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ANNEX 3

INDONESIA COUNTRY REPORT

FROM IDEAS TO ACTION: CLEAN ENERGY SOLUTIONS FOR ASIA TO ADDRESS CLIMATE CHANGE

June 2007

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CONTENTS

Tables and Figures 2
List of Abbreviations 3
1. Indonesia's Clean Energy Challenge 4
1.1. Trends in Energy Resources *4*
1.2. Impacts of Energy Use *5*
2. Clean Energy Regulatory Framework 6
2.1. Key Laws, Decrees, and Policies *6*
2.1.1 *Overarching Framework* 6
2.1.2 *Energy Efficiency* 10
2.1.3 *Renewable Energy* 10
2.1.4 *Clean Transport* 11
3. Institutional Analysis 11
3.1. Organizational Overview *11*
3.2. Institutional Needs Assessment *15*
4. Current Status and Potential of Clean Energy 15
4.1. Overview of Fuels and Resources *15*
4.1.1 *Fossil Energy and Nuclear Power* 15
4.1.2 *Renewable Energy and Distributed Generation* 17
4.1.3 *Energy Efficiency* 18
4.1.4 *Clean Transport* 19
4.2. Comparison of Economic Potential and Cost Effectiveness *21*
5. Carbon and Greenhouse Gas Abatement 22
5.1. Status of Activities in the Carbon Markets *22*
5.2. Institutional Capacity for Measuring and Reporting Greenhouse Gas Abatement *23*
6. Donor Activity in Clean Energy 23
7. Barriers and Needs Assessment in Clean Energy 26
8. Conclusions 27
8.1. Recommendations for a Clean Energy Strategy *27*
8.2. Recommended Interventions and Activities *29*
References 31

TABLES AND FIGURES

Table 1: Estimated Health Impacts and Costs of Air Pollution in Jakarta, 1998 6
Table 2: Clean Energy Decrees, Regulations, Policies, and Laws 8
Table 3: Institutions Working on Clean Energy 12
Table 4: Status of Indonesia's Energy Reserves 15
Table 5: Emissions and Fuel Consumption Factors for Uncontrolled Thai Motorcycles 20
Table 6: Indonesia's Potential for Renewable Energy Development 21
Table 7: Estimated Installed Cost per kW/Capacity and Generating Cost per kWh 22
Table 8: CDM Projects Registered with the CDM Executive Board (as of October 2006) 23
Table 9: Donor Support for the Clean Development Mechanism in Indonesia 24
Table 10: Current Donor Assistance Projects Under Way in Clean Energy 26

Figure 1: Primary Energy Supply by Source 4
Figure 2: Projected CO_2 Emissions by Sector 5
Figure 3: Relationship Between GDP and Oil Fuel Sales with Subsidies in Place 7
Figure 4: Relationships Among Key Energy Institutions 11
Figure 5: Plan for Nuclear Power Development 2000-2025 17
Figure 6: Number of Vehicles in Indonesia 20

LIST OF ABBREVIATIONS

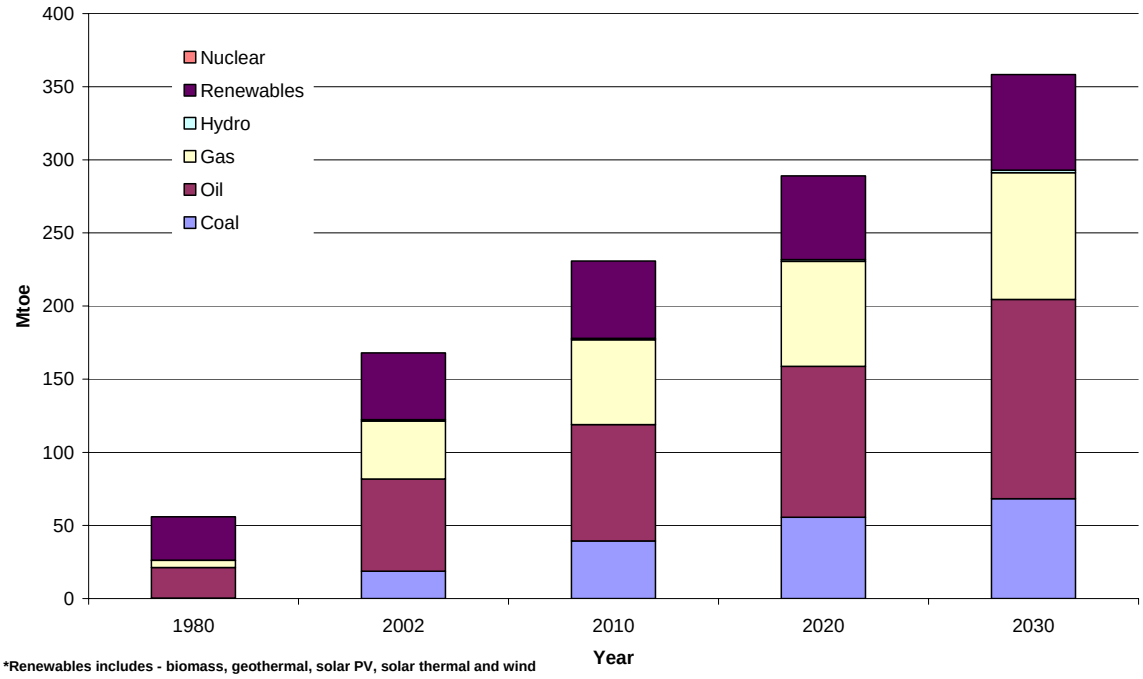
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
ASEAN	Association of Southeast Asian Nations
BAKOREN	National Energy Coordination Board
BAPPENAS	National Development Planning Agency
BCPA	Bilateral CER Purchase Agreement
BPMIGAS	Executive Agency for Upstream Oil and Gas Activity
BPPT	Agency for the Assessment and Application of Technology
CDM	Clean Development Mechanism
CER Indonesia	Carbon and Environmental Research Indonesia
CERs	Certified Emission Reductions
CERUPT	Certified Emission Reduction Unit Procurement Tender
CFLs	Compact Fluorescent Lamps
DGEEU	Directorate General for Electricity and Energy Utilization
DNA	Designated National Authority
ECN	Energy Research Centre of the Netherlands
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GJ	Gigajoules
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, or German Enterprise for Technical Cooperation.
GW	Gigawatt
IDR	Indonesian Rupiah
KfW	Kreditanstalt für Wiederaufbau, or the German Bank for Reconstruction and Development
MOE	Ministry of Environment
LNG	Liquefied Natural Gas
LULUCF	Land Use, Land Use Conversion, and Forestry Projects
MEMR	Ministry of Energy and Mineral Resources
MOU	Memorandum of Understanding
Mt	Million Metric Tons
MW	Megawatt
NEDO	New Energy and Industrial Technology Development Organization of Japan
OPEC	Organization of Petroleum Exporting Countries
PDD	Project Design Document
PGN	State Gas Company
PLN	Indonesia's State Electricity Company
PM_{10}	Particulate Matter < 10 microns, unit mg/m^3
PT Bukit Asam	National Coal Company
PT Pertamina	State Oil and Gas Company
RENI	Renewable Energy Network Indonesia
RUKN	National Electricity General Plan
UNDP	United Nations Development Programme
VERs	Verified Emission Reductions

1. INDONESIA'S CLEAN ENERGY CHALLENGE

1.1. TRENDS IN ENERGY RESOURCES

Indonesia has a wide variety of abundant energy resources, including fossil and non-fossil resources, and has been a net energy exporter for many years. The primary energy source fueling Indonesia's economy continues to be oil, although decreasing domestic production, increasing domestic consumption, and global price hikes over the past few years have reduced oil consumption and prompted efforts to develop other domestic energy resources. Coal will be the primary domestic energy resource, particularly to fuel new power generation capacities. The second most important fuel source for Indonesia's population is biomass, although most of its use occurs in the informal economy. Meanwhile, biofuels have been identified as the primary energy resource to diversify transport fuels.

FIGURE 1: PRIMARY ENERGY SUPPLY BY SOURCE



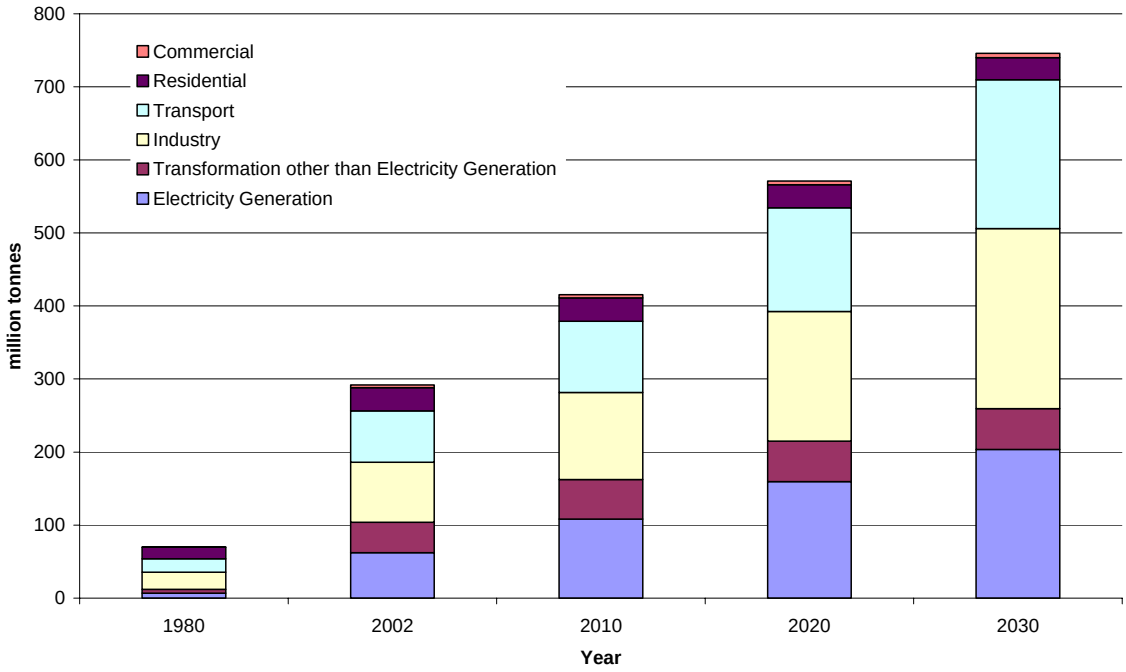
Source: APERC (2006).

In addition to the role they play in the energy sector, oil and gas together continue to lead export earnings for Indonesia, increasing from US$15.2 billion in 2003 to US$17.6 billion in 2004 and US$ 19.2 billion in 2005. However, despite being a significant exporter of crude oil, Indonesia is now a net importer of oil. Indonesia, one of the few members of the Organization of Petroleum Exporting Countries (OPEC) outside of the Middle East, is the only OPEC member that is a net oil importer. Its oil production has declined over the years, owing to ageing oil fields and lack of investment in new equipment. Indonesia, nevertheless, remained the world's leading exporter of liquefied natural gas (LNG) in 2005, capturing 18.8 percent of the world market, and allowing it to remain a net exporter with both oil and gas considered. At the same time, oil and gas imports increased from US$8.4 billion in 2003 to US$12.1 billion in 2004 and US$17.4 billion in 2005. Meanwhile, coal exports have grown dramatically, exceeding US$5 billion in 2006.

The removal of subsidies from oil and increases in electricity tariffs have resulted in decreased energy consumption in most sectors and make it difficult to forecast future energy demand. Most models look at past trends to project future demand. In Indonesia, the fact that the change in subsidies is significant and ongoing makes future predictions difficult. For example, the industrial sector's energy consumption, which accounted for 35 percent of total energy consumption 2003, dropped by 7 percent from 2001 to 2002 and an additional 3.7 percent from 2002 to 2003. Similarly, the transport sector's energy consumption, which accounted for 31 percent of total energy consumption in 2003, fell 7 percent from 2001 to 2002 and by a further by 5.1 percent from 2002 to 2003 (APERC, 2005 and 2006).

Figure 2 provides projections of CO_2 emissions by sector and shows that electricity generation, industry, and transport will dominate CO_2 emissions in the future.

FIGURE 2: CO_2 EMISSIONS BY SECTOR



Source: APERC (2006).

1.2. IMPACTS OF ENERGY USE

Indonesia's plans to rapidly expand the use of coal for power generation include building more than 3,000 MW of new coal-fired power generation in Western Java alone by 2010. The expanded use of coal will significantly increase emissions of SO_x, NO_x, PM_{10}, and a range of other pollutants. Current pollutant emissions standards in Indonesia are less stringent than in other countries in the region. However, newspaper reports claim that responses to early tenders for coal-fired plants have not met existing Indonesian standards for emissions. The extent of the impact of the plants will depend heavily on what national standards Indonesia sets and enforces for coal-fired power generation. Setting higher standards will increase the cost of new power generation and could reduce the thermal efficiency of the plants to be built, resulting in increased CO_2 emissions. The increased cost needs to be offset against the adverse health impacts of not applying more stringent standards. Table 1 shows some of the estimated health impacts associated with air pollution in Indonesia's capital city, Jakarta.

TABLE 1: ESTIMATED HEALTH IMPACTS AND COST OF AIR POLLUTION IN JAKARTA, 1998

Health Effects	Number of Cases	Cost (US$ million)
PM_{10}		
Premature mortality	3,307	30.94
Restricted activity days	18,194,822	31.94
Hospital admissions	5,905	0.49
Emergency room visits	115,845	1.59
Asthma attacks	1,323,551	3.31
Lower respiratory illness (children)	296,909	0.36
Respiratory symptoms	90,057,542	108.8
Chronic bronchitis	30,118	0.18
NO_2		
Respiratory symptoms	3,506,535	4.24
Total		181.4

Source: Syahril and Tomo (2002).

2. CLEAN ENERGY REGULATORY FRAMEWORK

2.1. KEY LAWS, DECREES, AND POLICIES

2.1.1. Overarching Framework

The energy sector in Indonesia is dominated by four key policies and objectives:

- **Diversification:** A key objective of the Government of Indonesia is to reduce dependence on oil by expanding the use of coal, gas, and renewable energy resources.
- **Rational Energy Pricing:** The Government of Indonesia recognizes that it can no longer sustain uniform pricing for electricity and petroleum products across the country, and it has begun to eliminate subsidies.
- **Energy Sector Reform:** The combination of decentralization of government decision-making to give greater involvement to regional authorities, and the need to attract capital investment in

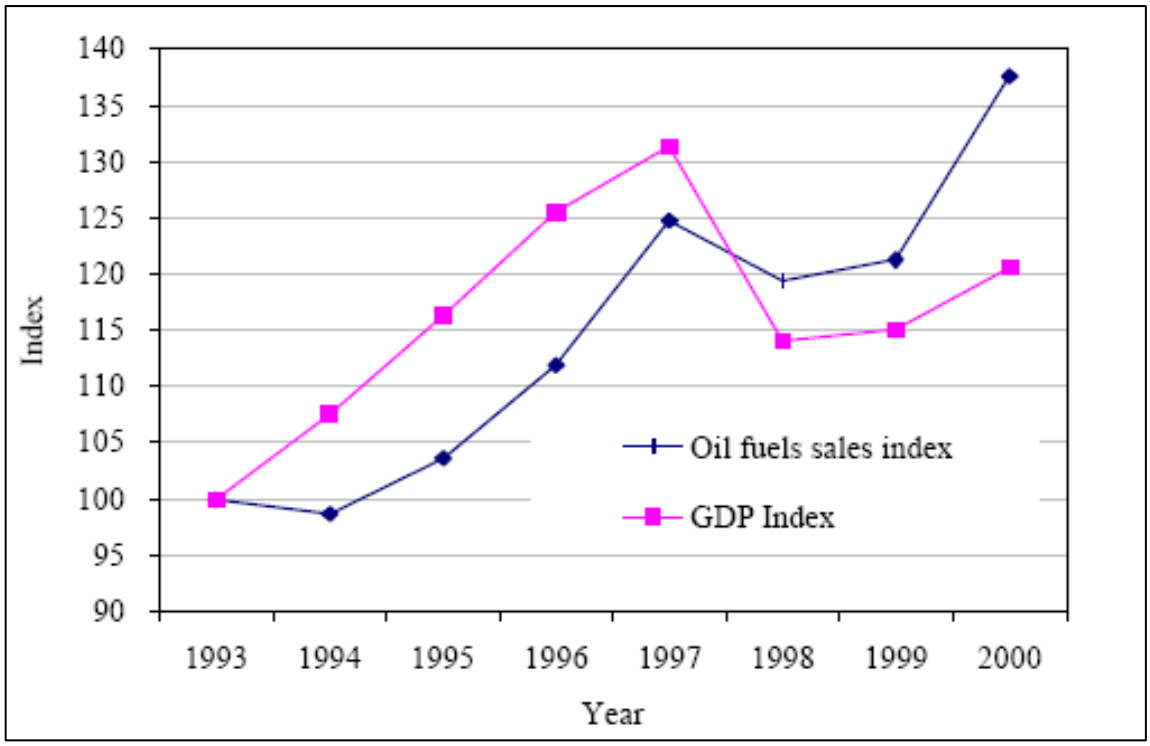
the energy sector call for energy sector reform that introduces greater transparency to planning and decision-making. This is now a critical priority for the government.

- **Rural Electrification:** The Government of Indonesia wants to bring electricity to 90 percent of the population by 2020.

The Indonesia Energy Outlook 2010 Study conducted in 2002 recognizes that the many problems the country faces have resulted from the policy of subsidizing petroleum products, which had been adopted and maintained by the government over the past few decades. Prices had been set lower than market prices to enable all strata of society to easily procure oil fuels. The policy has led to an approximately 75 percent reliance on oil in Indonesia's primary energy mix.

The oil price subsidy policy also put other energy options at a financial disadvantage, and hampered programs for energy conservation and energy diversification. Rural electrification programs were developed based on diesel generators rather than on lower-cost renewable energy options. As domestic oil production declined and international oil prices increased, the economic and financial cost of rural electricity service jumped dramatically. The subsidy program also encouraged economic inefficiencies. Smuggling of oil fuels to other countries proliferated following the financial crisis in 1997 when the exchange rate of Indonesian Rupiah to the US dollar was weak and the subsidized prices of domestic oil fuels were below the international market prices. Figure 3 shows the effect of smuggling.

FIGURE 3: RELATIONSHIP BETWEEN GDP AND OIL FUEL SALES WITH SUBSIDIES IN PLACE



Source: MEMR (2003).

Despite the national economic recession, oil consumption did not decrease as much as GDP and increased more sharply than GDP when the economy began to recover (MEMR, 2003).[1]

[1] Stakeholders consulted do not agree with this statement. They offer alternative explanations for the relative sharp increase in oil consumption: (i) during and just after the economic crisis of 1997, people's mobility went up (e.g., traveling or finding jobs); or (ii) funds were available for upgrading old and inefficient machinery.

TABLE 2: CLEAN ENERGY DECREES, REGULATIONS, POLICIES, AND LAWS IN INDONESIA

Title	Date	Purpose
Presidential Regulation No. 5 on National Energy Policy	2006	Sets energy diversification targets for 2025 that include 5 percent biofuel, and 5 percent geothermal and other renewables. Sets energy conservation target of reducing energy intensity by 1 percent per year.
Ministerial Regulation No. 2 on Medium Scale Power Generation from Renewable Energy Sources	January 2006	Extends the same price guidelines as MD No. 1122/K/30/MEM for projects from 1 MW to 10 MW. Sets a minimum contract period of 10 years.
Presidential Decree No.1 on Supply and Use of Biofuel	25 January 2006	Set targets for biofuels utilization.
Blueprint of National Energy Implementation Program 2005-2025	2005	Delineates measures for Indonesia to enhance energy supply security. Provides development road maps for various sectors. Describes programs to phase out subsidies and improve energy efficiency.
MEMR Regulation 8	April 2005	Seeks to attract private investments in exploration. Allows an additional 20 percent cost recovery for developers of marginal oil and gas fields. Offers more favorable split to contractors for oil and gas development in the 2005 round of bidding.
Government Rule No. 3 Year 2005 on Supply of Electricity	2003	Supports Law No. 15/1985 on electricity, which was reenacted in late 2005 following a Constitutional Court ruling that annulled Law No. 20/2202 on electricity. Requires that independent power producers (IPPs) partner with PLN to develop electricity projects. However, companies generating power for their own use or those using renewable energy can set up plants independently without having to partner with PLN.
Law No. 27 on Geothermal Power	2003	Provides certainty of law to the geothermal industry. Defines new rules under which exploration and development can occur using a competitive bidding process to grant three-year licenses for exploration with possible two-year extensions to complete feasibility studies.
Ministerial Decree No. 141/Men-LH	2003	Requires motor vehicles to be compliant with the Euro 2 standard: by January 2005 for new types of motor vehicles, and by January 2007 for all types.
Ministry of Environment Mandatory Disclosure of Automotive Emissions Program	2003	Complements Ministerial Decree No. 141/Men-LH. Supports implementation of Clean Air Act of Indonesia. Support development and sale of environmentally friendly vehicles and prevents import of "dirty" vehicles. Vehicle manufacturers must have their vehicles tested to measure emissions of CO, HC+NO_x, and PM_{10} using procedures developed by the program.
Ministerial Decree No. 1122/K/30/MEM on Small-Scale Power Purchase Agreement	6/2002	Requires PLN to purchase electricity generated from renewable energy sources by non-PLN producers for projects of up to 1 MW capacity. Institutions eligible to participate are cooperatives, and private and

		government companies. Sets purchase tariffs at 80 percent for medium voltage and 60 percent for low voltage of PLN's announced "Electricity Base Price", which is intended to be its marginal production cost at the point of gridline interconnection of the renewable energy power plant.
Oil and Gas Law No. 22	2001	Stipulates that downstream oil and gas operations, including processing, transportation, storage, and marketing of oil fuel products shall proceed in a transparent manner. Bases pricing mechanisms on market prices. Provides investors equal regulatory and legal treatment.
PROPENAS 2001 Law	2001	Reduces burden of energy subsidies on the state budget. Increases the prices of energy, particularly oil and electricity.
Regional Autonomy Law Laws No. 22 and No. 25	1999	Gives regional governments a greater role in natural resource management. Allows each region to adjust energy sector management to conform to its socio-economic conditions and energy resources.

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

To reduce the burden of energy subsidies in the state budget, the government has committed to increase the prices of energy, particularly oil and electricity. Elimination of the subsidies will open an opportunity for developing other types of energy resources. Unsubsidized oil prices and electricity tariffs will encourage industry and residential and commercial consumers to practice energy conservation. Renewable energy options, which have so far had difficulty penetrating the market because they cannot compete with subsidized oil, will become the lowest-cost options in many locations. Table 2 provides brief descriptions of the laws and regulations affecting the energy sector in Indonesia.

National Energy Policy

The basis for renewable energy development in Indonesia is Presidential Regulation No. 5/2006 on National Energy Policy (Kebijakan Energi Nasional). It sets national targets for an optimal energy mix in 2025: (i) less than 20 percent from oil; (ii) more than 30 percent from gas; (iii) more than 33 percent from coal; (iv) more than 5 percent from biofuel; (v) more than 5 percent from geothermal; (vi) more than 5 percent from other renewables, especially biomass, nuclear, micro-hydro, solar and wind; and (vi) more than 2 percent from liquefied coal.

The 2006 Presidential Regulation guides the Energy Blueprint issued by the Ministry of Energy and Mineral Resources (MEMR) to steer development of the energy sector in Indonesia. The blueprint includes a program to replace the general subsidies of the past with more targeted incentive programs that achieve social objectives and encourage diversification. It also includes road maps for solar, geothermal, and nuclear energy, and suggests provisions for introduction of a carbon tax.

Earlier in the year, Presidential Instruction (Inpres) No. 1/2006 was issued on the Supply and Use of Biofuel. The road map for biofuel aims to develop pro-growth, pro-poor, and pro-job biofuel projects in Indonesia. The government seeks to use investment in biofuel projects to provide a sustainable source of energy supply, while helping to alleviate poverty and support national development. The Presidential Instruction underscores the need for a multi-sectoral approach and specifies the roles of eleven ministries in biofuel development.

Electricity Law

PLN's financial viability was severely damaged by the 1997 economic crisis. Efforts to restructure the electricity sector were initiated in 1998. The restructuring aimed to separate the commercial, social, and regulatory functions of PLN. Electricity Law No. 20 was passed in 2002 to facilitate the liberalization and privatization of the sector by introducing a "multi-sellers, multi-buyer" system in which private investors could sell power to PLN, which would retain control of the transmission and distribution systems. However, on 15 December 2004, the Constitutional Court ruled that:

- Electricity Law No. 20 of 2002 was not in line with Article 33 of the Indonesian Constitution of 1945 and was annulled;
- All contracts issued based on Law No. 20/2002 will remain valid until the end of the contracting period;
- Electricity Law No. 15/1985 has been reenacted to replace Electricity Law No. 20/2002; and
- The Government of Indonesia shall draft a new electricity law in line with Article 33 of the Indonesian Constitution of 1945.

This decision returned the electricity sector to a monopoly and centralized control. With the liberalization of the energy sector, the Government of Indonesia gave MEMR more responsibility to oversee market activities, especially for oil and electricity. In addition, greater emphasis on transparency and decentralization followed the decision to give regional governments more control over managing their energy resources.

2.1.2. Energy Efficiency

The movement away from subsidies heightens the attractiveness of investments in energy efficiency. Higher prices for electricity and fuels naturally drive consumers in the industrial, transport, commercial, and residential sectors toward more efficient energy use. Because past policies did not encourage efficient energy use, initial investments in energy savings can yield large benefits. In particular, demand-side impacts can be achieved quickly, and support for minimum standards and labeling can avoid confusion in the marketplace. Nonetheless, energy-efficiency opportunities have received relatively little attention from government planners. The target to reduce energy intensity by 1 percent per year is modest.[2]

2.1.3. Renewable Energy

In contrast to energy efficiency, renewable energy projects have received considerable attention from policy-makers in Indonesia. The electricity regulations for small and medium-scale power generation from renewable energy resources described in Table 2 specifically seek to increase the use of renewable energy. However, despite efforts to clarify procedures and terms of sale, negotiation of power purchase agreements with PLN to achieve acceptable rates of return on investment in renewable energy projects remains challenging, even in locations where the renewable option is significantly cheaper than the conventional diesel generators used by PLN.

Other regulations for selling power to the grid include:

1. Ministry Regulation No. 001/2006 (Revision of Regulation No. 09/2005) on Procedures for Electric Power Purchase and/or Transmission Line Leasing for Public Electricity Supply

[2] Stakeholders consulted argue that 1 percent is not modest. Moreover, they contend that energy efficiency receives support from the government through Presidential Instruction No. 10/2005.

2. Ministry Regulation No. 010/2005 on Procedures for Electric Power Business Licenses for Inter-Provinces, Regions, or for National Grid Connections
3. Ministry Regulation No.1213K/31/MEM/2005 on National Electricity General Plan (RUKN)
4. Ministry Regulation No. 2059K/31/MEM/2005 on Establishment of PLN's Power Supply Plan for 2006-2015

2.1.4. Clean Transport

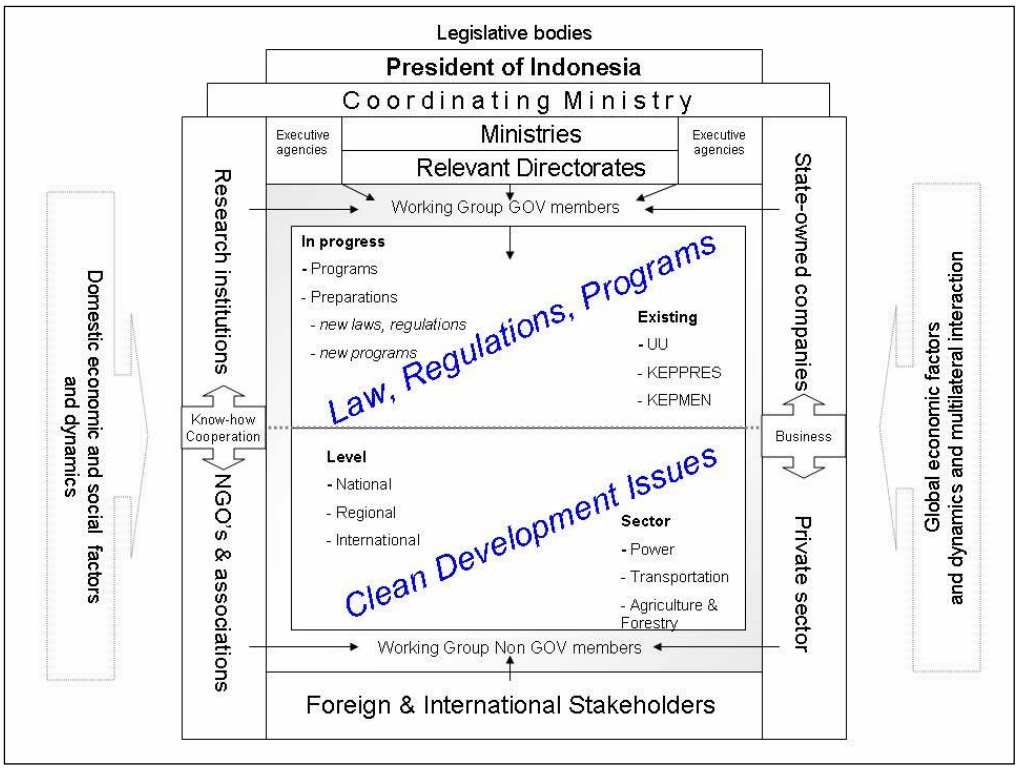
In 2003, the Ministry of Environment launched the Mandatory Disclosure of Automotive Emissions program to help implement the Clean Air Act of Indonesia. The primary objective was to support the development and sale of environmentally friendly vehicles and prevent importation of "dirty" vehicles. Under the program, vehicle manufacturers must have their vehicles tested to measure emissions of CO, HC, NO_x, and PM_{10} using procedures developed by the program. Results are released to the public. The program complements Ministerial Decree No. 141/Men-LH/2003, which was issued to make motor vehicles compliant with Euro 2 (by January 2005 for new types of motor vehicles and by January 2007 for all motor vehicle types).

3. INSTITUTIONAL ANALYSIS

3.1. ORGANIZATIONAL OVERVIEW

Indonesia has a complex set of public and private institutions responsible for various aspects of the energy sector. Figure 4 shows how they work together and Table 3 provides brief descriptions of the roles of key organizations as they relate to clean energy development.

FIGURE 4: RELATIONSHIPS AMONG KEY ENERGY INSTITUTIONS



Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

TABLE 3: INSTITUTIONS WORKING ON CLEAN ENERGY IN INDONESIA

Organization	Scope of Work
Indonesian Government Agencies	
Ministry of Environment (KLH)	*Task/responsibility* ▪ Establish environmental policies and regulations ▪ Monitor/control environmental impacts based on existing regulations ▪ Serve as focal point for UNFCCC ▪ Heads National Commission on Climate Change (Komnas Perabahan Iklim) ▪ Published National Strategy Studies (NSS) on CDM for the forestry and energy sectors *1. Implementation at regional level* ▪ Five regions ▪ Work through Center of Environmental Management (PPLH) ▪ Regional Environmental Impact Management Agency (Bapedalda) under local government
Ministry of Energy and Mineral Resources (MEMR)	• Supervise state-owned utilities and energy service companies • Prepare analyses and recommendations on energy sector issues • Conduct energy research and testing *Sections active in Clean Development* ▪ Directorate General of Mineral, Coal and Geothermal (DGMCG/DJMBP) ▪ Director General of Electricity and Energy Utilization (DGEEU/DJLPE) ▪ Center for Research and Development of Energy and Electricity Technology (P3TEK) ▪ Directorate General for Oil and Gas (Ditjen Migas) ▪ Centre for Energy Information (PIE)
Executive Agency for Upstream Oil and Gas Activity (BPMIGAS)	▪ Replaced Pertamina as regulator and manager for oil and gas contractors ▪ Appoint sellers for government share of oil and gas ▪ Environmental section coordinates with KLH, ESDM
National Development Planning Agency (BAPPENAS)	▪ Consolidate national planning including energy ▪ Prioritize renewable energy projects ▪ Prioritize rural electrification projects ▪ Determine level of government support ▪ Appoint government project partners
National Energy coordination Board (BAKOREN)	▪ Inter-ministerial national energy coordination board ▪ Coordinate national energy program
Agency for the Assessment and Application of Technology (BPPT)	▪ Support technology assessment for the Government of Indonesia ▪ Assist national planning in technology application and energy auditing ▪ Develop and implement pilot and pre-commercial projects, e.g. bottled gas for cooking and biodiesel production ▪ Manage clean energy research laboratories and testing facilities

TABLE 3: INSTITUTIONS WORKING ON CLEAN ENERGY IN INDONESIA

Organization	Scope of Work
Ministry of Forestry (Dephut)	▪ Develop forestry sector policy relevant to UNFCC ▪ Prepare sustainability criteria and indicator for GHG mitigation projects ▪ KLH published National Strategy Study on CDM in forestry sector ▪ Provide technical support to National Commission on Climate Change
Ministry of Foreign Affairs (Deplu)	▪ Manage implementation of international treaties related to CDM and GHG mitigation ▪ Facilitate the negotiation process on bilateral GHG mitigation and CDM related agreements
Ministry of Agriculture (Deptan)	▪ Plays a key role in biodiesel development
Ministry of Industry (Depperin)	▪ Apply energy efficiency measures, improve process technology and use of alternative materials
Ministry of Transportation	▪ Develop national transportation plan ▪ Director General for Land Transportation is the most relevant section for GHG reduction programs ▪ Promote public transportation ▪ Control vehicle emissions ▪ Promote use of cleaner fuels
Ministry of Home Affairs	▪ Supervise regional governments under decentralized system ▪ Decentralization efforts over the past few years have increased resource allocations to regional and local governments who sometimes choose to invest in electrification
Ministry of Finance	▪ Develop and manage national financial and investment plan ▪ Create action plan based on work plan of BAPPENAS ▪ Manage government assets
Ministry of Cooperatives and Small enterprise Development	▪ Enhance role of cooperatives in rural electrification and in some cases initiate rural electrification projects
Ministry of Public Works	▪ Carry out hydro power resource surveys and operate some hydro plants
National Standards Bureau (BSN)	▪ Set standards for end-use appliances such as CFLs, refrigerators, air conditioners, and small motors
Coordinating Minister of Economic Affairs (Menko Perekonomian)	▪ Coordinate and synchronize preparation and formulation of economic policies ▪ Coordinate state ministries and heads of non-departmental agencies ▪ Increase integration of policies, plans, and programs of all departments ▪ Coordinate utilization of biofuel and report status to president

TABLE 3: INSTITUTIONS WORKING ON CLEAN ENERGY IN INDONESIA

Organization	Scope of Work
State-owned companies	
State Electricity Company (PT PLN (Persero))	▪ Monopoly reinstated in 2005 ▪ Develop and implement plan for power sector, including clean energy, energy efficiency, rural electrification, and plans for capacity expansion ▪ Negotiate small power purchase agreements (<10 MW) with private sector ▪ Manage tenders for new grid-connected coal power plants ▪ Analyze energy-efficiency options, e.g. costs and benefits of CFL distribution on peak load ▪ Manage testing and introduction of pure palm oil to replace diesel for remote power generation ▪ Implement renewable energy projects financed by ADB and World Bank (note: approval through BAPPENAS) ▪ Coordinate renewable energy policy with ESDM
State Oil and Gas Company (PT Pertamina (Persero))	▪ Upstream responsibility to manage PSC's shift to BPMIGAS ▪ Downstream monopoly ended (Law No. 22/2001) ▪ Legally own geothermal steam ▪ Implement biofuel program
National Coal Company (PT Bukit Asam)	▪ Develop and manage coal resources
State Gas Company (PGN)	▪ Manages and develops gas transmission network ▪ Expand gas pipeline to create opportunities for GHG mitigation projects
Koneba	▪ Energy service company (ESCO) ▪ Provide consulting services for energy management and engineering, including energy audits ▪ Renewable energy division
Private companies and non-governmental organizations	
DP Solusi	▪ Provide consulting services for climate, energy and environmental issues (PIN, PDD)
Carbon and Environmental Research Indonesia (CER Indonesia)	▪ Build capacity ▪ Conduct environmental studies
Eco-Securities	▪ Operates carbon project worldwide ▪ Provide consultation and financial support to GHG mitigation projects
Renewable Energy Network Indonesia (RENI)	▪ Established by Yayasan Bina Usaha Lingkungan (YBUL) ▪ Stimulate development and implementation of renewable energy projects
IBEKA	▪ Develop micro-hydro projects through an integrated approach includes institutional design and funding partnerships
Pelangi	▪ Focuses on climate change, forestry, energy, and air quality to find solutions

TABLE 3: INSTITUTIONS WORKING ON CLEAN ENERGY IN INDONESIA

Organization	Scope of Work
	to climate change through mitigation and adaptation
Yayasan Dian Desa	▪ Project to develop and implement improved cooking stoves
Energy Saving Society Communication Forum	▪ Capacity building in energy efficiency

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

3.2. INSTITUTIONAL NEEDS ASSESSMENT

During meetings in Indonesia, the most commonly expressed institutional needs fell into two categories. One category was for effective ways to communicate potential benefits of clean energy in order to strengthen political commitment from various stakeholders. Participants said it was challenging to generate sufficient momentum to overcome inertia. The second category was for sharing best practices from other countries, especially those that have been successful in overcoming similar obstacles to successfully implement effective clean energy programs with measurable results.

4. CURRENT STATUS AND POTENTIAL OF CLEAN ENERGY

4.1. OVERVIEW OF FUELS AND RESOURCES

4.1.1. Fossil Energy and Nuclear Power

Coal: Table 4 shows that coal is Indonesia's largest fossil energy resource. The Government of Indonesia plans to rapidly expand domestic use of coal for electricity generation, especially the low-rank coals that dominate Indonesian reserves. The President has emphasized expanded coal use with the commitment to add 10,000 MW of coal-fired capacity before 2010, of which 6,900 MW is to be installed in the Java-Bali grid. PLN has already issued the first round of tenders and bids have been received. Indeed, power generation and industrial use will dominate growth in the use of coal for the foreseeable future. However, besides expanded use of coal for power, the government is developing coal briquettes to displace diesel for home cooking and is investigating possibilities for coal liquefaction to make alternative transport fuels.

TABLE 4: STATUS OF INDONESIA'S ENERGY RESERVES

Reserves (2002)	Total	Proven	Probable	Production	R/P ratio
Coal (million metric tons)	38000	6500	31500	97	67
Oil (million barrels)	9692	4867	4825	460	11
Natural gas (billion cubic meters)	4814	2690	2124	76	35

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

Oil: Indonesia became a net importer of oil in 2005 and faced a mini-crisis caused by rising oil prices and the need to import oil products due to declining production and the lack of refinery capacity to match demand. High prices meant the government could not sustain the massive fuel subsidies it had been paying to keep the price of fuels low throughout the country. Elimination of the fuel subsidy

resulted in a more than doubling of the price of petroleum products, which caused double-digit inflation. Oil use dropped by 9 percent in 2005.

Indonesia, therefore, has embarked on a multi-faceted program to reduce the need for oil imports, even if domestic production continues to decline for the foreseeable future because new fields have not been found and time and capital will be required for development. In the meantime, Indonesia has offered incentives to encourage greater private investment in exploration. MEMR Regulation 8/2005 issued in April 2005 allowed an additional 20 percent cost recovery for developers of marginal oil and gas fields. The government also allowed a more favorable government/contractor split for oil and gas development in the 2005 bidding round (US Embassy, 2006). Still, it remains unclear whether the government is prepared to make the changes stipulated in the new regulations to attract the needed major investments.

Gas: Natural gas has been growing in importance in the Indonesian economy. Currently, Indonesia exports most of its gas as LNG, with a small amount sent by pipeline to Singapore. With falling oil production and rising international oil prices, Indonesia has been encouraging greater domestic use of gas. But this requires major investment in infrastructure, as more than 70 percent of Indonesia's gas fields are located offshore. Current regulation sends mixed signals to investors. Prices for gas inside the country are set by the government and incorporate the kinds of subsidies it has sought to eliminate in the oil sector. For example, PLN plans show increased use of gas for power generation, but the current negotiated rates it is willing to pay for gas are less than half the world market price. Expansion in the use of gas by PLN would reduce export revenues and therefore does not feature prominently in national energy plans. The industrial sector in Indonesia is likely to be the largest user of gas in the future. Several gas pipelines are under construction, and Indonesia is planning at least one LNG terminal in West Java to receive LNG for domestic industrial use.

Nuclear Power: Indonesia has revived plans to introduce nuclear power.[3] In fact, in line with the Presidential Decree No. 5/2006 on national energy policy, it has been reported that Indonesia will build a nuclear power plant by 2016 at a total cost of about US$1.5 billion.[4] Earlier, Research and Technology Minister Kusmayanto Kadiman had described plans to build up to four nuclear power stations, each with a capacity between 1,000 MW and 1,500 MW, on a 600 hectare site on the northern coast of Central Java. This site and another on an island off East Java had been selected as prospective sites because they are not on earthquake fault lines or near active volcanoes.[5]

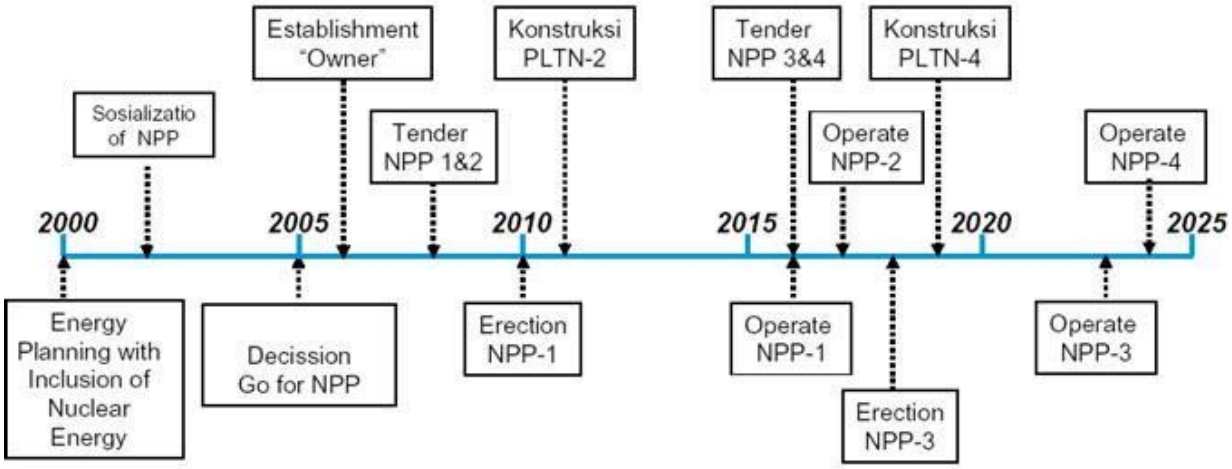
Figure 5 depicts the government road map for nuclear power, which calls for tenders to be issued for the first plant in 2008 and plans for its operation to begin in 2016. Given the current high cost of nuclear power relative to other options, it is difficult to forecast how quickly this road map will be implemented.

[3] Indonesia had first developed plans to introduce nuclear power in the mid-1990s, during the Suharto regime, but the plans were opposed by environmentalists and postponed indefinitely following the Asian economic crisis in 1997.

[4] http://www.indonesiavancouver.org/portal2/ff80808110e320a50110ec145cf8002a.do.html

[5] http://www.indonesiamatters.com/

FIGURE 5: PLAN FOR NUCLEAR POWER DEVELOPMENT 2000-2025



Source: National Energy Coordination Agency (2005).

4.1.2. Renewable Energy and Distributed Generation

Renewable energy resources have been largely unexploited because of the perceived high up-front costs or the lack of infrastructure to match supply with demand. Yet, a portfolio of geothermal and hydropower projects, as well as power generation from biomass residues, has been drawn up and will likely be developed over the next five to 10 years. Moreover, decentralized renewable energy systems remain the most cost-effective options in many rural areas and should attract private investment as the government continues to address the regulatory framework for selling power to PLN.

Solar Photovoltaics: In recognition of the potential market in Indonesia, all major international solar photovoltaic (PV) system manufacturers, including BP Solar, Kyocera, Shell Solar, Siemens, and Solarex, have subsidiaries or at least local distributors in Indonesia. They maximize the use of local components and employ local labor in order to keep their costs down. The primary weakness in the Indonesian solar industry is the lack of local manufacturing facilities for high quality batteries and PV modules, though the government actively supports development of solar PV applications.

Biomass for Power Generation: National studies estimate the electricity generation potential from the roughly 150 Mt of biomass residues produced per year to be about 50 GW or equivalent to roughly 470 GJ/year. These studies assume that the main source of biomass energy in Indonesia will be rice residues with a technical energy potential of 150 GJ/year. Because Indonesian policy requires rice mills to be situated close to where rice is grown, most mills are small and decentralized. The rice husks produced by rice mills have low bulk density and are expensive to transport, so the technical potential from rice residues probably overstates the economically viable potential. Other potential biomass sources are rubber wood residues (120 GJ/year), sugar mill residues (78 GJ/year), palm oil residues (67 GJ/year), and less than 20 GJ/year in total from plywood and veneer residues, logging residues, sawn timber residues, coconut residues, and other agricultural wastes.

Geothermal: The nearly 200 volcanoes and 100 geothermal fields distributed throughout Indonesia make it a promising area for geothermal power generation. Geothermal resources were managed by Pertamina until 2000, when they were transferred to regional authorities.

Expectations for geothermal power development were high in the early 1990s when independent power contracts were awarded for 11 projects with a total committed capacity of 3,417 MW. The financial crisis in 1997, however, led to the suspension of seven of these projects. As of 2005, Indonesia had developed 802 MW out of an estimated potential of 30,000 MW. The National Energy Blueprint projects that geothermal capacity will grow to 9,500 MW by 2025 and the government plans to tender seven geothermal areas in 2007 to generate about 575 MW of electricity.[6]

The primary barriers to the development of Indonesia's geothermal resources have been the pricing of electricity and a shifting regulatory environment. The surge in development in the 1990s was stimulated by electricity prices between US$0.069 and US$0.085. PLN is now seeking to pay prices only under US$0.05/kWh. In general, geothermal projects require more capital to develop than other energy projects. The project developer must invest in drilling to map and evaluate the quality of the resource prior to the capital investment to build the plant. Although the higher capital costs are offset by the zero fuel cost (unless you treat the resource mapping as an up-front fuel cost), it will be hard for private developers to move forward with these projects without greater confidence in the long-term pricing of electricity.

Small Hydropower: Indonesia has abundant hydropower resources and has been successful in developing micro, mini, small, and large hydropower plants over the past decades. Hydropower contributed 12.9 TWh to total electricity supply in 2005. Official data estimate that the national hydropower potential is about 75 GW, with small hydro projects accounting for only 500 MW. Because of the processes used for these estimates, the small hydropower potential is likely larger than 500 MW, although it still remains a small percentage of total potential. The current installed capacity for all hydropower plants is about 4,260 MW, of which small hydropower comprises about 64 MW. There is a significant portfolio of small hydropower projects planned or under construction. Small hydropower sites will likely receive significant private interest following the change in the law requiring PLN to purchase power from plants up to 10 MW. However, financing will remain a major challenge because of the difficulty in negotiating long-term power purchase agreements with PLN.

4.1.3. Energy Efficiency

Although hampered by subsidized energy prices that make investments in many energy-efficiency activities unattractive, Indonesia has undertaken several demand side management (DSM) programs with some success. Four areas of activity have been:

- Establishment of testing labs within PLN, MEMR, BPPT, MOE, and IT Bandung;
- Broad introduction of CFLs by PLN;
- Free energy audits for large industrial consumers; and
- Testing of automobile energy performance by MOE.

Globally, energy standards and labeling programs are among the most cost-effective market interventions because almost the entire cost is met either by manufacturers who produce more efficient products or the consumers who buy them. They include mandatory minimum energy performance standards for appliances and equipment, voluntary activities such as endorsement labeling programs for appliances and equipment, building codes, automobile fleet standards, and government purchasing standards. Investments in credible testing labs are required for labeling and standards programs to be effective.

[6] http://english.indonesiaheadlines.com/

Several testing labs have been set up in Indonesia, although they have not sought international accreditation. PLN subsidiary PT PLN Electric Power Technical Services (LMK) has specialized equipment for testing CFLs and ballasts. The Institute of Technology at Bandung (IT Bandung) has equipment to measure the efficiency of refrigerators, air conditioners, and water pumps.

Beginning in 2002, PLN began to promote expanded use of CFLs based on analysis showing that lighting was a major component of PLN's peak load. PLN commissioned LMK to test the CFL product offerings of international and domestic manufacturers, and used the test results to inform volume purchases of CFLs to help bring down the average retail price seen by consumers. They also made it easy for customers to obtain CFLs by making them available through payment points in targeted areas. Sales of CFLs have surged, and prices have come down. According to recent data from the Indonesia Electrical Lighting Industry Association, imports of CFLs surged from eight to 10 lamps per year during the period 1999 to 2001, to 64 million lamps per year in 2005.

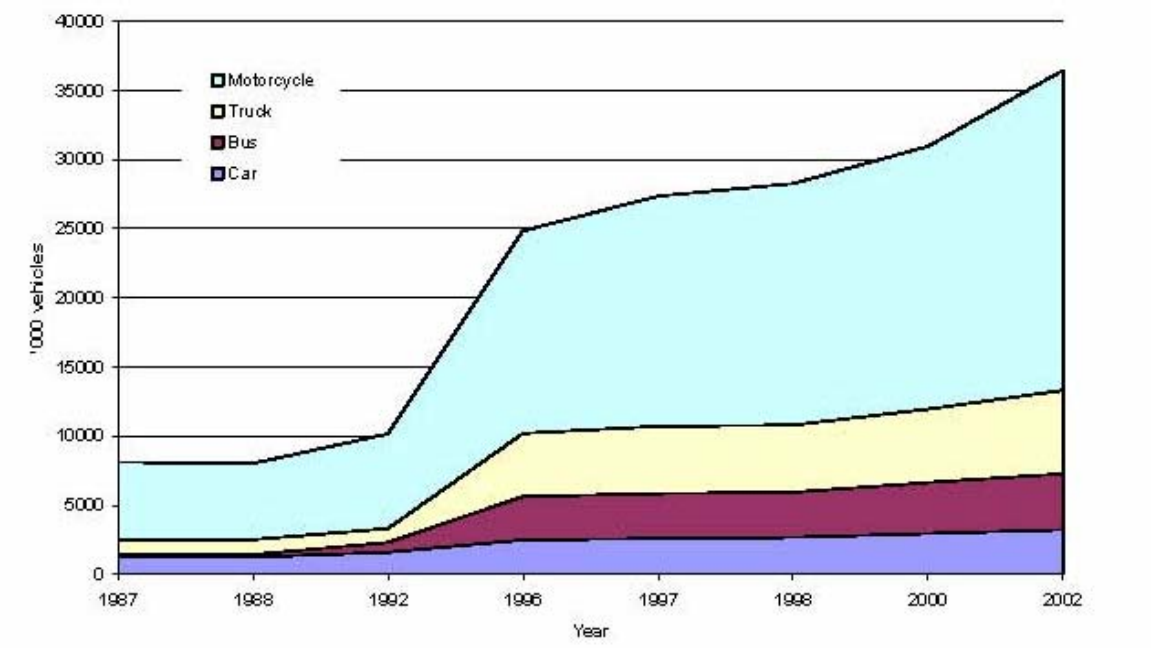
In 2006, the Asian Development Bank worked with PLN and the Indonesian government to develop an innovative new loan for demand-side efficiency that includes financing to distribute millions of CFLs to PLN's poorest customers. This program makes economic sense for PLN because each CFL that replaces an incandescent lamp in a subsidized customer's house will save the utility US$15 over its lifetime. It is expected that the loan will be approved and the tender process for CFL procurement will begin before the end of 2007.

Within industry, the top energy-consuming segments are fertilizer (30 percent), cement (18 percent), metal including iron and steel (16 percent), and textiles (15 percent). The Directorate General for Electricity and Energy Utilization has initiated a program that provides free energy audits to industries. The state-owned enterprise PT Koneba has carried out energy audits funded by MEMR to power, oil and gas, mining, steel, and cement companies. BPPT has also carried out audits in the cement, pulp and paper, iron and steel, and fertilizer sectors that quantified costs, expected energy savings, and CO_2 emissions reductions for recommended action (Winanti, 2006). The program identifies three categories of opportunities: no cost, low cost, and requiring investment. Only a few industries have taken action to reduce energy use. Even no-cost items sometimes are not implemented because companies lack energy managers.

4.1.4. Clean Transport

Testing of automobiles by MOE was made mandatory for new models starting in 2005 and will be mandatory for all models in 2007. The primary output from the testing program is emissions and performance information to support consumer choice. The Ministry of Environment has set up a testing lab for measuring the performance and emissions of automobiles as part of its Mandatory Disclosure of Automotive Emissions program.

FIGURE 6: NUMBER OF VEHICLES IN INDONESIA



Source: ADB (2006).

Vehicle ownership in Indonesia is dominated by motorcycles (Figure 6). While total vehicle kilometers traveled by motorcycle is a small fraction of total vehicle kilometers traveled in the United States and Europe, they are a much larger fraction of total vehicle kilometers in Indonesia and other countries of Asia. In Indonesia, increases in motorcycle ownership track growth in GDP.

Emissions from motorcycles usually exceed emissions from automobiles, particularly two-stroke engines that run on a mixture of gasoline and lubricating oil. Table 5 shows data gathered in Thailand in the early 1990s that found emissions and fuel consumption significantly higher for two-stroke engines than four-stroke engines. Although not included in the table, PM_{10} emissions are also much higher from two-stroke engines. Emissions can be reduced by about 90 percent for two-stroke engines by incorporating timed fuel injection and crankcase lubrication at a cost of about US$60 per vehicle, but fuel economy still lags. These results ultimately led Thailand to phase out two-stroke motorcycles. Indonesia also plans to phase out two-stroke engines to improve air quality. This will also result in a 50 percent efficiency gain.

TABLE 5: EMISSIONS AND FUEL CONSUMPTION FACTORS FOR UNCONTROLLED THAI MOTORCYCLES

Engine Type	Carbon Monoxide (g/km)	Hydrocarbons(g/km)	Fuel Economy (liters/100 km)
Four-stroke	19.0	2.9	1.6
Two-stroke	28.1	14.6	2.5

Source: Chan and Weaver (1994).

Besides voluntary (and soon mandatory) emissions and fuel efficiency reporting, and phasing out two-stroke motorcycles, Indonesia plans to replace oil fuels with biofuels. The Indonesian Government has a target for biofuels to meet 10 percent of its transportation needs by 2010. In 2006, it pledged to invest a total of IDR 13 trillion (US$1.4 billion) to encourage the development of the fledgling biofuel industry (*Jakarta Post*, 2006). It also plans to allocate nearly 500,000 hectares of land for new biofuels

development in 2007. Under the plan, Indonesia will use palm and jatropha as the primary feedstocks for biodiesel, and sugarcane and cassava as the primary feedstocks for ethanol.

Feedstock represents 70-80 percent of the total cost of biodiesel. When the Indonesian biodiesel program was launched, the price of palm oil was low enough that biodiesel could be produced for less than the price of diesel. Oil prices have declined slightly, and disruptions in international vegetable oil markets have pushed up prices of palm oil so that the cost to produce biodiesel at the end of 2006 was greater than the cost of diesel.

Pure vegetable oil can be burned directly in most diesel engines, saving the cost of transesterification. Because the viscosity of pure vegetable oils increases as temperatures decrease, it is not commonly used as a direct fuel in temperate climates. Different oils have different characteristics and some, like coconut oil, blend more easily with diesel fuel than others. In Indonesia's climate, it should be possible to use pure palm or jatropha oil in diesel engines with minor engine modification.[7]

4.2. COMPARISON OF ECONOMIC POTENTIAL AND COST EFFECTIVENESS

Estimates of the potential for different clean energy options vary depending on the source of the information, especially on the amount of geothermal potential and what percentage of the hydropower potential should be classified as small. Table 6 contains the estimates used by MEMR.

TABLE 6: INDONESIA'S POTENTIAL FOR RENEWABLE ENERGY DEVELOPMENT

Type	Potential	Installed Capacity
Hydropower	75.67 GW	4.200 MW
Geothermal	27 GW	807 MW
Mini/micro-hydro	500 MW	84 MW
Biomass	49.81 GW	445 MW
Solar	4.8 kWh/m2-day	8 MW
Wind	3-6 meters/sec	0.6 MW

Source: DGEEU (2005).

Table 7 provides the estimated capital and operating costs in Indonesia for a variety of clean energy options. These estimates are not the result of an analysis of projects under development, nor do the ranges reflect the lowest and highest costs associated with known projects. They are approximations based on the available experience in Indonesia and should not be used as benchmarks. Costs can also vary substantially based on local conditions.

[7] PLN has been actively experimenting with the use of an 80 percent blend of pure palm oil and diesel to replace diesel in its remote diesel generators, and it announced in December 2006 that it would expand the program to other sites (*Jakarta Post*, 2006). It has asked regional managers to survey their regions for potential local suppliers who may be willing to provide pure palm oil under contract to PLN. Other government research facilities are working to develop a Bio Oil product to displace household uses of fossil fuels for cooking.

TABLE 7: ESTIMATED INSTALLED COST PER KW/CAPACITY AND GENERATING COST PER KWH

Power Plant Type	Estimated Cost Installed per kW (IDR)	Estimated Generating Cost per kWh (US cents)[1]
Small Hydro	900-1600	4.2-5.5
Large Hydro	800-1200	3.5-4.5
Medium Scale Wind Energy	1500-2500	8.0-12.0
Large Scale Wind Energy	1250-1750	7.0-10.0
Biomass Power	800-1000	5.0-6.0
Bagasse Cogeneration	600-800	4.5-5.5
Biomass Gasification	600-800	5.0-6.0
Solar PV	5000-6500	20-50
Geothermal (large scale)	1400-1800	4.5-5.5
Coal Fired Power Plant	700-1000	3.8-4.5
Diesel Power Plant	275-450	20-25

Source: USAID ECO-Asia Clean Development and Climate Program, 2006. [1] Exchange rate: 9,000 IDR = US$1

5. CARBON AND GREENHOUSE GAS ABATEMENT

5.1. STATUS OF ACTIVITIES IN THE CARBON MARKETS

Indonesia signed the Kyoto Protocol in 1997 and established its Designated National Authority (DNA) within the Ministry of Environment in 2003. It has developed procedures that all CDM projects must follow. The procedures require submission and distribution of Project Design Document (PDD) to each Technical Team and National Committee member. The Technical Team reviews the PDD with assistance from experts and stakeholders as deemed necessary and makes a recommendation to the National Commission. The entire process is to be completed within three months. Although Indonesia lags behind India and China, several CDM projects have been successfully developed and approved by the Indonesian DNA. The experience with the first set of PDDs presented was promising – the technical team presented PDDs on 21 December 2005, and the National Commission announced its decision to the project developers on 27 December 2005.

Table 8 provides details of the projects that have been approved by the Indonesian DNA[8] and registered with the CDM Executive Board. One additional waste management project has been approved by the DNA, and other projects are in the pipeline, including two landfill gas recovery projects, an additional geothermal project, and an alternative fuel use project.

Although revenue from emission reductions under the CDM can improve the financial feasibility of projects, there are transaction costs that place small projects at a disadvantage. Transaction costs in Indonesia are estimated to range from US$50,000 up to US$300,000, depending on the complexity of the project (such as the selection of the baseline methodology and additionality compliance) and the availability of local expertise to help develop the project. The challenge for small-scale renewable energy projects in pursuing CDM revenue lies in the capability of the project owner to pay the transaction costs in advance and the capacity of the project to produce sufficient revenues from CDM to justify the transaction costs.

[8] As of December 2006, the Indonesian DNA had approved 11 projects.

TABLE 8: CDM PROJECTS REGISTERED WITH THE CDM EXECUTIVE BOARD (AS OF OCTOBER 2006)

Project	Developer	Emissions Reductions (t CO_2) per year	Remarks
Indocement Alternative Fuels	PT Indocement Tunggal Prakarsa	100,000	Switching a part of coal as kiln fuel to alternative fuel such as rice husks and palm kernel shells Project developed with support from World Bank PCF
Indocement Blended Cement	PT Indocement Tunggal Prakarsa	400,000	Reduction of CO_2 emissions by producing new type of cement which requires less clinker
MNA Biomass 9.7 MWe Condensing Steam Turbine	PT Multimas Nabati Asahan	46,000	Power generation using biomass
MSS Biomass 9.7 MWe Condensing Steam Turbine	PT Murini Samsam	46,000	Power generation using biomass
CDM Solar Cooker Project Aceh I	PT Petromat Agrotech	3,500	Thermal energy for cooking by using solar energy
Methane Capture and Combustion from Swine Manure Treatment	PT Indotirta Suaka	116,000	Avoidance of methane that would have been emitted in the absence of manure treatment system
Darajat Geothermal Unit III	Chevron Geothermal Indonesia Ltd.	650,000	Power generation by geothermal energy (connected to Java-Bali grid)
Lampung Bekri Biogas	Eco-Securities Indonesia	18,800	Anaerobic digestion project that treats wastewater from the Lampung Bekri feedlot in Lampung, Indonesia.

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

5.2. INSTITUTIONAL CAPACITY FOR MEASURING AND REPORTING GREENHOUSE GAS ABATEMENT

Donors actively support capacity building and project preparation in Indonesia. Table 9 summarizes donor efforts to strengthen capacity to develop and implement CDM projects in Indonesia.

6. DONOR ACTIVITY IN CLEAN ENERGY

In addition to support for the development of CDM projects in Indonesia, donors have a long history of support for renewable energy and energy-efficiency projects in Indonesia.

In addition to providing many years of support for energy policy analyses and regulatory reform, USAID funded the development of research facilities for solar PVs, biomass gasification, and coal combustion in partnership with BPPT. USAID also funded feasibility studies to assess cogeneration opportunities in the plywood, palm oil, and sugar industries, and supported a major program to introduce small wind technology in the Eastern islands.

TABLE 9: DONOR SUPPORT FOR THE CLEAN DEVELOPMENT MECHANISM IN INDONESIA

Donor	Activity	Sectors in Indonesia
World Bank	• Support CDM project preparation • Purchase CERs or VERs • Up-front payment of up to 25 percent • Carbon payments beyond 2012 • Capacity building	• Landfill gas utilization • Gas Flaring • Cement
Asian Development Bank	• Support CDM project preparation • Capacity building • Provide CDM finance facility	• Gas generation from palm oil waste • Land Use, Land Use Conversion, and Forestry Projects (LULUCF)
Germany	• Technical assistance to help establish DNA • Capacity building through GTZ • KfW Carbon Fund open to projects from Indonesia	
NEDO	• Support CDM project preparation • Up-front payment of up to 50 percent • Capacity building	• Clean energy technology • Landfill gas utilization • Methane recovery from waste treatment: palm oil, cassava, swine
UNDP	• Capacity building • Support for preparation of national communications	
Canada	• Policy assistance • Vulnerability and adaptation • Support CDM project preparation • Signed Letter of Intent to cooperate with Indonesia on CDM in December 2005 • Hired Canadian firm to develop portfolio of 10 projects	• Energy efficiency and conservation • LULUCF • Geothermal • Waste to energy • Energy efficiency • Power generation: Rice husks, palm residues • Hydro • Methane capture
Netherlands	• Certified Emission Reduction Unit Procurement Tender (CERUPT) • Bilateral CER Purchase Agreement (BCPA) • Capacity building • MOU signed with Indonesia in February 2005	• Geothermal • CERUPT and BCPA open to all sectors
Denmark	• Danish Carbon Facility • CDM Project Development Facility • Capacity building • MOU signed with Indonesia in July 2005	• Energy efficiency • Fuel switching • Landfill gas and methane capture • Reduce industrial emissions • Palm oil • Cement

TABLE 9: DONOR SUPPORT FOR THE CLEAN DEVELOPMENT MECHANISM IN INDONESIA

Donor	Activity	Sectors in Indonesia
Austria	• Austrian CDM Program • MOU signed with Indonesia in December 2005	• Renewable energy • Retrofit industrial boilers • Construct new power plants • Landfill gas • Energy efficiency • Waste management

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

The German agency GTZ was one of the first supporters of solar PV projects in Indonesia with its sponsorship in 1979 of a solar water-pumping project. Other major projects include GTZ Eldorado Sun, a GTZ project that developed solar pumping projects on four islands, and a project funded by the Australian Aid agency AusAid that aims to install 36,400 50 Wp solar home systems.

In 1997, the Indonesian Government set a target for 50 MWp of PV by 2005, to be installed across 6,000 of the country's 13,000 islands. In the same year, the World Bank and the Global Environment Facility (GEF) launched a project to help Indonesia achieve its target of 1 million solar home systems, providing funds for the installation of 200,000 PV systems (10 MWp) for households and commercial establishments in West Java, South Sulawesi, and Lampung, Sumatra. The plan was to concentrate on 50 Wp solar home systems. Solar equipment was to be exempted from import tax and duties if equivalent products were not manufactured in Indonesia.

Unfortunately, a financial crisis hit Indonesia in 1997, reducing the affordability of 50 Wp systems. Although the program had been modified, only US$0.1 million of a US$20 million loan was used by December 2000, and the World Bank loan was closed early. The GEF grant was also reconfigured. By 2003, a total of 8,054 solar home systems had been installed.

Germany has provided long-term support to the development of mini hydro power (MHP) since 1991. The first phase of its MHP project (1991-96) focused on the introduction of MHP technology to local institutions and individuals active in micro hydro project development. In the second phase (1999-2002), the scope of intervention was broadened to include policy dialogue, scaling-up MHP technology packages, and improving operation and management practices applied. The project has developed a variety of MHP technology packages together with local manufacturers in Java and Sumatra, which have been applied in more than 100 installations over the past 10 years. These schemes presently supply over 20,000 families with a clean sustainable source of energy.

The ASEAN COGEN program supported the development of a 5.5 MW waste wood power plant at T Siak Raya Timber in Pekanbaru, Sumatra. Earlier feasibility studies and demonstration projects had showed favorable returns on investment for biomass cogeneration, but the projects did not go ahead because subsidized diesel made energy costs a relatively small concern for plant managers. With the increase in diesel prices following the elimination of subsidies, many of these projects will have earned very high rates of return. Table 10 describes several other donor programs.

7. BARRIERS AND NEEDS ASSESSMENT IN CLEAN ENERGY

The key barrier to scaling-up clean energy projects in Indonesia continues to be the difficulties associated with achieving acceptable rates of return on investment. Demand side energy efficiency (EE) must overcome the low cost of electricity, the limited buying power of the majority of energy consumers, and the lack of fuel efficiency standards for vehicles, all of which suppress investments to reduce power and fuel consumption. Supply side EE projects in the power sector are possible and can be scaled-up by working with PLN, but they must compete for capital with investments needed to expand generating capacity to meet growing demand.

In the electric power sector, project developers continue to face challenges in negotiating and signing power purchase agreements with PLN. Projects that want to sell power to the Java-Bali grid must compete with relatively low power generation costs. Projects that sell power to the many mini-grids primarily supplied by diesel generators with high power generation costs must negotiate purchase agreements with PLN.[9]

TABLE 10: CURRENT DONOR ASSISTANCE PROJECTS UNDER WAY IN CLEAN ENERGY

Donor	Program	Budget	Objective
UNDP	UNDP-GEF Integrated Micro-hydro Program (IMIDAP)	US$2 million	Reduce GHG emissions from fossil-based power generation by accelerating development of micro hydro resources.
EU Asia Pro Eco	CDM and Urban Air Pollution Project	EURO 388,000	Improve air quality in Asian mega cities while mitigating climate change by using the Clean Development Mechanism.
Various supporters for CDM project development and capacity building	See Table 9		Projects include the following components: • Develop capacity in Indonesia to prepare and implement CDM projects, including the establishment of the DNA • Support CDM project preparation • Sign bilateral agreements • Purchase emission reduction credits from identified CDM projects • Provide up-front funds to cover CDM transaction costs, including development of project design documents, validation, registration, and first verification.

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

Despite policies that attempt to make the negotiation process more transparent, project developers face the underlying reality that the price for which PLN sells electricity is significantly lower than the cost

[9] Stakeholders consulted add that financing of RE projects remains a major stumbling block as the financial sector continues to perceive that the risk associated with these projects are high. A technical assistance program targeting bank managers to develop or increase their capacity for due diligence assessment of RE and EE projects would be timely.

of production. PLN loses money on almost every kWh sold in areas off the main grid, so simply expanding supply with clean energy sources increases losses. Theoretically, buying power from clean energy sources that are less expensive than current diesel plants allows available subsides to support expanded rural supply. However, long term contracts require careful planning because of the implied commitment of future subsidies. They are also challenging to administer in a volatile fuel market based on cross-subsidies from urban consumers in a decentralized system that necessarily involves multiple layers of government. The government continues to make progress in clarifying policies to make the process of negotiation with PLN more transparent, but the process is slow.

The fossil fuel sector faces the same return-on-investment barrier, but decisions in this sector are driven by national economic and environmental considerations. With declining oil resources and high international oil prices, Indonesia has increased its use of coal and plans to dramatically expand coal use over the next three years, adding 10,000 MW of new capacity, with coal projected to supply more than 60 percent of primary electricity generated by PLN by 2010. Decisions made on the environmental standards for the new fleet of coal power plants will have major implications for emissions of SO_X, NO_X, PM_{10}, and other pollutants associated with burning coal. Decisions made on the efficiency of the new fleet of coal plants will have major impact on future CO_2 emissions. The Government of Indonesia plans to seek international tenders and must decide what environmental standards to apply knowing that stricter standards will increase capital costs but produce measurable health benefits.

Low domestic prices for electricity and petroleum products have led to Indonesia's high energy intensity and created a significant burden on the government budget. In 2004, about US$ 7.9 billion, equivalent to 14 percent of government expenditures, went to fuel subsidies.

8. CONCLUSIONS

8.1. RECOMMENDATIONS FOR A CLEAN ENERGY STRATEGY

During the listening tour, the team met with representatives of key private and public institutions concerned with clean energy development in Indonesia in individual and group settings. The discussion focused on three questions:

1. What are the opportunities and priorities with the greatest potential impact that program sponsors and their partners can pursue?
2. How can a regional program be most effective in addressing these opportunities?
3. What measurable results can be achieved in the near term?

The results of those meetings and subsequent analysis of the data obtained produced the following recommendations. The most important clean energy opportunities for Indonesia are:

- Introduction of clean coal technology;
- Demand side management to reduce peak power demand;
- Development of minimum standards for key end-use applications, including lighting, transport, refrigeration, air conditioning, and buildings;
- Development of biofuels (such as biodiesel, ethanol, and pure palm oil) to displace fossil fuels for transportation; and
- Development and financing of new hydro and geothermal power projects.

Clean Coal Technology: Indonesia's plan to increase coal use to 35 percent of primary energy supply by 2025 and its accelerated plan to add 10,000 MW of new coal fired capacity by 2010 mean effective interventions can have an immediate and significant impact within the timeframe of the project. Regional collaboration can help establish emissions and performance standards and provide better insight into the trade-offs between cost and environmental performance. The scale of planned coal expansion in Indonesia and the long life of the capital infrastructure associated with coal plant development means potential benefits from improving supply-side efficiency and environmental performance of new coal capacity dwarf potential impacts for any other activity. Strong private and public sector interest was expressed for actions to improve coal plant performance by multiple stakeholders.

Demand Side Management: During the individual meetings, PLN explained that underinvestment in capacity over the past 10 years has decreased reserve margins in the Java-Bali grid forcing the rolling blackouts in late 2006. Meeting peak power demand requires PLN to use its most expensive generating equipment. Since new capacity will take time to come on line, reducing peak demand can have a dramatic effect on the cost of power. Since current peaking units run on oil products, reducing peak demand also reduces CO_2 emissions. The value of investments in EE has been analyzed and documented. In particular, lighting has been found to be a key component of peak demand.

Starting in 2002, PLN initiated a program to encourage the use of compact fluorescent lamps (CFLs) based on an analysis that showed widespread use of CFLs could reduce peak demand, postpone investment in new capacity in the Java-Bali grid, and reduce diesel consumption to supply electricity outside the Java-Bali grid. PLN worked with five CFL manufacturers (Philips, General Electric, Osram, Panasonic, and Chiyoda) to stimulate sales by assisting with distribution and subsidizing the price of CFLs (IDR 3.000 per lamp). The program distributed more than 1 million lamps and led to the design of a new ADB loan to the Indonesian government that will include financing to distribute millions of CFLs to PLN's poorest customers. This program makes economic sense for PLN because each CFL that replaces an incandescent lamp in a subsidized customer's house will save the utility US$15 over its lifetime. It is expected that the loan will be approved and the tender process for CFL procurement will begin before the end of 2007.

Minimum Energy Performance Standards: The experience with lighting can be matched in other products and sectors: refrigerators, air conditioners, transportation, and buildings. Currently, refrigerators, air conditioners, and personal vehicles have relatively low market penetration in Indonesia. Sales of these technologies are projected to accelerate with GDP growth and continued urbanization. Setting minimum energy performance standards is the least-cost way to meet projected energy demand associated with increased market penetration of these technologies. For devices that use electricity, energy-efficiency investments made by industry and consumers avoid the need for investment in new power generation capacity. For motorcycles and vehicles, private investments reduce the need for imported fuels and improve air quality.

Biofuels: Presidential Decree No. 1/2006 on the Supply and Use of Biofuel (25 January 2006) set targets for biofuels. A national standard for biodiesel had been established, and Pertamina began selling Biosolar, a 5 percent blend of biodiesel with diesel fuel, through197 outlets in Jakarta in May 2006 and added 12 outlets in Surabaya in August 2006. Indonesia plans to expand the automotive biodiesel program over the next 10 years, and add programs for biofuel blends with kerosene and industrial diesel. Production of automotive diesel is set to increase from 200,000 kiloliters in 2006 to more than 4.7 million kiloliters in 2025.

In Indonesia, plans call for both biodiesel and bioethanol to be produced from agricultural crops. Achieving the production targets set out in the biofuel roadmap will require investment to increase yields of existing crops and to expand planted area. Investments can also produce higher revenue per hectare and create jobs in rural areas where the majority of Indonesians live. Transfer of best practices for production and use of biofuels will provide immediate benefits.

Hydro and geothermal power: Hydro and geothermal power are often the least-cost options for power generation but have been held back by challenges of negotiating fair long-term contracts to sell power. Further efforts are needed to define contracting terms in order to reduce transaction costs.

8.2. RECOMMENDED INTERVENTIONS AND ACTIVITIES

Participants in the listening tour offered multiple suggestions for activities where regional collaboration could advance national objectives:

Regional standards for clean coal technology, especially for NOx, SOx, PM10, mercury, and CO2 emissions. Current plans call for coal to be the major fuel source for expanded power generation in Indonesia and throughout the region. Setting regional supply side efficiency and emissions standards in partnership with the private sector, and helping planners quantify air quality and heath impacts, will facilitate introduction of best available technology. Initial actions would be to take advantage of information available through existing regional organizations and private companies.

Harmonization of regional standards and testing for CFLs and collaboration to share program experience with efforts to expand CFL use. Under this activity, a working group on CFLs would be established in each country. The working group in Indonesia would include representatives from PLN, DGEEU, BPPT, IT Bandung, Association of Electric Lamp Industries, the National Standards Bureau, interested companies manufacturing CFLs for sale in Indonesia, and interested NGOs, especially those working in rural off-grid communities with limited incomes. The working group would discuss standards and labeling issues relevant to Indonesia and nominate two representatives to participate in semi-annual regional meetings with the objective of harmonizing regional standards, improve the quality of CFLs and reduce their cost. The initiative would support the cost of regional meetings and could provide technical assistance to develop analyses of energy savings and associated emission reductions for targeted distribution programs. The outcome of the technical assistance would be bankable project designs to further expand market penetration of CFLs.

Regional standards for other important end-use technologies, including buildings, air conditioners, refrigerators, and two-wheeled vehicles. Similar efforts would be used to create national working groups linked with regional networks to harmonize standards for other classes of important end-use technologies where significant sales growth is expected over the next five years. National working groups would include public and private participants and actively seek to develop public/private partnerships and bankable project designs. There has been a particular lack of collaboration on transport efficiency despite common problems in the region, such as rapidly expanding use of motorcycles where substantial differences in efficiency and emissions exist. Indonesia's experience with voluntary reporting of efficiency and emissions could be of particular interest in other Asian countries.

Identify and share best practices for the implementation of labeling programs, including enforcement. The same working group structure could be used to address implementation of labeling

programs and enforcement of standards. The initiative would support accreditation and validation of testing centers.

Develop regional technical standards for biofuels to enable trade. The development of standards for biofuels requires coordination among the producers of the feedstocks, the biofuels, and the technologies that will use the fuel. The knowledge and expertise required to develop standards will vary by the type of fuel. All of the countries surveyed in this report plan large expansions in the production and use of biofuels. Under such a regional project, the focus would be on bringing together those organizations involved in the setting of national standards with representatives of the above-mentioned three categories of companies interested in biofuels standards. The initiative would organize an initial workshop to bring together experts from other regions to present and discuss the standards they use for biofuels. Companies would present issues of concern. Based on the inputs received, the working group would develop a three-year action plan with milestones and goals. The initiative would support semi-annual regional meetings to discuss progress of the action plan.

Identification and sharing of best practices for production of biofuels from different feedstocks. Processes for the production of biofuels have changed substantially over the past 20 years. The focus of this regional activity would be to bring together potential producers of biofuels to introduce best practices and to support the development of feasibility studies linked to funding mechanisms for building modern biofuels production facilities. The outcome would be operating biofuels production facilities using the most efficient production technologies.

Regional standards for sustainability of biofuels production. Increasing demand for biofuels as countries seek alternatives to diesel and gasoline will require identification and development of new feedstocks. Indonesia announced a plan in 2006 to set aside an additional 500,000 hectares of land for development of palm oil plantations. Several NGOs have expressed concern that development of biofuels could have negative impacts on the environment and on the people living in areas targeted for biofuels development. Environmental impacts include increased pressure on forests and other areas of critical biodiversity, expanded use of fertilizers and pesticides, and effluents from the biofuels processing facilities. Social impacts include pushing local people, especially the poor, off of the land they depend upon for survival, and exploitive labor practices.

From a base of 120,000 hectares in 1968, there are now around 5 million hectares of land in Indonesia given over to palm, most of it owned by a few large producers. At least 19 million hectares more have been earmarked for plantations by provincial governments, while the central government has said there are 27 million hectares of "unproductive forest land" available for development. Land clearance not only has implications for the health and sustainability of ecosystems, but also for climate change. Bringing forest, peat land or grassland under cultivation releases CO_2 into the atmosphere. Sustainability standards would help governments identify and develop available land.

Collaboration and sharing of best practices to mobilize pubic and private capital from domestic sources, and especially learning from India and China, which seem to have had success with domestic financing of clean energy projects. Participants in the listening tour in Indonesia were especially interested in understanding how India and China have organized and launched financing institutions for renewable energy technologies.

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