will continue to dominate the Asian energy market for years to come. The demand for energy in Asia doubles every 12 years compared to the world average of 28 years.

But, the energy sector has great potential for GHG abatement. The technology in use is highly inefficient, and improved technologies would result in increased energy-efficiency. Thus, abatement strategies in the energy sector should include a strong emphasis on using energy-efficient technologies. In particular, countries with abundant gas supplies, hydropower, and renewable energy sources should utilize them for electricity generation and supply. Alternately, the focus could be on reducing T&D (transmission and distribution) costs in electricity, which are generally high for the region, and improving the efficiency of existing power generation facilities. Upgrading technology would reduce energy consumption by up to 30%. In the industrial sector as well energy-efficiency is required, as are more efficient process technologies, particularly generic equipment, for example, boilers and motors in energy-intensive industries. Cogeneration is another important alternative energy generation technology that reduces the dependence on scarce fossil fuels. In residential and commercial subsectors, energy-efficient equipment used in lighting, refrigerating, and air-conditioning should be given priority. The transport subsector receives less attention in terms of policy measures compared to the other sectors. Incorporating strategies like fuel-efficient vehicles, improved vehicle maintenance, local air pollution, and promoting natural gas as a transport fuel should also be part of region-wide GHG abatement strategies.

Some of these options are win-win and some imply a cost. The win-win too might have a number of barriers like information barriers, policy barriers and so on and also one of the most important barriers is availability of resources. Having said that we believe that these strategies could happen but would require additional resources. Awareness-building, financial incentives, and regulations like efficiency standards for new equipment, vehicles, and buildings would encourage the adoption of abatement technologies. Disseminating information regarding abatement opportunities is a foundation for efforts to encourage greater use of abatement technologies. Strengthening international cooperation would facilitate transfer of efficient and environmentally friendly technologies.

This assessment of the energy sector in 10 countries shows that the adoption of the suggested abatement strategies would have negative abatement cost (or net economic benefits). Energy-efficiency measures in the industrial sector are significant and economically beneficial in all countries covered in the ALGAS project. The most common options include improving the efficiency of motors and boilers and cogeneration. In countries where coal is a major source in the baseline scenario, switching to lower GHG energy sources for electricity generation has significant

abatement potential. For example, Bangladesh should exploit gas resources since it has extensive reserves. Contrary to popular belief, renewable energy was not found to have significant abatement potential due to its high cost. However, biomass-based technologies and solar photovoltaics can be part of abatement strategies for most countries. Further the ALGAS project divided abatement strategies to be adopted by the countries into three time periods: short-term (1998–2000), medium term (2005–2012), and long-term (beyond 2015).

Main GHG abatement strategies

- Improving energy-efficiency of existing facilities, equipment, and systems. This would involve changing practices, modifying existing equipment, shifting to new ones, etc.
- Having new capital stock with more energy-efficient technologies, as technology improves over a period of time.
- Utilizing low-emission sources or alternative energy sources like natural gas for which there are vast reserves.
- Reducing methane emissions in production and transmission. This would yield larger cumulative impact by utilizing state-of-the-art technology and improved designs.

Country-specific mitigation strategies

Bangladesh

The industrial sector is a major user of energy in Bangladesh. The ALGAS project identifies industry as the most promising sector for GHG mitigation by improving the efficiency of equipment such as boilers. Intervention in the industrial sector would also result in reduced cost of manufacturing. The power sector too has ample scope for mitigation, as the technology in use is old and inefficient. The power generation technology could be upgraded using domestically available natural gas at no additional cost to the economy. In the transport sector, efficiency could be improved, among others, by phasing out two-stroke engines with four-stroke engines. The benefits of improved efficiency would be twofold – it would cut down energy consumption and reduce the foreign exchange costs for imported gasoline. Efficient refrigerators and air-conditioners should be encouraged in the residential and commercial sectors. The ALGAS project also found the T&D costs in electricity to be very high at 38%.

China

China accounts for two-thirds of the total GHG emissions from the energy sector of the 12 Asian countries that participated in the ALGAS project.[1] Most abatement strategies suggested for China, that are in compliance with its national development objectives, have a negative abatement potential. China's focus areas for GHG abatement include renovating motors and industrial boilers and promoting energy-efficient lighting. Apart from upgrading thermal power plants to use clean coal, hydro- and nuclear-power could be explored as part of the abatement strategy. Renewable energy sources offer significant

[1] The countries covered in the ALGAS study are Bangladesh, China, India, Indonesia, Korea, Mongolia, Myanmar, Pakistan, Philippines, Thailand, and Vietnam.

abatement opportunity in energy conservation in the residential sector with the use of wind power, solar water heaters, and solar photovoltaics. Additional measures for energy conservation should be given priority as projections for the future show a decline. These energy conservation strategies would require additional capital investments of up to 20%

India

Abatement strategies suggested for India would be effective only if economy-wide measures on sector specific policies are implemented to remove barriers to adoption of some of the suggested options. Though state intervention could be a driver, active participation from the private sector will be critical to effective implementation in cross-sectoral levels. Market forces and increased awareness will help popularize energy-efficient technologies, but the rate of penetration could get accelerated. Specific abatement strategies for the energy sector include fiscal incentives and taxes, voluntary emission reductions, green rating, and capacity-building.

GHG emissions could also be mitigated by aggressively promoting advanced technologies in the renewable energy sector and improving energy-efficiency by upgrading existing technology. Most of these technology improvements are expensive except for ones like small hydroelectric plants, which have geographic limitations. Cogeneration is the least-cost abatement option in the power sector. This is followed by clean coal, which is an important option as coal is likely to continue as the mainstay of the power generation sector. The priority abatement options in the power generation sector are gas-based combined cycle operation and hydro- and wind-power. Stricter carbon emission norms are likely in the future to replace coal-based power generation with gas-based generation. In the rural domestic sector, the use of solar cookers would result in substantial CO_2 reduction. An increase in the use of compact fluorescent lamps and efficient fans in the domestic sector will phase out usage of kerosene. In the transportation subsector, battery-operated vehicles and MRTS (mass rapid transport system) are good options but these would still produce some GHG emissions because electricity to power these options is produced from coal-fired plants.

Indonesia

In the energy sector, Indonesia can reduce 3296 Tg (tetragram) of CO_2 through conservation, deregulation, and tax. Among these, deregulation has the largest potential for CO_2 reduction. Use of hydropower, geothermal energy, biomass, cogeneration, and gas-fired coal plants for electricity generation have negative abatement cost. Indonesia's alternative energy policies attempt to reduce the share of coal in the energy sector. In the transport subsector, the use of fuel cells, CNG (compressed natural gas), and ethanol would have positive abatement costs.

Pakistan

The energy sector is the most prominent among those short-listed for GHG inventories in Pakistan. Alternatives identified in this sector include introduction of energy-efficiency in refrigerators, fans, water heaters, lighting systems, and building designs. In the industrial sector, more efficient boilers and motors, waste-heat recovery systems, and cogeneration were considered main options. For the transportation sector, which is the second largest

energy-consuming sector in Pakistan, engine and vehicle maintenance along with improved energy-efficient engine design should be the key options. In power generation, improved T&D and improved efficiency of gas are the viable options. Substituting oil with natural gas was found to have positive abatement costs. Although the renewable sector has been largely untapped, solar photovoltaics for lighting and heating, wind energy systems, and mini-hydro power plants should also be considered.

Philippines

In the Philippines, the energy sector is projected to have the highest growth rate of GHG emissions and it will be the largest source of GHGs in the next 30 years. Important abatement options in the energy sector are fuel switching, supply efficiency, efficient lighting and other demand side management options, and reduction of electricity T&D losses. High-efficiency refrigerators, motors, and boilers show a negative abatement cost. In the transportation sector, use of high-efficiency vehicles and diesel vehicles have negative abatement costs.

Thailand

The GHG abatement strategies in the energy sector in Thailand include measures to reduce energy demand, increase process efficiency, and switch from high to low carbon fuels. In the industrial subsector, cogeneration and efficient motors have the most potential. In the commercial sector, efficient lighting and air-conditioning have the most potential.

GHG mitigation strategies in the forestry sector

Forestry sector emissions

The forestry sector is both a source and a sink of GHGs. While deforestation and the clearing of land for cultivation and settlement result in CO_2 emissions, afforestation and reforestation help sequester atmospheric CO_2.

Asia is a major contributor to global CO_2 emissions resulting from forestry and land-use change. But there are significant differences across Asian countries in GHG emissions or removals by the forestry sector. For instance, the Philippines forestry sector contributed half of the nation's total GHG emissions in 1990. In Indonesia, on the other hand, net GHG emissions were negative, implying that Indonesian forests were able to absorb all CO_2 emissions from energy and non-energy sources. In India, the net CO_2 uptake and emissions from the land-use change and forestry sector were almost equal, resulting in negligible net emissions from this source (ADB–GEF–UNDP 1998a).

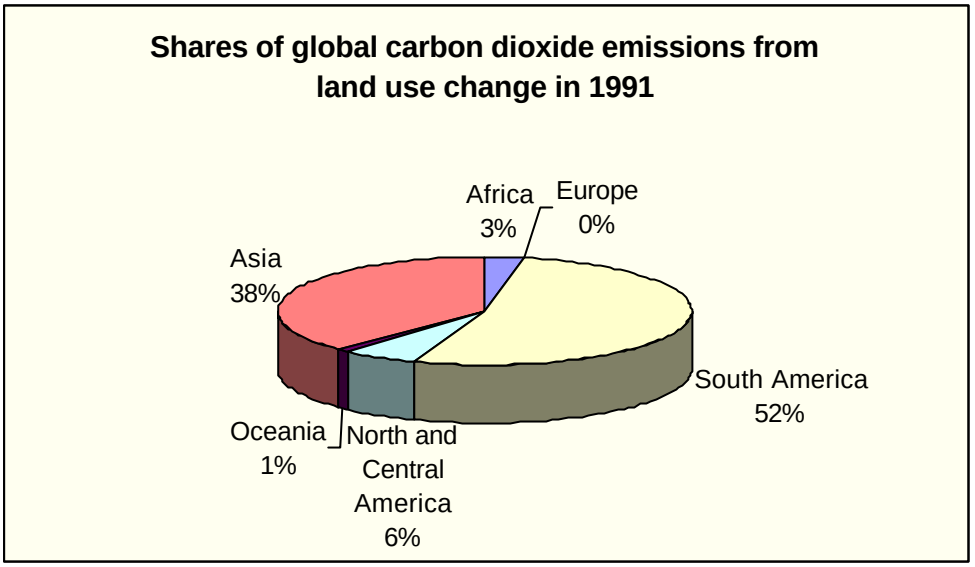

Figure 1

Source: Sanderson J and Islam M N. (2000)

Mitigation options in the forestry sector

The Second Assessment Report of the IPCC (IPCC 1996) has identified three broad categories of forestry sector mitigation options.

1 *Conservation management (prevent emissions).* This strategy attempts to conserve the existing carbon storage capacity of forests by halting or slowing down deforestation and forest degradation. This can be done by
   - increasing agricultural productivity
   - planting trees on farms, sustainable logging
   - improving the efficiency of harvesting, processing, and use of forest products
   - developing markets for secondary species and whole tree harvesting.

2 *Storage management (short-term measures over next 50 years).* This strategy attempts to increase carbon storage in woody vegetation and soil in existing degraded forests, as well as to create new carbon sinks in areas where forests do not exist or have been cleared. These options include

- promotion of natural regeneration (through protection of degraded forest land)
- reforestation on deforested lands
- afforestation on non-forest lands
- agroforestry on crop and pastureland.

3 *Substitution management (long-term measures).* This strategy involves the replacement of fossil fuels by renewable fuelwood or other biomass products.

The ALGAS study (ADB–GEF–UNDP 1998a) emphasized the need to consider mitigation options in the forestry sector because of the following factors.

- large mitigation potential
- low-cost mitigation options

- significant non-GHG environmental benefits (biodiversity conservation, watershed protection, halting deforestation)
- socio-economic benefits (rural employment, renewable forest products, export earnings).

Country-specific mitigation options Bangladesh

The forestry sector mitigation options identified for Bangladesh were
- reforestation in previously forested areas and afforestation in newly accreted lands
- artificial reforestation to enrich existing forest land with poor tree cover
- enforcement of the Forestry Act against encroachment.

If these options are implemented, forest resources will be developed and GHG emissions abated. Table 1 presents a summary of forestry sector mitigation options for Bangladesh, along with their carbon sequestration potential and cost.

Table 1 GHG mitigation options for the forestry sector in Bangladesh

GHG abatement option	*Carbon sequestration potential* (million tonnes of CO_2 equivalent)	*Cost* ($/ tonne of CO_2 equivalent)
Long rotation artificial reforestation	33.2	3.67
Medium rotation participatory coastal plantation	6.9	4.77
Medium rotation sal plantation	12.9	5.5
Medium rotation artificial reforestation	67.47	4.4

Source: ADB–GEF–UNDP (1998b)

China

The ALGAS study identified assisted natural regeneration in north-eastern and north-western China as the most cost-effective option. On the other hand, agroforestry was found to be a high cost mitigation option. Table 2 gives the GHG mitigation options for China's forestry sector along with their environmental and socio-economic benefits.

Table 2 GHG mitigation options for China's forestry sector

GHG mitigation option	*Local environmental benefit*	*Socio-economic benefit*
Short rotation forestry	Industrial wood provision	Employment generation
Long rotation forestry	Environment protection and wood provision	Employment generation

Natural or assisted natural regeneration	Biodiversity conservation, supply of non-timber forest products	Rural income generation
Bioenergy or bioelectricity	Environment improvement	Local industry development
Agroforestry	Environment improvement	Rural income generation
Protected area	Environment and biodiversity protection	Supply of non-timber forest products

Source: ADB–GEF–UNDP (1998c)

India

India has one of the largest afforestation programmes in the world. The mitigation options identified for the Indian forest sector are (1) conservation of existing closed and open forests and (2) expansion of carbon sinks through reforestation of degraded forest areas and afforestation on private land.

In the short term, the appropriate strategy would be to check degradation and deforestation of the existing forest cover through legal and institutional reforms. In the medium term, market-based instruments could be employed, with the long-term strategy focusing on greater R&D efforts.

Table 3 describes potential forestry sector mitigation options in India.

Table 3 GHG mitigation options for India's forestry sector

Option	Suitable land category	Global goals	National goals	Potential benefits
Natural regeneration	Partially degraded open forest area	Forest conservation, biodiversity, carbon sink	Environmental stability, ecological diversity, timber, NTFPs	Employment
Enhanced natural regeneration	Degraded forest areas	Carbon sequestration, increased forest cover	Environmental stability, ecological diversity, timber, NTFPs	Employment
Private land	Degraded land under miscellaneous tree crops and groves, cultivable waste, fallow lands other than current fallow	Enhancement of carbon sinks	Increasing fuelwood and timber supply	Income generation

Source: ADB–GEF–UNDP (1998d)

Indonesia

As in the energy sector, Indonesia's GHG abatement options in the forestry sector have been identified for three time horizons: short term (1998–2005); medium term (2005–2015); and long term (beyond 2015).

Short- and medium-term mitigation options (such as reforestation and afforestation) have relatively low investment costs, yet help achieve significant GHG abatement. These options are listed in Table 4.

Table 4 GHG mitigation options for Indonesia's forestry sector

Option	*Time frame*	*Investment cost* ($/ha)	*Mitigation potential* (tonnes of carbon/ha)
Timber estate	Medium	311	165
Social forestry	Long	107	94
Reforestation	Short	186	214
Private forest	Long	205	99
Afforestation	Short	67	106
Bioelectricity	Short, medium, and long	3854	185

Source: ADB–GEF–UNDP (1998e)

Pakistan

The mitigation options for the forestry sector in Pakistan include rangeland management, watershed management, commercial plantations in irrigated areas, agroforestry, management of riverain forests, etc. Table 5 gives the total abatement potential and average incremental cost of the forestry options.

Table 5 Total abatement potential and average incremental cost of Pakistan's forestry options

Option	*Total abatement potential* (million tonnes of CO_2 equivalent)	*Average incremental mitigation cost* ($/tonne of CO_2 equivalent)
Commercial plantations	10.0	–23.9
Riverine forest plantations	17.0	–10.4
Reforestation in coniferous forests	21.8	–7.6
Enhanced natural regeneration in coniferous forests	26.0	–3.1
Agroforestry/social forestry	276.4	–0.4
Forest protection in coniferous forests	73.0	–0.2

Watershed plantation	63.4	0.3
Rangeland management	80.2	0.6

Source: ADB–GEF–UNDP (1998f)

Philippines

In Philippines, the GHG mitigation potential of the forestry sector is higher than that of the energy or agriculture sector. Table 6 provides the carbon sequestration potential and cost of forestry sector mitigation options in the Philippines. The option with the lowest CO_2 abatement cost is forest protection under total logging ban, while the option with the highest GHG reduction potential is short rotation forest plantation.

Table 6 Carbon sequestration potential and cost of forestry sector mitigation options in the Philippines

Option	*Carbon sequestration potential* (million tonnes of CO_2)	*Cost* ($/tonne of CO_2)
Protection with sustainable development	2853	0.14
Protection by logging ban	2332	0.13
Forest plantation		
Short rotation	2556	2.37
Long rotation	964	0.59
Urban forestry	21	1.48

Source: ADB–GEF–UNDP (1998g)

Thailand

The overarching goal of Thailand's forestry policy is to achieve self-sufficiency by maintaining the existing 14.1 million hectares of protected forest area and reforesting an additional 0.8 million hectares. The forestry sector mitigation options identified for Thailand in the context of this goal are listed in Table 7.

Table 7 GHG mitigation options for Thailand's forestry sector

Option	*Sequestration potential* (tonnes of CO_2/ha)	*Investment cost* ($/ha)	*Abatement cost* ($/tonne of CO_2)
Forest protection and reforestation for conservation in protected areas	117	283.8	–27.13
Forest protection and reforestation for conservation in community forests	143	408.0	–27.87
Short rotation in community forests	680	544.6	–2.93
Long rotation in community forests	620	550.0	–11.73
Short rotation in non-	583	466.7	–3.3

protected areas			
Medium rotation in non-protected areas	416	489.0	5.13

Source: ADB–GEF–UNDP (1998h)

GHG mitigation options in the agriculture sector

Agriculture sector emissions and abatement

The IPCC (1996) estimates that agriculture, an extremely important economic sector in Asian countries, is responsible for nearly one-fifth of the annual increase in radiative forcing. Methane emissions from rice cultivation represent the major source of GHG emissions from the agriculture sector in these countries. Other sources of GHG emissions include

1 enteric fermentation
2 manure management
3 agricultural soils
4 prescribed burning of savannas
5 burning of agricultural residues in the field (IPCC 1997).

China and India are the largest contributors to agriculture sector emissions in the region. But in per capita terms, agriculture sector emissions from these countries are less than the global average.
The Second Assessment Report of the IPCC estimated that the global potential for GHG mitigation in the agriculture sector is 23–88 million tonnes of methane (IPCC 1996). Significant means to reduce GHGs from agriculture include improved management of ruminant livestock feeding practices, manure management, and rice production practices.

Country-specific mitigation options

Bangladesh

In Bangladesh, the options identified to reduce methane emissions from rice cultivation include regulation of flooding and draining of fields. In terms of mitigating livestock sector emissions, the relevant options include use of molasses-urea as feed supplement and use of straw treated with urea for local dairy cattle. The last two options were found to be the most feasible, and also matched the government's main objective in the livestock subsector, namely that of increasing milk supply by improving the breed, enhancing feed, and controlling disease.

China

Total methane mitigation potential in the agriculture sector was estimated at 3 million tonnes, i.e. one-tenth of the projected methane emissions in 2020. In China, methane abatement options are associated with higher average costs than CO_2 abatement opportunities. The maximum costs for methane abatement options approach $1400 per tonne of methane.

India

GHG emissions in the Indian agriculture sector can be mitigated by

1 increasing the digestibility of animal feed by supplementing it with molasses, urea multi-nutrient blocks, and bypass protein
2 replacing open-pit method of manure treatment with small-scale digesters
3 using improved paddy varieties and draining fields frequently
4 improving application efficiency of nitrogenous fertilizers; for instance, by using nitrification inhibitors.

Indonesia

The ALGAS study analysed 12 mitigation options related to the agriculture sector. The option with the greatest potential to reduce methane emissions is substitution of rice variety (by IR64), while the next best option was intermittent irrigation. These options can be implemented extensively because the costs of methane reduction are relatively low and there are associated benefits.

Pakistan

In 1989/90, the agriculture sector in Pakistan had very high methane emissions amounting to 2000 gigagrams. As in most other countries of the region, the mitigation options that can be applied to this sector include improved feed for livestock and better water management practices in rice paddy fields.

Philippines

Methane emissions from the agriculture sector in the Philippines can be reduced by using composted rice straw, sulphate fertilizer, and low methane-emitting cultivar and by better water management. The most promising of these is the use of low methane-emitting cultivar, as this cuts methane emissions by more than half and, at the same time, increases yield by 65%. Draining plots two weeks at mid-tillering reduced methane emissions by 30% as compared to when the continuously flooded plots were drained before harvest.

Thailand

For the agriculture sector in Thailand, six main strategies have been identified to reduce methane emissions from rice cultivation. These are

1 aerating the soil naturally or by drainage during mid-season tilling or late tilling
2 minimizing the use of green manure and substituting it with pre-fermented compost from farm residues
3 adding nitrate or sulphate containing nitrogen fertilizer, particularly through the surface application of ammonium sulphate
4 minimizing the use of the tall, traditional rice variety and encouraging the use of high-yielding varieties
5 minimizing soil disturbance, ploughing, transplantation of rice seedlings, weeding, broadcasting fertilizer, and planting by dry, direct seeding

6 using methane production inhibitors, such as sulphate containing compounds and calcium carbide encapsulated in fertilizer granules.

To reduce methane emissions from livestock, the main strategies include the improvement of the feed and roughage quality, expansion of pasture and forage conservation for dry season feeding, and the use of monesic acid in ruminants.

Barriers to the adoption of mitigation options

Although GHG abatement technologies in the energy sector could yield financial benefits to users, in practice there are numerous factors that impede their adoption. These include, but are not limited to, lack of information and expertise, an aversion to the risk involved in using a new technology, shortage of capital and lack of access to acceptable financing, and the higher initial cost of the abatement technologies. To overcome these barriers and make the adoption of GHG abatement technologies more effective, financial incentives could be provided along with regulations on efficiency standards for new buildings, vehicles, and equipment.

The main obstacles to the accelerated implementation of mitigation options in the agriculture sector are uncertainty regarding costs and benefits, and concern regarding the impact on agricultural yields. Food security is the primary concern of Asian agriculture. GHG mitigation options become economically attractive to farmers only if they result in demonstrated productivity gains. In the absence of a financial and institutional support system, farmers are unwilling to bear the risks of investing in new practices.

The high population growth rate in these countries has put tremendous pressure on forests. Forest lands are being cleared and converted to agricultural land at an accelerated pace to feed a growing population. Forest land is also being encroached on for settlement and infrastructure development. Consequently, this limits the amount of land available for implementing forestry sector mitigation options.

In addition to population pressure, there are several financial and technical barriers. The implementation of the specified options requires large-scale investments by government, private sector, or individuals, which may not be forthcoming in the absence of institutional and policy incentives. ADB–GEF–UNDP (1998a) estimated that even at low unit mitigation costs, 156 billion dollars, spread over a 20-year period, is required to implement the least-cost mitigation options. Private companies and individuals may be unwilling to make long-term investments in afforestation projects, which typically have long gestation periods. Moreover, forestry sector projects are subject to the risk of forest fires, drought, pests, and diseases. In the absence of insurance, this may prove to be a barrier to the adoption of forestry sector mitigation options.

Both funding and R&D capability in the forestry sector are considerably limited in developing countries. There is substantial uncertainty associated with monitoring and verification of the extent of carbon abatement achieved by a forestry sector project. In

order to provide the right incentive environment for investment in forestry sector mitigation options, there is an acute need for institutions that provide finance and technology, as well as for markets for forest products.

Policy and institutional issues

The energy sector is critically important for the growing economies of the Asian region. International cooperation to enhance the flow of funds and transfer of technology can help overcome the barriers to the adoption of mitigation options in the energy sector. In addition to this, awareness-building through information dissemination, technology demonstrations, energy audits, etc., is an important first step towards reducing GHG emissions in the energy sector. Financial incentives, such as access to low-cost finance, should be provided to help cover the initial high cost that deters the adoption of renewable and more energy-efficient options. However, this needs to be supported through appropriate regulations, such as minimum energy-efficiency standards, and by strengthening institutions, including government ministries and departments, electric utilities, and financial institutions.

Mitigation strategies in the forestry sector are generally win-win options that yield significant local environmental and socio-economic benefits. However, these strategies will be successfully implemented only if the government, private industry, local communities, and individuals are effectively involved. Concerted efforts are necessary to build capacity among local institutions for R&D, monitoring, and verification.
A conducive environment must be created for the influx of domestic and foreign funds into forest sector projects. Furthermore, the overall regulatory framework (including laws governing land tenure, use of forest land, etc.) must support the promotion of appropriate mitigation strategies. Financial incentives such as low-cost credit or tax concessions could be provided to investors while reducing or removing subsidies that encourage excessive use of forest products.

In a country where food security is of paramount importance, and forest land and resources are already under pressure, the allocation of land for afforestation programmes cannot come at the expense of agriculture. Efforts to increase agricultural productivity must form the backdrop of any abatement strategy in the forestry sector.

Role of clean development mechanism

The CDM (clean development mechanism) is one of the financial mechanisms laid out in Article 12 of the Kyoto Protocol to the UN FCCC. The main objective of the CDM is to promote investment in projects that reduce GHG emissions and foster sustainable development in developing countries. CDM projects to be hosted by developing (non-Annex I) countries are expected to earn ‘certified emission reductions’ or credits that may be used by industrialized (Annex I) investor countries to help comply with their future emission reduction obligations under the Kyoto Protocol. The Kyoto Protocol is still to be

ratified by over 30 countries before it can formally set rules of operation at the sixth session of the COP in November 2000. Countries listed in the Climate Change in Asia web site could benefit from the CDM. The CDM is appealing to industrialized countries as a potential source of low-cost emission credits and because it may foster future business opportunities. Developing countries, on the other hand, could attract new and additional investment in priority sectors like energy and forests that can also promote more sustainable development. The priority for the CDM in the region would be energy-efficiency and renewable energy projects; tree planting and sustainable forest management could also be eligible projects. It remains to be seen whether certain types of technologies would be excluded from these projects. However, there are substantial differences between the Negotiating Parties on the scope, design, and applicability of CDM. If formulated properly, the CDM could become an important element in the effort to prevent dangerous impacts of climate change and help propel developing countries to cleaner development paths.

Possible issues for the discussion forum

- Would the CDM be available to undertake some of the mitigation options?
- What specific areas/projects would be more operational?
- What institutional frameworks would required to be put in place?

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