Access to Energy for the Poor:

The Clean Energy Option

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The Clean Energy Option

June 2011

Report written by Elizabeth Bast and Srinivas Krishnaswamy, with contributions by Heike Mainhardt-Gibbs, Traci Romine, Anuj Gurung, and Frikk Nesje.

Reviewed by Ilana Solomon, Anne Jellema, Harjeet Singh, Soren Ambrose, Traci Romine, and Stephen Kretzmann.

Thanks to the Charles Stewart Mott Foundation and Rockefeller Brothers Fund for their financial support of this report.

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Executive Summary

A dual focus on increasing access to energy services for the world's poorest and promoting clean sources of energy is a win-win scenario for development and the environment. Thus far, initiatives to increase energy supply in developing countries have not necessarily reached the poor, while initiatives specifically to increase energy access for the poor have not fully taken advantage of clean energy technologies. It does not have to be this way. Energy access for the poor and an increase in clean energy technologies are mutually reinforcing goals.

As a development bank, the World Bank could support clean, decentralized projects for energy access in developing countries. However, the Bank's current lending and its proposed Energy Strategy do not go far enough to support this shift. The World Bank's new Energy Strategy should support clean energy access by setting clear definitions and metrics for defining energy access and focusing its lending on projects that achieve these metrics with an emphasis on decentralized renewable energy and energy efficiency.

Over 20 percent of the world's population is without access to electricity and nearly 40 percent are still relying on traditional biomass for heating and cooking. Increasing access to modern energy services for the world's poorest – both for basic and productive uses – is a critical development issue. Increased access to lighting and basic utilities, water pumping, improved cooking fuels, and cleaner fuels for heating could significantly support progress towards achieving the Millennium Development Goals. Increased access to energy is important for issues of gender equality, as the burden of energy poverty disproportionately impacts women, who often need to spend large amounts of time on subsistence activities like collecting firewood. As this report shows, a number of initiatives are currently underway – internationally, nationally, and locally – to increase access to energy services. These initiatives prove that energy access and clean energy can go hand in hand.

Rooftop solar panels in rural India.

At the same time, moving global energy use towards clean energy pathways – energy that is truly clean, renewable, and safe, and not just less dirty – is critical for the poor because these sources of energy protect the environment and natural resources locally and do not compromise public health. A clean energy transition is also critical to limiting the most severe impacts of climate change, which will disproportionately affect the poor. Clean energy technologies include zero or low carbon technologies with greenhouse gas emissions an order of magnitude lower than conventional alternatives that do not have additional adverse social and environmental impacts through their lifecycles. Transmission and distribution and energy policies must support these source technologies to support a true clean energy transition.

The report highlights the following facts regarding clean energy access:

- Increasing access to energy is critical to supporting human and economic development, through the direct provision of energy services for basic needs, by supporting productive uses, and also by creating jobs.

- Fossil fuels and other conventional energy sources have negative externalities, including pollution and public health impacts, and fossil fuel extraction has been shown to correlate with higher levels of poverty, child mortality and malnutrition, civil war, corruption, authoritarian governance, and gender inequality. Clean energy sources benefit ecosystems and the environment and help protect natural resources that poor communities often rely on.

- Clean, decentralized renewable energy is often the most appropriate means of providing holistic energy services in rural areas that support both economic and social development, and these decentralized energy services can be more reliable than conventional grid based energy for providing energy access.

- Clean energy for access is economically feasible in comparison to conventional technologies, particularly for areas at a distance from the grid. The cost of decentralized, renewable energy can be less expensive than conventional, grid-powered electricity for areas at a distance from the grid.

- Improving demand-side, or end-use, energy efficiency (for example, by using more energy efficient lighting or appliances) can be one of the most cost effective ways of providing energy services.

- New research in India shows that people living in rural communities are able and willing to pay for clean, reliable energy services.

- While there is increased interest in expanding energy access in a number of countries, to date, large-scale initiatives in developing countries focused on increasing energy access could take greater advantage of the opportunities of decentralized renewable energy and energy efficiency.

The barriers to making a shift to renewable energy and energy efficiency often include an assumption that clean energy is automatically more expensive. However, the true costs of using conventional energy, including public health and environmental externalities, are often not incorporated into pricing of energy options. Existing national and international policies and frameworks often favor fossil fuels and large, centralized energy systems. Finally, alternative energy sources often face a lack of financing, particularly to address the upfront costs associated with efficiency and renewable energy sources.

The multilateral development banks could play a significant role in funding the transition to a healthier energy future – both in terms of increased energy access and a transition to clean energy. As an influential development bank, the World Bank, in particular could play an important role in an energy transition, but only if the institution truly embraces the idea that it should focus on closing the gap in financing clean energy options and make a commitment to increasing energy access.

The World Bank Group is currently revising its Energy Strategy, which serves as a guide for the institution's energy investments, and the two pillars of the Bank's new energy strategy are set to be energy access and low carbon growth. While these pillars could orient the Bank in the right direction, a strong Energy Strategy document will need to include clear metrics that will lead the institution to shift its portfolio towards clean energy and energy access projects.

The report's findings on the World Bank's energy access portfolio include:

- Only 9 percent of the World Bank Group's energy portfolio in FY 2009 and 2010 targeted increasing energy access for the world's poorest. Forty percent of the financing labeled energy access by the World Bank Group in the FY 2009 and 2010 did not meet the study's metrics for energy access.

- Of the 9 percent of World Bank projects that the analysis found targeted increased access for the poor, 76 percent of those utilized clean energy in the form of new renewable energy or energy efficiency.

- Not a single World Bank greenfield, or previously undeveloped, fossil fuel project targeted energy access for the poor.

- With less than one tenth of the energy portfolio targeting access and only 30 percent of its energy portfolio funding new renewables and energy efficiency, the Bank is not in fact prioritizing energy access and clean energy in its lending at the moment.

Our recommendations for the World Bank Group include:

- **The World Bank Group's energy lending should focus on increasing energy access for the poor through clean, decentralized energy sources.** As this report shows, clean, decentralized energy sources and energy efficiency are appropriate, affordable means for increasing access to energy. The World Bank should focus its energy lending on increasing clean energy sources – those sources without negative environmental, health, development, and social impacts – for the populations that currently lack electricity and lack access to modern energy.

- **The Bank should clarify its definition and criteria for 'energy access,' focusing on the world's poorest and increase its level of ambition with regards to funding energy access projects with the aim of reaching the poor.** The World Bank Group should make it clear that its priority is to provide access to energy services to the billions of people currently without access to electricity and modern fuels. Concurrently, the World Bank should do a better job at specifying and disclosing the expected outcomes from its energy projects that will directly benefit the poor. The World Bank should require projects to clearly identify targeted consumers (direct beneficiaries) for energy projects, which would help to better gauge its progress on energy access for the poor, and should consistently monitor and report back on actual project energy outcomes to ensure the poor are benefitting.

- **The World Bank Group should stop lending for fossil fuels except in extreme cases where there is clearly no other viable option for increasing energy access to the poor.** As this report shows, the negative impacts of fossil fuels, large hydropower and nuclear energy have negative impacts to the climate, the environment, and public health. The World Bank Group's energy lending should focus only on clean energy options such as energy efficiency and clean renewable energy, which can support increased energy access and do not have negative impacts to the climate, the environment and natural resources, or public health.

Tackling the related problems of energy access for the poor and transitioning to a global clean energy economy are not small tasks. To advance towards goals of universal energy access and a truly clean energy pathway, all relevant actors, including governments, those in the energy industry, and development banks will have to take steps to change policies, approaches, and actions. The World Bank could take a positive step forward by making a clear commitment to advance these goals.

Why Energy Access is Important

Worldwide, some 1.4 billion people, or over 20 percent of the world's population, still have no access to electricity and approximately 2.7 billion people rely on traditional biomass as their primary source of energy.[1] The large majority of electricity-deprived people – around 85 percent – live in rural areas of the developing world, mainly in Sub-Saharan Africa and South Asia.[2]

The International Energy Agency predicts that "without additional dedicated policies, by 2030 the number of people [that lack access to electricity] drops, but only to 1.2 billion," while "the number of people relying on traditional use of biomass is projected to rise from 2.7 billion today to 2.8 billion in 2030."[3]

Access to energy has been shown to facilitate other development indicators, and the United Nations has made clear that access to affordable, modern energy services is essential for the achievement of sustainable development and the eight Millennium Development Goals:[4]

1. **End Poverty and Hunger.** Access to energy services can help eradicate extreme poverty and hunger by promoting micro-enterprise, creating jobs, improving agricultural outputs, and making basic cooking easier and cleaner.

2. **Universal Education.** Access to adequate lighting can significantly support achieving universal primary education.

3. **Gender Equality.** Energy access can promote gender equality by decreasing the time spent cooking, boiling water, and collecting fuel for household use – chores that usually fall to women – and increasing the time available for economic and educational opportunities.

4. **Child Health.** Basic health improvements that come with energy access, such as decreases in indoor air pollution and increased water purification with faster boiling, can help reduce child mortality.

5. **Maternal Health.** Energy access can also help improve maternal health by improving indoor air quality, reducing the intensity of household chores, and improving conditions in health clinics.

6. **Combat HIV/AIDS.** Improved health care facilities, including lighting, sterilization, and refrigeration and electricity to facilitate communication about health issues can help combat HIV/AIDS, malaria and other diseases.

7. **Environmental Sustainability.** Cleaner energy systems and the reduction of the use of wood for heating and cooking can help ensure environmental sustainability.

8. **Global Partnership.** A focus on increasing access to energy services is one way to help develop a global partnership for development.

At the same time, there are clear costs for development, health and the environment in continuing the status quo. The International Energy Agency estimates that by 2030, reliance on traditional fuels for cooking would lead to 1.5 million deaths per year from household air pollution – more than the estimates of deaths from malaria, tuberculosis, or HIV/AIDS by 2030.[5]

Discussion and Definition of Energy Access

There is no universally accepted definition or list of indicators for the term "energy access." UN Energy uses the term 'energy services' to refer to "the benefits produced by using energy supplies." UN Energy compares traditional fuels that provide low quality energy services with "good quality heating and lighting, modern fuels and electricity" that "provide mechanical power for agro- processing, refrigeration for clinics, motive power for transport and telecommunications for education and public awareness."[6]

It can be challenging to measure access to different forms of energy services. "Access" is sometimes measured simply as the provision of a connection to an electricity grid. However, in order to achieve poverty reduction and development goals, the definition of energy access must be broader than an intermittent electricity connection.

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1 International Energy Agency. Energy Poverty: How to make modern energy access universal? Special Early Excerpt of the World Energy Outlook 2010 for the UN General Assembly on the Millennium Development Goals. OECD/IEA, September 2010. http://www.worldenergyoutlook.org/docs/weo2010/weo2010_poverty.pdf

2 Ibid.

3 Ibid.

4 UN Millennium Project. Energy Services for the Millennium Development Goals: Achieving the Millennium Development Goals. Washington, DC and New York: The International Bank for Reconstruction and Development/The World Bank and the United Nations Development Programme, 2005. http://www.unmillenniumproject.org/documents/MP_Energy_Low_Res.pdf

5 International Energy Agency. Energy Poverty: How to make modern energy access universal? Special Early Excerpt of the World Energy Outlook 2010 for the UN General Assembly on the Millennium Development Goals. OECD/IEA, September 2010. http://www.worldenergyoutlook.org/docs/weo2010/weo2010_poverty.pdf

6 UN Energy, "The Energy Challenge for Achieving the Millennium Development Goals," July, 2005. http://esa.un.org/un-energy/pdf/UN-ENRG%20paper.pdf

The report of the UN Advisory Group on Energy and Climate Change breaks down energy access into incremental levels of 1) basic human needs; 2) productive uses; and 3) modern society needs. 'Basic human needs' is the level that is used for forecasts of costs for universal energy access. This includes "electricity for lighting, health, education, communication and community services (50-100 kilowatt hours per person per year)" and "modern fuels and technologies for cooking and heating (50-100 kilograms of oil equivalent of modern fuel or improved biomass cook stove)."[7]

The Advisory Group on Energy and Climate Change goes on to make the case for 'productive uses' to be included in the goal of universal energy access. This includes "electricity, modern fuels and other energy services to improve productivity," "agriculture: water pumping for irrigation, fertilizer, mechanized tilling," "commercial: agricultural processing, cottage industry," and "transport: fuel."

Beyond productive uses comes 'modern society needs,' which would include "modern energy services for many more domestic appliances, increased requirements for cooling and heating (space and water), and private transportation, with an electricity usage of around 2000 kilowatt hours per person per year."

It is clear that for energy access improvements to meet development needs and achieve poverty reduction, energy access must be targeted not only at the provision of basic energy services to poor households, but also at the improvement of livelihoods and income generation. For example, energy produced in poor communities for the development of rural agro-processing industries can boost employment and reduce poverty.

In its study of International Bank for Reconstruction and Development (IBRD) and the International Development Agency (IDA) energy access investments from 2000 to 2008[8], the World Bank Energy Sector Management Assistance Program (ESMAP) focused on "energy

In many energy poor communities, dried manure is still used for cooking.

Candles and kerosene lanterns use comparatively large amounts of energy for poor quality light.

investments that support new delivery or improvement in the quality of energy services for households, communities, or local enterprises that are without access to a specific type of energy… This means that the production or transmission of energy services is not considered energy access, unless all or part of that energy reaches the households, communities, or local enterprises."

At the same time, "energy access" is often used as a justification for large-scale fossil fuel projects providing energy to industrial production and export – often without regard to serving the local communities. These projects often bring additional negative development impacts, including immediate environmental health impacts on surrounding communities from extraction and production and greenhouse gas emissions that lead to climate change impacts on vulnerable communities, and potential increases in inequality.

Why Clean Energy Is Important

As with energy access, the use of clean energy can bring multiple benefits to developing countries. The use of clean energy rather than conventional fuels can reduce the impacts of climate change. Clean energy technologies are also often renewable and can be utilized again and again without being depleted. Further, clean energy does not deplete natural resources or destroy the environment and has fewer public health impacts.

Conversely, fossil fuel energy has a number of serious environmental and public health impacts that have harmful effects on human populations,

7 UN Advisory Group on Energy and Climate Change. "Energy for a Sustainable Future: The Secretary-General's Advisory Group on Energy and Climate Change (AGECC) Summary Report and Recommendations," New York: April 28 2010. http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGECC%20summary%20report%5B1%5D.pdf

8. Douglas F. Barnes, Bipul Singh and Xiaoyu Shi. Modernizing Energy Services for the Poor: A World Bank Investment Review – Fiscal 2000–08, World Bank Energy Sector Management Assistance Program (ESMAP): December 2010. http://siteresources.worldbank.org/EXTENERGY2/Resources/EnergyForThePoor.pdf

increasing the true cost of fossil fuels. Fossil fuels are also major contributors to climate change.

The development impacts of climate change from continuing on a high carbon development path are dire, particularly for many areas of the developing world. While industrialized countries that have contributed the most climate pollution must take on the majority of the burden for reducing greenhouse gas emissions and must provide the necessary funding to developing countries for mitigation and adaptation, the energy trajectories of the developing world will also be critical to ongoing stabilization of atmospheric levels of greenhouse gases and reducing the impacts of climate change.

Climate change will increase flooding, the impacts of which can already be seen in this village in Malawi.

The World Bank's World Development Report 2010 highlights how the consequences of climate change will fall disproportionately on developing countries, pointing out that these countries will bear as much as 75 to 80 percent of the costs of the damages of climate change. The World Development Report also explains that even only 2 degrees Celsius of warming above preindustrial temperatures – an almost inevitable level of warming at current carbon dioxide levels – would result in "increased weather variability, more frequent and intense extreme events, and greater exposure to coastal storm surges," with "between 100 million and 400 million more people… at risk of hunger," and potentially 1 billion to 2 billion more people without access to enough water to meet their needs. This same level of warming "could result in a 4 to 5 percent permanent reduction in annual income per capita in Africa and South Asia," largely driven by impacts to agriculture.[9]

In fact, climate change is already erasing gains from many development efforts, plunging nations into repeated food crises and other natural disasters and threatening their people with chronic hunger and disease. As time goes on, impacts are expected to worsen:

- A World Health Organization assessment concluded that climate change may have caused more than 150,000 deaths in the year 2000 alone. This number is likely to increase as impacts worsen.[10]
- By 2020, in some countries in Africa, yields from rain-fed agriculture could be reduced by up to 50 percent as a result of climate change.[11] This will mean increased hunger and famines across an already food insecure continent.
- India alone could lose approximately 18 percent of its rain-fed cereal production because of climate change.[12]
- Between 75 and 250 million people across Africa could face more severe water shortages by 2020.[13]
- In Latin America, shifting rainfall patterns and the loss of glaciers will significantly reduce water availability for human consumption, agriculture, and energy generation.[14]

Beyond the severe global climate impacts of fossil fuel use, there are local environmental and public health impacts from using oil, gas and coal. Two studies by Harvard Medical School on the lifecycle costs of oil and the lifecycle costs of coal to public health reveal how significant these impacts are economically.

The Harvard Medical School study on oil[15] examines the wide-ranging impacts of extraction, transport, refining, distribution, and combustion of oil on humans, wildlife and environmental systems. It cites the numerous impacts on the environment and humans directly from oil spills and leaks, from chemicals released as byproducts and pollution throughout the oil lifecycle, and from air pollution as a result of these processes. The study also looks specifically at the impacts to various communities, including workers, communities surrounding oil facilities, fish, marine mammals, and coastal communities, as well as the broad reaching effects of acid rain and climate change.

A more recent Harvard Medical School study on coal[16] examines and quantifies the impacts of coal extraction, transport, processing, and

9 World Bank. World Development Report 2010: Development and Climate Change. Overview: Changing the Climate for Development. November 2009. http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1226014527953/Overview.pdf

10 World Health Organization. Climate and health Fact Sheet, July 2005. http://www.who.int/globalchange/news/fsclimandhealth/en/index.html

11 Intergovernmental Panel on Climate Change, Fourth Assessment Report (AR4), Climate Change 2007: Synthesis Report, 2007. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

12 Prioritizing Climate Change Adaptation Needs for Food Security in 2030. David B. Lobell, Marshall B. Burke, Claudia Tebaldi, Michael D. Mastrandrea, Walter P. Falcon, Rosamond L. Naylor Science 1 February 2008: Vol. 319. no. 5863, pp. 607 – 610. http://iis-db.stanford.edu/pubs/22098/Lobell_et_al_Science_2008.pdf

13 Intergovernmental Panel on Climate Change, Fourth Assessment Report (AR4), Climate Change 2007: Synthesis Report, 2007. http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

14 Ibid.

15 Paul R. Epstein and Jesse Selber, Eds. Oil: A Life Cycle Analysis of its Health and Environmental Impacts, Harvard Medical School, March 2002. http://chge.med.harvard.edu/publications/documents/oilfullreport.pdf

16 Paul R. Epstein, Jonathan J. Buonocore, Kevin Eckerle, Michael Hendryx, Benjamin M. Stout III, Richard Heinberg, Richard W. Clapp, Beverly May, Nancy L. Reinhart, Melissa M. Ahern, Samir K. Doshi, and Leslie Glustrom. 2011. Full cost accounting for the life cycle of coal in "Ecological Economics Reviews." Robert Costanza, Karin Limburg & Ida Kubiszewski, Eds. Ann. N.Y. Acad. Sci. 1219: 73–98.

combustion, putting an economic value on the costs that coal exacts on the environment and public health. The study examines the impacts on occupational health and public health; the ecological impacts of coal mining; and the climate impacts of coal, including from underground and mountaintop removal, transportation, combustion, waste disposal, and electricity transmission. The study estimates that the externalities associated with coal range from 9 to 27 cents per kilowatt hour, or an average of nearly 18 cents per kilowatt hour.

Coal-fired power plants also require huge quantities of water for coal processing and boilers. Where the quality of coal is poor, with high ash and low carbon, coal needs to be washed, as is the case in India. It has been estimated that an average coal washery in India consumes between 60 and 170 gallons of water for 1 tonne of coal, and the average effluent discharged varies from 110 to 750 cubic meters,[17] with current demand in India at 555 million tonnes of coal. With many countries already facing water scarcity, the impacts of coal use on water supplies can be devastating. The effluent from coal washing can also contaminate surrounding groundwater, further polluting the environment and also causing public health problems.

It was previously thought that whatever other curses oil, gas and mining brought, its vast revenues offered a path out of debt for exporting countries, and thus perhaps, eventually out of poverty. But countries that produce oil tend to be poorer, more violent, more corrupt, and less productive economically than they should be.

A 2005 Oil Change International study found that oil dependency in fact exacerbates developing country debt.[18] The report found that:

- Increasing oil production leads to increasing debt.
- Increasing oil exports leads to increasing debt.
- Increasing oil exports improves the ability of developing countries to service their debts, while at the same time increasing their total debt.
- Increases in oil production predict increases in debt size.
- World Bank programs designed to create wealth by increasing Northern private investment in Southern oil production have drastically increased debt.

Oil extraction and transport can create severe environmental pollution, as it has in the Niger Delta. Photo credit: Ed Kashi.

This "resource curse" – a strong negative correlation between a country's dependence on mineral exports (particularly oil), and their gross domestic product (GDP) – has been well documented across extractive industries.[19] Evidence from the coal producing region of Appalachia in the United States suggests that this same resource curse exists in the case of coal mining. Studies have found that areas with especially heavy mining have the highest unemployment rates in the region and that the economic distress that Central Appalachia "has been associated with employment in the mining industry, particularly coal mining."[20]

A global clean energy pathway is essential to avoid more severe climate impacts, as well as to reduce the public health and environmental costs of conventional energy and increase energy services to the world's poor.

Discussion and Definition of Clean Energy

Looking broadly through a lens of sustainability, clean energy could be viewed as "the provision of energy that meets the needs of the present without compromising the ability of future generations to meet their needs."[21] A further examination of the environmental and social impacts of specific technologies throughout their lifecycles helps to further define what energy sources can be considered "clean" or "sustainable."

For the purposes of this report, clean energy can be considered zero

17 Gurdeep Singh and Ravi Kumar Gupta. Water Pollution from Coal Washeries and its Impact on Damodar River. The Indian Mining and Engineering Journal, December 2007. http://www.ismenvis.nic.in/My_Webs/Digital_Library/GSingh/Water%20Pollution%20from%20Coal%20Washeries.pdf
18 Stephen Kretzmann and Irfan Nooruddin, Oil Change International, Jubilee USA Network, Institute for Public Policy Research, Milieudefensie, and Amazon Watch. "Drilling into Debt: An Investigation into the Relationship Between Debt and Oil," July 2005. http://priceofoil.org/educate/resources/drilling-into-debt/
19 Jeffrey D. Sachs and Andrew M. Warner, Natural Resource Abundance and Economic Growth. Center for International Development and Harvard Institute for International Development, Cambridge MA, November, 1997. http://www.cid.harvard.edu/ciddata/warner_files/natresf5.pdf
20 Appalachain Voices. Economic Impacts of Mountaintop Removal. Accessed online May 2011. http://appvoices.org/end-mountaintop-removal/economy/
21 Wikipedia, "Sustainable Energy." Accessed online May 2011. http://en.wikipedia.org/wiki/Sustainable_energy

Using food crops for the production of biofuels can decrease access to food crops for poor communities.

or ultra-low-carbon energy technologies that generate GHG emissions per unit of energy output in lifecycle of production that is at the level of near-zero or at the order of one magnitude less as compared with what the emissions would be otherwise,[22] and that do not have significant environmental or social impacts throughout the lifecycle of the energy technology.

Renewable energy sources – energy coming from naturally replenished resources such as sunlight, wind, rain, tides, geothermal heat, and plant sources – are often regarded as clean. Renewable resources are those that will not be depleted, and as energy resources they often have fewer environmental impacts. Solar power, wind power, geothermal power, wave or tidal power, hydropower, and energy from biogas, biomass or biofuels are considered to be "renewable."

However, within renewable energy, the development of some sources – notably large hydropower and large-scale biofuels – have significant impacts on the environment and on human populations that make it difficult to consider them 'green' or 'clean.'

Large hydropower can have unacceptable environmental and social costs. According to International Rivers:

> *Big dams have frequently imposed high social and environmental costs and long-term economic tradeoffs, such as lost fisheries and tourism potential and flooded agricultural and forest land. According to the independent World Commission on Dams, most projects have failed to compensate affected people for their losses and to adequately mitigate environmental impacts. Local people have rarely had a meaningful say in whether or how a dam is implemented, or received their fair share of project benefits.*[23]

The large-scale production of biofuels can also have significant impacts, including decreasing access to food for poor communities. The production of biofuels was one of the key contributors to the food crisis in 2008 that pushed further 100 million into poverty and about 30 million more people into hunger. According to ActionAid:

> *The drive to expand biofuels production is creating new pressures on land and food rights all over the world. This process is most advanced in Latin America, where national and international companies are increasing the production of sugarcane, palm oil, jatropha and other crops to take advantage of high prices and high expectations for markets in the United States and Europe. In many cases, smallholder farmers are being driven off their lands, and fragile ecosystems are threatened.*[24]

Technologies that improve energy efficiency, both through demand side efficiency, or reducing the use of energy, and by improving supply side efficiency, or reducing the inefficiencies in energy production and distribution are also often considered to be clean. However, it is important to note that the upgrading of fossil fuel systems for greater efficiency perpetuates the use of fossil fuels, even if energy use and pollution are reduced.

Nuclear power is considered to be clean by some definitions, but nuclear power creates radioactive waste that is extremely difficult, if not impossible, to dispose of safely. The radiation threats and the difficulties encountered in shutting down the Fukushima Daiichi nuclear power plant in Japan following the major earthquake and tsunami in March 2011 also demonstrate continued problems of nuclear power. According to Public Citizen:

> *Nuclear power is not a clean energy source: it produces both low and high-level radioactive waste that remains dangerous for several hundred thousand years. Generated throughout all parts of the fuel cycle, this waste poses a serious danger to human health. Currently, over 2,000 metric tons of high-level radioactive waste and 12 million cubic feet of low-level radioactive waste are produced annually by the 103 operating reactors in the United States. No country in the world has found a solution for this waste.*[25]

For the purposes of this report, we do not consider fossil fuels, nuclear power, hydropower over 10 megawatts, and conventional biofuels to be clean given their impacts to the environment, public health, and development.

22 Bank Information Center. "Sustainable Energy for Equitable Development: Contribution to the World Bank Group's Energy Strategy Review and Development." April 2010. http://www.bicusa.org/en/Document.102113.aspx

23. Aviva Imhof and Guy R. Lanza. "Greenwashing Hydropower: The Problems with Big Dams." World Watch Magazine, Jan/Feb 2010, Volume 23, No. 1. http://www.internationalrivers.org/greenwashing-hydropower

24 ActionAid. "Biofuels in the Americas: Driving Farmers off Their Lands." Accessed online May 2011. http://preview.actionaidusa.org/what/food_rights/biofuels_in_americas/

25 Public Citizen. "Nuclear's Fatal Flaws: Radioactive Waste." Accessed online May 2011. http://www.citizen.org/cmep/article_redirect.cfm?ID=15210

Suitability and Economics of Clean Energy for Energy Access

Recently electrified village in India.

As the REN21 Global Status Report 2010[26] begins, "changes in renewable energy markets, investments, industries, and policies have been so rapid in recent years that perceptions of the status of renewable energy can lag years behind the reality." Global investments in renewable energy are increasing, and the relative costs of renewables are decreasing. Renewable energy and energy efficient technologies also support economic development by creating employment (See Box 1. Clean Energy Access and Job Creation).

Most developing countries are situated in areas with high renewable energy resources, notably wind and solar resources. Solar radiation and other renewable energy resources are more equally distributed than oil, coal, gas or uranium. This means that by transitioning to renewable energy, developing nations are less exposed to the volatile prices of imported energy. Renewable energies also reduce the pressure on fossil fuels and are therefore less exposed to armed conflicts over scarce resources.[27]

Decentralized Renewable Energy

Decentralized, renewable energy technologies are often the most suitable for rural areas that are far from the electricity grid. With 85 percent of those people without access to electricity globally living in rural areas[28], renewable energy technologies are good options for energy access. The World Bank's report on expanding energy access in India focuses on decentralized, renewable energy systems as the key to improving service.[29]

Some of the renewable energy technologies that are particularly appropriate for off-grid rural areas include[30]:

- **Small hydropower**. Pico, micro, and small-scale hydropower can provide electricity for lighting and other small electric needs, and communications, through radios, TV, and cell phones. Micro hydropower can provide electricity to small grid systems for small industry and agricultural water pumping.

- **Solar and wind power.** Village scale mini-grids with solar/wind hybrid systems and solar home systems can provide electricity for lighting and other small electric needs, and communications through radios, TV, and cell phones. Solar cookers can provide clean cooking. Solar crop dryers and solar water heaters can provide heating and cooling for crop drying, agricultural processing, and hot water. Mechanical wind or solar photovoltaic pumps can replace diesel generators for water pumping.

- **Biomass.** Biogas from household scale digester and small-scale biomass gasifiers can provide for lighting and small electric needs. Gasifiers, direct combustion and large biodigesters can feed small electricity grid systems to fuel small industry or pump water for drinking or agriculture. Biogas digesters can also help with heating, cooking, heating water, and commercial stoves and agricultural processing.

26 Renewable Energy Policy Network for the 21st Century (REN21), Renewables 2010 Global Status Report. Paris: REN21 Secretariat, 2010. http://www.ren21.net/REN21Activities/Publications/GlobalStatusReport/GSR2010/tabid/5824/Default.aspx
27 International Solar Energy Society, "White Paper: Renewable Energy Future for the Developing World," 2005. http://whitepaper.ises.org/ISES-WP-600DV.pdf
28 Organization for Economic Cooperation and Development and International Energy Agency. "Energy Poverty: How to make modern energy access universal?" September 2010. http://www.worldenergyoutlook.org/docs/weo2010/weo2010_poverty.pdf
29 The World Bank. "Empowering Rural India: Expanding Electricity Access by Mobilizing Local Resources - Analysis of Models for Improving Rural Electricity Services in India through Distributed Generation and Supply of Renewable Energy." 2010. http://online.wsj.com/public/resources/documents/WorldBankreport0215.pdf
30 Renewable Energy Policy Network for the 21st Century (REN21), Renewables 2010 Global Status Report. Paris: REN21 Secretariat, 2010. http://www.ren21.net/REN21Activities/Publications/GlobalStatusReport/GSR2010/tabid/5824/Default.aspx

- **Energy efficiency.** Improved cooking stoves (fuel wood, crop wastes) with efficiencies above 25 percent can supply residential cooking needs, while improved heating stoves can provide hot water and support agricultural processing.

Decentralized, renewable energy is not a stopgap measure in these cases, but is providing the basic necessities of modern life, providing electricity services and replacing traditional fuels such as firewood and dung and dirtier technologies such as diesel generators in homes, schools, hospitals, agriculture, and small industry. Tens of millions of rural households are now estimated to be served by renewable energy.[31]

The cost of decentralized, renewable energy decreases in comparison to conventional, grid powered electricity the farther away from the grid the electricity is used (See Figures 1 and 2. Cost Comparison of Various Sources of Electricity and Cost Comparison of Electricity at Distance from Grid). Even at a distance of 5 kilometers from the grid to a village, the cost of generation from micro and mini hydro systems are more or less the same as the costs per kilowatt hour from coal-fired grid based power plants. At a distance of 12 kilometers between the grid and the village, the cost of generating from wind-solar hybrid systems are on par with that of coal. Stand alone solar photovoltaic systems cost the same to generate 1 kilowatt hour of electricity as coal at a distance of 18 kilometers from the grid to a village.

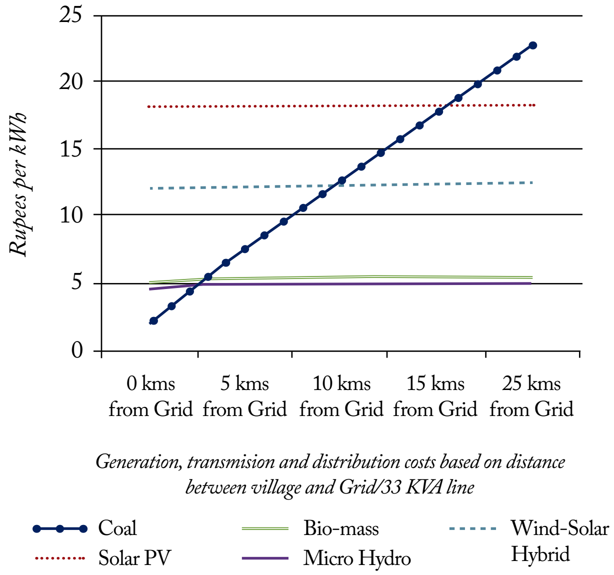
Figure 1. Cost Comparison of Various Sources of Electricity[32]

Source of Fuel	Generation Cost per kWh (Rs.)	Transmission Infrastructure Cost Per Km for a load of 100 kW	Other Maintenance costs/ distribution infrastructure etc (per kWh)	Total Cost of Generation per kWh per Km	Total Cost of Generation per kWh at a 5 Km distance from Grid/33KVA line	Total Cost of Generation per kWh at a 10 Km distance from Grid/33KVA	Total Cost of Generation per kWh at a 15 Km distance from Grid/33KVA	Life of the Unit
Coal	Rs. 2.00	Rs. 1/-	Rs. 0.50	Rs. 3.50	Rs. 7.50	Rs. 12.50	Rs. 17.50	30 years
Micro Hydro	Rs. 4.50	Nil	Rs. 0.30	Rs. 4.80	Rs. 4.80	Rs. 4.80	Rs. 4.80	25 years
Bio-mass	Rs. 5/-	Nil	Rs. 0.50	Rs. 5.50	Rs. 5.50	Rs. 5.50	Rs. 5.50	15 years
Wind-Solar Hybrid	Rs. 12/-	Nil	Rs. 0.30	Rs. 12.30	Rs. 12.30	Rs. 12.30	Rs. 12.30	25 years
Solar PV	Rs. 18/-	Nil	Rs. 0.20	Rs. 18.20	Rs. 18.20	Rs. 18.20	Rs. 18.20	25 years

31 Ibid.

32 The cost table has been arrived at based on a) The cost of laying transmission infrastructure from the grid to the village based on per kilometer (km) and per kilowatt hour (kWh) transmission costs, which has factored in the capital costs, the life of the transmission lines, etc. b) The maintenance cost based on certain costs obtained from various utilities for a normal expenditure pattern. The basic figures for this graph were taken from the following studies. We have further filed various applications using the "right to information tool" to different electricity utilities to confirm the transmission infrastructure capital and maintenance costs and other cost information. These costs have taken into account very conservative plant load and efficiency factors for all renewable energy based systems and the lowest current costs for coal-based generation. Sources: M.R. Nouni, S.C. Mullick, T.C. Kandpal (2009), Providing electricity access to remote areas in India: Niche areas for decentralized electricity supply, Renewable Energy, Volume 34, Issue 2, February 2009, Pages 430-434; James Cust, Anoop Singh and Karsten Neuhoff (2007). "Rural Electrification in India: Economic and Institutional aspects of Renewables." December 2007. http://www.eprg.group.cam.ac.uk/wp-content/uploads/2008/11/eprg0730.pdf and Hansen, Chris and Bower, John, (2004), An Economic Evaluation of Small-scale Distributed Electricity Generation Technologies, Others, EconWPA.

Figure 2. Cost Comparison of Electricity at Distance from Grid



Given the strong linkage of energy to livelihoods in rural areas, and the costs associated with the use of conventional energy, even the higher cost of some of the renewable options make economic sense. While solar photovoltaic systems are currently relatively expensive and rely on government support for promotion, it is important to consider that coal-fired power plants have been and continue to be heavily subsidized, and the actual cost of generation from coal-fired power plants is more than is shown in the figure and graphs above. Similarly, if the externalities of coal are included in the pricing, the actual cost of coal is much higher than what is shown in the graph. Even without these additional considerations, solar photovoltaic is cost competitive for coal-fired generation for villages beyond 18 kilometers from the grid.

In Pakistan, small power houses of 50 to 500 kilowatt capacity are of great significance for towns in the remote hilly regions of this developing country, where it is not easy or economical to extend the National Electricity Grid, but where sizable streams or rivulets provide hydroelectric potential of up to 1 megawatt at each site. These so-called "mini-hydel" plants have capital costs that are 3 to 5 times higher than large hydro-electric power stations per kilowatt hour, but because of the relatively lower costs of transmission lines, the cost of electricity from these plants is not necessarily higher.[33]

At larger scales, the cost of power-generation from solar electricity can be lower, ranging from US$ 0.12 - 0.20 per kilowatt hour, in some cases making it competitive compared to fossil fuel.[34] The cost per unit (kilowatt hour) of wind-electricity has also come down from 16.9 cents per kilowatt hour to 6.15 cents per kilowatt hour during the period 1981 to 1995.[35] By 2003, the cost had dropped to 4.5 to 5.5 cents per kilowatt hour at sites with good wind speeds, while sites with low wind speeds ranged from 6.8 to 9.1 cents per kilowatt hour.[36]

The competitive costs of renewables are further highlighted by a comparison to the cost of kerosene when used for lighting. Kerosene puts out poor light and significant pollution, but it is heavily relied upon in rural communities that currently have no other options. The world's poor currently pay almost US$40 billion for kerosene and other fuel-based lighting; when comparing the amount of light created for the money spent on kerosene against the money spent for conventional electric lighting, a person relying on kerosene for light spends 10,000 times more than a person in an industrialized country spends for the same output of light.[37]

A number of development programs are focused on upgrading lighting from kerosene. For example, a U.S. Agency for International Development program is developing off-grid renewable energy systems to replace kerosene lighting:

> *"In the Philippines, USAID is developing off-grid renewable energy systems in 160 remote rural communities in the Autonomous Region in Muslim Mindanao, through the Alliance for Mindanao Off-Grid Renewable Energy (AMORE). Through solar power battery charging stations and individual batteries for households and public facilities, residents are now saving 70 percent each month of what they used to spend on kerosene for light. Residents have increased opportunities for productive activities such as mat weaving, sewing, extension of 'daylight' hours for study time and household work."*[38]

Energy Efficiency

In areas that already have some electricity generation capacity, energy efficiency measures – and particularly end use efficiency - are often the most cost effective way to expand access to energy services. A mix of end use energy efficiency and smaller generating capacity is also a cost effective option for those areas that currently lack access to energy.

The cost of energy efficiency measures, when compared to the cost of

33 Quarashi, M. M. and Engr. Tajammul Hussain, "Renewable Energy Technologies for Developing Countries: Now and to 2023," Islamic Educational, Scientific and Cultural Organization, 2005. www.isesco.org.ma/english/publications/Renewable%20Energy%20Technologies/Renewable.pdf
34 Ibid.
35 Ibid.
36 European Wind Energy Association, "Wind Power Economics," http://www.ewea.org/fileadmin/ewea_documents/documents/press_releases/factsheet_economy2.pdf
37 Lisa Friedman. "Bringing Clean Light to Poor Nations and Moving Beyond Charity." ClimateWire, October 20, 2010. http://www.nytimes.com/cwire/2010/10/20/20climatewire-bringing-clean-light-to-poor-nations-and-mov-88428.html
38 US Agency for International Development. "Renewable Energy for Sustainable Rural Economic Development," http://www.usaid.gov/our_work/economic_growth_and_trade/energy/publications/projects/global_winrock.pdf

adding additional generating capacity, can be staggeringly low. The benefits of higher energy efficiency are achievable with an investment of US$90 billion annually over the next 12 years—only about half of what these economies would otherwise need to spend on their energy supply infrastructure to keep pace with higher consumption.[39] The World Bank's Independent Evaluation Group recommends energy efficiency as the most important and cost effective strategy for the World Bank in expanding and improving energy service delivery for the poor and facilitating a transition to cleaner energy systems.[40]

The cost effectiveness of energy efficiency and the cost competitiveness of decentralized renewable energy described above does not even account for the avoided costs of fossil fuels on the environment and public health. If these costs were properly accounted for, the cost effectiveness of energy efficiency and renewables would be even greater.

Box 1. Clean Energy Access and Job Creation

Increasing the use of clean energy and energy efficiency for access can promote job growth. Investments in clean energy create high-tech and high-skilled jobs and can also provide opportunities for young people, women, slum dwellers and members of poor rural communities.[41] For example, in Bangladesh, Grameen Shakti has installed more than 100,000 solar home systems in rural communities in a few years and is aiming for 1 million by 2015, along with the creation of some 100,000 jobs for local youth and women as solar technicians and repair and maintenance specialists.[42]

The development of renewable energy technologies creates more jobs per average megawatt of power generated and per dollar invested in construction, manufacturing, and installation when compared to coal or natural gas.[43] In the United States, relative to spending on fossil fuels, clean-energy investments create 2.6 times more jobs for people with college degrees or above, 3 times more jobs for people with some college, and 3.6 times more jobs for people with high school degrees or less. [44]

Energy end-use efficiency investments create three to four times the number of jobs created by comparable energy supply investments, i.e. coal-fired and nuclear power plants.[45] Investments in improved energy efficiency in buildings are projected to generate an additional 2 to 3.5 million green jobs in Europe and the United States alone. The potential is much higher in developing countries.[46]

In China, an estimated one million people work in the renewable energy sector, with China being a dominant force in solar hot water and small hydropower development and an emerging leader in solar photovoltaics and wind turbine manufacturing.[47] In India, Suzlon is one of the world's leading wind manufacturers, employing 13,000 people directly, including 10,000 in India, and the remainder in China, Belgium, and the United States.[48] Kenya is also emerging as a leader in solar energy, with 10 major solar photovoltaic import companies, and an estimated 1,000 to 2,000 solar technicians.[49]

39 Farrell, Diana and Jaana Remes. "Promoting Energy Efficiency in the Developing World," McKinsey Quarterly, 2009. www.mckinseyquarterly.com/Promoting_energy_efficiency_in_the_developing_world_2295

40 World Bank Independent Evaluation Group. "Climate Change and the World Bank Group, Phase I: An Evaluation of World Bank Win-Win Energy Policy Reforms," 2008. http://siteresources.worldbank.org/EXTCLICHA/Resources/Climate_ESweb.pdf

41 Worldwatch Institute and Cornell University Global Labor Institute, "Green Jobs: Towards Decent Work in a Sustainable, Low-carbon World," United Nations Environmental Programme, International Labor Organization and the International Trade Union Confederation, Green Jobs Initiative, 2008. www.unep.org/labour_environment/features/greenjobs.asp

42 Environmental and Energy Study Institute, "Jobs from Renewable Energy and Energy Efficiency," 2008. www.eesi.org/files/green_jobs_factsheet_102208.pdf

43 Daniel Kammen, Kamal Kapadia, and Matthias Fripp, "Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?" UC Berkeley: Renewable and Appropriate Energy Laboratory (RAEL), 2004, updated January 2006. www.rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf

44 Robert Pollin, James Heintz, Heidi Garrett-Peltier for Center for American Progress, "Clean Energy Investment Creates Jobs in Every State" (2009), www.americanprogress.org/issues/2009/06/clean_energy_factsheets.html

45 Meera Ghani-Eneland, "Low carbon Jobs for Europe: Current Opportunities and Future Prospects," World Wide Fund for Nature, 2009. http://assets.panda.org/downloads/low_carbon_jobs_final.pdf

46 Daniel Kammen, Kamal Kapadia, and Matthias Fripp, "Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?" UC Berkeley: Renewable and Appropriate Energy Laboratory (RAEL), 2004, updated January 2006. www.rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf

47 Worldwatch Institute. Jobs in Renewable Energy Expanding. Accessed online May 2011. http://www.worldwatch.org/node/5821

48 Ibid.

49 Arne Jacobson and Daniel M. Kammen, "Engineering, Institutions, and the Public Interest: Evaluating Product Quality in the Kenyan Solar Photovoltaics Industry," Energy Policy, vol. 35 (2007), pp. 2960-68; Arne Jacobson, "Research for Results: Interdisciplinary Research on Solar Electrification in Kenya," University of California at Berkeley, Renewable and Appropriate Energy Laboratory, undated, at http://iis-db.stanford.edu/evnts/3920/Jacobson_6nov.pdf as cited in Worldwatch Institute. Jobs in Renewable Energy Expanding. Accessed online May 2011. http://www.worldwatch.org/node/5821

International Efforts and Commitments to Expand Energy Access

An international effort is currently emerging around access to sustainable energy. The United Nations Secretary General Ban Ki-Moon recently said that, "2012 will be the International Year for Sustainable Energy for All."[50] The Secretary General's Advisory Group on Energy and Climate Change (AGECC), which was convened in 2009, issued a report that recommends targets to achieve universal access to modern energy sources and a 40 percent increase in energy efficiency by 2030.[51]

Reliable electricity services are a key driver behind economic development and raising standards of living. In many developing countries, the growth of installed electricity generation capacity has not been able to keep pace with an ever-growing demand, leading to supply shortages, which affect all sectors of the economy.

A number of developing countries have existing targets to increase energy access. According to the UN Development Program (UNDP) and the World Health Organization (WHO)[52], 68 developing countries have electricity targets, 16 countries have targets for modern fuels, 11 have targets for improved cook stoves, and 5 countries have targets for mechanical power. A number of countries also offer free basic electricity allocations. In the Philippines, each electricity connection is allowed 10 kilowatt hours per month free; Zambia allows 300 kilowatt hours per month; and South Africa allows 50 kilowatt hours per month.[53] Often, national policies and initiatives have originated with or gained momentum from community and regional organizing and campaigns for increased access to energy.

South Africa

With urban electrification rates at 80 percent and rural electrification rates at 50 to 60 percent, South Africa has significantly higher electrification rates than other countries in sub-Saharan Africa. But there are still approximately 2.5 million rural and urban households that are not connected to the electricity grid.[54]

Increased access to energy is important for issues of gender equality.

The government of South Africa acknowledges "the critical role electricity plays in improving the quality and potential of life for poor South Africans."[55] The South African constitution provides explicit rights to equality of electricity services through Section 9 – the state must ensure that electricity provision is equal and equitable.[56]

Additionally, the constitution implies the right to energy by ensuring citizens the right of access to adequate housing – section 26(1).[57] In a landmark socioeconomic case, Government of the Republic of South Africa v Grootboom (2000), the Constitutional Court declared that a state's obligation to provide adequate housing depends on the context, which can include "potable water, adequate sanitary facilities and domestic energy supply."[58]

In 2000, the South African government announced a policy to provide basic services of water, sanitation and energy to poor households.[59] Based on this policy, in 2003 the government started implementing the Free Basic Electricity (FBE) policy. The rationale was to provide 'electricity for all' with a limited amount of free electricity (50 kilowatt hours per household per month) to poor households.[60]

50 UN Industrial Development Organization. "Secretary-General Ban Ki-moon : 2012 will be International Year for Sustainable Energy for All." January 18, 2011. http://www.unido.org/index.php?id=7881&tx_ttnews[tt_news]=850&cHash=f160cd2d5384f734eb5b44efae2ee2a9

51 UN Advisory Group on Energy and Climate Change. "Energy for a Sustainable Future: The Secretary-General's Advisory Group on Energy and Climate Change (AGECC) Summary Report and Recommendations," New York: April 28 2010. http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGECC%20summary%20report%5B1%5D.pdf

52 UN Development Programme and World Health Organization. "The Energy Access Situation in Developing Countries - A Review on the Least Developed Countries and Sub-Saharan Africa," New York, 2009. http://content.undp.org/go/cms-service/stream/asset/?asset_id=2205620

53 Morgan Bazilian and Patrick Nussbaumer. "UNIDO Contribution to the 4th UN Conference on LDCs Energy Services," http://www.unohrlls.org/UserFiles/File/UNIDO%20Contribution%20on%20LDC%20IV%20Energy%20Services.pdf

54 Jackie Dugard, "Power to the People? A rights-based analysis of South Africa's electricity services." Electric Capitalism: Recolonising Africa on the Power Grid. David A. McDonald, ed. South Africa: 2008. http://www.hsrcpress.ac.za/downloadpdf.php?pdffile=files%2FPDF%2F2243%2F10_electric_capitalism.pdf&downloadfilename=Electric%20Capitalism%20-%2010%20Power%20to%20the%20people%3F%20A%20rights-based%20analysis%20of%20South%20Africa%27s%20electricity%20services

55 Ibid.

56 Ibid.

57 Ibid.

58 Government of the Republic of South Africa v Grootboom (2000). http://www.saflii.org/za/cases/ZACC/2000/19.html

59 Ferrial Adam. Free Basic Electricity: A Better Life for All. Earthlife Africa Johannesburg. February, 2010. http://www.earthlife.org.za/wordpress/wp-content/uploads/2010/03/Free-Basic-Electricity-Final-Low-res.pdf

60 Ibid.

Despite this policy, there are two immediate problems hindering access to electricity. First, electricity in South Africa is distributed by the state-owned utility company Eskom or municipal businesses. Eskom's distribution of electricity is mostly to poor black townships, while municipalities distribute to primarily white areas, continuing the apartheid-era tradition of segregated service distribution systems. Eskom is known to practice cost recovery principles including tariffs, disconnections and unequal customer services.[61] This practice stands in opposition of Section 9 of the Constitution - the right of equal and equitable treatment.

Second, the 50 kilowatt hours of free electricity allotted by FBE is under dispute. Earthlife Africa, Johannesburg, conducted a study and concluded that 50 kilowatt hours per household per month is an inadequate amount to sustain livelihoods even for the poorest households.[62] Only 1 pre-paid meter, which actually has to be purchased and charges a higher rate per unit, is installed per house, even if it holds a large number of electricity users.[63] In some cases, the free electricity would only last for a week, and the rest of the month would be resigned to darkness.[64]

Some have called for resolution of this inequality; the Group for Environmental Monitoring (GEM) and University of Pretoria recommend a flat-rate system, "which would allow poor consumers to use an unlimited amount of electricity for a fixed monthly fee [of about R 50 or USD 7]."[65] Others are demanding a universal rights-based framework that enables every citizen their share of electricity regardless of their financial situation or any other difference.

Nepal

Access to energy is a major issue in Nepal: approximately 70 percent of rural Nepal is not connected to the electricity grid. In 2003, the Nepal Electricity Authority (NEA) created a bylaw to encourage rural electrification through private investment and community management. According to the statistics provided by the NEA, electricity has been introduced to 176,000 Nepali households in large part because of the Community Electricity Distribution Bylaw 2060.[66]

The creation of this bylaw was inspired by one community's determination to bring electricity to its town. In the absence of a national policy to expand electricity, residents of south Lalitpur came together to form an electricity community in 1993. They contacted the Minister for Water Resources and proposed to bear 50 percent of the required costs in order to supply electricity to their town.[67] Their plan laid the foundation of the bylaws and the NEA created the Community Rural Electrification Department (CRED) to focus on community-based electrification. Now, NEA has increased its funding from 50 to 80 percent in rural electrification initiatives.[68]

Fundamental to the bylaw is the establishment of a Distributing Institution[69] that applies for electricity from the NEA to redistribute to local households.[70] After approval, the NEA leases or rents the electricity lines to the Distributing Institution (unless the community already has the resources and expertise to supply its own lines). A bulk meter is installed at the distributing organization to show the cumulative usage of individual meters installed within the community at the bulk rate of Nepali Rupees (NR) 3.60 per unit (USD 0.05). The rate charged by the Distribution Institution to local homes cannot exceed the national rate – NR. 6.70 (USD 0.09) – for up to 50 units. The lowest recorded amount paid by households is NRs. 80 for 20 units (USD 1.10).[71]

According to the bylaw, 10 percent of monthly sales from the Distributing Institution are to be held aside for a repair and maintenance fund, and the NEA or the Authority is to establish and maintain a Community and Rural Electrification Fund for extension of distribution lines and other logistics.

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61 Jackie Dugard, "Power to the People? A rights-based analysis of South Africa's electricity services." Electric Capitalism: Recolonising Africa on the Power Grid. David A. McDonald, ed. South Africa: 2008. http://www.hsrcpress.ac.za/downloadpdf.php?pdffile=files%2FPDF%2F2243%2F10_electric_capitalism.pdf&downloadfilename=Electric%20Capitalism%20-%2010%20Power%20to%20the%20people%3F%20A%20rights-based%20analysis%20of%20South%20Africa%27s%20electricity%20services

62 Ferrial Adam. Free Basic Electricity: A Better Life for All. Earthlife Africa Johannesburg. February, 2010. http://www.earthlife.org.za/wordpress/wp-content/uploads/2010/03/Free-Basic-Electricity-Final-Low-res.pdf

63 All poor households connected to the national electricity grid qualify for this free allocation of energy. For customers not connected to the grid, an allocation of up to 80 percent subsidy of the monthly service is to be provided.

64 Jackie Dugard, "Power to the People? A rights-based analysis of South Africa's electricity services." Electric Capitalism: Recolonising Africa on the Power Grid. David A. McDonald, ed. South Africa: 2008. http://www.hsrcpress.ac.za/downloadpdf.php?pdffile=files%2FPDF%2F2243%2F10_electric_capitalism.pdf&downloadfilename=Electric%20Capitalism%20-%2010%20Power%20to%20the%20people%3F%20A%20rights-based%20analysis%20of%20South%20Africa%27s%20electricity%20services
Ferrial Adam. Free Basic Electricity: A Better Life for All. Earthlife Africa Johannesburg. February, 2010. http://www.earthlife.org.za/wordpress/wp-content/uploads/2010/03/Free-Basic-Electricity-Final-Low-res.pdf

65 Daniel Malzbender. Domestic Electricity Provision in the Democratic South Africa. Nordic Africa Institute's Conflicting Forms of Citizenship Programme, September 2005. http://www.acwr.co.za/pdf_files/01.pdf

66 Aditya Batra, "When Villages Plug in." Down to Earth. May 15, 2010. http://www.downtoearth.org.in/node/129

67 Ibid.

68 Household installation of electricity is also cheaper when communities get involved - $100 instead of $300.

69 According to the bylaw, "the office of the Distributing Institution shall have to be located in the place accessible to the concerned distributing area." Based on Mr. Batra's article, formation of the Distributing Institution is not limited to a district but any group, company, association, committee, cooperative or user association can form a Distributing Institution.

70 The application process includes providing documents such as constitution of the organization, list of homes to receive electricity, identification of Chairperson of the Executive Committee and application fee of NRs. 100 (app. USD 1.38). NRs stands for Nepali Rupees – Nepali currency.

71 Aditya Batra, "When Villages Plug in." Down to Earth. May 15, 2010. http://www.downtoearth.org.in/node/129

Following the initial success of this initiative, there is a strong push to define a strong, clear policy on rural electrification. The CRED wants to function as an independent entity working alongside NEA and directly responsible to the government, while creating a separate central fund to attract foreign aid for rural electrification. Another vehicle is the Bill on Electricity 2065 (2009) "which streamlines licensing procedures, prioritizes domestic energy needs over export-oriented projects, allows power trading by private entities and unbundles NEA"[72] and is currently under review by the Parliamentary Statutory Committee.[73]

Challenges for Clean Energy in Increasing Access: Lessons from India and Brazil

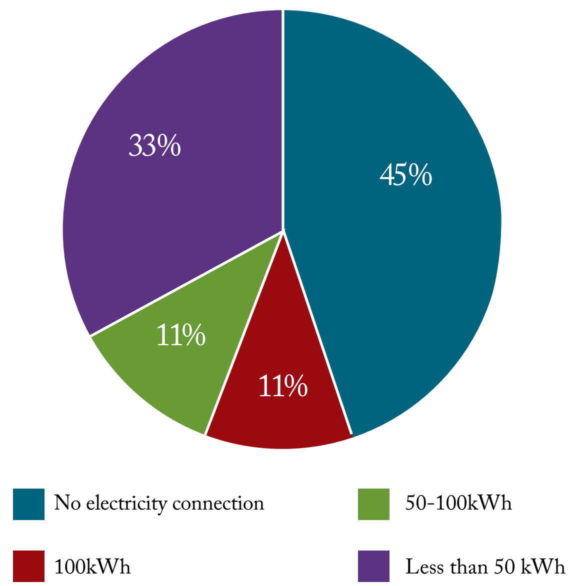
The emerging initiatives around increasing access to energy are heartening, but how this increase in energy access is implemented – and whether clean technologies are used – will be critical to confronting global environment and development challenges. An examination of previous efforts to expand access to energy shows some of the challenges to addressing increasing energy access in an effective, reliable and clean manner. In the case of India, much of the additional electricity generation capacity in recent years – largely through coal-fired power plants – has gone towards providing electricity to the rich and the urban sectors, rather than increasing access for the poor in rural areas. In Brazil, although the Luz para Todos (Light for All) program has been successful in increasing electrification rates, it has not taken full advantage of the benefits of renewable, decentralized energy. Moving forward, global actors should work to change the parameters of efforts to increase energy access to rely more heavily on clean energy, which often may be the less expensive option.

India: Expanded Conventional Power Not Increasing Electrification

In India, over 45 percent of the population currently has no access to electricity and close to 100,000 villages remain un-electrified (See Figure 3. Snapshot of Electricity Consumption in India). The majority of the 55 percent of the population who have access to electricity live in urban centers. The graph below gives an overview of the electricity consumption and access issues in India. While the figures vary from country to country, a similar trend exists in a number of developing countries, particularly in Asia and Africa.

There is a general perception in India that inequities in energy access exist due to a huge deficit in power generation and the overwhelming amount of time and resources involved in setting up new electricity generation plants. In fact, substantial additional electricity generation capacity has been added in the past few years. But this additional capacity has not led to a proportional access of energy to the poor, particularly the rural poor.

Figure 3. Snapshot of Electricity Consumption in India[74]



In 2002, the total installed capacity of coal-fired power plants in India was 74,429 megawatts.[75] The installed capacity of coal-fired power plants increased to 96,794 megawatts in 2009 with the construction of new plants.[76] In addition to the 22,365 megawatt increase in coal generation, an additional 10,000 megawatts[77] of large hydropower capacity was also added between 2002 and 2009. During the same time period, the percentage of un-electrified households came down only marginally from 52 percent in 2002 to 45 percent in 2009,[78] and only 20,000 of the over 120,000 un-electrified villages were electrified during that time.[79]

72 Ibid.
73 The Bill on Electricity 2065 will be tabled first and the CRED case may have to wait until the Bill on Electricity is passed.
74 Source: Narasimha Rao, Girish Sant, and Sudhir Chella Rajan, "An overview of Indian Energy Trends: Low Carbon Growth and Development Challenges." Prayas, Energy Group, Pune, India, September 2009. http://www.climateworks.org/download/?id=f21a4576-0cec-4ee3-bd3f-86d2acd578ce
75 Planning Commission, Government of India. "Sources of Electricity Supply 1985-2009."
76 Ibid.
77 Ibid.
78 Source: Rural Electrification Programme, Ministry of Power, Government of India
79 Ibid.

Figures 4. Major Thermal Power Plants in India

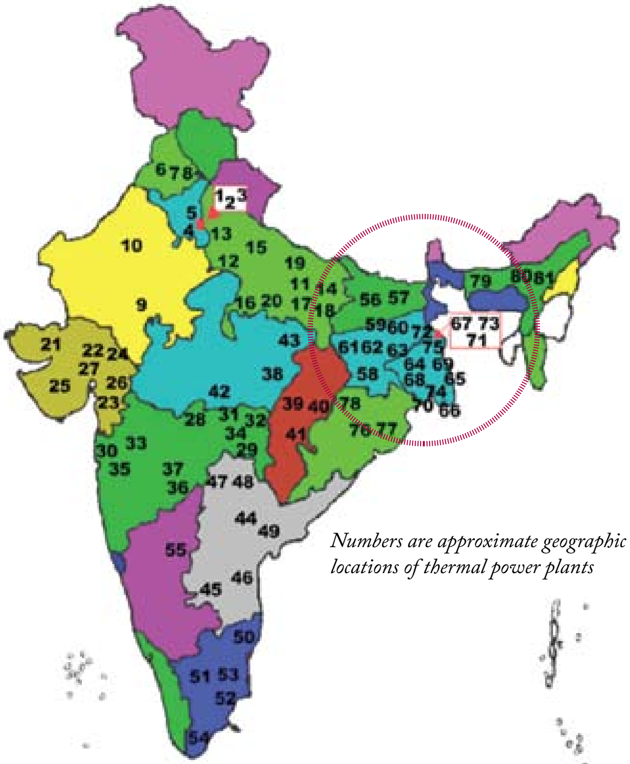
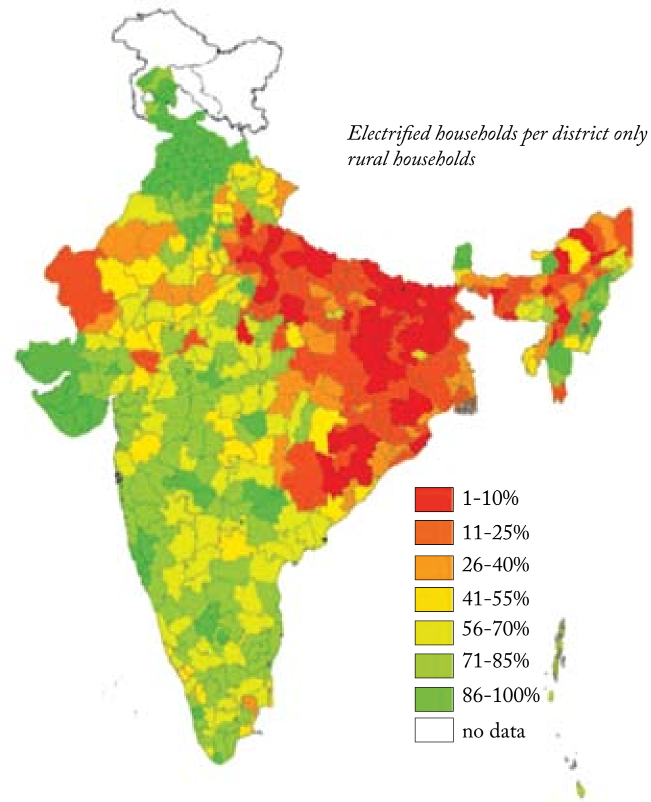


Figure 5. Household Electrification Rates in India

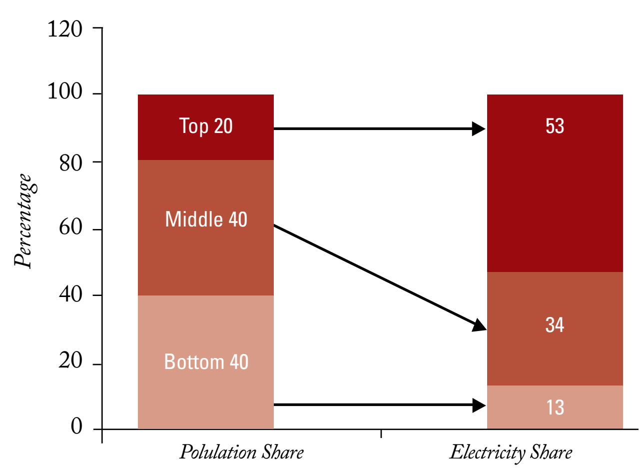


Further, of the 20,000 villages electrified in that period, 2000 villages were electrified through decentralized renewable energy systems, and of the 7 percent reduction in the number of un-electrified households in that period, renewable energy solutions contributed to 2 percent of those registered reductions in un-electrified households. So, the addition of over 33,000 megawatts of coal-fired power plants and large hydropower only electrified 18,000 villages and improved overall electrification by only 5 percent between 2002 and 2009.

The addition of electricity generation from conventional power plants, be it large hydropower or coal-fired power plants, has not sufficiently addressed the issue of electricity access for the rural poor. It is clear in comparing maps from India that show the locations of coal-fired power plants and the extent of household electrification that areas with a high concentration of coal-fired power plants have a very low level of household electrification (See Figures 4 and 5. Major Thermal Power Plants in India and Household Electrification Rates in India.) This vividly demonstrates how the conventional power supply model has failed India's rural poor.

The question therefore arises: Which sectors of society have benefited from the substantial increase in electricity generation in past years? Figure 6. Distribution of Electricity by Income Class shows that the bulk of the electricity generated goes to higher-income households, with the top 20 percent of households by income consuming 53 percent of the total electricity generated, and the lowest 40 percent of households by income consuming less than 13 percent of the total electricity generated.

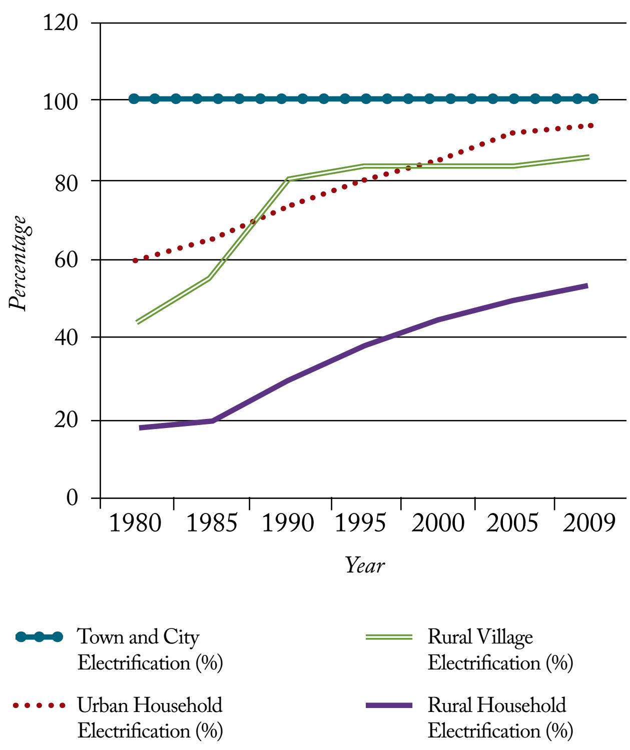
Figure 6. Distribution of Electricity by Income Class



A majority of the population without access to energy lives in rural areas, with agriculture, fisheries and animal husbandry being the most predominant occupations and source of livelihoods. The bulk of the food produced in developing countries comes from the rural areas. A majority of the rural population lives on subsistence living and hence leads a very simple but sustainable lifestyle. There is also a huge disparity in the lifestyle of a rural household as compared to an urban household. The income disparity between the urban communities and rural communities are increasing substantially, and therefore; the purchasing power of the urban communities has also increased proportionately. This has a bearing on the demand for electricity as well. The urban centers are also the showpiece of a country, and therefore; to ensure that the demands of the urban centers are fully met, rural areas are often compromised.

Figure 7. Electrification Rates in India show that the priority of the Government of India was to ensure electrification of urban centers followed by rural households and finally villages. While there was a clear increase in the pace of electrification in rural areas, the priority continued to be electrification for urban areas, with the urban centers growing rapidly. Meanwhile, the goal posts for rural electrification kept shifting backwards to ensure that the urban centers had enough electricity and energy.

Figure 7. Electrification Rates in India[80]



Yet another interesting observation is the quality of the electrical supply from conventional and gigawatt-sized power plants for so-called "electrified villages." The results of a survey conducted by Vasudha Foundation, in partnership with Christian Aid UK, examining the quality and quantity of electrical supply in some rural areas in India, are stark. Many of these villages, which now receive grid-connected electricity from conventional power, get access for just 2 to 6 hours[81] per day and often it is not even enough to light a single tube-light. Furthermore, the bulk of the electricity supply is during the nighttime.

Willingness to Pay: What do the poor actually pay for grid electricity?

The perception that the poor in rural communities pay less for electricity than their urban counterparts is generally misplaced. The rural poor are in fact often paying more for less energy than those in urban areas. Some of the key factors that need to be looked into in analyzing the subsidization of electricity in rural areas are 1) the quality and quantity of electricity supply in rural areas; 2) the actual consumption of electricity; and 3) the actual tariff that rural electricity users pay.

In a good majority of Indian villages, the average electricity supply ranges from 6 to 10 hours a day, at best, with a total consumption of not more than 1kilowatt hour per household per day,[82] even in the best conditions. Assuming that the best conditions prevail all year long, the average electricity consumption of a rural household in India ranges from a low of 10 kilowatt hours to a high of 50 kilowatt hours per month or an average of 30 kilowatt hours per month.

Many of the Indian villages do not have metered electricity supply and hence enjoy a flat rate per month, which is charged to every connected rural household. The average flat rate per month is roughly Rs. 60/- to Rs. 100/- per household. [83] Therefore, assuming an average consumption of 30 kilowatt hours per month and assuming a tariff of even Rs. 60/- per month, the tariff for 1 kilowatt hour of electricity consumption comes to Rs. 2/-. However, if the hours of supply and the number of days of non-supply of electricity are factored in, the actual tariff that a rural household pays can vary anywhere from Rs. 1.50 per kilowatt hour to as much as Rs. 3/- per kilowatt hour.

In contrast, most urban centers in India have electricity tariffs based on consumption patterns. For the first 50 kilowatt hours of consumption of electricity per month, the tariffs range from Rs. 0.75 to Rs. 2/-, depending on the state and the city.[84] The average tariff for all urban centers in India for the first 50 kilowatt hours of consumption works to Rs. 1.25/- per kilowatt hour. Given that most urban centers have electricity supply ranging from 12 to 24 hours and even assuming the minimum consumption of 50 kilowatt hours at Rs. 1.25, the consumer

80 Source: Ministry of Power, Government of India.

81 Srinivas Krishnaswamy, "Shifting of Goal Posts - A report card of Rural Electrification in India & a Recipe for Accelerated Progress." Vasudha Foundation, April 2010. http://vasudhafoundation.files.wordpress.com/2010/08/shifting-of-goal-posts-a-report-on-rural-electrification_by-srinivas-krishnaswamy_vasudha-foundation.pdf

82 Ibid.

83 Central Electricity Regulatory Commission, India. "Compilation of tariffs for electricity for rural and urban households in India," 2010.

84 Ibid.

pays under Rs. 65/- per month. Therefore, when factoring in availability of electricity service, the poor and particularly the rural poor actually end up paying more than the urban domestic consumers for the same amount of energy.

Affordability and willingness to pay also have a positive correlation when it comes to energy access. Further, there is a need for better articulation of what 'energy access' actually means for a rural household in a developing economy. For most rural households in developing countries, 'electricity supply' or 'electricity access' is generally restricted to 'lighting of light bulbs' and perhaps a bonus of 'running a radio or maybe charging a mobile.' It generally does not extend beyond this.

While lighting is an important requirement for rural households in developing countries, additional considerations may be increasing energy and adequate energy supply to meet heating requirements and importantly to provide energy for water pumping systems for water and irrigation. As has been pointed out earlier in this report, a good majority of the rural population depends on agriculture and animal husbandry in addition to fishing for their livelihood. This extra energy requirement needs to be both adequate and reliable.

For rural agrarian communities that can afford to pay, there is always an option to use diesel generators for pumping water for irrigation. The majority of rural communities that cannot afford to buy diesel are forced to resort to rain-fed agricultural practices, which means that, droughts and floods affect them the worst. In a number of drought-prone areas with electricity access, farmers are in deep debt, but they do not get enough electricity to run water pumping systems, despite the fact that their village is so-called electrified.

Policymakers in India tend to blame the "lack of willingness to pay for energy" as the reason for non-supply of electricity. To verify the veracity of this claim, Vasudha Foundation in partnership with Christian Aid, UK, commissioned "Synovate" to conduct a field survey in rural India on "ability and willingness to pay for energy services". This survey is being conducted in 8 states of India, covering a total of 240 villages, and roughly 2000 households.

While the full details of the field research is trickling in, preliminary analysis of the survey's early results suggests the following:

a) People are more than willing to pay for energy if they are assured high quality and reliable energy supply;

b) People want energy supply to cater to lighting needs and also for water for irrigation and specifically for flour mills, tailoring, small drying equipment for agro products, and refrigeration, particularly for dairy communities and fishing communities.

c) While traditional practices of threshing of wheat and paddy is carried out as a ritual, people also want energy for mechanized threshing, as it would reduce time and ensure timely delivery to market, which means quicker income flow.

Figure 8. Energy Needs for Rural Communities shows the results of the survey of household energy needs for rural communities, including electricity for water pumping, electricity for lighting, electricity for flour mills and livelihood operations, and entertainment.

Discussions with rural women further identified rural energy needs. In addition to the household needs demonstrated above, rural women also included energy for cooking and electricity for pumping drinking water as energy needs. (See Figure 9. Energy Need Perception of Rural Women in India).

Figure 8. Energy Needs for Rural Communities

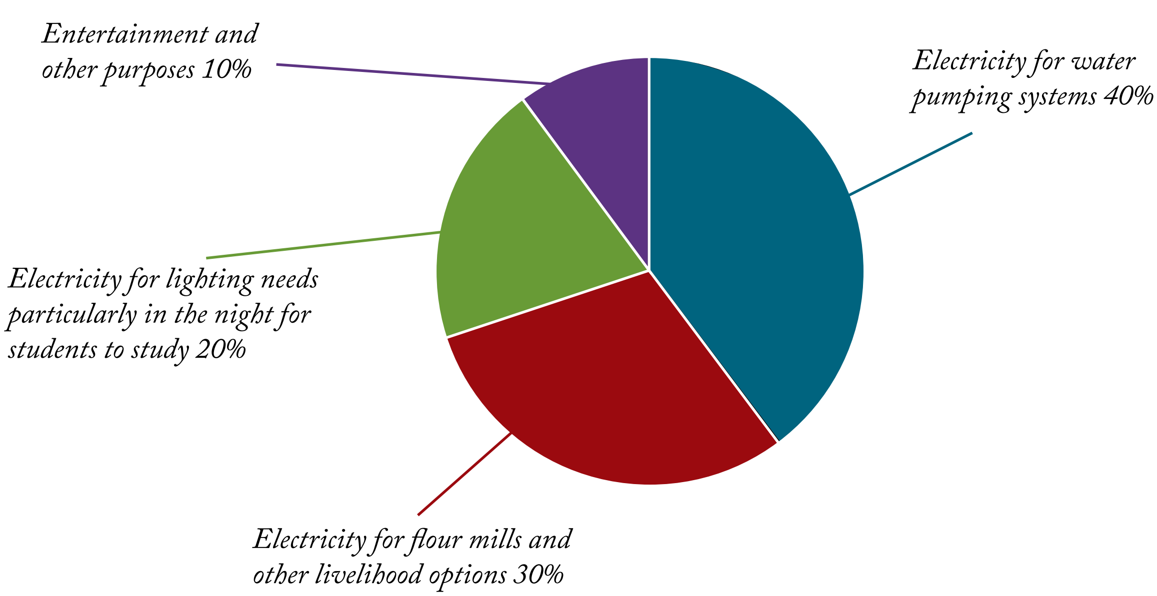


Figure 10. Willingness to Pay for Electricity by Household Income Level shows the amounts that households are willing to pay for energy services. The highest priority was placed on water for irrigation and drinking water.

Among the 800 households where the survey has been completed, not a single household refused to pay money for energy services. The bottom line for all was that they would be willing to pay as long as they got the right quality and quantity of supply.

As the information from India shows, rural populations are not being served by conventional energy sources. In spite of large increases in magawatts produced, electrification rates have not increased substantially in India. Areas of India with large energy production from coal plants continue to have low electrification rates, and areas that are connected to the grid have intermittent service. Surveys of rural poor show a high willingness to pay for reliable energy services.

It is evident that conventional gigawatt-scale power generation has not really delivered energy access, particularly in the case of rural India. This is also the case in other developing economies. So are there energy sources that have delivered energy access?

Many of the rural areas of India are in remote locations, with rough terrain, high altitudes and close proximity to dense forests. Therefore, to ensure that more of the rural population gains access to quality energy, kilowatt-scale power plants, which are renewable and decentralized, have worked best. The case study of a decentralized power plant in rural Rampura, India is testimony to this. (See Box 2. Effectiveness of Kilowatt-Scale Power: Case Study of Rampura, India).

Figure 9. Energy Need Perception of Rural Women in India

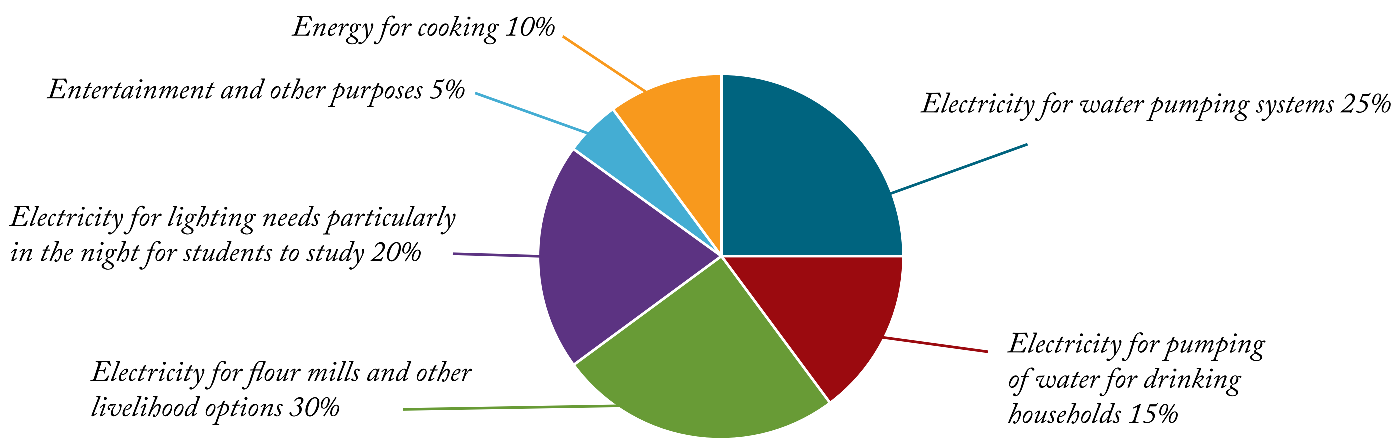


Figure 10. Willingness to Pay for Electricity by Household Income Level

	Electricity for pumping of water for drinking in households and irrigation	**Electricity for flour mills and other livelihood options**	**Electricity for lighting needs for study purposes**	**Entertainment and other purposes**	**Energy for cooking**
Annual Income of Rs. 10,000/-	Rs. 200/-	Rs. 25/-	Rs. 50/-	Rs. 20/-	Rs. 30/-
Annual Income of Rs. 25,000/-	Rs. 300/-	Rs. 40/-	Rs. 50/-	Rs. 50/-	Rs. 50/-
Annual Income of Rs. 40,000/-	Rs. 500/-	Rs. 40/-	Rs. 75/-	Rs. 50/-	Rs. 100/-
Annual Income of Rs. 50,000/-	Rs. 600/-	Rs. 50/-	Rs. 100/-	Rs. 75/-	Rs. 150/-

Box 2. Effectiveness of Kilowatt-Scale Power: Case Study of Rampura, India

Rampura is a village with a population of around 350 on the outskirts of Jhansi in Uttar Pradesh. As late as 2008 – 61 years after India's independence – this village was amongst the un-electrified villages in Jhansi district, Uttar Pradesh, until a Norway-based company Scatec Solar decided to set up an 8.7 kilowatt power plant in Rampura. Assisted by Development Alternatives, an NGO working locally, the community in this village was mobilized to take charge of perhaps India's first community-managed solar power plant. As a result, since January 26, 2009, this village has not been without power for a single day. The plant distributes power through a micro grid, approximately 0.75 to 1 km in length. An electronics company, DD Solar 23 India Pvt. Ltd (which works under the banner of the Bergen Group) has provided the technical knowhow for this project.

There are 60 solar panels in the plant, each one producing 145 watts of power. A battery bank consisting of 24 cells of two volts each provides the power back up for 4 to 5 cloudy or rainy days, when there is no sun.

Now, as the sun goes down and nearby villages plunge into darkness owing to erratic power supply, Rampura's street lights get switched on through a separate power switch at a local powerhouse, only to be switched off at 4 o'clock in the morning. Moreover, every home in this village has an energy conserving compact fluorescent bulb.

"While Rampura is always lit up at night, we in Mathanpura continue to harp over the fact that our village, which is connected through the grid and is regularly plagued by 10-to -15-day-long power cuts, either because of damaged transmission wires or lately because of the transformer getting burnt, all this despite the fact that we stay just 15 kilometers away from the neighborhood town of Jhansi."

Shivam Yadav, the class 9 educated supervisor at the GPL
Construction company is a resident of the neighboring Mathanpura Village

Rampura village has 69 houses, of which 44 have solar power connections. A private initiative for the generation and distribution of solar power, this venture is unique because it is totally managed by the community. The village has set up a 16-member Village Electrification Committee (VEC), named 'Rampura Urja Vikas Samiti,' which maintains the billing documents and receipts.

"All members of VEC serve their responsibilities and contribute their time in an honorary and voluntary capacity. We meet every month to discuss the problems being faced by consumers and address complaints and requests. On a day-to-day basis, we supervise the management, operation and security of the equipment and solar panels at the solar power station. We have also set up a system to penalize the offenders: We disconnect the connections of those who delay payments beyond a month and then charge Rs. 200 for reconnecting the same."

Ghanshyam Singh Yadav, President of the Village Electrification Committee

"I was always interested in this project and now I am fortunate to have been entrusted with the responsibility of looking after this power plant since February 2010. I got this job after successfully completing the one-month induction period under the solar company's technical representative at this power plant who was posted here for the first year of this project."

Balwan Singh Yadav, 25-year-old full-time Solar Power Plant operator, is a high school graduate and resident of Rampura village and has been employed by the VEC as a full-time solar power plant operator.

The solar power plant is the pride of Rampura and the envy of neighboring villages of Mathanpura and Pehelguan, all three of which come under a common panchayat, or village council. All these villages are located in the drought-prone Bundelkhand region of Uttar Pradesh, which is plagued by poverty and illiteracy. Agriculture is the main occupation of the villagers but since implementation of solar electrification, a small flour mill has also been set up, which has provided employment to a few people, thereby accelerating economic activity of the village.

"Solar power is a blessing as we can now also study at night time. Now most children in our village attend the refurbished primary school built on the panchayat land adjacent to the solar power station. The computer training centre set up adjacent to the school building is a primary attraction and draws kids like me to school every day as none of the students want to miss it…and though the school teaches in Hindi medium, our computer teacher (paid for by Bergen) gives English classes for students.

Shanno, 10 year old girl Class 4 student at the village's primary school

"Now, we have access to light from the street lights… we don't cook food amidst mosquitoes that a kerosene lamp used to attract. The street lights have also prevented anti-social elements and robbers from entering into the village, thus making the villagers, specifically the women feel safe. Additionally, the village also has improved sanitation facilities as most people are now building toilets at home – people are visually embarrassed to defecate in the open at night due to the street lights being on."

Birmati on how solar-powered street lighting has changed life of women in Rampura village

"Access to solar power has given women like us the opportunity to watch a few television soaps and added recreation after long tiring days doing housework and tilling the fields. Under the Self Help Group Scheme, started for women, the women have been depositing Rs. 50 every month into an account. We hope this money will come in handy to our families in times of need."

Shanti, Kailashi Devi and Ramvati are amongst the many women who are also members of a Self Help Group that was initiated in the village after the commencement of the Solar Power Plant.

Encouraged by the success of Solar Power Plant, the VEC has now remodeled itself into a Village Development Committee (VDC).

"We supervise tree plantation, groundnut crop plantations and spraying of pesticides and fertilizers in the field. The village committees in partnership with the local NGO have also initiated discussions with organizations like NABARD to finance a Biomass Gasifier project for the village to meet its energy needs for irrigation purposes in times to come, the fuel for which will come from the large cattle population being reared by the villagers."

Thakur Das Yadav, head of the Village Development Committee

Brazil: As Electrification Reaches More Remote Areas, Conventional Energy for Access Not Necessarily Least Cost Option

A decade ago two million rural Brazilian families, or roughly 12 million people, had no access to electricity. The 2000 National Census by Brazil's National Institute of Geography and Statistics (IBGE) also found that 90 percent of these families earned less than US$252[85] a month and 80 percent of them were located in rural areas.

In 2003, the Government of Brazil (GOB) launched the program Luz Para Todos (LPT) or "Light for All" to subsidize universal access to electricity by:

- Extending and establishing connections to the national electrical grid.
- Establishing a small number of off-grid distributed energy pilot systems, including photovoltaic solar and wind power systems; and hybrid systems of solar, wind and diesel.

The program was implemented in 2004, extended in 2008, and again in 2010. By May 2009, electrical services were being provided to 10 million people through 2 million new connections to the national electrical grid. A total of 883,000 km of new electric cable had been strung over 4.6 million new poles to bring transmission lines and power switches to rural communities.[86]

Considered a success by the government, the program was extended in 2010 to 2011, to add 310,000 new households, and is expected to be extended until 2014 to add an additional 495,000 households. In total, the objective of this phase of the program is to bring energy services to approximately 810,000 new households in the remotest areas of the country, including the greater Amazon rainforest in Brazilian territory.[87]

To pay for the program, Brazil established three funds: The Energy Development Fund (Conta de Desenvolvimento de Energia, CDE); the Global Reversion Reserve (Reserva Global de Reversao, RGR), and the Fuel Consumption Fund (Conta de Consumo de Combustivel, CCC) into which tax revenues are designated. These funds provide the subsidies for both implementation and operation of the program, and to offset the costs of individual electrical consumption in the most remote regions.
Overall, LPT was estimated to cost R$20 billion, of which R$14.3 was to be provided by the federal government. The rest was to be funded by state governments (R$2.3 billion) and by power companies (R$3.4 billion). By 2010, the government had R$13.5 billion in contracts, funded by the CDE and RGR. State governments had spent R$2.081 billion and power companies, R$3.164 billion.[88]

The second phase of LPT, extended in March 2010 to end in 2014, foresees a total investment of R$5.5 billion, and the government is likely to extend the RGR, set to expire in 2010 and which has R$7 billion available, to cover the next phase.[89]

Program costs per installed electrical connection rose over time as more distant areas were connected to the grid. The average cost per connection in 2004 was R$4,300. By 2010, connection costs had risen to between R$7,000 to R$9,000 per connection.[90]

Luz Para Todos (LPT) can be defined as one model for developing countries to provide energy access to rural poor communities and has met specific development goals for improving health, increasing educational opportunity, and enhancing economic activity and jobs for millions of low-income Brazilians. The program is also attracting attention from other developing countries, including India, China, Angola, Bolivia, Columbia and Kenya, which engaged in consultations, asked for methodology, and examined the program.[91]

However, because the program relies primarily on extending the electrical grid, using a business-as-usual model, Luz Para Todos should not be advanced as a model for environmentally sustainable, clean energy access and services for the poor. While development goals have been met, the program is neither an environmental victory for Brazil nor a model that balances environment and development to achieve sustainability.

Clean, renewable energy alternatives, which are implemented through Luz Para Todos, benefit very few people. Since its inception in 2004, small renewable energy pilot programs have been implemented benefiting less than 5,000 people. By the end of the program, no more than 60,000 people—of the millions to receive electrical services for the first time—will be recipients of renewable or hybrid energy systems.[92]

When the Program began in 2004, the opportunity and seeming willingness to maximize renewable resources existed.[93] Yet despite this apparent enthusiasm, Brazilian planners from the Ministry of Mines

85 The Census found that 90 percent of Brazilians without energy access also earned less than three minimum wage salaries a month. The Brazilian minimum wage in March 2000 was R$151 or roughly US$84 a month. Three minimum wages was R$453, or US$252, using the 2000 exchange rate of R$1.8 to US$1.

86 Ministry of Mines and Energy (MME), "*Light for All: A Historic Landmark, 10 million Brazilians out of darkness*," April 7, 2010.

87 Ibid.

88 Palito, R., "The Rising Challenge of Universalization (O Aumento o desafio da universilizacao)," Energy Today (Energia Hoje), January 1, 2011, translated from Portuguese.

89 Ibid.

90 Interview on March 1, 2011 with Paulo Goncalves Cerqueira, Regional Coordinator, Light for All Program, Secretary of Electric Energy, Ministry of Mines and Energy.

91 Ibid and Ministry of Mines and Energy (MME), "Light for All: A Historic Landmark, 10 million Brazilians out of darkness," April 7, 2010.

92 Ibid.

93 A. Ghandour, Sustainable Rural Energy Development in Brazil, Presented at the 2004 DOE Solar Energy Technologies Program Review Meeting, October 25-28, 2004, Denver, Colorado.

and Energy have not produced a national plan to identify and expand renewable energy sources feeding the national grid or encouraging large-scale deployment of distributed renewable energy systems in the LPT program.

In 2009, the Brazilian government announced that it would offset the cost of implementing more distributed renewable systems in remote communities. And Helio Shinoda, a program director of the Ministry of Mines and Energy, said in an article by the United Nations Development Programme (UNDP): "The goal is to make the power concessionaires lose their fear of having to work with new energy sources."

The report continued: "Alternative energy sources can help small communities far from the grid have power for much less than it might cost to extend the grid, especially in areas such as the Amazon, Sinoda believes. Shinoda admits that Luz para Todos' work in the Amazon so far "leaves much to be desired." If the Program can encourage large-scale investment in alternative energy sources, it can be judged a total success."[94]

Brazilian authorities also argue that Luz Para Todos is a low-carbon energy universalization model because the majority of the nation's electricity is supplied by large hydroelectric power plants that have lower greenhouse gas emissions than national electrical generation, which is reliant on fossil fuel sources.

For comparison, hydropower was the leading source of energy for Brazilian power generation, accounting for 85 percent of the national total in 2007. In 2007, coal accounted for 49 percent of the U.S. energy source for power generation. Petroleum-based liquid fuels and natural gas, together accounted for 63 percent of Mexico's total electricity generation in 2007.[95]

Since 2007, however, Brazil has been working toward diversification of its energy sources for electrical generation to create less dependence on hydropower in order to avoid blackouts during droughts. Currently, national installed electrical generation capacity is 71.07 percent hydroelectric; 11.4 percent gas; 6.95 percent biomass; 6.2 percent petroleum; 1.77 percent nuclear; 1.71 percent coal; 0.82 percent wind power and less than 0.01 percent solar.[96]

In 2010, the Brazilian government extended LPT to provide an additional 310,000 households with electricity by 2011. The Second National Accelerated Growth Program (Programa de Crescimento Acelerado, PAC2) also foresees a R$5.5 billion investment to electrify 495,000 additional households by 2014.

This final phase of the Program is an opportunity for Brazil to more actively plan and implement distributed renewable energy models, mini-grids, and other low carbon energy access options, such as replacing diesel with biodiesel, not only in the Amazon rainforest, but also in remote communities in other northeastern Brazilian states, such as Bahia, Maranhão and Piauí.

Financing for Clean Energy Access: The Role of the World Bank

A number of perceived barriers exist to increasing the use of renewable energy and energy efficiency measures for access, including perception of costs, existing policy frameworks, and financing. As an influential development bank, the World Bank could play a catalyzing role in financing for clean energy and energy access, but to do so, the Bank would need to significantly change its energy lending practices.

There is often an assumption that clean energy sources will automatically be more expensive than conventional energy. As can be seen above, this is often not the case, particularly for rural areas away from the electricity grid. Nor is it the case oftentimes for energy efficiency measures that could reduce the need for energy generation. Additionally, the true costs of using conventional energy, including the additional costs to public health, the environment, and development, are generally not incorporated into pricing of energy options. Accounting for the true lifecycle costs of energy options would begin to level the playing field for clean energy.

There may also be a perception that somehow decentralized renewable power generation is not a permanent solution to increasing energy access. However, as is shown in the Rampura case study, decentralized mini grid and off grid systems can be even more reliable than electricity connections to the central grid.

Further, existing national and international policies and frameworks often favor fossil fuels and large, centralized energy systems. National electricity policies have often been created around centralized electricity grids, and therefore favor this type of electricity input. These policies can also create barriers for renewable energy inputs. National and international policies often subsidize conventional energy use – by creating artificially low prices for coal power or gasoline. The low-

94 Sousa, D. Light for "All will pay for renewable energy, (Luz para Todos bancará energia renovável)," Brasília, February 27, 2009, at UM Development Programme Brazil website: http://www.pnud.org.br/energia/reportagens/index.php?id01=3157&lay=ene. Translated from Portuguese.

95 U.S. Energy Information Administration (EIA), International Energy Outlook 2010, Electricity, 2010. http://www.eia.doe.gov/oiaf/ieo/electricity.html

96 Brazilian Ministry of Mines and Energy, "Monitoring of the Brazilian Electrical System," January 2011 (Monitoramento do Sistema Elétrico Brasileiro, Boletim de Janeiro/2011). http://www.mme.gov.br/see/galerias/arquivos/Publicacoes/Boletim_mensalDMSE/Boletim_de_Monitoramento_do_Sistema_Elxtrico_-_JANEIRO-2011.pdf

interest financing to fossil fuel energy from the World Bank, regional development banks, and bilateral lending agencies also act as subsidies for conventional energy – counteracting any efforts to finance clean alternatives.

An additional barrier faced by clean energy sources and the expansion of energy access is that these sources often face a lack of financing, particularly to address the upfront costs associated with efficiency and renewable energy sources.

The multilateral development banks could play a significant role in funding the transition to a healthier energy future – both in terms of increased energy access and a transition to clean energy. As an influential development institution, the World Bank in particular could play an important role in an energy transition, but only if it truly embraces a set of policies and metrics for closing the gap in financing clean energy options and increasing energy access.

Although the World Bank Group does not lend large amounts of money in comparison to global investments in the energy sector, its financing is often a signal to other investors. Further, the World Bank's energy lending – about US$13 billion in FY2010 – is significant in relation to the US$36 billion a year in additional investment that the International Energy Agency predicts will be necessary to achieve universal energy access by 2030.

As such, the World Bank Group is well-placed to address issues of energy access and support clean energy, but its current energy lending portfolio remains heavily biased towards conventional fossil fuels instead of on energy access, renewable energy, and energy efficiency. The World Bank Group has maintained that continued funding of fossil fuels is necessary as a way of increasing energy access for the poor.

However, the World Bank's own Independent Evaluation Group suggests:
To meet power demands, the WBG's scarce human and financial resources will be best spent helping clients find domestically preferable alternatives to coal power, such as through increased energy efficiency. Coal support should be a last resort used only when lower cost and concessionally financed alternatives have been exhausted and when there is a compelling case that WBG support would reduce poverty or emissions.[97]

The Independent Evaluation Group also makes clear that energy efficiency is a particular area where the World Bank could be of particular assistance in promoting clean energy economies.

The World Bank Group is currently revising its Energy Strategy, which serves as a guide for the institution's energy investments, and the two pillars of the Bank's new energy strategy are set to be energy access and low carbon growth. While these pillars orient the Bank in the right direction, a strong Energy Strategy document will need to include clear policies and metrics that will lead the institution to shift its portfolio towards clean energy and energy access projects.

Metrics for Energy Access

A particular interest of this report is to identify renewable energy and energy efficiency projects and evaluate their ability to provide energy access. In evaluating projects for energy access at international financial institutions, analysis was focused on whether projects increase energy access at the level of basic human needs and productive uses. Because the provision of electricity services and increased reliability of electricity services are clear ways of demonstrating increased access to energy, these are included as indicators, along with the increased provision of energy services, which could be provided through the provision of cook stoves or modern fuels for heating.

The following indicators are used by the study to evaluate projects in terms of whether they address energy access for the poor:

1. The project focuses on a targeted number of new electricity connections or energy services, such as clean cook stoves, to low-income households.

2. The project focuses on electricity for services important to the poor, such as health clinics, schools, or telecommunications.

3. The project focuses on improving the reliability of electricity services in an area that largely serves low-income households and/or electricity services important to the poor and currently has intermittent or unreliable access.

4. The project focuses on provisions to make energy affordable for the poor – e.g., effective, transparent safety nets to ensure that poor people can afford energy for basic needs, such as subsidies targeted at access, not consumption (as opposed to only having measures aimed at cost recovery – such as tariff increases).

5. The project is focused on productive uses in energy poor communities, such as looking at energy provision to smallholder farmers, small and medium enterprises and labor-intensive industries.

6. The project involves power grid extension to new peri-urban or rural areas (as opposed to simply feeding into the existing grid system).

7. The project involves rural, off-grid solutions for providing energy services.

97 Independent Evaluation Group for the World Bank, IFC and MIGA. "Phase II: The Challenge of Low-Carbon Development Climate Change and the World Bank Group." Washington DC: The World Bank Group, 2010. http://www.worldbank.org/ieg/climatechangeII/index.html

While indicators 1) and 2) include the most basic energy services, the improvement of reliability to low-income households and communities (indicator 3), provisions for making energy affordable (indicator 4), and energy for small-scale productive uses (indicator 5) are also important in achieving a base level of energy access for all. Indicators 6) and 7) do not reflect energy access per se, but these indicators provide a proxy for initiatives that are likely to improve access when looking at projects.

Assessment of World Bank Energy Access projects[98]

In recent years, the World Bank has touted its increased support for renewable energy and energy efficiency, and more recently, energy access projects.

In the fall of 2010, the World Bank Group released a list of projects from 2003 to 2010[99] that it describes as energy access. The following findings are based on an assessment of the projects in this list for FY2009 and FY2010. In addition, the current assessment draws from and builds upon an earlier report by Oil Change International: "World Bank Group Energy Sector Financing: Access for the Poor?" published in October 2010.

The assessment looked at projects to determine 1) whether the projects in fact meet a set of criteria for energy access; and 2) what proportion of the World Bank's energy access projects are clean energy.

Of the projects the World Bank categorized as energy access projects for FY2009 and FY2010, the assessment found US$1.94 billion in energy access projects (compared with the US$3.2 billion the Bank claims). Only 9 percent of the World Bank Group's energy portfolio in FY 2009 and 2010 targeted increasing energy access for the world's poorest.

According to the World Bank Group,[100] the Bank's overall energy portfolio was US$8.33 billion in FY2009 and US$13.02 billion in FY2010, for a total of US$21.35 billion over the two-year period. The Bank's list of energy access projects for FY 2009 and 2010 included 59 projects totaling US$3.2 billion in lending.

This analysis found that only 51 of the 59 projects listed by the Bank qualified as targeting energy access based on the metrics outlined above. These 51 projects totaled only US$1.94 billion in Bank financing, meaning that 40 percent of the financing labeled energy access by the World Bank Group in the FY 2009 and 2010 did not meet the metrics for energy access. Of the total energy lending by the World Bank in FY2009 and FY2010, only 9 percent targeted energy access for the poor.

Of the 51 World Bank projects targeted to increased access for the poor, the analysis found that 76 percent utilized clean energy in the form of new renewable energy or energy efficiency. Not a single World Bank greenfield, or previously undeveloped, fossil fuel project targeted energy access for the poor.

Overall, our assessment found a high overlap between World Bank lending for new renewable energy[101] and energy efficiency projects and projects that provide access to energy for the world's poor. Of the World Bank's projects deemed by the assessment to qualify as energy access projects, a large majority (76 percent by number of projects) were new renewable energy- and energy efficiency-based projects. However, not a single World Bank greenfield fossil fuel or large hydropower project targeted energy access for the poor. (See the Discussion of Energy Access projects for further information on the evaluation of projects.)

With less than one tenth of the energy portfolio targeting access and only 30 percent of its energy portfolio funding new renewables and energy efficiency, the Bank is not in fact prioritizing energy access and clean energy in its lending at the moment.

According to the World Bank's data, new renewables and energy efficiency totaled US$6.58 billion for FY2009 and FY2010, or about 31 percent of lending. With only 9 percent of lending targeting energy access, and most of that overlapping with the new renewables and energy efficiency, the small fraction of World Bank energy lending going for energy access and clean energy do not suggest the focus on these issues that the Bank has claimed.

Discussion of Energy Access Projects

Of 51 projects the analysis found to target energy access, 22 projects utilized new renewable energy technologies, 17 utilized energy efficiency measures, 4 involved existing large hydropower plants, 1 involved gas connections to replace firewood/coal, 2 involved existing thermal power generation[102], and 1 involved payments to an existing oil supply contract to avoid power disruptions. In addition, there were a number of access projects that were related to policies or capacity building and/or the energy fuel source was not yet determined.

It was not always possible to determine the specific intended end use

98 The assessment of World Bank Group energy access projects was conducted and this section of the report was written by Heike Mainhardt-Gibbs for Oil Change International.

100 World Bank, 2010. Excel spreadsheet: World Bank Group Energy Access Projects, FY03-FY10. Energy Anchor Database, World Bank. September 22, 2010 (unpublished).

101 All renewable energy sources excluding large hydropower (hydropower projects greater than 10 megawatts).

102 These two project loans actually go to one individual physical project, involving increasing thermal power generation and heat output at an existing combined heat and power plant–the fossil fuel source was not specified in project documents. It should also be noted that there are energy efficiency-based projects that involve fossil fuel-based generation.

of the projects. However, of the 51 qualified-energy access projects, the following was specified in project documents:

- 22 projects involved new electricity connections or energy services to low-income households;
- 6 projects involved grid extension or rural/mini grid development to connect poor areas;
- 16 projects involved energy for institutions important to the poor (e.g., health clinics and schools) and delivery of basic services (e.g., heat, public lighting, and water) to poor communities;
- 1 project involved financing of connection fees to make electricity more affordable for the poor;
- 7 projects involved energy for SMEs, agro-processing, or other productive activities; and
- 4 projects involved improved cooking stoves (biogas).

In addition:

- 12 projects were over US$50 million and of these 6 were over US$100 million. The large-scale projects (greater than US$100 million) with energy access benefits for the poor are listed in Annex 2.
- 33 projects were IDA funded, 7 projects were IBRD funded, 1 project was IFC funded, 5 projects involved GEF funding, 1 project was carbon finance, 2 were recipient executed activities (donor funds), and 2 were special financing (West Bank and Gaza - IBRD TF).

The assessment found **8 of the 59 projects reviewed as questionable** in terms of meeting energy access criteria. Although this represents only 14 percent of the number of projects, these 8 projects totaled **US$1.28 billion or 40 percent** of total Bank finance categorized as energy access projects by the Bank. The questionable projects include 2 fossil fuel-based projects (See Box 3. World Bank Fossil Fuel Projects: Is it Energy Access for the Poor?), 1 large hydropower/regional trade project, 4 development policy loans (DPL), and 1 carbon finance project[103] (See Annex 1).

The assessment found the Bank's classification of these projects as energy access as questionable. It is recognized that each project has the potential to benefit the poor, but the project documents did not indicate any specific provisions to ensure any energy access-benefits reach the poor. In general, for these projects, the Bank's approach tended to be too indirect in nature, based on unsubstantiated assumptions that any increased electricity generation or transmission feeding into the existing grid translates into access for the poor (See Box 4. Regional Power Trading Systems: Energy Access for the Poor?). Such an approach is vulnerable to perpetuating an energy scenario consisting of access only for the well off and industry (not necessarily labor intensive), – potentially leaving the poor yet again out of the equation. Although these projects may still be addressing energy needs that are important, the point stands that the increased energy generation does not necessarily result in access for the poor.

103 The original project, which involves energy efficiency and a payment system for the poor, would be considered an energy access project. However, it did not seem that the carbon finance aspect should be credited with energy access as it do not appear needed to make the project bankable.

Box 3. World Bank Fossil Fuel Projects: Energy Access for the Poor?

The World Bank Group (2010a) classifies two fossil fuel projects in FY2009 as energy access projects. However, whether energy services will actually reach the poor is questionable in both projects as described below.

IDA-financed & -guaranteed Nigeria Electricity and Gas Improvement Project. The Bank qualifies this as an access project because the project "allowed gas to continue to flow to critical power generation facilities." According to project documents, the project involves a US$400 million IDA Partial Risk Guarantee (PRG). It is believed that the PRG will ensure a regular and sufficient supply of gas, which in turn will increase power generation from existing public sector power plants because the PRG will "back-stop the payment obligations of the public power utility under proposed Gas Supply and Aggregation Agreements with oil companies." In addition, US$180 million of IDA-finance will partially go to "reinforce distribution networks to increase electricity supply in selected cities." It is unclear from the project information whether increased generation from urban-based existing power plants will provide access or increased reliability of energy services to the poor.

Moreover, the Bank project documents point out that "[g]iven the low access rates and given that around 50 million people in the rural areas are living in darkness, it is critical that the Bank supports Government's efforts to expand rural electrification. Promoting use of renewable energy is equally important given the need to diversify energy resources and high costs associated with extending the grid to hitherto unconnected areas. These can be addressed in a future operation exclusively designed to address these issues…" This Bank statement seems to suggest that future operations, not the current gas project, will specifically target Nigeria's energy poverty issues.

IDA-financed Bangladesh Siddhirganj Peaking Power Project. The Bank qualifies this as an access project because the project "provided 300MW of natural gas-fired power to help close Bangladesh's nearly 2,000MW daily power shortage." According to project documents, the project involves construction of a simple-cycle gas turbine power plant at an existing power generation site to the southeast of Dhaka (the capital and largest city in Bangladesh). It will also finance a 60 km natural gas pipeline from Bakhrabad to Siddhirganj that will improve the reliability of gas supply to the Siddhirganj power plant, and an 11 km electricity transmission line so that power from the plant can be distributed to consumers.

Given there are no planned new connections to the Dhaka grid that the plant feeds into or a specified part of the city to be served, it is difficult to determine if any poor will benefit. The power generation could be to serve industrial demand in Dhaka or the new growth in middle class high-rise apartment buildings. Although these energy needs may be important, the point stands that the increased energy generation does not necessarily result in access for the poor. The current assessment rated this project as potentially providing access or increased reliability of energy services to the poor. The Bank-supported gas project would need to be monitored to determine actual benefits to the poor.

Box 4. Regional Power Trading Systems: Energy Access for the Poor?

One of the projects the World Bank classifies as energy access is the Southern Africa Power Market project, which involved a US$180.62 million loan. This is an important project to highlight because it is part of the World Bank's active assistance to the development of regional power transmission and trade networks, mainly in sub-Saharan Africa, northern Africa, Central Asia and South Asia.[104] The main idea behind the regional power networks is to set up energy trading systems that will move electricity to locations where it is "most needed". However, "most needed" in this context does not typically refer to the country with the largest population without access to energy. Rather, it often means the country with the largest industrial demand, including multi-national energy-intensive industries taking advantage of cheap energy rates. For example, in the case of the Southern Africa Power Pool (SAPP), which is the target for the project in question, 80 percent of SAPP demand will come from South Africa.

There is no indication that these large-scale, export-oriented projects aim to provide access to energy for poor households, many of which are located off-grid and would be better served by small-scale decentralized energy solutions. With export-oriented energy projects, new household connections typically only take place in city centers close to existing or planned large-scale electricity grids.

Moreover, these regional power trading systems are not being designed in an innovative manner to take advantage of potential new renewable energy projects, such as power line infrastructure near sites where potential wind or concentrated solar power would be located. Typically, these regional power trade networks are dependent on large-scale infrastructure and mega feed-in generation projects, mainly fossil fuel-based power or large hydropower. The export-oriented energy infrastructure system promoted by the Bank in these cases largely locks countries into mega fossil fuel generation and large hydropower projects for the next 20 to 50 years, while failing to address the energy needs of the large majority of the population in developing countries.

Given that this assessment found 40 percent of the Bank's energy access financing to be questionable, it highlights the need for the Bank to both clarify its definition/criteria for energy access and to do a better job at specifying and disclosing the expected energy outcomes that will benefit the poor. Moreover, it is essential that the Bank consistently monitors and reports back on actual project energy outcomes to ensure the poor are benefitting.

The World Bank Group would be able to better gauge its progress on energy access for the poor, if it required projects to clearly identify targeted consumers (direct beneficiaries) for energy projects. In some cases, this could potentially stimulate more direct benefits to the poor, such as having an energy project include additional provisions that provide energy services to the poor, aside from the planned industrial or existing grid-provided services.

104 Regional power trading pools include: Southern Africa Power Pool (SAPP), West Africa Power Pool, East Africa Power Pool, Nile Basin, and Central Asia South Asia (CASA).

Recommendations

Tackling the related problems of energy access and a transition to clean energy are not a small task. To advance towards goals of universal energy access and a truly clean energy global economy, all relevant actors, including governments, development banks, and those in the energy industry, will have to take steps to change policies, approaches, and actions. But, if implemented, these changes present a win-win scenario for all involved.

The World Bank and other development banks should play a role in supporting clean energy and energy access, including educating clients about the nature of renewable energy and energy efficiency opportunities and examining and explaining the real lifecycle costs of renewable and energy efficiency options as compared to conventional options. Banks can also help educate governments about the appropriate scale of technology and the policy incentives that would help promote clean energy for access and help build in-country capacity for renewable energy and energy efficiency.

Development banks could be of particular assistance in directly supporting clean energy access through grants or loans. Direct lending may be appropriate for larger scale projects, while microfinance has proven effective in rural electrification schemes, particularly in covering the upfront cost of renewable energy.

Our recommendations for the World Bank Group include:

- **The World Bank Group's energy lending should focus on increasing energy access for the poor through clean, decentralized energy sources.** As this report shows, clean, decentralized energy sources and energy efficiency are appropriate, affordable means for increasing access to energy. The World Bank should focus its energy lending on increasing clean energy sources – those sources without negative environmental, health, development, and social impacts – for the populations that currently lack electricity and lack access to modern energy.

- **The Bank should clarify its definition and criteria for 'energy access,' focusing on the world's poorest and increase its level of ambition with regards to funding energy access projects with the aim of reaching the poor.** The World Bank Group should make it clear that its priority is to provide access to energy services to the billions of people currently without access to electricity and modern fuels. Concurrently, the World Bank should do a better job at specifying and disclosing the expected outcomes from its energy projects that will directly benefit the poor. The World Bank should require projects to clearly identify targeted consumers (direct beneficiaries) for energy projects, including those engaged in or benefiting from productive uses, which would help to better gauge its progress on energy access for the poor, and should consistently monitor and report back on actual project energy outcomes to ensure the poor are benefitting.

- **The World Bank Group should stop lending for fossil fuels except in extreme cases where there is clearly no other viable option for increasing energy access to the poor.** As this report shows, the use of of fossil fuels, large hydropower and nuclear energy have negative impacts to the climate, the environment, and public health. The World Bank Group's energy lending should focus only on clean energy options such as energy efficiency and clean renewable energy, which can support increased energy access and do not have negative impacts to the climate, the environment and natural resources, or public health.

Annex 1. Energy Projects with Questionable/Potential Access Benefits for the Poor

Country	Institute	Project Name	Amount (in millions of US$)	Technology	Energy Outcomes
Bangladesh	IDA	Siddhirganj Peaking Power Project	239.2	Gas power generation and pipeline to supply existing grid	Potential poor benefits - Not clear poor population is connected to the existing grid. (see OCI October 2010 report for details)
Vietnam	IDA	VN-Renewable Energy Development Project	199.2	FI and DPL: re-financing facility for commercial loans for RE not exceeding 30 MW and capacity building/regulatory infrastructure for the government to manage an investment/development program for RE	increase supply of electricity to national grid
AFR Region (DRC)	IDA	3A- S. Afr Power Market -Add.Fin. APL1	180.62	large hydro power (Inga 1 & 2), transmission infrastructure, policy - regional power trading	Quantity of reliable electricity exports from DRC to the SAPP (about 80% of SAPP demand will be from South Africa); Quantity of reliable power supplied to the mining sector in Katanga.
Nigeria	IDA/ Guarantees	Electricity and Gas Improvement	600	Gas supplies and gas power generation	Potential poor benefits. Does not specify target consumers or any new connections. (see OCI October 2010 report for details).
Ghana	IDA	GH-EGPRC (fast-track)	25.5	general energy sector DPL	policy actions aimed at restoring the financial viability of the energy sector
Georgia	IDA	Supplemental Credit for PRSO IV	8	DPL - general energy sector (hours of service and collection rate)	Indirect or questionable benefits to the poor: improved reliability for paying customers only
Sierra Leone	IDA	SL-GRG 3 DPL (Governance Reform and Growth Grant - 3)	1.7	DPL – improved investment climate	Indirect- power to improve investment climate
Yemen	Carbon Finance	RY-Loss Reduction (CDM)	28	EE and increased thermal generation, policy (payment system for poor)	Carbon finance did not change original project and was not necessary for project finance

Annex 2. Energy Access Projects over US$100 million

Country	Institute	Project Name	Amount (in millions of US$)	Technology	Energy Outcomes
China	IBRD	CN-Eco-Farming	103.4	biogas	improving farm production and cooking in rural households
Mali	IDA	Mali Energy Support Project SIL (FY09)	120	transmission/distribution, EE, lighting	Increased electricity in urban and rural areas - households and community buildings
Vietnam	IDA	Rural Energy II-Additional Financing	200	improving and sustaining EE of local distribution utilities	Rural communities: 550,000 households will receive access to good quality, affordable electricity
Kenya	IDA	KE-Electricity SIL (2010)	318.5	geothermal	connect 300,000 new customers, including city slums and rural areas, and public facilities important to the poor
Bangladesh	IDA	Renewable Energy (Additional Financing)	130	RE	Increased rural electrification
Ethiopia	IDA	Additional Financing for Energy Access	177	RE and EE	access to power, new consumer connections, rural grid, evaluate geothermal possibilities