



SECTION 6

PRIORITY CLEAN ENERGY OPTIONS FOR CLIMATE CHANGE MITIGATION

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SECTION 6

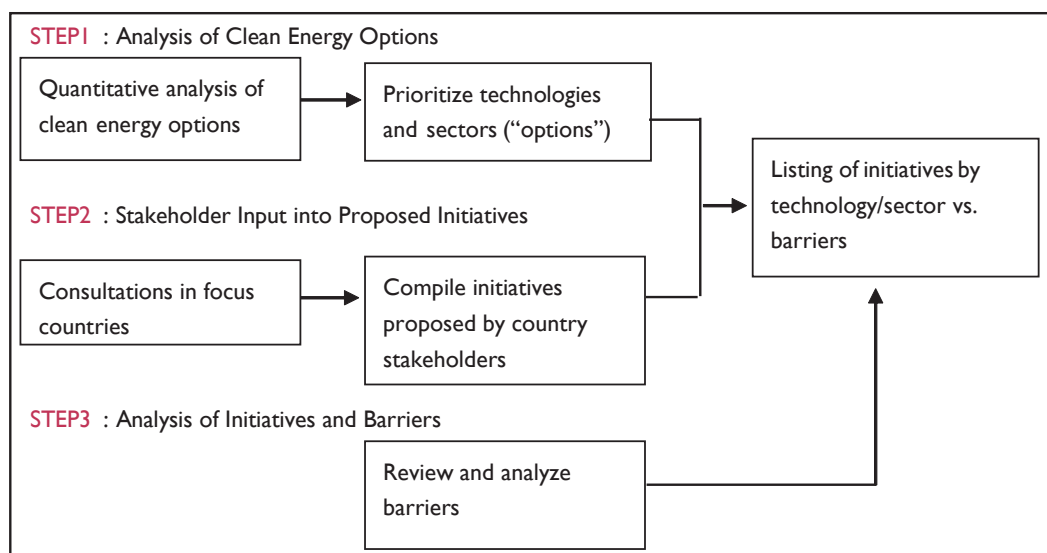
PRIORITY CLEAN ENERGY OPTIONS FOR CLIMATE CHANGE MITIGATION

This section presents a detailed list of priority clean energy options and proposed initiatives for the region that will lead to reductions in GHG emissions, while also bolstering energy security and addressing local air pollution concerns. This list is meant to serve as a resource in the planning efforts of public, private, and multilateral energy actors in the region.

A three-tiered process was applied in prioritizing the set of clean energy options and initiatives:

- **Step 1.** A list of priority technologies and sectors (“options”) was first developed based on the regional analysis of clean energy options (Section 3) and ranked by their regional applicability and potential for low-cost carbon mitigation (Table 16).
- **Step 2.** The list of priority options was matched against a list of policy and market initiatives that were proposed by stakeholders during consultation missions to the six focus countries during November and December 2006 (see Country Reports in Annexes 1-6).
- **Step 3.** Finally, each of the proposed initiatives was analyzed to determine how it would address the barriers identified in this report (Table 17) (see Section 4 for a discussion on barriers to clean energy deployment).

FIGURE 33. SCHEMATIC OF PROCESS USED TO PRIORITIZE CLEAN ENERGY OPTIONS FOR CLIMATE CHANGE MITIGATION



6.1 ANALYSIS OF CLEAN ENERGY OPTIONS

The clean energy options presented in Section 3 of this report were evaluated against a set of criteria (Table 15) to identify those that provide the greatest potential for low-cost carbon mitigation. Table 16 shows how the clean energy options are ranked against the criteria. The rankings are adjusted so that high is “good” or “desirable.” Therefore, for example, options with a low cost of saved energy receive a

high score. The ranking scheme also includes a crude weighting factor, to emphasize the greater importance of some criteria (i.e. regional applicability, GHG reductions) over others. Although the scoring system is inexact and somewhat subjective, it provides an approximate guide for ranking priority clean energy options. Of course, the authors recognize that alternate weighting schemes are possible, depending on organizational preferences or priorities.

TABLE 15. CRITERIA FOR SELECTING PRIORITY CLEAN ENERGY OPTIONS

Criteria	Ranking Scheme	Weighting Factor
Regional applicability (potential for common regional action)	= 1 to 5 (5 most applicable)	× 2
Total CO ₂ emissions reduction potential (Mt/yr)	= 1 to 5 (5 highest potential)	× 2
Cost of energy generated or saved (US cents/kWh)	= 1 to 5 (5 lowest cost)	× 2
Cost of GHG reductions (US\$/tCO ₂ e)	= 1 to 5 (5 lowest cost)	× 2
Potential to reduce pollution	= 1 to 5 (5 highest potential)	× 1
Employment benefits (jobs/dollar invested)	= 1 to 5 (5 highest potential)	× 1
Timeframe for widespread availability of technology ¹	= 1 to 5 (5-10 yrs; less than 5 yrs; current)	× 1
Potential for cost reductions in future	= 1 to 5 (5 highest potential)	× 1
Maximum score	60	

Table 16 shows the ranking scores assigned for each option. The rankings for the first four criteria have a maximum value of 10, instead of 5, since these criteria have a weighting value of 2. Options with the highest scores have the greatest potential for regional low-cost carbon mitigation in a short-term time-frame (three to five years).

TABLE 16. PRIORITIZATION AND RANKING OF CLEAN ENERGY OPTIONS

CLEAN ENERGY OPTION	Regional applicability (potential for common regional action)	Total potential reduction in Asian carbon emissions (tons/yr)	Cost of energy generated or saved (cents/kWh)	Cost of carbon reductions (US\$/tC)	Ability to reduce pollution impacts	Employment benefits	Timeframe for widespread availability of technology	Potential for cost reductions in future	TOTAL SCORE
Energy Efficient Lighting and Appliances	10	8	10	10	4	4	5	4	55
Energy Efficient Buildings and Factories	2	8	8	8	3	4	5	4	42
Pulverized Coal Technology Without CO ₂ capture	6	Baseline	Baseline	Baseline	4	2	5	4	21
With CO ₂ capture and storage	6	10	6	6	5	2	3	2	40

¹ The three possible levels of this criterion are assumed to be spread across the five-point scale.

TABLE 16. PRIORITIZATION AND RANKING OF CLEAN ENERGY OPTIONS

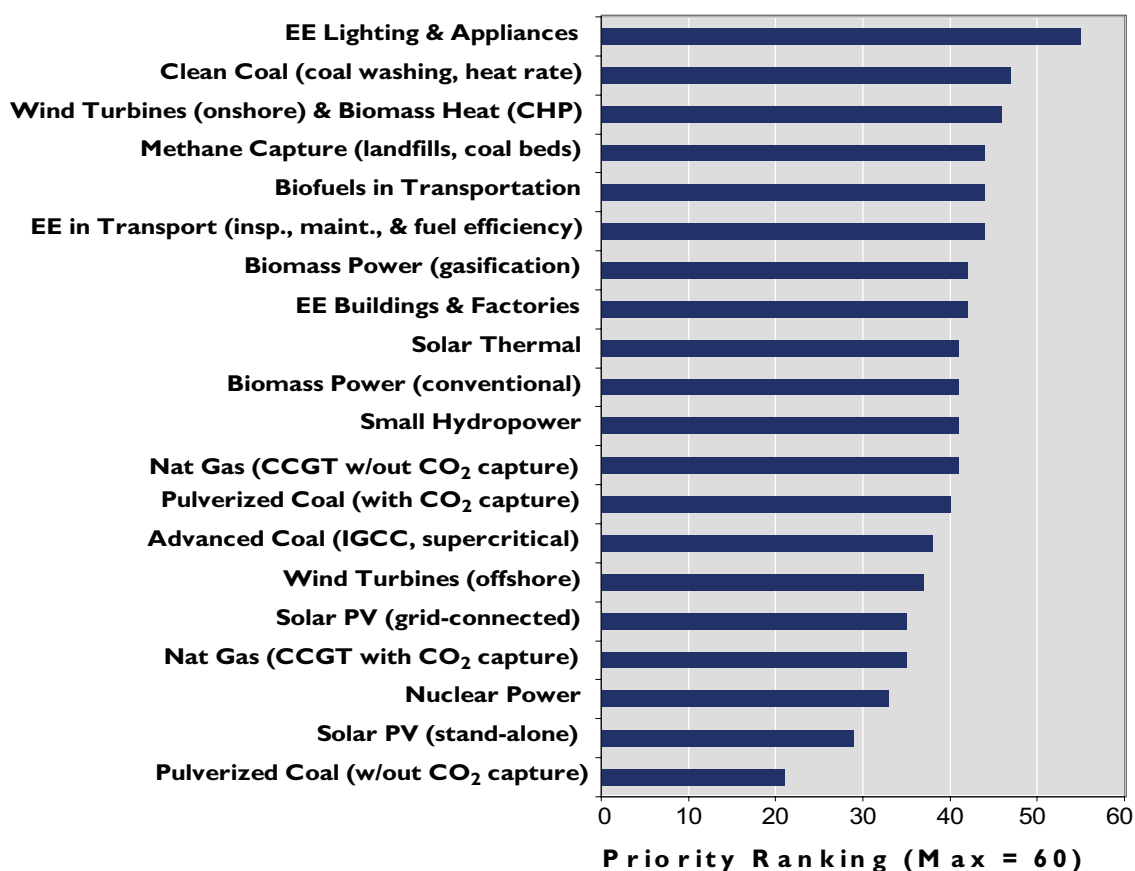
CLEAN ENERGY OPTION	Regional applicability (potential for common regional action)	Total potential reduction in Asian carbon emissions (tons/yr)	Cost of energy generated or saved (cents/kWh)	Cost of carbon reductions (US\$/tC)	Ability to reduce pollution impacts	Employment benefits	Timeframe for widespread availability of technology	Potential for cost reductions in future	TOTAL SCORE
Clean Coal Technology (coal washing, heat rate improvements etc)	6	10	8	8	5	1	5	4	47
Advanced Clean Coal Technology (IGCC and supercritical)	6	10	4	4	5	2	3	4	38
Natural Gas – CCGT Without CO ₂ capture With CO ₂ capture and storage	6	6	8	8	4	2	4	3	41
	6	6	6	6	4	2	3	2	35
Nuclear Power*	6	8	4	6	4	2	1	2	33
Small Hydropower**	8	6	6	6	3	3	5	4	41
Wind Turbines (Onshore)	8	6	8	8	3	4	5	4	46
Wind Turbines (Offshore)	6	6	6	6	3	3	3	4	37
Biomass (conventional)	8	6	6	6	3	4	5	3	41
Biomass (gasification)	8	6	6	6	3	4	5	4	42
Biomass (CHP)	8	6	8	8	3	4	5	3	45
Solar PV (Stand-alone)	6	2	2	2	3	4	5	5	29
Solar PV (Grid-connected)	8	6	2	2	3	4	5	5	35
Solar Thermal	8	6	6	6	2	4	5	4	41
EE in Transport (inspection and maintenance)	6	4	10	8	4	4	5	3	44
EE in Transport (improved fuel efficiency standards)	8	8	10	8	4	4	3	3	48
Biofuels (in transportation)	10	4	6	6	4	4	3	4	41
Methane Capture (landfills, coal beds)	8	4	10	10	2	2	5	3	44

Note: (*) Nuclear energy poses additional hazards related to radiation from accidents and the as-yet-unresolved issue of long-term waste disposal. (**) Large hydropower was not included in the analysis. IGCC = Integrated Gasification Combined Cycle; CCGT = Combined Cycle Gas Turbine; CHP = Combined Heat and Power; PV = Photovoltaic; EE = Energy Efficiency.

Figure 34 graphically displays the results of the above analysis with the technologies and sectors sorted by their ranking. The maximum score is 60. The following options emerge from the analysis as the top six priorities.

- **energy efficient lighting and appliances**,² including compact fluorescent lamps, refrigerators, room air conditioners, and electric fans;
- **clean coal technologies**, including coal washing, heat rate improvements, and advanced coal combustion technology such as IGCC and supercritical;
- **renewable energy technologies**, specifically onshore wind, CHP, and biomass gasification;
- **methane capture** from coal mines and municipal landfills;
- **biofuels for transportation**, including ethanol and various types of biodiesel; and
- **energy efficiency in the transport sector**, including inspection and maintenance of in-use vehicles and improved fuel efficiency of new vehicles.

FIGURE 34. RANKING RESULTS FOR CLEAN ENERGY OPTIONS THAT CAN BE IMPLEMENTED THROUGH REGIONAL COOPERATION PROGRAMS



6.2 STAKEHOLDER INPUT INTO PROPOSED INITIATIVES

During a series of consultation missions to each of the focus countries, the research team met with stakeholders in each country from the public, private, and civil-society sectors in order to review the energy sector and seek input on effective mechanisms to scale-up clean energy programs and investments. Working with stakeholders in each country, the research team developed a list of key initiatives that address critical barriers and help scale-up clean energy investment and implementation. These initiatives are elaborated on in each of the Country Reports (Annexes I-6) and form the basis for **Table 17**.

2. The IPCC, in its Fourth Assessment Report, concludes that energy-efficiency options could considerably reduce CO₂ emissions with net economic benefit, and that they have large co-benefits (IPCC, 2007b, p. 18).

6.3 ANALYSIS OF INITIATIVES AND BARRIERS

A complete set of proposed clean energy initiatives is presented in Table 17. They have been organized by technology and sector (“options”). The cross-cutting initiatives address more than one technology or sector. Further, these initiatives were assessed against specific “barriers” to the scale-up of clean energy that are identified and discussed in detail in Section 4 of this report (see column headings). The purpose of this table is to illustrate what barriers are addressed by the priority options identified in Section 6.1.

TABLE 17. SUMMARY OF ILLUSTRATIVE INITIATIVES BY TECHNOLOGY AND SECTOR, SHOWING BARRIERS ADDRESSED

Proposed Initiatives	Policy/ Regulatory	Institutional Design and Capacity	Market Development	Tech Transfer and Demonstration	Financing	Carbon Markets	Capacity Building	Knowledge Management
Cross-Cutting Initiatives								
Establish regional forum on legislation and implementing guidelines	✓						✓	✓
Facilitate public-private partnerships to promote voluntary clean energy			✓		✓		✓	
Launch regional campaign or network to promote green certificates (for renewable energy)	✓					✓		✓
Launch regional initiatives on fiscal and tax regimes for EE/RE	✓					✓	✓	✓
Establish regional platform for energy policy action research	✓	✓					✓	✓
Conduct regional workshops and forums on clean energy market development	✓		✓	✓			✓	
Facilitate regional network of experts on scaling-up project finance for clean energy			✓		✓		✓	✓
Establish Communities of Practice (in-person and online) on various clean energy issues	✓	✓	✓	✓	✓	✓	✓	✓
Promote regional sharing of energy data collection, statistics, and analysis	✓	✓					✓	✓
Conduct training courses for regulators and energy sector agencies	✓	✓					✓	
Conduct training courses in clean energy for banks/financial institutions					✓		✓	
End-Use Efficiency								
Establish regional energy efficiency appliance labeling initiative	✓	✓					✓	✓
Harmonization of regional standards for CFLs	✓	✓	✓					✓
Promote regional harmonization and cooperation on standards for EE equipment	✓	✓	✓				✓	✓

TABLE 17. SUMMARY OF ILLUSTRATIVE INITIATIVES BY TECHNOLOGY AND SECTOR, SHOWING BARRIERS ADDRESSED

Proposed Initiatives	Policy/ Regulatory	Institutional Design and Capacity	Market Development	Tech Transfer and Demonstration	Financing	Carbon Markets	Capacity Building	Knowledge Management
Establish regional program to share best practices in energy efficiency for SMEs			✓	✓			✓	✓
Establish regional information-sharing network on best practices energy efficiency in large buildings and factories			✓	✓			✓	✓
Mobilize investments in energy efficiency by city managers and local government units				✓	✓		✓	
Support logistics/ info support for green building construction				✓			✓	
Support regional information network on best practices in energy efficiency laws, policies, and best practices	✓	✓		✓			✓	✓
Provide incentives for public-private partnerships and public awareness building			✓		✓		✓	
Supply-Side Efficiency								
Support regional forum for sharing information and best practices on supply-side efficiency			✓	✓			✓	✓
Establish regional clearinghouse on best practices in T&D improvements				✓	✓		✓	✓
Establish regional forum on improved financial management of transmission and distribution utilities in Asia	✓	✓			✓		✓	
Support best practices in combined heat and power (cogeneration) in industry			✓	✓			✓	✓
Clean Coal Technologies								
Promote regional program support increased investment in clean coal technologies			✓	✓	✓		✓	
Promote national clean coal legislation and implementing guidelines	✓	✓						
Promote regional standards for clean coal (NO _x , SO _x , PM10, mercury, CO ₂)	✓							✓
Facilitate bilateral and multilateral or private funding for clean coal investments			✓		✓			
Promote innovative market mechanism such as carbon/green power markets	✓		✓			✓		✓
Demonstrate low-cost clean coal technologies (e.g. coal washing)			✓	✓				

TABLE 17. SUMMARY OF ILLUSTRATIVE INITIATIVES BY TECHNOLOGY AND SECTOR, SHOWING BARRIERS ADDRESSED

Proposed Initiatives	Policy/ Regulatory	Institutional Design and Capacity	Market Development	Tech Transfer and Demonstration	Financing	Carbon Markets	Capacity Building	Knowledge Management
Support technology transfer for advanced clean coal technologies (e.g. IGCC)			✓	✓			✓	
Transport Energy Efficiency								
Regional promotion of improved traffic planning and management approaches	✓	✓		✓			✓	
Regional promotion for planning of efficient mass transit systems (e.g. BRT)	✓	✓	✓	✓	✓	✓	✓	
Establish information clearinghouse on best practices and lessons learned in the areas of inspection and maintenance, fuel standards, and vehicle efficiency			✓	✓		✓		✓
Biofuels								
Promote national legislation and policy/research road maps for biofuels	✓	✓		✓	✓			✓
Establish regional technical standards for biofuels to enable trade	✓	✓						
Establish regional standards for sustainable biofuel production	✓	✓						
Promote best practices network on biofuel production from different feed stocks				✓			✓	✓
Provide biofuel business support (e.g. private-public partnerships, investment fairs, project preparation TA)		✓	✓		✓			
Facilitate technology transfer in advance ethanol and biodiesel production			✓	✓				
Facilitate technology transfer in flex-fuel vehicle technology, fuel infrastructure management and product quality enhancement			✓	✓				
Renewable electricity generation (biomass, wind, small hydro)								
Promotion of policy mechanisms for RE promotion (e.g. feed-in law, tax and credit schemes, RPS)	✓	✓				✓		
Provide RE policy and business support (e.g. fiscal policies, incentives) and regional sharing of lessons learned	✓	✓	✓			✓		✓
Promote greater access to finance (e.g. commercial, green funds, etc.)					✓	✓		
Establish a project preparation facility to integrate funds		✓			✓	✓		
Joint development of biomass utilization plans and road maps	✓						✓	✓

TABLE 17. SUMMARY OF ILLUSTRATIVE INITIATIVES BY TECHNOLOGY AND SECTOR, SHOWING BARRIERS ADDRESSED

Proposed Initiatives	Policy/ Regulatory	Institutional Design and Capacity	Market Development	Tech Transfer and Demonstration	Financing	Carbon Markets	Capacity Building	Knowledge Management
Training carbon markets and green markets for renewable energy	✓				✓		✓	
Demonstrate new RE technologies such (e.g. wind, PV)			✓	✓				
Demonstrate new financing and implementation models (e.g. energy concessions and output-based aid)	✓			✓			✓	
Regional cooperation in off-grid RE-based rural electrification		✓		✓	✓		✓	✓
Training in accessing sources of finance, including carbon markets		✓			✓	✓	✓	✓
Promote harmonization of standards for RE equipment	✓	✓						
Methane Capture								
Establish regional network to promote methane capture and sharing of best practices	✓		✓	✓			✓	✓
Demonstrate methane capture technologies			✓	✓				✓
Training in management of animal and agricultural waste (e.g. biogas systems), in landfill management and methane capture systems and capture of fugitive emissions from coal, oil and gas		✓					✓	

Note: BRT= bus rapid transit; CFLs = compact fluorescent lamps; IGCC= integrated combined cycle gasification; PM₁₀ = particulate matter sized ≤10 microns; RPS= renewable portfolio standard; TA= technical assistance; T&D = transmission and distribution.

Given the immense challenges faced by Asian countries – ensuring energy security, mitigating GHG emissions, managing local air pollution – it is clear that a “business as usual” approach to energy policy is inadequate. The initiatives listed in **Table 17** therefore represent a list of potential initiatives that could be pursued by stakeholders in ongoing and future efforts to address barriers in order to scale up clean energy investments and deployment in Asia.

6.4 CONCLUSIONS ON CLEAN ENERGY PRIORITIES

In summary, the research team has identified a set of six “top priority” clean energy options for Asia based on the regional analysis. It is important to note that this is an overarching list for Asia, meant to be useful to a range of stakeholders, funding agencies, and partners working at a regional level. As such, the list of priority initiatives for an individual country may be different. Country-specific clean energy needs and options are presented in the country reports (Annexes 1-6). It is also important to note that, while this analysis identified a number of programs that address these priority areas in the focus countries, there are currently

few or no sustained initiatives that focus resources on regional cooperation and problem-solving to address these priority areas in a sustained and systematic manner – combining policy, financial, and information-sharing aspects. The top priority options for regional action on clean energy identified in this report are:

Energy efficient lighting and appliances. In 2030, more than half of Asia's CO₂ emissions (56 percent) will come from the power sector. The most reliable and cost-effective way to obtain CO₂ reductions is by focusing on measures to improve appliance efficiency, and in particular, energy efficiency standards and labeling. Additionally, because of losses in generation and transmission of electricity, one unit of energy saved by the appliance will save approximately three to four units of energy at the power plant, thus magnifying the savings. Energy efficiency also has two additional benefits: it directly increases energy security by reducing energy imports; and it is a flexible resource, and can be implemented and scaled-up quickly. Although there have been a number of bilateral programs on energy efficiency, the actual rate of implementation and uptake is slow, and there is a need for a sustained regional push to make real efficiency gains.³

Clean coal technologies. One of the largest sources of CO₂ savings in Asia will likely come from efforts to improve the efficiency of coal plants and introduce clean coal technologies. Any viable “clean energy” solution for Asia must address the vast amount of coal that will be burned during the next 10 to 20 years. The amount of coal used in Asia will increase nearly four-fold over the next 25 years, and coal will account for 60 percent of CO₂ emissions in Asia in 2030.⁴ There are a number of promising clean coal options, including coal washing, heat rate improvements, and advanced coal combustion technology such as IGCC and supercritical plants. A major driver for increased adoption of clean coal could be linkages to environmental regulations for NO_x, SO_x, and particulate emissions, which are often assigned a higher priority by local and national policy makers and regulators.

Renewable energy technologies (wind turbines, biomass CHP). Renewable energy is the ideal source of energy supply, as it is indigenous, creates local employment benefits, and is a low or “carbon neutral” source of energy. This regional analysis gave a high ranking to the current set of renewable energy options that are commercially viable, including small hydropower, onshore wind energy, and biomass-fired electricity (including gasification technologies). There is no doubt that renewable energy is a significant part of the clean energy puzzle for the medium and long term. These technologies are already affordable, and as costs drop over time they will only become even more economically viable. However, currently renewable energy only makes a small contribution to Asia's primary energy mix. Future expansion hinges on several issues, including the extent to which governments will put in place technology demonstrations, fiscal and financial measures, and policy instruments to promote their scale-up, and the rate at which technological innovation will lead to lower production costs.

Methane capture. Projects that reduce methane emissions,⁵ especially through capture at landfills and waste management sites, and during the mining of coal, have economic benefits that partially offset the costs. In some instances, methane's value as a fuel pays for the cost of capture. China and India have large sources of methane and have a strong interest in methane capture projects. Partnership opportunities for methane capture projects are facilitated through the Methane to Markets Partnership, a multi-lateral initiative led by the

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3. In the area of compact fluorescent lamps (CFLs), for example, there have been a number of successful programs in the region. Yet a recent survey of CFL markets in seven APEC economies found a need for improved testing and harmonization to ensure availability of high-quality energy-saving products. The percentage of poor-quality CFLs in the survey ranged from 15 percent to as high as 40 percent.
 4. According to projections by the Asia-Pacific Energy Research Center (APERC) and the International Energy Agency (IEA), coal will account for more than 12 Bt of CO₂ emissions in developing Asia in 2030, out of total projected emissions for developing Asia of 20 Bt, and global emissions of 40 Bt.
 5. Methane's climate change mitigation potential comes from its higher global warming potential (21 times that of CO₂) and its shorter atmospheric residence time.

USEPA.⁶ Recently, the EPA helped develop a coal-bed methane power plant in China⁷ that is the largest developed to date. The project will avoid the equivalent of 40 Mt of carbon dioxide emissions over 20 years (Methane to Markets, 2006).

Biofuels for transportation. Biofuels offer a number of the same advantages of transport fuel efficiency (see below), including the fact that they increase energy security by reducing oil imports and also reduce local air pollution (especially SO_x, particulates, and mercury). However, the net energy benefit for biofuels is not nearly as large as for transport energy efficiency, and they take longer to make a substantial impact. Nonetheless, there is a significant potential for regional action on biofuels. Many countries in the region are embracing biofuels as a keystone in their strategy to reduce oil imports. In the national consultations leading to this report, two key needs were identified where regional cooperation could have a significant impact: (1) regional harmonization of standards for the quality and technical properties of biofuels (including ethanol and biodiesel); and (2) development of common standards for the sustainable production of biofuels, to mitigate potential negative impacts on forests and food supply.

Energy efficiency in the transport sector. Along with end-use efficiency, transport fuel efficiency measures are the most cost-effective way to reduce CO₂ emissions and mitigate global warming, and have significant co-benefits by reducing local air pollution. Many fuel efficiency measures can be implemented quickly and directly improve energy security by reducing oil imports. While some measures (i.e. vehicle labeling or minimum efficiency standards) can be implemented relatively quickly, many are complex due to the many governmental institutions involved in overseeing and regulating the transport sector. This is one reason why there has been less work done on energy efficiency in the transport sector compared to other sectors.

6.42 PIECING TOGETHER THE CLIMATE CHANGE MITIGATION PUZZLE

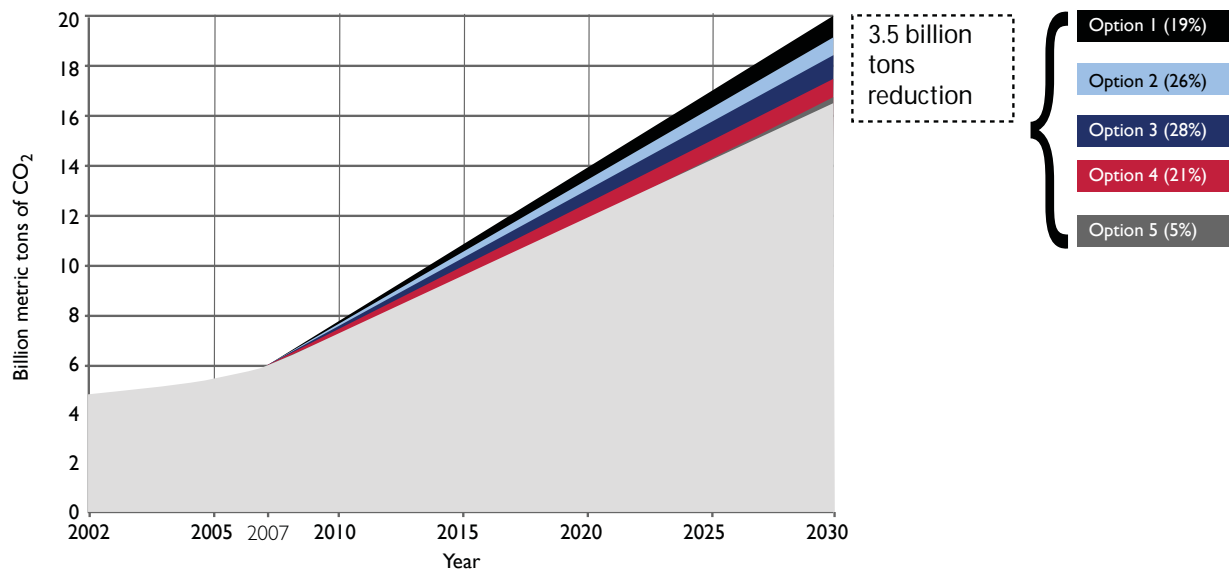
This section provides a compelling example of the potential effects on Asia's carbon emissions profile by implementing just five of the priority options identified above over the period 2008-2030. Under a business-as-usual (BAU) scenario, developing Asia's CO₂ emissions are expected to increase from a current level of 6 Bt annually (23 percent of global emissions) to roughly 20 Bt annually (50 percent of global emissions), a more than three-fold increase. The analysis below considers the estimated CO₂ reduction potential by 2030 for each of these five priority options individually and together.⁸

These options are considered to be the most politically viable and cost-effective solutions and capable of being implemented immediately with current, proven technologies. It should be recognized that this "back of the envelope" calculation is designed not to provide a precise forecast of emissions reductions, but rather a framework for evaluating the possible impacts of the proposed solutions relative to the total CO₂ emissions profile under a BAU scenario. It should be clearly understood that these only represent a small but important subset of the complete list of clean energy solutions shown in **Figure 34**. Numerous additional "wedges" could be pursued to help further reduce – and stabilize – Asia's future contributions to global GHG emissions, while also addressing energy security and the environment.

6. Methane to Markets (2004). "Views on Methane." <http://www.epa.gov/methanetomarkets/docs/views.pdf>

7. Methane to Markets (2006). "Power Plant to be Largest Run on Coal Mine Methane." <http://yosemite.epa.gov/opa/admpress.nsf/4d84d5d9a719de8c85257018005467c2/8ec89e33e48a863f852571720063e8d7!OpenDocument>

8. This analysis is loosely based on the "stabilization wedges" concept proposed by Pacala and Socolow (2004). In this analysis, projected emissions levels are not compared against a "target" emissions level that will allow for stabilization of the global climate regime.

FIGURE 35. CO₂ REDUCTION POTENTIAL OF SELECTED PRIORITY OPTIONS OVER THE PERIOD 2002-2030

Source: Estimates by the USAID ECO-Asia Clean Development and Climate Program, 2007. The upper-most line denotes total emissions in Asia under a BAU scenario, and the lowest line denotes the reduced carbon emissions profile. The area between the two lines represents the overall carbon reductions, “wedges,” arising from the implementation of the five priority initiatives.

The analysis assumes that the following measures would be implemented in Asia during the period 2008-2030. Information on assumptions, conversion factors and carbon reduction calculations are presented in Attachment 3.

- Option 1:** Reduce energy use in buildings by 30 percent.
- Option 2:** Improve the average coal-fired power plant fleet efficiency from 33 percent to 48 percent.
- Option 3:** Expand renewables-based power generation by 10-fold.
- Option 4:** Reduce oil demand in the transport sector by 30 percent.
- Option 5:** Replace 25 percent of oil demand in the transport sector with biofuels.

Implementation of these five options alone would reduce total CO₂ emissions in developing Asia by 3.5 Bt annually in 2030 – a reduction of 25 percent from projected emissions increases. Among the different options, Options 2 and 3 (coal plant efficiency and renewable power generation) account for 26 and 28 percent of the reductions respectively, while Options 1 and 4 (building efficiency and transport efficiency) account for 19 and 21 percent, respectively. Option 5 (biofuels) has the least impact, at 5 percent.

The above modeling exercise puts the challenge of clean energy development and energy security needs into context. There is no “silver bullet” that can address Asia’s GHG mitigation, development, and energy security needs. What is needed is a portfolio of options, beginning with easily implemented, “no net-cost” activities that are widely acceptable. Politically viable, cost-effective “first-tier” activities serve as a bridge and can provide the momentum for Asia to aggressively pursue a suite of second-tier activities that are essential to achieving the remaining reductions.

What is needed now is urgent action on multiple fronts, starting with strong commitments from both public and private sector actors to commit to and implement an aggressive mix of enabling policies and advanced technologies, backed up by access to adequate financial resources. Moreover, in order to maximize returns, these initiatives should be regionally coordinated to allow for sharing of best practices, lowering of barriers, and rapid scale-up in a short time-frame.