

SECTION I

PURPOSE OF THIS REPORT

1.1 CONTEXT

During the next 30 years, the direction that Asian countries embark upon to meet their energy needs will have a profound impact on global climate change, global energy security, and Asia's economic future.¹ In addition, recent reports suggest that the overall risks and costs associated with the impacts of climate change would be significantly more than the costs of reducing greenhouse gas (GHG) emissions (Stern, 2006; IPCC, 2007b).²

In 2005, Asia's developing economies accounted for about 23 percent of global carbon dioxide (CO₂) emissions, and their share of emissions is projected to increase to nearly 50 percent by 2030 (IEA, 2006).³ If the region's robust economic growth continues as expected, Asia's energy consumption is projected to more than triple over the next 30 years (IEA, 2006). The burning of coal to satisfy future energy demands is projected to increase at a disproportionate rate (IEA, 2006),⁴ and this will increase greenhouse gas (GHG) emissions, leading to accelerated global climate change.⁵ The trend of rapidly growing fossil-based energy use will also result in enormous challenges for urban and public health officials. Levels of particulate pollutants (TSP and PM10) in most of Asia's mega-cities exceed the World Health Organization's (WHO) health limits by a factor of two, three, or more (Clean Air Asia, 2006). Poor urban air quality may contribute to as many as 530,000 premature deaths in developing Asia every year (Krzyszczak, 2006). The World Bank reports that 20 of the 30 most polluted cities in the world are located in China (2007).

Energy security is also a growing concern for Asian countries as they become more dependent on imported fossil fuels. By 2030, 80 percent of Asia's oil will be imported from the Middle East (Saha, 2006).⁶ The projected dependence on imported fossil fuels (including oil, gas, and coal) raises legitimate concerns for Asian countries about price volatility and shocks, import disruptions, and the possibility of terrorist attacks on energy supply routes.

It is a daunting challenge to address the global climate change impacts associated with the region's energy use and its implications for economic growth and environmental impacts. However, there is cause for optimism as several policy and programmatic prerequisites are being put in place. The US has initiated efforts to mitigate climate change with its Asian partners through the Asia-Pacific Partnership for

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1. While this report is focused on Asia and its role in accounting for future GHG emissions, the authors fully recognize that, historically, developed nations have contributed to the majority of GHG emissions and will continue to be major emitters in the future. From a public policy and international political economy perspective, it may be appropriate to simultaneously analyze GHG emissions control measures and related international policies in terms of both equity and opportunity. Developing Asian countries, with their high rates of projected energy demand growth, provides a significant opportunity for clean development, and these opportunities form the focus of this report.
 2. The Stern Review estimated that the overall costs and risks associated with climate change could reduce global GDP by 5 to 20 percent per year. Estimates of the cost of reducing GHG emissions were around 1 percent of global GDP per year in the Stern Review and ranged from a 3 percent reduction to a 0.6 percent increase in 2030 in the IPCC's Fourth Assessment Report.
 3. Developing Asia's emissions of CO₂ in 2005 were over 6 billion metric tons of CO₂ (tCO₂) out of a global total of 26 billion tCO₂; by 2030, developing Asia's CO₂ emissions are projected to increase to 20 billion tCO₂ in 2030, out of a global total of 40 billion tCO₂.
 4. The share of coal in developing Asia's energy mix will increase, and coal use is projected to increase nearly four-fold during the period 2006-2030.
 5. It now appears that China's emissions of CO₂ will exceed those of the United States by 2009, a decade earlier than previously believed (IEA, 2006). The rapid increase in emissions from China is mirrored throughout the region, as coal – with its high rate of GHG emissions compared to other fuels – will attain a much larger share of the energy mix in most developing Asian countries.
 6. In 2002, slightly more than half of the oil imported by developing Asian countries came from the Middle East (Wu & Fesharak, 2002).

Clean Development and Climate (APP). At the same time, Asian policymakers are increasingly aware of the need for energy conservation and clean energy promotion, and they have announced a plethora of policies in this area. In addition, there has been a proliferation of high-level international and regional initiatives on energy efficiency, renewable energy, energy security, and energy cooperation in the region. More than ever before, there is a need for effective information-sharing and integration among these initiatives.⁷

This report analyzes current and projected energy demand in Asia and the implications for GHG emissions, with a focus on six Asian countries (referred to as “focus countries” throughout the report): China, India, Indonesia, the Philippines, Thailand, and Vietnam. The report identifies priorities to slow the rate of GHG emissions, which are contributing to global climate change.

The report explores three key questions related to clean energy opportunities in the Asia region:

- Which clean energy technologies and sectors hold the greatest potential to mitigate climate change, reduce air pollution, and improve energy security?⁸
- What specific or thematic policy, financial, technical, and incentive-based initiatives would be most effective in addressing these priorities?
- What regional networks and alliances can be leveraged in order to strategically implement these initiatives?

Funded by the United States Agency for International Development, this report is the initial task of USAID’s ECO-Asia Clean Development and Climate Program. While this report analyzes a broad collection of clean energy options and identifies a number of regional programs and initiatives, it is not an exhaustive assessment of clean energy in the region.⁹ This report is intended to serve as a technical resource to help public and private sector entities prioritize their activities in the area of clean energy and global climate change. As it is hoped others in the region will do, the USAID ECO-Asia Clean Development and Climate Program will draw significantly from the findings in this report, and select a few of these options to implement over the next three years to catalyze regional efforts. However, the report is not a reflection of specific activities or plans for the ECO-Asia program.

1.2 METHODS

This report was prepared based on two strands of research: (1) a stakeholder assessment in the six focus countries; and (2) an analysis of data trends in energy supply and use, as well as related environmental, health, and social impacts. During November and December 2006, the ECO-Asia research team carried out a set of consultations with key energy stakeholders (i.e. public, private, and non-profit sectors) in the six countries. In parallel, a team of researchers in the regional office, based in Bangkok, Thailand, collected and analyzed data on clean energy in the region. The report included the following data collection activities:

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7. To name just a few, these initiatives include the G8 Gleanegles Dialogue; the Asian Development Bank’s Energy Efficiency Initiative and Carbon Markets Initiative; the Asia-Pacific Partnership on Clean Development and Climate (APP); the APEC Energy Security Initiative; the Enhanced ASEAN-US Partnership; the ASEAN Plan of Action for Energy Cooperation; regional programs funded by the Global Environment Facility; and the Renewable Energy and Energy Efficiency Partnership (REEEP).
 8. In Section 6 of the report, the options are screened to assess the availability of the technology in the short, medium, and long term.
 9. In the body of the main report (Sections 2-6), regional data sets were used to undertake the analysis. This allowed for consistent data, definitions and quality across countries. However, in some cases this means the data are not the most currently available and may be inconsistent with country-level data as presented in the country reports (Annexes 1 to 6).

1. an initial set of consultations with government agencies and stakeholders in the United States;
2. interviews and technical consultations in each of the focus countries;¹⁰
3. a desktop study using internet databases and published reports available to the research team, and additional materials provided by USAID and other stakeholders; and
4. targeted email, phone, and in-person interviews with stakeholders involved with key regional organizations.

While recognizing that the IPCC's list of key GHGs includes six gases, this report focuses primarily on CO₂ because its atmospheric concentrations are rising the fastest and it is expected to be the dominant cause of climate change in the future (IPCC, 2007; Pacala and Socolow, 2004).¹¹ In addition, sources of CO₂ are primarily related to energy use and are concentrated, allowing for effective monitoring and control, while methane and N₂O are derived from dispersed sources, such as cattle and agricultural activities. Finally, a wide range of industrial-scale mitigation options with established cost profiles are available for CO₂, allowing for rapid deployment and scale-up.

I.3 FOCUS COUNTRIES

Because of their strategic importance in the region, this report focuses on six focus countries that account for the majority of developing Asia's GDP and energy use. These six countries represent Asia's largest emerging economies and account for 96 percent of developing Asia's GDP. All have experienced sustained or robust economic growth and will rely increasingly on imported fossil fuel.

Table I details key trends in these six countries, highlighting their central importance to any regional effort to promote clean energy and GHG mitigation.

TABLE I. KEY ENERGY AND ECONOMIC INDICATORS OF FOCUS COUNTRIES

	China	India	Indonesia	Philippines	Thailand	Vietnam	Total or Average
Population	1,304 million	1,095 million	220 million	83 million	64 million	83 million	2,849 million
Projected Population in 2030	1,446 million	1,449 Million	270 million	114 million	73.8 million	108 million	3,461 million
GDP Growth (2002-2030)	6.4% annually	8.0% annually	4.6% annually	4.1% annually	4.7% annually	6.3% annually	5.3% annually
Energy Demand Growth (2002-2030)	3.7% annually	5% ¹² annually	2.7% annually	3.4% annually	4.6% annually	4.4% annually	4.0% annually
Total Final Energy Demand (2002)	1,119 Mtoe	370 Mtoe	168 Mtoe	43.9 Mtoe	74 Mtoe	42 Mtoe	2,212 Mtoe
Electrification Rate (2006)	99%	44.4%	52.5%	89%	91%	91.5%	78%

10. Due to time limitations, and limitations on USAID's ability to work in China, a consultation tour was not conducted. Nonetheless, the team worked with a Chinese consultant to develop a comprehensive country profile, which is included in Annex I in this report.

11. It should be noted that significant opportunities exist with respect to other GHGs, such as coal-bed methane (CBM) and coal mine methane (CMM), at some sites. A short discussion of CBM and CMM can be found in Section 3.

12. Current projections for demand growth assumed by the Indian government are closer to 7 percent.

TABLE I. KEY ENERGY AND ECONOMIC INDICATORS OF FOCUS COUNTRIES

	China	India	Indonesia	Philippines	Thailand	Vietnam	Total or Average
Average Electricity Consumption per capita	1,379 kWh	435 kWh	440 kWh	574 kWh	1,752 kWh	443 kWh	837 kWh
Reliance on Fossil Fuels (2002)	78%	80%	71%	56%	85%	43%	69%
Net Energy Imports by 2030	18%	76%	0%	68%	80%	15%	42.8%
Net Oil Imports by 2030	70%	90%	60%	97%	94%	57%	78%
Total CO₂ Emissions in 2005	3,128 Mt	1,218 Mt	291 Mt	75 Mt	193 Mt	56 Mt	4,961 Mt
Total Projected Annual CO₂ Emissions in 2030 under BAU Scenario	9,500 Mt	6,800 Mt	745 Mt	262 Mt	734 Mt	301 Mt	18,318 Mt

Sources: APERC, 2006 (for APEC countries); IEA, 2006 and TERI, 2006 (India); WDI, 2006.