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CLEAN ENERGY AND DEVELOPMENT: TOWARDS AN INVESTMENT FRAMEWORK

(Prepared by the World Bank)

**CLEAN ENERGY AND DEVELOPMENT:
TOWARDS AN INVESTMENT FRAMEWORK
EXECUTIVE SUMMARY**

1. *This paper discusses the issues underlying the development of an Investment Framework for Clean Energy and Development*—responding to the request in the September 2005 Development Committee Communiqué and in the context of the Gleneagles Communiqué on Climate Change, Clean Energy and Sustainable Development (July 2005)—and outlines the key elements of an associated work program. The paper has been prepared for discussion at the Spring 2006 meetings of the Development Committee, and was preceded by consideration by the Bank Board’s Committee of the Whole on March 30, 2006.

2. *The paper takes a global perspective rather than a Bank-centric one, covering three interlocking and complementary issues:* (i) the need for, and investment requirements of, meeting modern energy needs for developing countries over the long term in a manner that provides attention to efficiency and local environmental considerations; (ii) the additional steps needed in the energy, transport, and industrial sectors to address climate change mitigation through the reduction of greenhouse gases; and (iii) the impact of climate change and the need for developing countries to adequately adapt to changes in climate and weather variability. These three issues are critical to the World Bank’s core mission of poverty reduction and the realization of many of the Millennium Development Goals, and build upon existing World Bank strategies.¹

3. *The global community today is working toward a potential “double dividend* by meeting the energy needs that are essential for economic growth and fighting poverty, while at the same time leaving a smaller environmental footprint. The paper recognizes that meeting developing countries’ energy needs is both an urgent and difficult challenge, which requires domestic policies that provide incentives for efficiency in energy production, delivery, and use and incentives for public and private resource mobilization. The report also recognizes that climate change can undermine development and that dealing with climate change will require the development and implementation of climate-friendly technologies as well as adapting to climate change. Consistent with the principle of “common yet differentiated responsibilities,” the report recognizes that funding for energy-related climate change must be additional.

4. *The paper concludes by outlining a two-track approach to further develop an Investment Framework*, which complements ongoing World Bank Group activities in energy sector reform, energy investment, implementing GEF projects, developing the carbon market, and developing and applying methodologies to address climate variability and change.

¹ Fuel for Thought, Energy Strategy, Water Resources Management Strategy, Infrastructure Action Plan, Environment Strategy, and The Role of the World Bank in Carbon Finance.

A. Clean Energy for Development²

5. ***Today's challenge: reliable, clean, and efficient energy.*** Developing countries must accelerate access to affordable and reliable modern energy services to decrease poverty and increase productivity, enhance competitiveness, and thus improve their economic growth prospects. Without access to modern, clean, and sustainable energy services, the poor are exposed to unhealthy air pollution and deprived of modern energy services, which provide lighting, cooking, heating, refrigeration, transportation, motive power, and electronic communication that are indispensable to increasing productivity, creating enterprises, employment, and incomes. Maintaining current policies and technology choices will have highly undesirable economic, social, and environmental outcomes.

6. ***Energy sector policy reform is urgently required to stimulate the investments needed for developing and transition economies to meet their energy needs.*** Much of the investment need is unmet because of policy constraints: addressing these problems through joint public and private participation and working across the spectrum of public and private interventions are required. Actions needed include removal of broad-based subsidies and targeting the poor who may need income support; establishment of credible legal and regulatory frameworks; development of enabling policy environments through regulatory interventions such as appliance energy efficiency standards, mandated utility demand side management programs, and mandatory energy audits; creation of market-based approaches such as emissions trading, energy service companies, energy performance contracts, and credit guarantees; and information dissemination regarding energy savings and clean energy options.

7. ***Strengthening energy security is essential to alleviate some of the macroeconomic concerns of developing countries*** by diversifying supply and rationalizing energy use. Improvements in the effectiveness of energy use should be assigned a high priority because of its three-fold impact of improving energy security, reducing costs and decreasing environmental impacts.

8. ***An extensive array of clean and efficient energy supply and demand technologies exists.*** On the supply side, technologies aim to enhance access to clean and efficient energy, improve energy security, and promote environmental protection at the local, regional and global level. They include new thermal power plants based on combined cycle and supercritical boilers; natural gas as a bridging fuel in the transition period until renewable energy technologies become commercially viable; new renewable energy technologies (solar, wind, small and large hydro, biomass/biofuels and geothermal sources); and nuclear fission. Energy supply technologies are complemented by end-use efficiency technologies in the transportation sector (including efficient gasoline/diesel engines); the buildings sector (insulation, advanced windows, new lighting technology, efficient space cooling and heating); the industrial sector (cogeneration, waste heat recovery, pre-heating, new efficient process technologies, efficient motors/drives,

² This report does not equate clean energy only with small-scale modern renewable energy technologies, but with a complete suite of clean and efficient production, supply and end-use technologies.

improved control systems); the agricultural sector (efficient irrigation pumps); and in municipalities and urban centers (district heating systems and combined heat and power).

9. ***Low-cost, high impact approaches to providing clean energy should be addressed first.*** The first element is where investments and expenditures can be made in a “no regrets” format, that is, where clean energy investments are financially attractive under sound, commercially viable policies. An example is improving the efficiency in the production and use of energy. The second element would address promising new technologies that are not currently financially viable, but could be supported through taxes and subsidies that internalize the environmental costs of local and regional pollution. The third element would include a research and development program for promising new technologies that could yield commercially viable results within 10 to 25 years.

10. ***The IEA estimates that a total capital investment of \$8.1 trillion, equivalent to an average of \$300 billion per year (in 2005 dollars), is needed from 2003 to 2030 for the developing and transition economies to meet their energy needs,*** of which electricity comprises roughly 73 percent, oil 12 percent, natural gas 12 percent and coal 3 percent. Financing for the energy supply sector comes from three sources: internal cash generation, private financing, and public funding. One challenge in the energy sector is the electricity sub-sector where the current levels of investments are about 50 percent of the needs, that is, about \$80 billion per year out of \$160 billion per year. The extent to which the huge investment gap, especially in the electricity sector, can be funded in the future would depend on the pace of policy and regulatory reform, including the measures needed to attract private sector investment in developing countries and transition economies. End-use efficiency improvements in the transportation, industry, commercial and residential sectors can also have a significant impact on the clean energy investment requirements. Consultations with the private sector have confirmed that private investments in cleaner energy in developing countries will not occur without better risk management cover, especially in regulated industries.

B. Climate Change

11. ***Climate change presents an urgent and additional challenge.*** To reduce the threat of human-induced climate change to socio-economic sectors, human health, and ecological systems will require a significant reduction in the emissions of greenhouse gases globally. Emissions are estimated to be a factor of 1.6 to 3.5 above present levels by 2050. Most of the emissions come from industrialized countries and from a few large developing countries with rapidly expanding economies. Transformational policies and strategies will be needed to meet national expectations of secure, safe, and clean energy and to deal with the implications of climate change. The energy sector accounts for about 80 percent of greenhouse gas emissions and the agricultural sector for most of the remaining 20 percent. Decisions taken today on technologies and policy will have profound consequences on development paths for 40 to 60 years.

12. ***Addressing climate change will require mitigating greenhouse gases and adapting to the impacts of climate change now.*** The incremental costs of mitigating

greenhouse gas emissions is estimated to range from less than \$10 billion per year to about \$200 billion per year depending on the stabilization target, the pathway to stabilization, and the underlying development pathways of developing countries³. While the costs of adaptation are uncertain they are expected to be considerable, i.e., tens of billions of dollars per year, with developing countries being the impacted.

13. ***Technologies are currently available or will soon be available to reduce greenhouse emissions***, including ultra-efficient coal-fired power plants (e.g. integrated gasification combined cycle (IGCC) with carbon capture and storage), natural gas, advanced renewable energy technologies, nuclear, biological sequestration, (e.g., afforestation), reducing the rate of deforestation, waste management (e.g., capture of methane emissions), incineration of process by-product gases as well as highly efficient end-use technologies (e.g., buildings and vehicles). Research, development, and demonstration (RD&D) is needed to further improve certain technologies in several key areas, including IGCC with carbon capture and storage, zero- or low-emission vehicles, and nuclear energy.

14. ***Climate is a global public good***⁴. Because of the recognition of common yet differentiated responsibilities in the United Nations Framework Convention on Climate Change (UNFCCC) and because the industrialized countries are responsible for most of the anthropogenic greenhouse gases currently in the atmosphere, developing countries are not expected to bear the additional costs of a low-carbon economy. There are only three sources of funding for mitigating greenhouse gas emissions: voluntary actions, international grants, and trade. While all are potentially important, trade is likely to confer the biggest flow of funds (between \$20 and \$120 billion per year). An efficient trading system will require a long term, stable and predictable framework and accompanying regulatory system, which could be based upon targets, policies, and other measures⁵.

15. ***All countries are vulnerable to climate change and instability in weather patterns but the poorest countries and the poorest people within them are most vulnerable, being the most exposed and having the least means to adapt***. Climate variability is already a major impediment to reducing poverty and will become increasingly so given that a significant degree of climate change is inevitable. Immediate attention is needed for small island states and low lying coastal areas exposed to storms, but the longer term challenge is in the key sectors relating to agriculture and associated water resource management.

16. ***Adaptation will require the transfer of existing technologies, new technologies and the revision of planning standards and systems***. Priority funding is needed to (a)

³ The IPCC estimated, in 1990 \$, that the average annual gross cost over the next 100 years of stabilizing at 450 ppm, 550ppm and 650 ppm of carbon dioxide, respectively could range from less than 40 billion per year up to 180 billion per year; less than 10 billion per year up to 80 billion per year, and close to zero and up to 40 billion per year.

⁴ Climate and the prevention of climate change can be viewed as global public goods

⁵ This paper acknowledges that the UNFCCC is the international body responsible for negotiating any regulatory framework. This is a technical paper, which can be used as an input to the negotiations.

develop typologies of country cases to better understand options and costs; (b) establish better planning and screening tools especially for hydrological and biological resource management; and (c) agriculture needs to be “climate proofed” through the development of a new generation of drought and water resistant seeds and breeds. Much of the technology and knowledge needed for adaptation is either currently available or can be developed at relatively low cost. Given the probability of more extreme weather events, there is an urgent need to upscale emergency response mechanisms.

17. ***The incremental annual costs to adapt to projected climate change are likely to lie in the \$10 billion to \$40 billion per year range***, of which about a third is associated with public finance. Most of the initial funding will come from the public sector including ODA, but it needs to be integrated in countries development planning and private investment plans. The challenge remains to identify genuine incremental costs of adaptation and to find financial mechanisms to channel additional resources to activities that effectively reduce climate vulnerabilities.

C. Financing Options

18. ***New financing instrument options.*** Even with an improved regulatory environment and the use of policy and political risk mitigation instruments, the challenge of financing incremental costs and reducing technology risks will be significant. These issues could be addressed by means of innovative financial instruments, which could complement existing World Bank Group and IFI instruments, among which the following hold promise:

- ***Clean Energy Financing Vehicle (CEFV)*** could provide a mechanism to transfer high efficiency technology to mitigate climate change. This financing vehicle could blend grants and carbon finance to provide funds to collateralize clean energy technologies. It could (i) buy down the costs of new technologies and energy infrastructure; and (ii) mitigate technology risks.
- ***Power rehabilitation financing facility.*** This mechanism could enable developing countries to rehabilitate inefficient plants without loss of power, with repayment provided from the increased efficiency and capacity of rehabilitated plants as well as any resulting carbon emissions reductions.
- ***Project development fund.*** Consultations with the private sector indicated a dearth of “Bankable” projects. Funds with public and private sector participation could be considered for project development.
- ***Venture capital funds for technology adoption.*** The private sector’s suggestion to introduce dedicated venture capital funding to provide financing for promising new and clean energy technologies and to assist their penetration in the marketplace is also worth analyzing.

D. Next Steps

19. Further follow-up work, which would be carried out in collaboration with the other IFI's, governments, finance and energy sectors, export credit agencies, and civil society, and include outreach and communications, would proceed on two parallel tracks, which involves country dialogues, financing analysis, and detailed research on adaptation.

- ***First track—activities to be completed by September 2006.*** The purpose would be to develop a more detailed proposal for financing facilities, for discussion at the World Bank Annual Meetings in September 2006. These would include: (1) analyzing the strengths, weaknesses, complementarity's, and utilization of existing World Bank Group and other IFI instruments to address clean energy for development, mitigation of greenhouse gas emissions, and adaptation to climate change; (2) completing the design or pre-feasibility studies for the proposed new financing instruments; (3) updating and refining, jointly with the IEA and others, alternative energy scenarios and financing needs; and (4) seeking alignment of different partnerships. **This would be submitted for further direction to the World Bank's Annual Meetings in the fall of 2006.**
- ***Second track—activities to be developed over the next two years.*** The purpose would be to generate (1) new knowledge on technology options, and evaluate the environmental, social (including gender) and economic impact of climate change, and (2) proposed programs of action for selected countries including, as relevant, assessing and addressing any transitional costs. **This work would then be submitted for consideration to the G-8 2008 Summit, in Tokyo, Japan.**
- ***Outreach Program – over the next two years.*** The goal is to facilitate a dialogue and broad engagement among stakeholders, using existing multi-stakeholder platforms and partnerships. The outreach program will engage a variety of constituencies, including the business community, civil society, and legislators.

Note: The complete document is available on the World Bank's website:

[http://siteresources.worldbank.org/DEVCOMMINT/Documentation/20890696/DC2006-0002\(E\)-CleanEnergy.pdf](http://siteresources.worldbank.org/DEVCOMMINT/Documentation/20890696/DC2006-0002(E)-CleanEnergy.pdf)