Banking on DE

International Financial Institutions and Cogeneration

March 2005

WORLD ALLIANCE FOR DECENTRALIZED ENERGY

Contents

Index of Abbreviations & Acronyms

ADB	Asian Development Bank
ASTAE	Asia Alternative Energy Unit
CCGT	Combined Cycle Gas Turbine
CDM	Clean Development Mechanism
CHP	Combined Heat and Power
DSM	Demand Side Management
DE	Decentralized Energy
EIA	Environmental Impact Assessment
ESMAP	Energy Sector Management Assistance Project
EU	European Union
GEF	Global Environment Facility
GHG	Greenhouse Gas(es)
IADB	Inter-American Development Bank
IBRD	International Bank for Reconstruction and Development
IDA	International Development Agency
IFC	International Finance Corporation
IFI	International Financial Institution
IPP	Independent Power Producer
JI	Joint Implementation
MDG	The Millennium Development Goals
MIGA	Multilateral Investment Guarantee Agency
NGO	Non-Governmental Organization
PCF	Prototype Carbon Fund
PPP	Purchasing Power Parity
T&D	Transmission and Distribution
UNFCCC	United Nations Framework Convention on Climate Change
WADE	World Alliance for Decentralized Energy
WBG	World Bank Group

About WADE

WADE is a non-profit research and advocacy organization that was established in June 2002 to accelerate the worldwide deployment of decentralized energy (DE) systems. WADE is now backed by national cogeneration and DE organizations, DE companies and providers, as well as a range of national governments. In total, WADE's direct and indirect membership support includes over 200 corporations around the world.

WADE believes that the wider use of DE is a key solution to bringing about the cost-effective modernization and development of the world's electricity systems. With inefficient central power systems holding a 93% share of the world's electricity generation, and with the DE share at only about 7%, WADE's overall mission is to bring about the doubling of this share to 14% by 2012. A more cost-effective, sustainable and robust electricity system will emerge as the share of DE increases.

To ensure that its goal can be achieved, WADE undertakes a growing range of research and other actions on behalf of its supporters and members:

- WADE carries out promotional activities and research to document all aspects of DE, including policy, regulatory, economic and environmental aspects in key countries and regions.
- WADE works to extend the international network of national DE and cogeneration organizations. Current WADE network members represent Europe, the USA, India, China and Brazil.
- WADE provides a forum for DE companies and organizations to convene and communicate.
- WADE jointly produces an industry journal: "Cogeneration and On-Site Power" (published by James and James in association with WADE).

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All efforts have been made to ensure that the data contained in this report is the best available at the time of publication. If you are aware of any omissions or errors in the data used to quantify IFI funding, please contact WADE and bring the error(s) or omission(s) to our attention.

Executive Summary

Decentralized Energy (DE), especially high efficiency cogeneration, holds great potential for advancing the development goals laid down by three major multilateral funding agencies: the World Bank Group (WBG), the Asian Development Bank (ADB), and the Inter-American Development Bank (IADB).

Cogeneration is increasingly recognised as a cost-effective option for reducing the costs of energy supply, improving efficiency and cutting emissions. Cogeneration, along with other forms of DE, can reduce the major capital commitment required for network investment in electricity systems dominated by remote central power plants. The International Energy Agency, among other institutions, has identified that more than half of investment required in global power systems is required for the network alone. DE can lighten this burden considerably, a major potential benefit for developing countries without abundant capital resources.

Though the international financial institutions (IFIs) have recognized that renewable energy and end-use energy efficiency offer promise for meeting their development objectives, the great potential of high efficiency on-site cogeneration (also known as combined heat and power) remains overlooked. Efficiency measures, in other words, have focused entirely on demand side efficiency at the expense of improving the efficiency of supply. In general IFIs have not been able to see the value of on-site power for cutting infrastructure costs (especially transmission and distribution networks), reducing retail prices and decreasing pollution.

Cogeneration accounts for over 90% of overall global DE electrical output and represents by far the greatest potential for worldwide DE development. For this reason, the World Alliance for Decentralized Energy (WADE) has undertaken detailed research in order to assess the commitment of the IFIs to cogeneration.

Although the activities of these institutions impart, in the broadest sense, a foundation for incorporation of cogeneration in their development projects, WADE has found that there is a general lack of explicit policy support for cogeneration among them. The lack of clear intent among the Banks to encourage the development of cogeneration projects is mirrored by the track record of their actual financing.

WADE recognizes that IFIs are not ideally organized in a manner best suited to develop cogeneration projects. By its nature, cogeneration does not fall into any of the typical departments of IFI institutions. In order for cogeneration projects to succeed, actors from diverse offices such as agriculture, environment, industry and energy must not only support one another but also directly cooperate to get projects up and running.

Research Goals

WADE's goals in this study were to assess:

1. IFI policy and commitment to cogeneration (a qualitative analysis), and;
2. The extent to which IFIs have been supportive of cogeneration by quantifying the financing for projects involving cogeneration in the banks' portfolios (a quantitative analysis).

Bank documents, including relevant project reports and project databases, have been searched extensively for evidence of initiatives including general renewable energy and energy efficiency as well as on-site cogeneration in particular. Total bank financing for renewable energy and energy efficiency has been estimated based on figures compiled directly from bank documents. To estimate overall financing for cogeneration projects, all projects identified with a cogeneration element have been assessed and the financing for those projects has been totalled.

Findings

For the qualitative analysis, WADE discovered little direct acknowledgement of the role that cogeneration can play in achieving development goals.

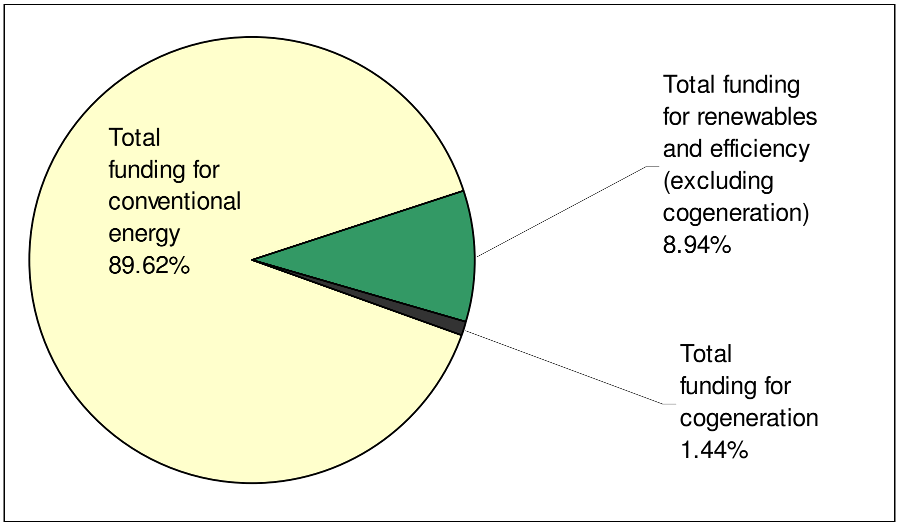
For the quantitative analysis, WADE has found that cogeneration is not a development priority for the WBG. WADE estimates that the WBG has allocated about $US 8.67 billion to renewable energy and energy efficiency projects since its inception (including large hydro). This translates into approximately 10% of its overall energy financing or 15% of the Bank's electricity portfolio. However, only about 1% of the Bank's energy portfolio has been allocated to projects with an element of cogeneration.

In the case of the ADB, although its total budget is much less than that of the WBG, energy efficiency and renewable energy projects seem to have been given a similarly low priority. Only about 2% of the Bank's energy portfolio appears to have been allocated to renewable energy and energy efficiency projects whereas an amount slightly more than half of this has involved cogeneration projects.

The IADB has allocated about 4% of its overall energy portfolio funds towards renewable energy and energy efficiency projects. A figure equal to slightly more than 2% of the total energy portfolio has been allocated to cogeneration. Cogeneration is similarly absent from the Bank's policy agenda.

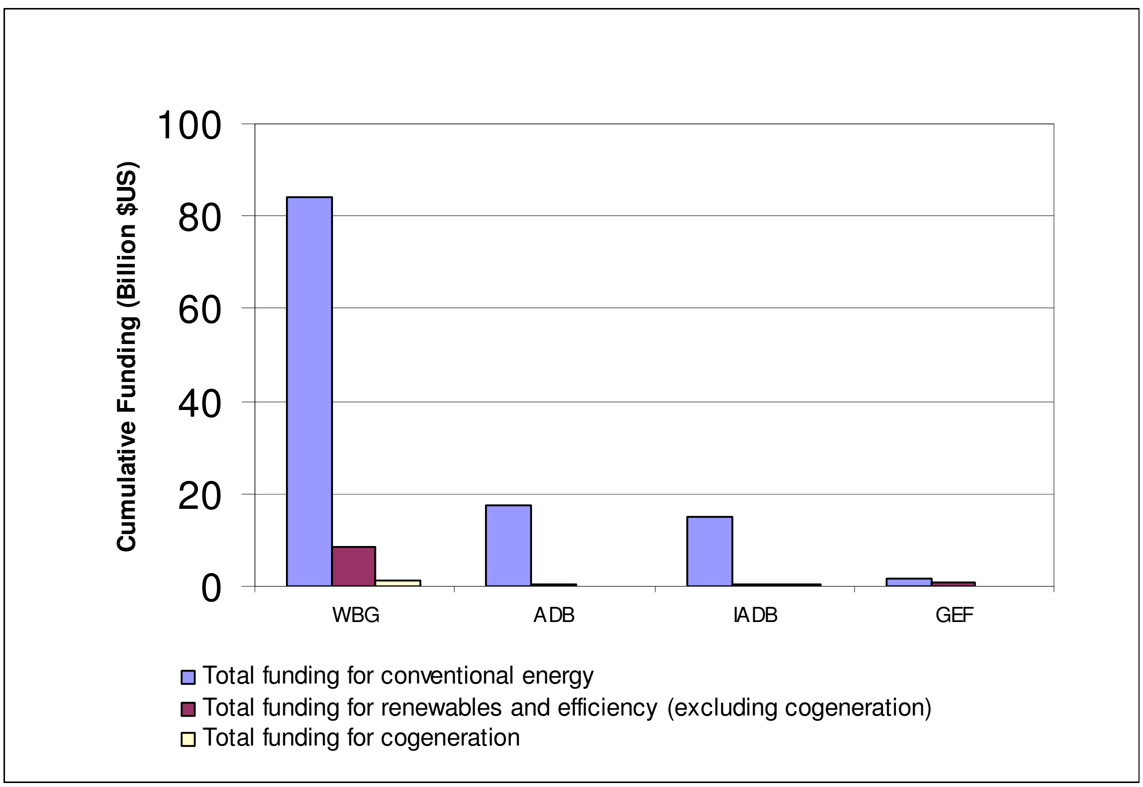
When their total financing (cumulative since the inception of the institutions) is combined, the three institutions examined have allocated about 9% of funding to renewable energy and energy efficiency projects, and only around 1% of the total energy portfolio has been allocated to cogeneration projects. Figure E1 shows the level of bank resources that have been apportioned to cogeneration compared to those resources apportioned to the whole energy portfolio. Figure E2 illustrates the support that each institution has provided to renewables and efficiency in general, as well as cogeneration, as compared to their overall energy spending.

Figure E1.
ENERGY PORTFOLIO RESOURCE ALLOCATION, WORLD BANK GROUP, ASIAN DEVELOPMENT BANK AND INTER-AMERICAN DEVELOPMENT BANK



SOURCE: WADE (SEE ANNEXES 2 AND 3)

Figure E2.
ENERGY PORTFOLIO RESOURCE ALLOCATION FOR THE WORLD BANK GROUP, ASIAN DEVELOPMENT BANK, INTER-AMERICAN DEVELOPMENT BANK AND GLOBAL ENVIRONMENT FACILITY



SOURCE: WADE (SEE ANNEXES 2 AND 3)

On the basis of this analysis, WADE believes that the level of support commitment shown by the IFIs for cogeneration is substantially below what is merited on the basis of the developmental benefits that it brings to client countries. Even though cogeneration is clearly beneficial to IFIs to help them meet their stated objectives, it has so far been under-utilised.

WADE Recommendations

Overall, WADE has found that there is as yet a fairly limited explicit recognition among the IFIs assessed as to the benefits of on-site cogeneration, from economic, energy efficiency and environmental stand-points. Addressing this challenge is a crucial starting point.

WADE also recommends that the financial institutions increase the share of total energy financing for sustainable energy (renewable energy, energy efficiency and cogeneration), and that they increase the proportion of cogeneration in their sustainable energy portfolios. Ambitious short term and long term targets should be set. These recommendations are based on the view that renewable energy, end use efficiency, and efficiency of supply (cogeneration) deserve equal priority in achieving development objectives.

Simply prescribing more funding, though important, is not sufficient to encourage better cogeneration endorsement of the IFIs. The IFIs have much work to improve internal capacity for dealing with cogeneration projects, especially improving inter-departmental communication and collaboration.

Finally, and of critical importance in the context of power sector reform, more work must be done to establish competitive energy market conditions that are conducive to cogeneration investment. WADE recommends that IFIs continue working with client countries to build open and competitive markets where cogeneration investors are assured fair and transparent conditions for grid access and power trading.

Introduction

It is of increasing importance that development projects in the energy sector, like all development projects, be economically, socially and environmentally sustainable. In other words projects must exploit resources in a way that allows the present generation to meet its needs without compromising the ability of future generations to meet their needs. Decentralized energy (DE) is one way to move us towards the combined objectives of electricity supply and environmental sustainability, yet it remains unclear how much support DE projects are receiving from major International Financial Institutions (IFIs). It appears that larger scale centralized projects have so far enjoyed more favour from almost all policy makers. However there is now rapidly growing recognition that the centralized model is no longer always the optimal energy pathway.

This report reviews the experience of three major multilateral investment agencies with regard to investing in decentralized grid-connected energy development, with particular attention paid to experience facilitating investment in cogeneration. It attempts to summarize activity to date and makes recommendations on how efforts could be focused and augmented to optimise the role of cogeneration and other DE in furthering future development objectives.

Decentralized Energy

DE technologies consist of the following forms of power generation systems that produce electricity at or close to the point of consumption:

- High efficiency cogeneration / combined heat and power (with which this report is primarily concerned).
- On-site renewable energy systems.
- Energy recycling systems, including the use of waste gases, waste heat and pressure drops to generate electricity on-site.

WADE classifies such systems as DE regardless of project size, fuel or technology, or whether the system is on-grid or off-grid.

Benefits of DE

In many situations, DE has several advantages over centralized generation including:

- DE is modular, which means that it can be quickly built in step with marginal demand growth.
- Building generation at the distribution level relieves grid congestion at the transmission level and generally reduces the need for transmission and distribution investments. In some circumstances modest investments in DE capacity can alleviate the need for large-scale transmission and distribution installations or upgrades (see Figures 1 and 2).
- DE can ease peak demand which allows grid managers to reduce reserve margins.
- DE offers the end user increased reliability and increased power quality.
- The efficiency of cogeneration gives it environmental benefits even when fossil fuels are used.
- Improvements in fuel conversion efficiency can decrease the energy intensity of economic production, and improve financial savings for plant managers.
- When cogeneration is employed, and suitable infrastructure, regulatory frameworks and market structures exist, a supplementary by-product, electricity or heat, can become available for sale.
- In many cases DE is the most cost effective method of making energy available to a community. Typical appraisals of costs for centralized plant do not consider overall cost of delivery and so significantly underestimate actual cost. Important factors such as T&D capital costs, transmission losses, electricity theft and routine operation at below nameplate capacity are all factors ignored in typical cost appraisals. Compared to a range of DE applications cogeneration installations between 100kW and 40MW capacity are the most cost effective DE applications.[1] If network costs are also included in cost assessments, even the most expensive forms of DE (such as PV) can offer attractive cost recovery.
- DE can provide entrepreneurs and utilities alike the ability to better meet customer needs because, unlike centralized generators, it can be tailored to distinct market segments. Because it is near the point of use DE can be more responsive to various types of customer loads such as residential, commercial or industrial.

DE can be of particular potential benefit to developing nations for several reasons:

- In many developing countries, there is a pressing need for new capacity. The modular nature and short lead times of DE ensure that the capacity can be brought on line faster.
- Developing countries are typically poor and there is often insufficient capital to

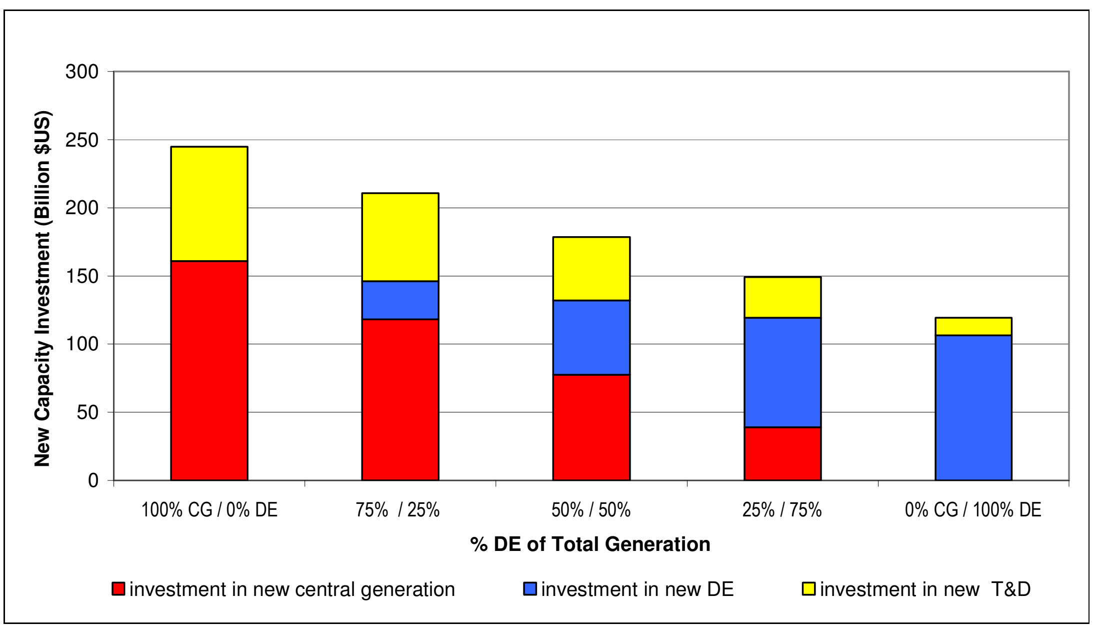
[1] EPRI, 2004. Decentralized Energy Resources: Current Landscape and a Roadmap for the Future, Figure ES-4

develop new infrastructure or improve the reliability of existing infrastructure. This is especially the case for large central generation plants and T&D infrastructure.

- Developing nations are often inadequately equipped to deal with the major environmental challenges associated with large power plants and T&D infrastructure. DE technology can significantly reduce the environmental impact of supplying electricity.
- In many developing countries, even more so than in industrialised countries, economic output can be severely limited by unreliable power supply[2] (see Table 1). Cogeneration can improve the reliability of existing grids in developing countries where networks are constrained and or unreliable.

Figures 1 and 2. show some recent results from studies conducted by WADE to quantify the economic benefits of investment in DE compared to investments in centralized generation. The Figures illustrate the results of comparisons of capital investment requirements over a spectrum of mixes of technology used to meet demand in Brazil and China. In both cases, sole use of central generation to meet new demand growth requires significantly higher capital investment than sole use of DE. Indeed, any use of DE in place of central generation reduces capital costs, largely through the savings in network investment.

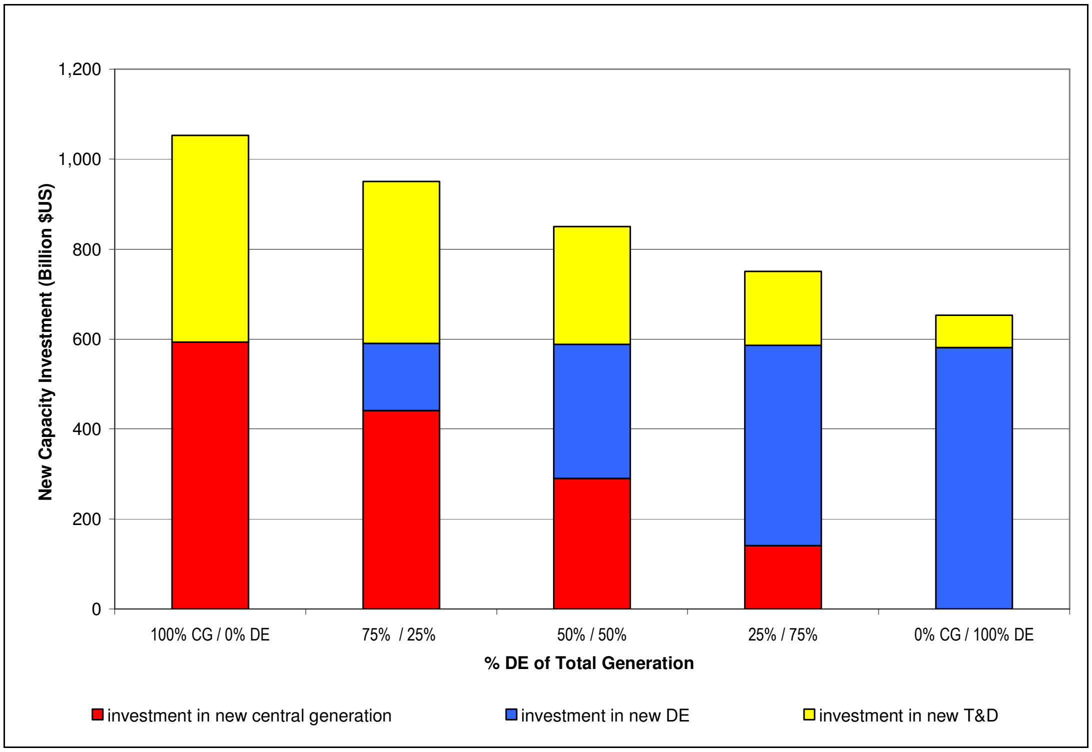
Figure 1.
CAPITAL COST REQUIREMENTS TO MEET 20 YEAR PROJECTED ELECTRICITY DEMAND IN BRAZIL



SOURCE: WADE

[2] World Bank, 2004. Annual Report 2004, p. 70

Figure 2.
CAPITAL COST REQUIREMENTS TO MEET 20 YEAR PROJECTED ELECTRICITY DEMAND IN CHINA



SOURCE: WADE

Table 1.
ESTIMATED LOSS OF ECONOMIC PRODUCTIVITY RESULTING FROM BLACKOUTS IN SELECTED DEVELOPING COUNTRIES

Country	# of firms surveyed	Percentage of overall sales lost resulting from blackouts according to firms surveyed		
		Minimum	Average	Maximum
China	1,500	1. 6	2. 0	2. 4
Bangladesh	924	3. 0	3. 3	3. 7
Pakistan	963	4. 9	5. 4	5. 9

SOURCE: WORLD BANK. 2004. ENERGY PROGRAM IMPLEMENTATION PROGRESS REPORT 2001-03 P.28

DE currently presents a clear and cost-effective alternative to conventional centralized generation plants that use high voltage transmission networks to carry power to customers often over long distances. Both grid-connected and remote stand-alone DE applications show great promise for cost effective investment, although WADE believes that it is the former category that shows the most economic and environmental potential. Indeed, this report will largely focus on the opportunities of high efficiency fossil fired cogeneration for meeting development objectives.

Just as DE in general offers many benefits over centralized generation, cogeneration has advantages over centralized fossil-fired generation. Cogeneration offers efficiency benefits over even the best centralized machines, which results in better fuel economy and reduced emissions. When the losses of the entire system are included in assessments, cogeneration can increase the overall efficiency of thermal generation of electricity from 30% (world average) and from 50-55% (world best practice) to 70-90%. These improvements can be translated directly into emission reductions of greenhouse gases (GHG) and other air pollutants.

Cogeneration has benefits wherever there is demand for both electricity and heat: not only in cold climates where district heating is employed. The potential for cogeneration in developing countries, where climate tends to be warmer and therefore demand for heating lower, may therefore lie mostly in factories requiring process heat or in countries with significant cooling and chilling requirements. All fuels, including natural gas, biomass and other solid fuels can be used more efficiently in cogeneration applications. So even in areas without gas infrastructure all manner of industrial processes throughout the world lend themselves to cogeneration investments, from textiles and food, to refineries and smelters.

This is not to say that DE does not have its disadvantages. There is some truth in the presumption that developing a large number of distributed plants offers some additional planning challenges compared to developing a single plant with similar capacity. Multiple timelines and supply chains can be more difficult from an organizational perspective. For many reasons however WADE feels that the disadvantages of DE are outweighed by its advantages. The benefits of DE as outlined above make it difficult to substantiate the claim that central plants offer economies of scale over DE. By limiting electricity projects to central generation without heat recovery, IFIs are unnecessarily constraining the range of effective means to reach their development goals.

Decentralized Energy for Development

Since the middle of the 20th century, IFIs have played an important role in financing development projects around the world. The World Bank Group (WBG) [3], founded in 1945, the Asian Development Bank (ADB), founded in 1966, and the Inter-American Development Bank (IADB), founded in 1959, are three organizations that share the goal of improving the quality of life of the world's poor in an environmentally sustainable way.

The institutions carry out their missions using a combination of methods including:

- Setting investment agendas and development goals.
- Building foundations for private investment by creating stable regulatory, legal, and economic frameworks.
- Financing projects directly.
- Encouraging private investment by matching privately raised funds.
- Building technical and managerial capacity.

Globally, approximately 1.5 billion individuals live without access to electricity. Increasing access to electricity has therefore traditionally been seen as one method for improving the lives of the world's poor. As a result, international financial institutions have strong backgrounds in financing infrastructure projects that include electricity generation and delivery projects. Standard of living and economic output are both closely related to energy availability. The WBG states that energy is basic to development at both an individual and community level[4]. Energy issues are at the core of all four of the WBG's main lines of business[5]:

- Helping the poor.
- Improving macroeconomic and fiscal balances.
- Promoting governance and private sector development.
- Protecting the environment.

Environmental, social and economic sustainability are explicit goals of all the major IFIs. The three banks reviewed in this paper have all endorsed the United Nations' Millennium Development Goals[6]. The ninth Millennium Development Goal is perhaps the most relevant to discussions of energy investment. It states that the banks must "integrate the principles of sustainable development into country policies and programs and reverse the losses of environmental resources." The fact that all major projects proposed to the banks must undergo

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[3] The World Bank Group, includes the original International Bank for Reconstruction and Development as well four other member organizations: the International Finance Corporation, the International Development Agency, the Multilateral Investment Guarantee Agency, and the International Centre for Settlement of Investment Disputes.
[4] World Bank, 2000. Fuel for Thought, p.3
[5] World Bank, 2004. Renewing Our Energy Business World Bank Energy Program Implementation Progress Report 2001-03
[6] World Bank, 2003. Annual Report 2003, p.5; IADB, 2003, 2003 Annual Report p.19-20; ADB 2003, 2003 Annual Report, p.36

environmental impact assessments prior to approval will also have ramifications in discussions of electricity related investments.

Energy development and electricity development in particular have great potential to advance other priority goals such as illumination and communication systems for educational objectives[7], and pumps and filters for water provision objectives[8].

The electricity related investments favoured by the IFIs to date have not captured the benefits of DE. In financing projects of a physical nature (rather than those of a policy reform nature) IFIs have typically funded projects to replace or supplement existing central generators with combined cycle plants, large dams and upgrades to T&D networks[9]. Small-scale rural electrification projects also now appear to be enjoying considerable support.

It is indisputable that such projects offer benefits, such as efficiency improvements over coal-fired or single cycle turbines, and improved access to electricity for the world's poor. However, as was made clear in the previous section, it is equally undeniable that CCGT projects and large-scale transmission and distribution upgrades do not always offer the optimum cost and energy efficiency of DE. It follows that the tendency of IFIs to fund large-scale electricity infrastructure is not the ideal solution for meeting electricity development objectives. The missing piece of the puzzle is IFI support for smaller grid-connected power generation and high efficiency cogeneration close to the load centres: sectors which offer considerable opportunity for sustainable energy development.

Part of the role of the IFIs is to help finance priorities identified by lending nations. Globally the most common form of DE currently installed is cogeneration[10]. Many nations have recognized the advantages of cogeneration and have transparent objectives for cogeneration capacity additions in the near future. Examples include the European Union's *Cogeneration Directive*, the United States' *Combined Heat and Power Roadmap*, Brazil's new 2004 electricity *Decree 5163*, and China's *Energy Conservation Law*, all of which call for the increased use of cogeneration and high efficiency DE. Support for such plans in those nations where they exist, and encouraging the development of similar plans in regions where they do not exist is therefore one way the IFIs could further their objectives and foster interest in the potential of DE.

Finally, industrial cogeneration development tends to fall more clearly into IFI mandates than do commercial or residential cogeneration projects. As a result IFIs may find that the best way to promote commercial cogeneration will be via broad policy reform, whereas both policy reform and direct project financing will be effective for promoting industrial cogeneration.

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[7] UN Millennium Development Goals, Goal number 2: Achieve universal primary education
[8] UN Millennium Development Goals, Goal number 7, Target 10: Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation.
[9] Best practice central generation is represented by CCGT plant, with a maximum generation efficiency of around 55%, *before* taking into account network losses. The capital cost of such plant should include the network infrastructure necessary to deliver the energy to final consumers. Taking these factors into account, CCGT plant is almost always less efficient and more costly than on-site cogeneration systems.
[10] World Alliance for Decentralized Energy, 2004. World Survey of Decentralized Energy 2004.

Challenges To Decentralized Energy

To stimulate greater IFI commitment to DE, further progress has to be made to tackle the various barriers that exist in most countries to DE. The IFIs can play an important role in this. The main obstacles facing DE projects in developing countries have now been well documented and include:

- Regulatory barriers, including grid access issues.
- A general lack of awareness to the benefits of DE.
- Lack of institutional capacity within the IFIs to advance CHP projects.
- A general lack of financing capacity for DE, largely as a result of no experience in the field by financial institutions and lending agencies.
- The logistical challenge of financing many small projects compared to fewer, larger projects.
- The disproportionate burden imposed by environmental impact assessment studies for smaller projects.
- The lack of investment in time and money to ensure projects remain successful throughout their useful operating life.

An important factor currently limiting investment in cogeneration, the DE technology with the biggest cost competitive potential, is that the IFIs are not internally structured to best deal with the logistics of bringing cogeneration plants online. WADE recognizes that the complex organizational structure of the IFIs poses unique challenges to the advancement of cogeneration as a means to achieve their goals for development. Units concerned with agriculture, industry, environment and energy, among others, could all benefit from cogeneration; but in order to implement a successful project in any sector, proponents require not only the support of other departments, but also their involvement. It is clear that in order to capitalize on the benefits of cogeneration, the banks need to build internal organizational capacity to meet the special challenges such projects entail.

Regulatory barriers, though in some respect the easiest barriers to overcome, come in many forms. The way electricity markets (and where they exist heat markets) are regulated plays an important part in determining the success or failure of DE. The most obvious barrier imposed in some countries is a rule which makes DE installations illegal; for example in areas where a single vertically integrated utility has a monopoly. Other forms of regulatory obstacles can include unfair tax arrangement for DE compared to central power, burdensome safety regulations, and unnecessarily onerous administrative and / or approval procedures.

Ensuring fair access to the grid is a key challenge for DE. In order for DE to flourish, investors in DE technology must be guaranteed fair and transparent access to the grid, in both a technical sense and market sense. For this to be realized both a sufficient market framework and legal framework must be established.

Environmental Impact Assessment (EIA) requirements are another difficulty. For example, in order for the International Finance Corporation (IFC) (the private sector investment arm of the WBG) to allocate any financing the project must meet its own environmental guidelines and those of the host country. According to IFC EIA guidelines[11], thermal plants are subject to the assessment with the highest level of scrutiny, category A, no matter which technology is employed, nor how efficienct. High voltage transmission infrastructure projects meanwhile are subject to the less intensive category B assessment[15].

As with any investment it is important that resources be allocated to ensure that DE projects are maintained throughout their useful life. Successfully developing DE projects is not enough in order to guarantee overall success. In fact having poorly maintained and operated plants is a sure way to guarantee the benefits of DE will not catch on.

Report Coverage

The three main approaches to sustainable energy are as follows:

- Renewable Energy
- End-use efficiency
- Cogeneration and other supply-side efficiency measures.

Prior to undertaking the research that went into this report WADE had the general sense that IFIs had identified that opportunities existed in both end-use efficiency and renewable energy. As a result, WADE felt most financing in the energy sector tended to be allocated to those two categories at the expense of the third. In other words WADE sensed that very little financing had been allocated to grid-connected cogeneration applications, whether based on fossil or renewable fuels.

WADE has therefore focused its research on trying to verify if indeed the portfolios of the IFIs reflected its assumptions.

[11] IFC, 1998. Procedure for Environmental and Social Review of Projects, Annex B Project Categorization and Examples, p. 20-21, December 1998

The Role of International Financial Institutions in Promoting Cogeneration

Like any product or service, cogeneration requires a suitable environment for ensuring that investment in the sector is attractive. Steps can be undertaken which will improve the investment climate for cogeneration just as certain actions may decrease the attractiveness of cogeneration investment. IFIs are in a particularly good position to affect market changes in the cogeneration sector and remove or mitigate some of the obstacles discussed in the previous section.

There are two ways in which IFIs can demonstrate their commitment to cogeneration: through their *intentions* and *actions*.

Intentions

Indicators of an organization's intentions with respect to cogeneration include:

- Explicit policy statements such as mission statements, policy objectives, visions etc.
- Work plans, strategy papers etc.
- Numerical targets (e. g. commitment to source a certain percentage of its own power from cogeneration or allocate a certain percentage of its budget for cogeneration).

In some cases there may be intentions implicit in documents and statements that can be interpreted in multiple ways by the readers. For example a strong statement in support of energy efficiency might to its author clearly imply support for cogeneration whereas others may take it to exclusively mean support for end-use efficiency. Unfortunately when a text does not make the intention explicit it is impossible for the actual intention to be determined by readers.

WADE has established a set of seven principles for guiding electricity market design that fosters investment in DE. The degree to which the principles are adhered to in IFI policy documents can provide clues as to the extent to which the institutions support cogeneration.

Some revealing characteristics of policy that would indicate a supportive environment for cogeneration include:

- A fully independent regulator of the system.
- Cost reflective electricity system pricing.
- Universal, non-discriminatory, access to the grid (see Annex One).

Actions

IFI actions which would also indicate a clear recognition of the role of cogeneration in achieving IFI goals include:

- Direct funding or financing of cogeneration projects.
- Establishing demonstration projects.
- Promoting cogeneration related training and capacity building programs.
- Stimulation of projects that create pro-cogeneration energy markets and regulatory frameworks.
- Investment in capacity to generate onsite power and heat to meet their on-site needs.

Methodology

IFI Intentions

First, WADE sought to determine the extent to which the value of cogeneration was acknowledged in IFI policy. WADE conducted an exhaustive literature review to identify examples of concrete statements by the IFIs relating to industrial and commercial cogeneration applications in their own documents. For instance, WADE looked for guidelines that considered the role of onsite-power in power sector reform initiatives, or examples of environmental policies that urged consideration of DE as an alternative to large-scale thermal power plants without heat recovery. WADE searched IFI documents extensively for all references to cogeneration[12] and policies conducive to the development of cogeneration projects.

IFI Actions

Here, WADE's overall goal was to assess the shares of both overall energy sector financing and sustainable energy financing (renewable energy and energy efficiency) that were directed towards cogeneration project financing. In order to do this, WADE had to secure three main pieces of information: total cogeneration project financing, total overall energy sector financing and total sustainable energy financing. For the first, a bottom-up approach was used; for the second and third, a top-down. In every case, all publicly available sources of information were combed for relevant data, including project databases and documents. This was an extensive and time-consuming research programme.

Bottom-up Analysis

WADE compiled as complete a list as possible of all IFI-funded projects that involved cogeneration to any extent. WADE searched IFI online archives for all mention of cogeneration and attempted to identify every relevant project. All projects were included, no matter how insignificant a portion of the overall project budget cogeneration comprised. In total WADE identified about 70 projects that were partly or wholly financed by the IFIs and which involved cogeneration to some extent. As a result of its research, WADE is confident that the figures provide a fair assessment of cogeneration financing.

[12]All variations of cogeneration were also looked for including: co-generation, CHP, combined heat and power, on-site power, small scale thermal generation etc

In addition, WADE believes that its analysis is on the conservative side since the IFI financing for the entire project is included as ‘cogeneration spend’ even if there were non-cogeneration elements to the project.

Cogeneration can of course be both fossil fuelled and biomass fuelled. As a result some double counting has probably occurred in WADE’s effort to quantify IFI investment. Biomass fired cogeneration project financing would be included in the sustainable energy renewables / efficiency portfolios, as well as in the cogeneration portfolio quantified by WADE. This will have slightly inflated the renewables / efficiency shares shown in the Figures in this report.

Further notes and references for how the data was derived can be found in Annexes 2 and 3.

Top-Down Analysis

Again, WADE undertook exhaustive research among publicly available IFI data sources to identify total energy sector and sustainable energy spending. This was a surprisingly difficult challenge and indicates that there is some scope for improving the transparency of project financing data among some IFIs.

Track Record

The World Bank Group[13]

Intentions

The WBG is without question making strides in respect of sustainable energy financing and development. However, WADE's analysis suggests strongly that, although the Bank understands the importance of prioritising renewable energy and end use efficiency, it has not yet been able to grasp the potential for high efficiency cogeneration or the general principle of on-site generation for cutting infrastructure costs, reducing retail prices and decreasing emissions.

The WBG recognizes that in order to ensure sustainable infrastructure investments from the private or public sectors it is vital that an appropriate policy foundation be in place[14]. Implicit in this recognition is the implication that in order to promote/facilitate investment in any sphere, WBG policies must clearly state goals and strategies for action. As a result, one would expect the WBG to demonstrate a strong policy foundation to promote measures for improving the environmental, social and economic sustainability of the electricity sector. Cogeneration is one such measure.

The WBG specifically states throughout its publications that infrastructure investments must be 'environmentally and socially sustainable'[15]. Yet, despite the possibilities of dramatic efficiency increases it offers, cogeneration appears to be overlooked in most policy documents where one would expect mention (see Annex 2). Some documents mention the topic in passing but WADE was unable to find a policy document which discusses cogeneration in any depth.

By contrast, many documents and projects mention the need for improving efficiency of power generation but almost always in the context of replacing older central generation with more/newer/cleaner central generation. One recent example is the 2003 Samra Power Project in Jordan[16], the main objective of which was to "meet the electricity needs of the country in an economically and environmentally sustainable manner to contribute to economic growth, and well-being of the population of Jordan." The project, calls for the construction of a 450 MW

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[13] Includes the IBRD, IDA, IFC, MIGA, and the much smaller ESMAP and ASTAE.
[14] World Bank, 2003. Infrastructure Action Plan, p. 2
[15] World Bank, 2003. Infrastructure Action Plan, p. 3
[16] World Bank Project number P057862 Updated Project Information Document (PID) PID6671 Rev. April 15, 2003

gas-fired combined-cycle (CCGT) power station; and puts little emphasis on cogeneration to meet industrial or commercial heating / cooling loads as possible alternatives to the centralized model.

Document Review

Despite the fact that its aim is to "rebalance the Bank Group's business so as to reposition infrastructure as a key contribution to achieving the Millennium Development Goals"[17], the *Infrastructure Action Plan*, makes no reference to increasing efficiency via on-site or local cogeneration capacity. This indicates an inconsistency with the stated aims of the document. The *Plan* does commit the Bank to "analysing the effectiveness of and need for infrastructure in developing countries, and to strengthening its own instruments and approaches"[18]. If the project development teams implement this commitment strictly, cogeneration will benefit through its capacity to reduce dependence on T&D.

Similarly, *Fuel for Thought* does not explore the relevance of cogeneration. For example, the document states: "In urban and peri-urban areas, Bank support for investments will generally focus on improving the efficiency of energy utilities and on promoting improvements in end-use efficiency. Wherever possible, this support will focus on the private sector, facilitating the switch from coal to gas or other cleaner fuels for households and small businesses"[19]. While this is desirable, cogeneration is a clear opportunity to improve energy service provision in such areas but it is not obvious that the Bank is aware of it. The Bank's explicit recognition of the need to "balance between transmission and distribution and generation"[20] is an indication that awareness exists of network deficiencies. The potential of decentralized cogeneration for alleviating network constraints is not explicitly acknowledged. In the six "Monitorable Progress Indicators" listed in the document there is a brief mention of cogeneration as a means to: "Improve health and well-being of urban residents through improving ambient air quality in highly polluted cities by switching to cleaner technologies involving gas, including cogeneration"[21]. This seems to miss the main potential benefits.

Though the *Energy Program Implementation Progress Report* makes no specific reference to DE there is mention of the "Investment Climate Assessment" survey that may lay important foundations for building cogeneration capacity. The objective of the report is to systematically analyse conditions and opportunities for private investment throughout the world by benchmarking and monitoring changes over time. Information gathered in the survey includes: electricity cost, losses in economic production related to service interruptions, typical lead times for interconnection, as well as ownership and cost of electricity self generation[22].

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[17] World Bank, 2003. Infrastructure Action Plan, p. 4
[18] World Bank, 2004. Annual Report, p. 70
[19] World Bank, 2000. Fuel for Thought, p. 8
[20] World Bank, 2000. Fuel for Thought, Annex 3, p. 101
[21] World Bank, 2000. Fuel for Thought, Annex 9, p. 113
[22] World Bank, 2004. Energy Program Implementation Progress Report 2001-03, p. 27

The most recent document identified that provides any guidance for WBG funded projects in the power sector is the 1998 *Pollution Prevention and Abatement Handbook*[23]. The document sets forth maximum emission levels for all common pollutions and summarizes different methods for mitigating them. Cogeneration is identified as a "Power Sector Opportunity"[24] in the document but the technology is only mentioned in passing and there is no explicit recommendation or endorsement of cogeneration over central generation.

The handbook provides industry sector guidelines for 39 industrial sectors including both new and rehabilitated thermal power plants above 50 MW capacity. The guidelines make it clear, implicitly, that cogeneration should always be considered whenever electricity sector developments are being prepared:

- "The evaluation of project alternatives should include an analysis of reasonable alternatives that meet the ultimate objective of the project"[25] including looking at different fuels, power generation technologies and heat rejection technologies;
- "Those alternatives that provide cost-effective environmental management are preferred".[26] Provided T&D costs are included in cost estimates, cogeneration will benefit.
- "It is not acceptable to prepare an environmental assessment that considers a small number of options in order to justify a predetermined set of design choices".[27] This implies that project proponents must consider decentralized options instead of solely centralized options.

The Energy Sector Management Assistance Program (ESMAP) is one of the WBG's major energy programs. To date the ESMAP program has focused on six key areas[28], none of which deal specifically in grid-connected cogeneration though there is a focus in building off-grid renewable electricity capacity. The latest *ESMAP Business Plan* makes no reference to either cogeneration or grid-connected renewables. Although ESMAP's *2002 Annual Report* acknowledges that: "In many developing countries, numerous opportunities exist to improve energy efficiency by 10 to 30 percent (or more) using low-cost, commercial technologies with a short payback period on the investment"[29], the report does not stress how such efficiency gains could be made using technologies such as cogeneration.

Targets

Setting a target for investment in cogeneration would represent a direct statement of commitment for the WBG. Examples of precedents include the European Union's concrete goal of producing 18% of electricity from cogeneration applications by 2010 compared to

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[23] World Bank, 1998. Pollution Prevention and Abatement Handbook
[24] World Bank, 1998. Pollution Prevention and Abatement Handbook, p. 34
[25] World Bank, 1998. Pollution Prevention and Abatement Handbook, p. 415
[26] World Bank, 1998. Pollution Prevention and Abatement Handbook, p. 415
[27] World Bank, 1998. Pollution Prevention and Abatement Handbook, p. 415
[28] World Bank, 2004. A Review of the ESMAP Rural Energy and Renewable Energy Portfolio, p. 1
[29] ESMAP, 2003. ESAMP Annual Report 2002, p. 27

11% in 1998[30] and the 22% target for renewable energy production by 2010[31]. Also effective is the binding strategy for achieving the targets contained in the Europe Union's Cogeneration directive[32]. Though setting quotas for renewables or cogeneration for client nations is outside the mandate of the WBG, the Bank is able to set ambitious financing targets.

Indeed the Bank has recently made just such a promise. At the major conference on renewable energy held in Bonn in June 2004 the Bank made the following commitments[33]:

- Ensure that renewable energy and energy efficiency are seen as economically viable and essential ingredients in the energy choices, not marginal considerations.
- Increase financing by 20% per year until 2010 for renewable energy commitments and 20% per year until 2010 for energy efficiency commitments.
- Participate in or convene a steering group to help lead the transition to a cleaner energy future.
- Commit to reporting annual performance in renewable and energy efficiency programs against the figures of other leading organizations.
- Provide sector-specific information, to better engage a wide range of stakeholders on trends regarding specific technologies.
- Increase staff capacity, resources at its disposal, and incentives to improve effectiveness of renewable energy and energy efficiency projects, and more rapidly transfer best practice across sectors and regions.

These are important commitments. If the Bank found the resources and political fortitude to follow through with all of the above recommendations there would be important positive implications for cogeneration. It is probable, however, that the commitments to energy efficiency reflect the demand side rather than supply side, and that the Bank can see no better alternative than central generation as a means of utilising fossil fuels.

Off-grid renewables would be the biggest beneficiary of an increase in resources. However, augmented financing for energy efficiency projects may also benefit cogeneration initiatives, especially if the WBG were to include decentralized cogeneration in their definition of energy efficiency projects explicitly. The sixth recommendation may however hold the most potential for increasing investment in high efficient cogeneration: lack of awareness amongst both lending agencies and their clients as to the benefits of cogeneration may be the single largest obstacle to its more widespread use.

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[30] European Secretariat, 1997. A Community Strategy to Promote Cogeneration (CHP) and to Dismantle Barriers to its Development COM(97) 514 final, 15. 10. 97

[31] European Secretariat, 2001. Directive 2001/77/Ec Of The European Parliament and of the Council of 27 September 2001 on the Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market

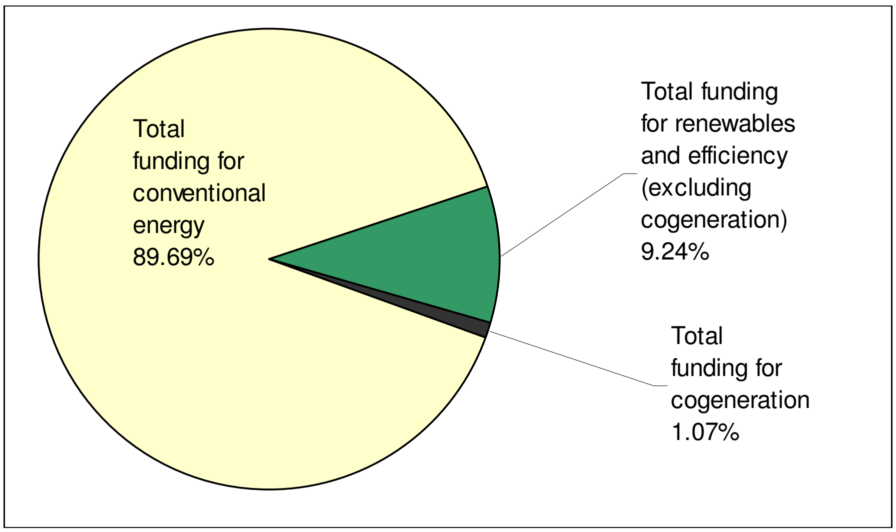
[32] European Secretariat, 2004. Directive 2004/8/Ec Of The European Parliament and of the Council of 11 February 2004 on the Promotion of Cogeneration Based on a Useful Heat Demand in the Internal Energy Market and Amending Directive 92/42/Eec

[33] Renewables 2004 Conference, Plenary Session A: Peter Woicke, World Bank Keynote address Bonn Germany, conference transcripts

Actions

While little is spelled out in WBG policy documents in terms of intention there is certainly much action deserving of praise in terms of support for DE in the context of both power sector reform and off-grid rural electrification. WADE estimates that total WBG financing for renewables[34] and efficiency to date is around $US 8.67 billion, which translates to roughly 10% of the group's overall energy portfolio or 15% of the group's electricity sector sub-portfolio (see Annex 2). Decentralized cogeneration accounts for close to $US 1 billion since 1984 or about 1% of the group's overall energy portfolio and closer to 2% of all the group's electricity related financing (see Figure 3 and Annex 2).

Figure 3.
WORLD BANK GROUP ENERGY PORTFOLIO FINANCING



SOURCE: BASED ON WADE ANALYSIS (SEE ANNEXES 2 AND 3)

Power Sector Reform

Financial institutions have an important role to play in ensuring that appropriate regulatory and legal frameworks exist in the areas where cogeneration investment is to be promoted. Establishing a stable market is a prerequisite to private investment in cogeneration. Perhaps in recognition of this the WBG has done much work on power sector reform. A small sampling of such restructuring initiatives includes projects undertaken in Romania, Peru, Russia and the Ukraine[35]. Though creating a market for cogeneration may have been an implicit part of the intent of these market design projects, the primary objectives of such schemes were more likely to create an atmosphere conducive to the leveraging of private funds, and increasing the efficiency of public firms by fostering competition. If fostering

[34] World Bank includes large hydro in its definition of renewables
[35] World Bank projects: P081406, P008040, P044444, and P050891 respectively

cogeneration was a major goal of power sector reform schemes the WBG has not made this clear.

Off Grid Rural Electrification

Much of the WBG group's renewable energy portfolio has focused on rural electrification and in the great majority of cases the projects developed have been small-scale renewable applications installed where the electricity is used. Examples of such activity include projects in Turkey, Nicaragua, Croatia and Bangladesh.[36] According to WBG estimates it has spent $US 900 million on off-grid renewable DE.

Moving Forward

A shift in focus from large central fossil fuel projects to high efficiency fossil fuel cogeneration is clearly desirable for the WBG to better meet its objectives. Making it explicit in WBG policy documents that energy efficient cogeneration shall be chosen preferentially over wasteful central thermal generation, provided a balanced cost comparison of alternatives is made that includes network costs, would be a positive first step towards achieving this.

An example of a project funded by the WBG may best illustrate a potential opportunity for moving forward. The Bank contributed $US 300 million to the $US 678.8 million Hunan Power Development Project in China, one component of which was to build two new coal-fired generating units[37]. The units were to "facilitate the retirement of 10 small, aging, inefficient, and polluting generating units". Projects such as this beg the question if any analysis was done to weigh the possible benefits of financing the retrofit of smaller decentralized plants or investment in smaller cogeneration plants compared to building new centralized capacity. An analysis may have revealed that environmental, economic and social objectives would have been better met had decentralized energy been considered.

To date only 2% of the Bank's electricity portfolio has been allocated to projects involving a decentralized cogeneration component. This therefore remains a missed opportunity, which the Bank has in part recognised in its 2003 document, '*The Regulation of Heat and Electricity Produced in Combined-Heat-and-Power Plants*', which explores the complexities of compensating investors for the production of heat and power from cogeneration applications. The Bank also outlined some major obstacles to cogeneration projects[38]: This is at least a first step forward.

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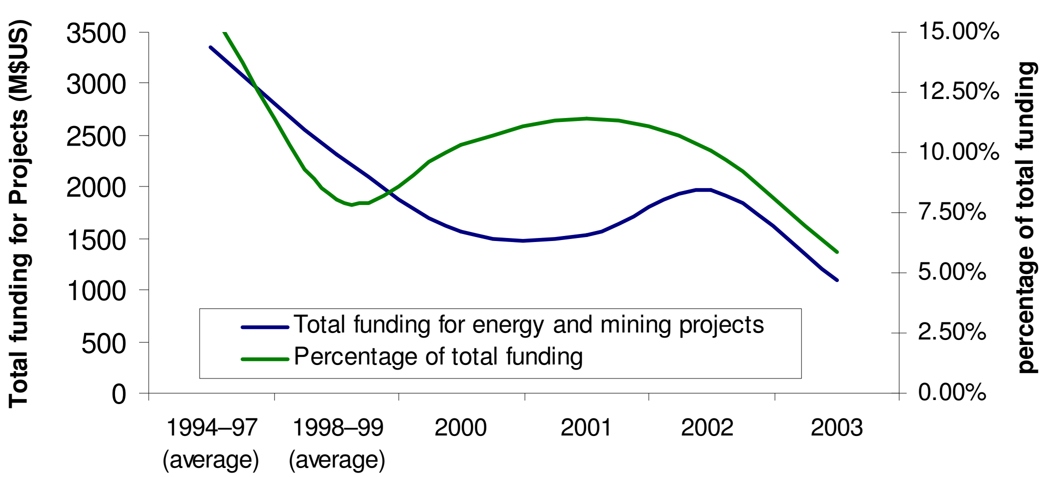
[36] World Bank projects P072480, P073246, P071464, and P071794respectively
[37] World Bank, 1998. Hunan Power Development Project, Project Information Document, 1998
[38] World Bank, 1998. Pollution Prevention and Abatement Handbook 1998, p36

Summary

Several observations of significance can be made based on WADE's analysis.

- In general, the WBG is allocating fewer funds to energy sector projects over the last decade or so (Figure 4). It is therefore of increasing importance that those energy projects which do receive financing are of optimum value in furthering the WBG's stated sustainable development objectives.
- Of the relatively small proportion of financing which is allocated to energy efficiency, a disproportionately low amount is being allocated to cogeneration projects.

Figure 4.
WORLD BANK GROUP FINANCING IN THE ENERGY AND MINING SECTOR



SOURCE: WORLD BANK ANNUAL REPORT, 2004, P.106.

Earmarked Funds

There are two unique funds which deserve special mention with regards to the WBG and its relationship to cogeneration projects, the Global Environment Facility (GEF) and the Prototype Carbon Fund (PCF)

The Global Environment Facility

The GEF was founded in 1991. This institution was designed to help developing countries fund projects and programs that protect the global environment. Funding allocation is organized into six thematic categories and the fund is managed by three implementing agencies, one of which is the World Bank. Cogeneration projects applying for GEF funding would best fit within the climate change category, organized into four sub-areas[39]:

- Removing barriers to energy efficiency and energy conservation.
- Promoting the adoption of renewable energy by removing barriers and reducing implementation costs.
- Reducing the long-term costs of low greenhouse gas emitting energy technologies
- Supporting the development of sustainable transport.

Between 1991 and 2004, the GEF allocated $US 1.74 billion to climate change projects, of which about $US 990 million, 57%, was for renewable energy and energy efficiency[40]. WADE has identified thirteen projects that involve cogeneration to some extent. The total GEF financing for these projects was $US 75 million ,or about 4.3% of the GEF's total funding allocated for climate change related projects. Of the thirteen projects identified, eleven were biomass projects, and two were energy efficiency retrofits of existing systems. None were high efficiency fossil-fired projects.

The GEF's *Operational Strategy*[41] suggests that cogeneration projects, even gas fired ones, would be considered for financing, though this is never stated explicitly. However, there is some anecdotal evidence that fossil-fired cogeneration projects are not favoured. This is surprising given the low cost of emission reductions achievable from cogeneration.

The Prototype Carbon Fund

In mid 1999 the WBG founded the PCF in to undertake investments in carbon mitigation projects. To date, private and public sector participants have contributed $US 180 million[42] to the fund. The fund is designed to work within the United Nations Framework Convention on Climate Change (UNFCCC), and compliment the Kyoto protocol's flexibility mechanisms. All GHG mitigating projects are eligible, although "Most projects will be in small to medium scale renewable energy development…and…will either result in a switch in fuel source, from a fossil fuel to a renewable or alternative lower carbon fuel source, or in a change of technology to a cleaner more efficient technology, or both."[43] All manner of cogeneration projects are therefore in theory eligible for PCF financing, including natural-gas fired plants. It remains to be seen how much of a focus cogeneration applications will receive, but already two of the existing 18 projects funded by the PCF involve cogeneration: one in Bulgaria and another in Hungary. An additional three cogeneration projects are also under development in Brazil.

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[39] GEF website
[40] WADE estimate derived from totalling renewables and energy efficiency projects identified on GEF online project database.
[41] GEF, 1995. Operational Strategy of the Global Environment Facility
[42] PCF website (http://carbonfinance. org/pcf/router. cfm?Page=FAQ)
[43] PCF website (http://carbonfinance. org/pcf/router. cfm?Page=FAQ)

The Asian Development Bank

Intentions

Document Review

On p.1 of *Energy 2000* it states: "ADB's goal in the energy sector will, therefore, be to increase the availability of energy in a least-cost and environmentally friendly manner and to improve access to energy..."[44] This is consistent with the inclusion of cogeneration in the ADB portfolio. Indeed greater investment in cogeneration would help the ADB move closer to two of its "operational priorities"[45] stated in the document that are of special relevance to the energy sector:

- Environmental protection.
- Private sector development.

As with the WBG, ADB policy does provide a general policy framework which should provide a firm foundation for cogeneration projects. The most recent policy document[46] in the energy sector, the *Bank's Policy Initiatives for the Energy Sector* published in 1995, stated: "In general, before agreeing to finance new capacity addition, the Bank will have to be satisfied that the utility is paying adequate attention to both supply side efficiency options such as economically sound rehabilitation and retrofitting of existing plants, system loss reduction and optimising system operations, as well as demand side management options." Cogeneration should therefore be favoured in most cases given this statement of intent.

The document does contain a direct endorsement of cogeneration[47]: "The Bank should actively pursue environmental protection by giving high priority to power projects with minimum environmental impacts…energy conversion processes yielding high overall efficiency (such as cogeneration) will be encouraged." Discussion of energy related investment in the *Asian Development Bank 2003 Annual Report* to a great extent focused on large scale T&D investments[48].

Energy 2000 did not lay down any clear guidelines of how cogeneration should be incorporated into ADB practice. Indeed, cogeneration is only mentioned in appendices 4 and 5. In appendix 4 there is a brief discussion of how power sector reform initiatives stand to benefit IPPs and foster cogeneration investment. In appendix 5 of the report cogeneration is identified as a possible solution to barriers preventing development of renewable energy

[44] ADB, 2003. Energy 2000 Review if the Energy Policy, p. 1
[45] ADB, 2003. Energy 2000 Review if the Energy Policy, p. 1
[46] ADB, 1995. The Bank's Policy Initiatives for the Energy Sector, May 1995. p. 47
[47] ADB, 1995. The Bank's Policy Initiatives for the Energy Sector, May 1995, R4-95
[48] ADB, 2003, Annual Report, p. 40

projects. Finally, *Assessing The Impact Of Transport And Energy Infrastructure On Poverty Reduction*, contains no reference to cogeneration[49].

Targets

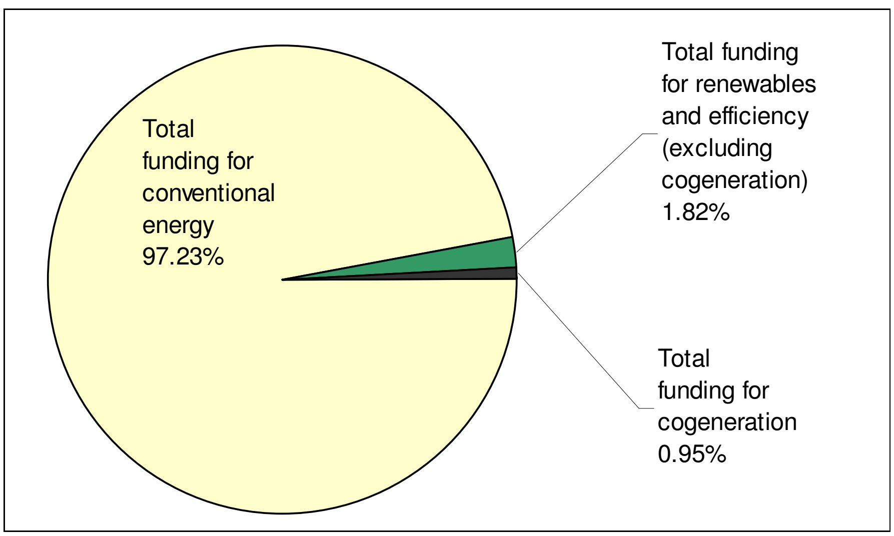
Nowhere in ADB documentation did WADE uncover explicit targets for either renewable energy and energy efficiency financing more generally or goals for financing cogeneration projects in Asia.

Actions

To date, most of the work the ADB has done in support of cogeneration (directly and indirectly) has taken the form of facilitating market reorganization that encourages IPPs. This goal is stated explicitly in the *2003 Annual Report*: "ADB should assist integrated utilities to unbundle their utility tariffs and to organize their business units by function". [50]

Overall, in 2003, the energy sector was the Bank's third largest portfolio after transportation and social infrastructure[51]. The proportion of the successful projects which involved an element of renewable energy or energy efficiency is unclear but WADE analysis shows that cumulative ADB support for renewables and efficiency totals $US 330 million, a little less than 2% of the total cumulative energy portfolio (See Annex 2.). Figure 5 shows the extent to which renewable energy and efficiency projects make up the Bank's overall energy portfolio, of which cogeneration makes up an even smaller fraction.

Figure 5.
ASIAN DEVELOPMENT BANK ENERGY PORTFOLIO FINANCING



SOURCE: BASED ON WADE ANALYSIS (SEE ANNEXES 2 AND 3)

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[49] ADB, 2004. Assessing The Impact Of Transport And Energy Infrastructure On Poverty Reduction, Final Report, June 2004
[50] ADB, 2003, Annual Report, p. 29
[51] ADB, 2003. 2003 in Review: Board of Directors' Report, p. 8

Summary

To date, most of the work the ADB has done in support of cogeneration has taken the form of facilitating market reorganization that encourages IPPs. The objective of power sector reform is clearly in ADB policy documents. Though work along these lines is vital in order to create stable markets for cogeneration investment, it must be undertaken in the correct way, providing a balanced, open and competitive environment for all generators. The ADB's SEIERP Project[52] for example does little to create markets which allow participation of cogeneration investors. Likewise, the ADB's efforts in the Asian region to upgrade T&D networks have overlooked the fact that financing local cogeneration may to a large degree eliminate the need for grid upgrades.

In short, it appears that cogeneration is not yet an integral part of the ADB's development intent as set out in official policy, but it is clearly open to the idea. A quote from the World Bank illustrates this: "Although cogeneration was not specifically included or excluded at appraisal, the inclusion of cogeneration projects based on their merits during loan negotiations reflects ADB's flexible approach in achieving the objective and was in line with the rationale for the loan"[53].

[52] World Bank project number P073778

[53] World Bank, Project Completion Report on the Industrial Energy Efficiency Project (Loan 1343-Ind) In India, p. 13

The Inter-American Development Bank

Intentions

Document Review

In 1994, in its *Report On The Eighth General Increase In Resources Of The Inter-American Development Bank*, the IADB clarified its mandate and stated its four main goals:

- Poverty reduction and social equity.
- Environmentally sustainable growth.
- Modernization of the state.
- Regional integration[54].

This statement of goals in combination with the IADB's endorsement of the Millennium Development Goals provides the foundation of broad policy support for cogeneration.

The *Sectoral Operational Policy for Electrical Energy*[55] presents many guidelines which are applicable to cogeneration and may have profound ramifications for its development. Of specific relevance is the policy's declaration that long-term planning in the electricity sector must establish energy conservation practices. The policy proceeds to list those activities which are eligible for funding. However, opportunities for financing the development of T&D systems in the large urban and industrial centres are highlighted in the policy.

The 2000 Energy Sector Strategy makes no mention at all of cogeneration or the use of DE for increasing efficiency and decreasing the environmental impact of the Latin American electricity sector.

In summary, none of the IADB policy documents explicitly state the desirability of financing cogeneration or DE projects in preference to central infrastructure. The intentions stated with respect to energy efficiency and resource conservation suggest that support for cogeneration may be institutionally legitimate; but so far such support has not been publicly announced.

Targets

No clear targets for either renewable energy and energy efficiency generally or cogeneration more specifically were apparent in IADB policy.

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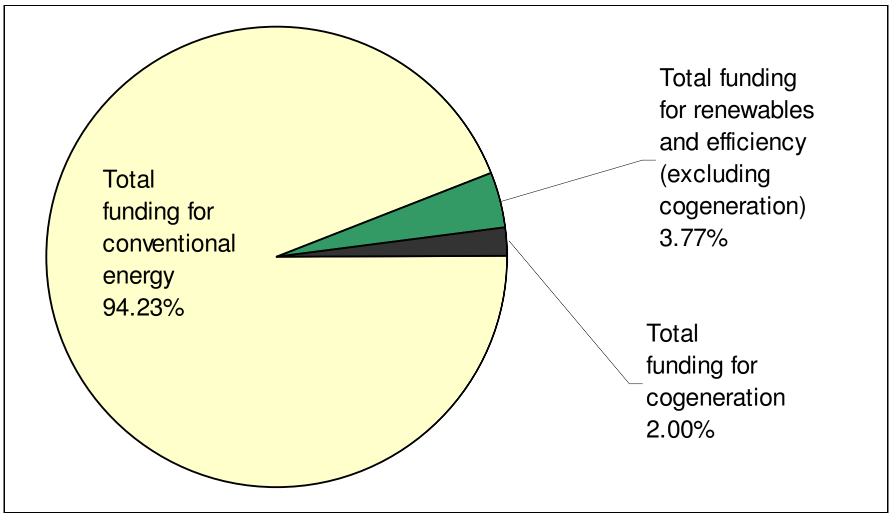
[54] IADB, 1994. Report On The Eighth General Increase In Resources Of The Inter-American Development Bank
[55] IADB, 1985. Sectoral Operational Policy for Electric Energy, GP-96-1

Actions

Cumulative IADB support for renewables and efficiency up to 2000 was $US 600 million. This translates into about 4%[56] of the total cumulative energy portfolio (see Figure 6). Over the same time period funding for projects which involved cogeneration to some degree totalled about $US 320 million. If IADB's estimation of total energy efficiency and renewables includes the three cogeneration projects identified that received financing, they accounted for over half of the total financing in the Bank's clean energy portfolio, or about 2% of the Bank's total energy portfolio[57].

Figure 6.
INTER-AMERICAN DEVELOPMENT BANK ENERGY PORTFOLIO FINANCING



SOURCE: BASED ON WADE ANALYSIS (SEE ANNEXES 2 AND 3)

Summary

Two conclusions can be drawn based on this analysis:

- Cogeneration has played a significant part in the work that the Bank has done with regards to renewables and efficiency.
- Given the IADB's stated development objectives one would expect renewables and efficiency to account for a much higher percentage of its energy portfolio. Certainly much potential exists for IADB to improve in this regard.

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[56] 3. 77% (see Figure 6)
[57] Compared to the WBG and ADB, the IADB tends to fund fewer but larger projects, making the projects easier to track. Though it is possible that this WADE analysis has overlooked some projects, this is less likely given the smaller overall number of projects with which the IADB involves itself.

Conclusions & Recommendations

WADE has, for the first time, examined in a systematic way the performance of several major IFIs to see to what extent cogeneration has been employed as a means to meet their stated development objectives. Several findings of significance have come to light as a result of this examination. The main conclusions that can be drawn are that:

- The extensive development of cogeneration is consistent with stated IFI objectives.
- Though IFIs have to date been vocal in their support for renewables and efficiency, they have been non committal to cogeneration in policy documents and other statements of intentions.
- A lack of recognition of the benefits of cogeneration is reflected in the IFIs disproportionate lack of project financing in this area. Therefore the great potential of cogeneration for meeting IFI objectives is far from being realized.

1. Cogeneration is Consistent with Stated IFI Objectives

Cogeneration can cost-effectively increase electricity access, reduce GHG emissions, improve living conditions and improve industrial competitiveness - all of which are specific objectives of IFIs. They have so far been active in financing energy sector projects such as natural gas pipelines, power transmission upgrades at the national scale, large dams and thermal power plants, energy market restructuring initiatives and renewable energy projects in rural areas. In WADE's view increased inclusion of cogeneration is to the advantage of the lending institutions in furthering their objectives.

2. Lack of Intent

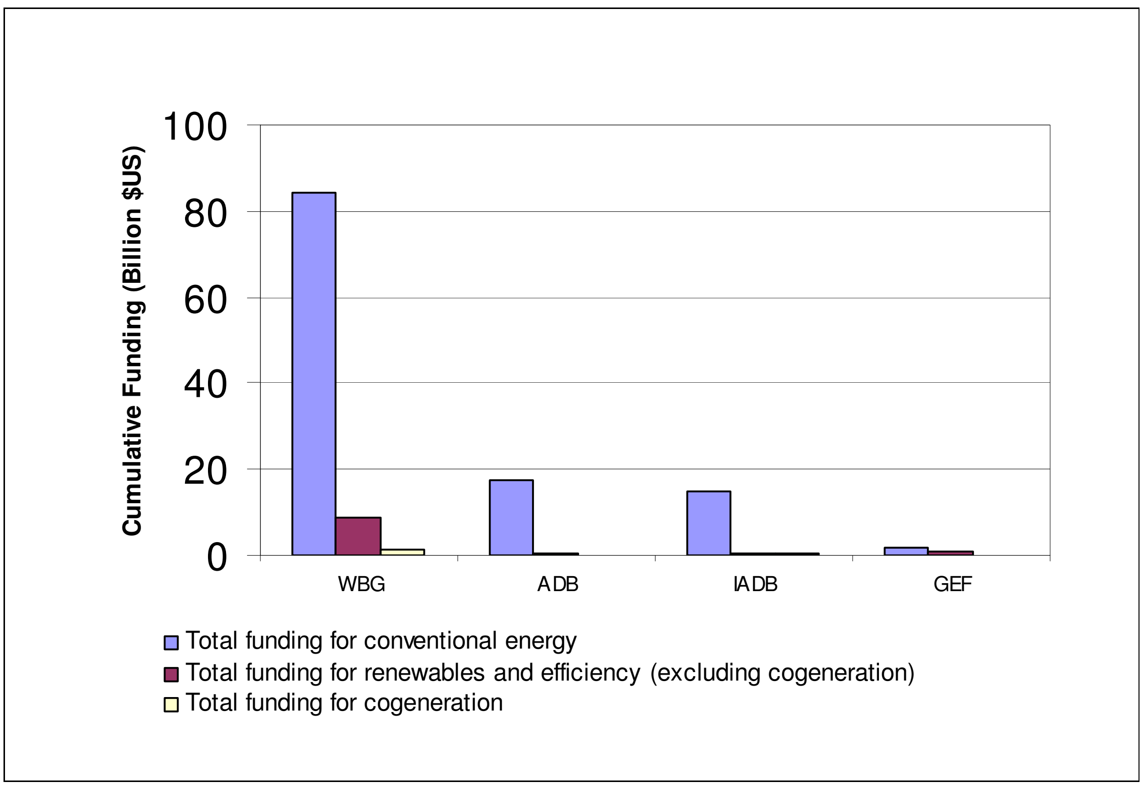
Policy documents of the three IFIs were searched extensively for evidence of discussion on cogeneration. Nowhere in any document was a discussion encountered explicitly considering cogeneration as a potential alternative or complement to conventional investment in central generation. Though in some cases targets were encountered for renewables and efficiency no targets or policy objectives were encountered for cogeneration.

3. Lack of Action

Though IFIs have already done much work in power sector reform much more work must be done in this regard before private or public investments in cogeneration will have optimum effectiveness. A foundation of an open and transparent market is vital for cogeneration to flourish. IFIs must continue working to reform power sectors to take advantage of the benefits offered by cogeneration. Reform measures should guarantee fair access to the grid at a fair price, and create clear interconnection procedures and rate structures that reward cogeneration installations for their grid relief function.

Figure 7 gives an idea of the scale of resources each of the IFIs have dedicated to cogeneration. Cumulatively the three main institutions examined in this paper have spent about 8.9 % of their total energy related budget on renewables and efficiency measures (see Figure 8). Together the IFIs have spent to date a combined 16.1%[58] of their renewable energy portfolios or 1.4% of their larger energy portfolios on cogeneration (see Figure 8). These shares fall well below what should be expected if the benefits of cogeneration were properly recognised.

Figure 7.
RESOURCE ALLOCATION BY IFI INSTITUTION



SOURCE: BASED ON WADE ANALYSIS (SEE ANNEXES 2 AND 3)

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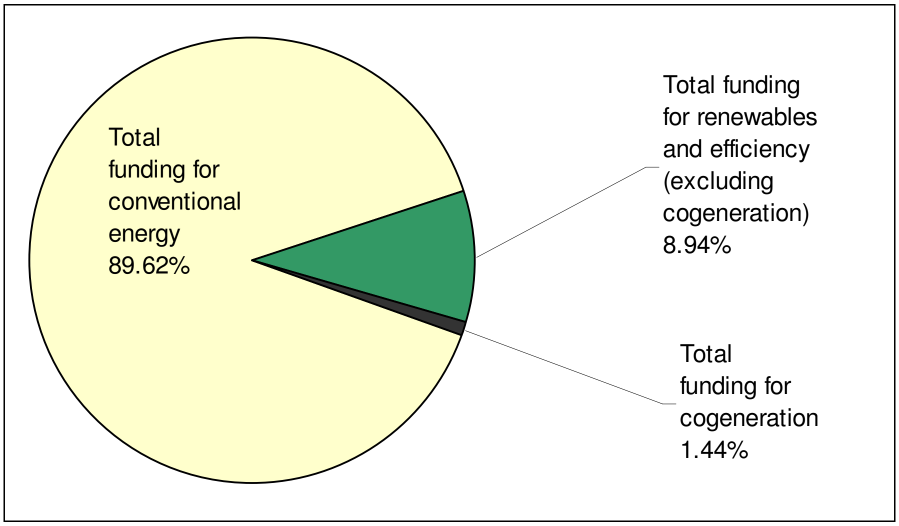
58 1.44 is 16.11% of 8.94 (see Figure 8)

Figure 8.
TOTAL IFI ENERGY PORTFOLIO FUNDING



SOURCE: BASED ON WADE ANALYSIS (SEE ANNEXES 2 AND 3)

There are a wide range of options at the disposal of IFIs to develop their role in fostering better investment climates for DE technologies. WADE has three broad recommendations:

1. Create concrete targets for financing cogeneration:

- Set more ambitious short-term and long-term targets for financing of future cogeneration projects.
- Create revolving funds, lines of credit, and loans that are forgiven if pre-specified cogeneration targets are met.

2. Explicitly incorporate the potential of cogeneration to meet development objectives into both policy documents and practice.

Examples of actions which could be undertaken by the IFIs include:

- Work to foster co-operation and understanding between different departments or constituencies within each institution (cogeneration projects require co-operation between departments working in areas traditionally seen as separate, such as agriculture, industry, environment and energy).
- Establish an interdepartmental committee involving staff from various departments. Task the committee to see how mutual goals can be met via collaboration on cogeneration projects. Projects agreed on could be funded by sharing resources from budgets of the various departments at the table.
- Draft guidelines for submitting co-operative bids to address the problem of transaction costs which make it logistically difficult to finance smaller decentralized projects relative to large centralized ones (i.e. ‘bundle’ projects).

- Invite clients to submit projects that involve high-efficiency cogeneration and allocate specific funds.
- Only proceed to financing of large-scale central projects if they have undergone a cost comparison with cogeneration alternatives (including network costs).
- Recognise the environmental benefits of cogeneration in documents providing environmental guidelines.
- Explicitly highlight the advantages of considering cogeneration options whenever new capacity is proposed in policy documents. For example, the WBG could explicitly state this in the Sector Specific Guidance Notes for Energy Infrastructure.
- Funds that are already earmarked for general efficiency, such as ESMAP's energy efficiency fund, could put an increased emphasis on cogeneration projects. Existing definitions of efficiency should be redefined to include both supply side ad demand side efficiency.

3. Encourage clients to adopt the policies, markets and legal frameworks conducive to cogeneration development.

Examples of client government initiatives that IFIs could encourage include:

- Power sector reform that ensures an equal playing field for cogeneration, including fair interconnection procedures and grid access fees. An open and transparent market is vital for cogeneration to flourish anywhere. Much more work can be done in this regard before private or public investments in cogeneration will have optimum effectiveness.
- The creation of mechanisms that ensure that network costs as well as generation plant costs are taken into consideration when new capacity investment is anticipated.
- The development of targets for on-site power for both on and off-grid applications such as the EU's 18% cogeneration target by 2010.
- A shift of emission standards to output based standards that set limits based on useful energy produced rather than consumed.
- Development of technical and managerial training to improve skill sets required to develop cogeneration capacity, operate it effectively and maintain the equipment throughout its useful life.

Annex One

WADE's Seven Guiding Principles for Effective Electricity Market Regulation

1. There should be a fully independent and properly resourced regulator of the system. Its duties should relate to:

- Reducing costs and prices.
- Reducing emissions of pollutants (including greenhouse gases).
- Minimizing the risk of system disruption.
- Avoiding 'boom and bust' cycles in the electricity market.
- The development and promotion of innovative energy technologies.

2. Electricity system pricing should be fully cost reflective with no cross subsidies from one part of the system to another;

3. Power generation and supply companies should have no ownership or management interest in the network;

4. All generators of electricity should have fair and non-discriminatory access to the grid;

5. Use of transmission and distribution networks should be priced according to the services they provide and not in such a way as to create incentive for distribution companies to avoid DE interconnection. In particular:

- Any benefits which generators (including DE) provide to the system (for example, voltage and frequency support, grid reliability and stability, reduction in transmission and distribution losses, reduced requirements for 'spinning reserve') should be fully and fairly reflected in system pricing.
- Equally, generators (including DE) should not be excessively charged for its system impacts (for example, 'shallow' rather than 'deep' connection charging). In particular, back-up charging for DE should fairly and transparently reflect system impact and no more.

6. Utilities should be required to engage in cost benefit analysis which can enable DE to be developed in areas where its local benefits outweigh the costs of constructing or upgrading new distribution facilities;

7. The electricity system should be subject to market based instruments, for example emissions trading, energy taxation and output-based standards, which fully reflect energy conversion efficiencies and internalise environmental costs of energy conversion.

Annex Two

IFI Documents Examined as part of WADE Research Programme

WBG documents assessed for discussion of DE policy.	
Operational Guidance for World Bank Staff, Public and Private Sector Roles in the Supply of Electricity Services	2004
Renewing Our Energy Business, World Bank Energy Program Implementation Progress Report 2001-03	2004
The WBG 2004 Annual Report	2004
A Review of the ESMAP Rural Energy and Renewable Energy Portfolio	2004
Infrastructure Action Plan, Operational Guidance for WBG Staff	2003
Striking A Better Balance: The Extractive Industries Review	2003
Power for Development. A Review of the World Bank's Experience with Private Participation in the Electricity Sector	2003
ESMAP 2002 Annual Report	2003
The ESMAP Business Plan 2002-2004	2002
Fuel for Thought	2000
Pollution Prevention and Abatement Handbook	1998
ADB documents assessed for discussion of DE policy.	
Asian Development Bank, 2003 Annual Report	2003
2003 in Review: Board of Directors' Report	2003
Assessing The Impact Of Transport and Energy Infrastructure on Poverty Reduction	2004
Energy 2000, Review of the Energy Policy	2003
The Bank's Policy Initiatives for the Energy Sector	1995
IADB documents assessed for discussion of DE policy.	
Sectoral Operational Policy for Electrical Energy	1985
Report On The Eighth General Increase In Resources Of The Inter-American Development Bank	1994
Energy 2000, Sector Strategy	2000

Annex Three

Compilation of Data on IFI Financing for DE projects

DECENTRALIZED ENERGY FINANCING AS PROPORTION OF TOTAL SPENDING BY INSTITUTION

Institution	Date	Estimated total cumulative support for projects (Billion $US)					% of total energy portfolio	% of total electricity portfolio	%of total renewables & efficiency portfolio
		Total Portfolio	Energy portfolio	Electricity portfolio	Renewables & efficiency portfolio	Cogeneration portfolio			
WBG	1944-2004	625.5	84.14	56.40	8.67	1.14	1.35n	2.02	13.11
WBG	1990-2003	n/a	39.56	27.50	6.00	0.98	2.47	3..55	16.28
IBRD	1944-2004	394.00	62.07		5.74	0.19	0.30		3.26
IDA	1960-2004	151.00	22.07		2.93	0.02	0.09		0.68
IFC	1956-2004	67.00	4.00		0.85	0..93	23.25		110.06
ESMAP	1983-2004	0.04	0.04		0.02	0.00	0.00		0.00
ASTAE	1991-2004	1.10							
MIGA	1988-2004	13.50	1.68		0.60	0.03	1.61		4.50
GEF	1991-2004	4.5	1.74		0.99	0.08	4.33		7.61
ADB	1966-2004	82.31	17.51	3.82	0.33	0.17	0.98	4.48	52.13
IADB	1959-2004	129.00	15.00		0.60	0.32	2.13		53.17
TOTAL	TOTAL	841.31	118.39	60.22	10.59	1.70	1.44	2.83	16.08
Portfolio as percentage of total spending			14.07	7.16	1.26	0.20			
Portfolio as percentage of total energy portfolio				50.86	8.94	1.44			
Portfolio as percentage of total electricity portfolio					17.98	2.83			
Portfolio as % of total renewables and efficiency portfolios						16.08			

No data available for greyed-out cells

NOTES AND SOURCES FOR "DECENTRALIZED ENERGY SPENDING AS PROPORTION OF TOTAL SPENDING BY INSTITUTION"

WBG (1944-present)	
Total	WBG, 2004. *2004 Annual Report,* p.8-9. Sum of IBRD, IDA, IFC and MIGA cumulative spending.
Energy	WADE estimate derived from WBG online database of projects in the energy sector.
Electricity	WBG, 2004. *Energy Program Implementation Progress Report 2001-03*, p.45. Sum of renewable and power sector data.
Renewables & Efficiency	WADE estimate derived from WBG online database of projects in the energy sector.
Cogeneration	WADE estimate derived from total financing of all projects identified with a cogeneration component.
WBG (1990-2003)	
Total	Data unavailable.
Energy	WBG, 2004. Energy Program Implementation Progress Report 2001-03. p.45.
Electricity	WBG, 2004. *Energy Program Implementation Progress Report 2001-03* p.45. Sum of renewable and power sector figures.
Renewables & Efficiency	Based on an average of three WBG estimates: $6 billion Since 1990 -Renewables 2004 conference, Plenary Session A: Peter Woicke, WBG keynote address, Bonn, Germany. $4 billion Since 1990 -*The Role of the WBG in Renewable Energy and Energy Efficiency*, Jamal Saghir, Director Energy and Water, Renewable Energy and Energy Efficiency Partnership: Global Network Launch, Thursday, 23 October 2003, p.1. 8$ billion since 1990 – ESMAP webpage.
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
IBRD (1944-present)	
Total	WBG, 2004. 2004 Annual Report, p.8
Energy	WADE estimate derived from WBG online database of projects in the energy sector.
Electricity	Data unavailable.
Renewables & Efficiency	WADE estimate derived from WBG online database of projects in the energy sector.
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
IDA (1960- present)	
Total	WBG, 2004. 2004 Annual Report, p.8
Energy	WADE estimate derived from WBG online database of projects in the energy sector.
Electricity	Data unavailable.
Renewables & Efficiency	WADE estimate derived from WBG online database of projects in the energy sector.
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
IFC (1956-present)	
Total	WBG, 2004. 2004 Annual Report, p.8
Energy	IFC, 2001. Financing Cogeneration in Developing Countries, Dana Younger, IFC GEF Coordinator/Principal Project Officer, Environmental Projects Unit, International Finance Corporation, WBG, 2nd International CHP Symposium, Amsterdam, 9-10 May 2001. Data is for up to and including 2001
Electricity	Data unavailable
Renewables & Efficiency	IFC, 2004. International Finance Corporation's Sustainable Energy Factsheet, May 2004
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.

ESMAP (1983-present)	
Total	ESMAP, 2004. *A Review of the ESMAP Rural Energy and Renewable Energy Portfolio*, April 2004, p.ix. Based on statement that US$16 million, represents 37 percent of total ESMAP project costs between 1999 and 2004
Energy	ESMAP, 2004. *A Review of the ESMAP Rural Energy and Renewable Energy Portfolio*, April 2004, p.ix. Based on statement that US$16 million, represents 37 percent of total ESMAP project costs between 1999 and 2004
Electricity	Data unavailable
Renewables & Efficiency	ESMAP, 2004. A Review of the ESMAP Rural Energy and Renewable Energy Portfolio, April 2004, p.ix.
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
ASTAE (1991-present)	
Total	WBG, 2001. Asia Alternative Energy Program (ASTAE) Status Report #9 June 30, 2001
Energy	IFC, 2001. *Financing Cogeneration in Developing Countries*, Dana Younger, IFC GEF Coordinator/Principal Project Officer, Environmental Projects Unit, International Finance Corporation, WBG, 2nd International CHP Symposium, Amsterdam, 9-10 May 2001. Data is for up to and including 2001
Electricity	Data unavailable
Renewables & Efficiency	Data unavailable
Cogeneration	Data unavailable
MIGA (1988-present)	
Total	WBG, 2004. 2004 Annual Report, p.9
Energy	MIGA 2004. *The Multilateral Investment Guarantee Agency (MIGA) Sustainable Energy Factsheet*. Sum of power portion of infrastructure portfolio and entire oil and gas portfolio.
Electricity	Data unavailable
Renewables & Efficiency	MIGA 2004. *The Multilateral Investment Guarantee Agency (MIGA) Sustainable Energy Factsheet*. Sum of power portion of infrastructure portfolio and entire oil and gas portfolio.
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
ADB (1966-present)	
Total	ADB, 2000. Energy 2000 Review of the Energy Policy, p.5
Energy	ADB, 2000. Energy 2000 Review of the Energy Policy, p.5
Electricity	ADB, 2000. *Energy 2000 Review of the Energy Policy*, p.52. Data is for between 1995-1999 only.
Renewables & Efficiency	ADB, 2000. *Energy 2000 Review of the Energy Policy*, p.52. Data is for between 1995-1999 only.
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
GEF (1991-present)	
Total	GEF website
Energy	GEF website
Electricity	Data unavailable
Renewables & Efficiency	WADE estimate derived from GEF online database of projects in the energy sector. Sum of all projects listed under “efficiency and renewable energy”(62 projects) and "energy conservation and efficiency" (45 projects).
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.
IADB (1959-present)	
Total	IADB website
Energy	IADB,2000. *Energy Sector Strategy*, May 2000, p.4
Electricity	Data unavailable
Renewables & Efficiency	IADB,2000. *Energy Sector Strategy*, May 2000, p.5
Cogeneration	WADE estimate derived from total financing for all projects identified with a cogeneration component.

Annex Four

Compilation of IFI Projects Identified by WADE Involving Cogeneration.

To approximate the extent to which cogeneration projects have been financed by the IFIs WADE conducted extensive research to identify as many projects as possible. Sources that were drawn upon to find example of projects include:

- Project databases
- IFI project documents
- IFI policy documents
- Presentations by IFI representatives
- IFI websites
- Project proponent websites
- NGO websites

The table that follows is the basis of the conclusions with respect to cogeneration related funding presented in the report. All cogeneration projects that were identified are listed. It is likely that some cogeneration projects financed in part by IFIs are omitted from this table because WADE could find no trace of them. This omission may however be partially off-set by the fact that the entire budget for all projects was included even if the cogeneration component of the project could not be determined. Project 36 (below) may be a particularly good example of how including the entire budget of a project may distort the amount of financing IFIs that appears to be allocated to cogeneration. If that project is omitted altogether only 17% of the IFC's energy portfolio budget is linked to cogeneration. If the project is included, this changes to 23%. In reality, many of the projects that include cogeneration will also include other investments that are not related, or only indirectly related to cogeneration. Nonetheless, WADE has attributed the full project budget to cogeneration investment. WADE believes therefore that its results probably over-estimate cogeneration investments, and it also welcomes any comments or ideas which may improve the accuracy of the estimates.

	Cogeneration projects identified by institution							
	Bank	Project ID	Year	Million $US		Description and/or name of project	Place	Total capacity after project (MW)
				Total funded	Total cost			
1	ADB	PRC:PRC 27093	1997	81.00	81.00	Xi'an-Xianyang-Tongchuan Environment Improvement project. 3 cogeneration and district heating subprojects in the three cities, two of which were cancelled in 2001along with their allocated loan funds of $75.0 million when no noticeable progress was noted.	China	
2	ADB	PCR: MON 29012	1996	10.00	10.00	Energy Conservation Project including new meters at existing CHP plants.	Mongolia	
4	ADB	PCR:IND 26470 019*	1994	12.02	70.67	Gujarat Alkalies & Chemicals Ltd. Cogeneration with waste heat recovery.	India	90
5	ADB	PCR:IND 26470 002*	1994	8.26	16.67	EID Parry India Ltd. Bagasse based cogeneration project Also achieved 20% energy savings per ton of production.	India	24.5
6	ADB	PCR:IND 26470 021*	1994	5.56	351.11	Oswal Chemicals & Fertilisers Ltd. Cogeneration with waste heat recovery.	India	110
7	ADB	PCR:IND 26470 003*	1994	4.53	9.11	Bellary Steels & Alloys Ltd. Cogeneration project (12 MW) from waste gases.	India	12
8	ADB	PCR:IND 26470 022*	1994	4.20	10.24	Sunflag Iron & Steel Co. Ltd. Cogeneration with waste heat recovery.	India	15
9	ADB	PCR:IND 26470 023*	1994	2.36	5.22	Sun Paper Mills Ltd. Cogeneration of 5.8 MW 7 process steam of 15.6 tons per hour.	India	5.8
10	ADB	PCR:IND 26470 005*	1994	1.40	7.84	Kothari Sugars Cogeneration plant of 12 MW based on bagasse.	India	12
11	ADB	PCR:IND 26470 031*	1994	1.27	24.00	Godavari Sugar Mills Ltd. Bagasse-based cogeneration.	India	24
12	ADB	PCR:IND 26470 001*	1994	36.50	1.11	Swadeshi Mills Ltd.Cogeneration plant – waste heat.	India	2.6
13	ADB	PRC 26454	1994	3.67	3.67	Qitaihe Thermal Energy and Environmental Improvement Project Including Coal fired cogen with district heating.	China	750
14	ESMAP/ UNDP	17428	1994			Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program including cogeneration opportunities assessment.	Zimbabwe	
15	GEF	948	2001	10.00	65.30	Vilnius District Heating Project including rehabilitation of CHP.	Lithuania	
16	GEF	P051829 dropped	2001	2.20	14.40	Industrial co-generation project 11.85MW Chemosvit Energochem A.S. Industrial Co-Generation Project (packaging factory).	Slovak Republic	11.85

Continued from page 38

17	GEF	P007400	1992	3.80	11.00	Demand Side Management Demonstration Project including reciprocating engine cogeneration and feasibility study.	Jamaica	
18	GEF/ IBRD	89 cancelled	1995	4.00	141.00	Renewable Energy Small Power Project (RESPP) Small DE including cogeneration and renewables.	Indonesia	
19	GEF/ IBRD/ IFC	1039/ PO502246	2000	5.50	105.50	Feasibility Study/Business Plan for an 80 MWe, Steam Cogeneration Plant at the Cosan Group Costa Pinto Sugar Mill.	Brazil	80
20	GEF/ IBRD	PID5950 dropped	2000	9.00	22.50	20.0 MWe and 24.0 MWth Szombathely CHP/Biomass Project.	Hungary	24
21	GEF/ IBRD	130 dropped	1997	6.00	60.30	Renewable Energy and Regional Development Project - Szekesfehervar Biomass-Gas CHP Project.	Hungary	
22	GEF/ IBRD	577	1994	3.30	55.10	Sugar Bio-energy project including IPP framework.	Mauritius	
23	GEF/ UNDP	940	2001	4.03	14.80	Biomass-based Power Generation and Co-generation in the Malaysian Palm Oil Industry, Phase I.	Malaysia	24
24	GEF/ UNDP	782	2000	12.50	85.80	Co-generation of Electricity and Steam Using Sugarcane Bagasse and Trash.	Cuba	
25	GEF/ UNDP	13	1999	6.80	73.20	Removal of Barriers to Biomass Power Generation and Cogeneration.	Thailand	
26	GEF/ UNDP	658	1999	4.40	12.30	Removing Barriers to the Increased Use of Biomass as an Energy Source including biomass as cogeneration.	Slovenia	
27	GEF/ UNDP	338	1996	3.80	6.50	Biomass Power Generation: Sugar Cane Bagasse and Trash.	Brazil	
28	IADB	BR0354	2001	173.40	248.30	Termobahia construction of cogeneration plant.	Brazil	190
29	IADB	CO-0163	1999	10.00	12.00	General energy efficiency: larger policy reforms including specific studies to implement and identify activities.	Columbia	
30	IADB	ME0228	2000	136.50	181.10	Vitro Cogeneration Project Monterrey 245 MW capacity cogeneration.	Mexico	245
31	IBRD	P008314	2003	34.20	132.70	District heating project.	Bulgaria	
32	IBRD	P075560	2003	3.60	3.60	Wood Residue to Energy project.	Bulgaria	
33	IBRD	P069996	2001	49.20	111.30	Uganda - Energy for Rural Transformation Project.	Uganda	
34	IBRD	HRPA8333 dropped	1999	100.00	100.00	Zagreb East Combined Cycle Power & Heat Project.	Croatia	
35	IDA	P008519	1996	20.00	98.50	Power and District Heating Rehabilitation Project.	Kyrgyz Republic	
36	IFC	022164	2004	261	487.00	Chenming LWC new paper manufacturer, waste water and 100MW capacity cogeneration plant.	China	100
37	IFC	022165	2004	35.00	61.00	Fenglin MDF (fibreboard board company) larger project including cogeneration feasibility study.	China	
38	IFC	021576	2004	20.00	20.00	China Green holding company specializing in CHP and MSW funds to manage and acquire existing CHP plants and develop new ones.	China	
39	IFC	022634	2004	15.00	110.00	Welspun India Limited Towel/line factory includes cogeneration plant.	India	
40	IFC	522661	2004	0.60	2.10	EOFI TurboTech micro-turbine manufacturer 50kW to 2.5MW range.	India	2.5
41	IFC	020721	2003	22.00	44.00	Cartones America S.A.(paper products 6million$ cogeneration plant biggest part of project.	Columbia	

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42	IFC	020625	2003	15.00		Two separate 20MW (40MWtotal) sugar mills with bagasse cogeneration Balrampur Chini Mills ltd.	India	40
43	IFC	020422	2003	10.00	10.00	Peak Pacific 2, funds to manage and acquire existing CHP plants and develop new ones.	China	
44	IFC	011431	2002	90.00	225.00	Commercialising Energy Efficiency Finance range of upgrades to energy-using facilities across the residential, commercial, industrial, and institutional sectors including cogeneration.	Eastern European Region	
45	IFC	011280	2002	20.00	20.00	Interstate Alliant funds to manage and acquire existing CHP plants and develop new ones.	China	
46	IFC	010774	2001	25.00	25.00	Peak Pacific Investment Company for financing CHP projects.	China	
47	IFC	10223	2001	17.50	30.20	Oriental Carbon and Chemicals Ltd. Expand production of carbon black and expansion of existing cogeneration facility.	India	
48	IFC	010706	2001	10.00	23.40	CSRC China Corporation Chemicals plant, expand production capacity and existing cogeneration capacity by 1.5 MW.	China	1.5
49	IFC	011197	2001	10.00	10.00	Modern Karton Working Capital Packaging factory production expansion including upkeep of existing cogeneration plant.	Turkey	
50	IFC	009339	1999	27.50	98.40	United Pulp and Paper Company, Inc expansion of production including new 30 MW cogeneration plant.	Philippines	30
51	IFC	009719	1999	9.00	25.80	Astha Power Corporation Private Ltd. Construction of new 26MW cogeneration plant for power supply resulting from power shortages.	India	26
52	IFC	009282	1998	10.00	40.50	Kunda Nordic Cement II, renovation of existing plant and construction of 6MW cogeneration facility.	Estonia	6
53	IFC	005028	1997	70.00	70.00	Upgrade and expansion of the Energeticke Centrum Kladno district heating plant to primarily power generation. 330MW total capacity.	Czech Republic	330
54	IFC	008279	1997	45.00	68.90	Agro Industrial Paramonga S.A. Bankruptcy bail out and introduction of cogeneration technology.	Peru	
55	IFC	008372	1997			Soktas Pamuk ve Tarim Urunlerini Degerlendirme Ticaret ve Sanayi A.S. Expansion and modernization of textiles plant that has existing cogeneration facility.	Turkey	
56	IFC	007103	1996	70.00	334.00	Turkiye Sise ve Cam Fabrikalari A.S. Glass producer. Large project to increase glass production including 27MW cogeneration plant motivated by power shortages in Turkey.	Turkey	27
57	IFC	004216	1995	25.00	83.00	Pantleon increase sugar production and & 35MW capacity bagasse cogeneration.	Guatemala	35
58	IFC	007131	1995	1.50	1.50	Smith-Enron Cogeneration Limited Partnership-financial risk abatement of cogeneration company.	Dominican Republic	
59	IFC	022440	2004	25.00	73.00	H & R Johnson ceramics company, increased production including 3MW cogeneration plant.	India	3
60	IFC	021154	2003		97.00	Lukoil Petrotel Chemicals. Improve environmental performance of refinery which already has cogeneration.	Romania	

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61	IFC	010520	2002	27.00	97.00	Magadi Expansion Project. New Soda Ash production plant including on-site power production.	Kenya	
62	IFC	011408	2002	24.00	49.00	Usha Beltron Limited, Increased Steel production and vertical integration including 7.5MW addition to existing 25MW on-site power plant.	India	32.5
63	IFC	008703	1998	31.00	42.00	Settavex textile production expansion including new cogeneration plant.	Morocco	
64	IFC	004859	1995	15.00	49.00	Yalova Elya Ve Iplika A.S. Textiles company, production expansion including cogeneration plant.	Turkey	
65	IFC/ INCaF	520722	2004			INCaF BCML Bagasse Cogen Balrampur.	India	
66	MIGA		1999			100 MW capacity cogeneration.	China	100
67	MIGA		1999	20.70	22.90	Nanjing Coastal Xingang Cogeneration Power Plant.	China	76
68	MIGA		1999			343 MW capacity cogeneration.	Czech Republic	343
	Total			1724.79	4365.54			2773.25

* These projects are all part of the same larger project

Other projects identified but which were not included in analysis because of insufficient data

ESMAP		1994			potential for cogeneration in Zimbabwe: Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program	Zimbabwe	
IFC		1996	26.40	186.00	Argentina Petrolera Argentina San Jorge S.A. build a coker and 59 megawatt, $232 cogeneration plant at a refinery near Concepcion, Chile, which imports oil from the Neuquen basin.	Argentina	59
IFC					part of larger project to modernize the steel plant	Peru	
GEF/IFC					EE Co-financing	Hungary	
GEF/ WB					Energy Service Delivery	Sri Lanka	
GEF/ WB					EMC Guarantee Facility	China	
WB						Bangladesh	
WB						Indonesia	
WB						Philippines	
EBRD						Poland	
GEF					Bagasse generation projects	China	
IFC			15.00			El Salvador	
IFC		2000	0.30		Carbon-funded municipal Phase II to establish two municipal cogeneration plants $240,000 cogeneration projects for the cities of Cluj-Napoca and Targoviste	Romania	
IFC					a 45MW bagasse cogeneration plant as part of an investment operation in a sugar mill		45
ASTAE					Energy Conservation	China	

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ASTAE					Haryana Power APL	India	
ASTAE					Renewable Energy II/Energy Efficiency	India	
IFC		1999	0.35		Development of combined heat and power projects	Romania	
ADB					Partial funding of the EC-ASEAN COGEN Programme ?	Asia pacific	
MIGA					IPP insurance	Jamaica	
PCF		2003	1.75		13.4 megawatt biomass-based boiler to utilize wood waste produced at the Svilosa pulp and cellulose plant to replace coal	Bulgaria	13.4
PCF		2003	5		Pannongreen Pécs Heat and Power Project Conversion of Pécs Power plant's existing coal-fired boilers to biomass. Annual generation 162 terajoules heat and 334.3 gigawatt-hour electricity	Hungary	65thermal /49electric