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PROJECT PERFORMANCE ASSESSMENT REPORT

INDIA

**RENEWABLE RESOURCES DEVELOPMENT PROJECT
(CREDIT 2449-IN; GETF 28633-IN)**

October 21, 2003

*Sector and Thematic Evaluation Group
Operations Evaluation Department*

Currency Equivalents (annual averages)

Currency Unit = Indian Rupees (Rs.)

1992	US\$1.00	Rs. 25.9
1993	US\$1.00	Rs. 30.5
1994	US\$1.00	Rs. 31.4
1995	US\$1.00	Rs. 32.4
1996	US\$1.00	Rs. 35.4
1997	US\$1.00	Rs. 36.3
1998	US\$1.00	Rs. 41.3
1999	US\$1.00	Rs. 43.1
2000	US\$1.00	Rs. 44.9
2001	US\$1.00	Rs. 47.2

Fiscal Year

Government: April 1 — March 31

Abbreviations and Acronyms

CAS	Country Assistance Strategy
DANIDA	Danish International Development Agency
EBRS	Energy Business Renewal Strategy
EIRR	economic internal rate of return
ESMAP	Energy Sector Management Assistance Program
FIRR	financial internal rate of return
FY	fiscal year
GEF	Global Environmental Facility
GOI	Government of India
GON	Government of the Netherlands
ICR	Implementation Completion Report
IDA	International Development Association
IREDA	Indian Renewable Energy Development Agency
kW, kWp	kilowatt, kilowatt peak
MNES	Ministry of Nonconventional Energy Sources
MW, MWp	megawatt, megawatt peak
NCE	nonconventional energy
NPA	non-performing assets
OED	Operations Evaluation Department
PPAR	Project Performance Assessment Report
PV	photovoltaic
RET	renewable energy technology
RRDP	Renewable Resources Development Project
SDC	Swiss Development Cooperation
SHS	solar home systems
TA	technical assistance
UNDP	United Nations Development Program

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OED Mission: Enhancing development effectiveness through excellence and independence in evaluation.

About this Report

The Operations Evaluation Department assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the Bank's self-evaluation process and to verify that the Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, OED annually assesses about 25 percent of the Bank's lending operations. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which Executive Directors or Bank management have requested assessments; and those that are likely to generate important lessons. The projects, topics, and analytical approaches selected for assessment support larger evaluation studies.

A Project Performance Assessment Report (PPAR) is based on a review of the Implementation Completion Report (a self-evaluation by the responsible Bank department) and fieldwork conducted by OED. To prepare PPARs, OED staff examine project files and other documents, interview operational staff, and in most cases visit the borrowing country for onsite discussions with project staff and beneficiaries. The PPAR thereby seeks to validate and augment the information provided in the ICR, as well as examine issues of special interest to broader OED studies.

Each PPAR is subject to a peer review process and OED management approval. Once cleared internally, the PPAR is reviewed by the responsible Bank department and amended as necessary. The completed PPAR is then sent to the borrower for review; the borrowers' comments are attached to the document that is sent to the Bank's Board of Executive Directors. After an assessment report has been sent to the Board, it is disclosed to the public.

About the OED Rating System

The time-tested evaluation methods used by OED are suited to the broad range of the World Bank's work. The methods offer both rigor and a necessary level of flexibility to adapt to lending instrument, project design, or sectoral approach. OED evaluators all apply the same basic method to arrive at their project ratings. Following is the definition and rating scale used for each evaluation criterion (more information is available on the OED website: <http://worldbank.org/oed/eta-mainpage.html>).

Relevance of Objectives: The extent to which the project's objectives are consistent with the country's current development priorities and with current Bank country and sectoral assistance strategies and corporate goals (expressed in Poverty Reduction Strategy Papers, Country Assistance Strategies, Sector Strategy Papers, Operational Policies). *Possible ratings:* High, Substantial, Modest, Negligible.

Efficacy: The extent to which the project's objectives were achieved, or expected to be achieved, taking into account their relative importance. *Possible ratings:* High, Substantial, Modest, Negligible.

Efficiency: The extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared to alternatives. *Possible ratings:* High, Substantial, Modest, Negligible. This rating is not generally applied to adjustment operations.

Sustainability: The resilience to risk of net benefits flows over time. *Possible ratings:* Highly Likely, Likely, Unlikely, Highly Unlikely, Not Evaluable.

Institutional Development Impact: The extent to which a project improves the ability of a country or region to make more efficient, equitable and sustainable use of its human, financial, and natural resources through: (a) better definition, stability, transparency, enforceability, and predictability of institutional arrangements and/or (b) better alignment of the mission and capacity of an organization with its mandate, which derives from these institutional arrangements. Institutional Development Impact includes both intended and unintended effects of a project. *Possible ratings:* High, Substantial, Modest, Negligible.

Outcome: The extent to which the project's major relevant objectives were achieved, or are expected to be achieved, efficiently. *Possible ratings:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Highly Unsatisfactory.

Bank Performance: The extent to which services provided by the Bank ensured quality at entry and supported implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of the project). *Possible ratings:* Highly Satisfactory, Satisfactory, Unsatisfactory, Highly Unsatisfactory.

Borrower Performance: The extent to which the borrower assumed ownership and responsibility to ensure quality of preparation and implementation, and complied with covenants and agreements, towards the achievement of development objectives and sustainability. *Possible ratings:* Highly Satisfactory, Satisfactory, Unsatisfactory, Highly Unsatisfactory.

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Principal Ratings

	<i>ICR*</i>	<i>ES*</i>	<i>PPAR</i>
Outcome	Satisfactory	Satisfactory	Satisfactory
Sustainability	Likely	Likely	Likely
Institutional Development Impact	Substantial	Substantial	Modest
Bank Performance	Satisfactory	Satisfactory	Satisfactory
Borrower Performance	Highly Satisfactory	Highly Satisfactory	Satisfactory

* The Implementation Completion Report (ICR) is a self-evaluation by the responsible operational division of the Bank. The Evaluation Summary (ES) is an intermediate OED product that seeks to independently verify the findings of the ICR.

Key Staff Responsible

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Preface

This is a Project Performance Assessment Report (PPAR) on the India Renewable Resources Development Project (RRDP) for which a credit of US\$115 million equivalent (2449-IN) was approved on December 17, 1992, and a GEF grant of US\$26 million equivalent (GETF 28633-IN) was approved on November 30, 1992. The project's original closing date of December 31, 1999, was extended twice, to December 31, 2001.

The RRDP is one of the first major renewable energy projects financed by IDA and GEF, and the first of its kind to be assessed by OED. RRDP focused on strengthening a central financing agency under a government ministry in order to commercialize a range of technologies — small hydro, wind, and solar — through the private sector. Among major developing countries, India also has the oldest and strongest renewable energy development program.

This report is based on the Implementation Completion Report (Report No. 23489) prepared by the South Asia Region, issued on June 21, 2002, the Memorandum and Recommendation of the President, loan documents, project files, and discussions with Bank staff. An Operations Evaluation Department (OED) mission visited India in March 2003 to discuss the effectiveness of the Bank's assistance with the government, project implementing agencies at the national and state levels, commercial banks, private investors and business associations for renewable energy technologies, research institutes, nongovernmental organizations, and other stakeholders. Their cooperation and assistance is gratefully acknowledged.

Following standard OED practice, the draft assessment report was sent to the Borrower for comments before it was finalized. The Borrower comments are attached (Annex D).

Summary

This is the Project Performance Assessment Report (PPAR) prepared by the Operations Evaluation Department on the India Renewable Resources Development Project (RRDP). A credit of US\$115 million equivalent (Credit 2449-IN) from the International Development Association (IDA) was approved in 1992 and closed in December 2001 after a two-year extension. The project was cofinanced by the Global Environment Trust Fund (GETF 28633-IN) in the amount of US\$26 million equivalent, and by the Swiss Development Corporation, the Danish International Development Agency, and the Government of the Netherlands.

The objectives of the RRDP were to (a) promote commercialization of renewable energy technologies by strengthening the capacity of the Indian Renewable Energy Development Agency (IREDA) to promote and finance entrepreneurial investments in alternate energy; (b) create marketing and financing mechanisms for the sale and delivery of alternative energy systems based on cost-recovery principles; (c) help set up the institutional framework for encouraging entry of private sector investors in small-scale power generation; and (d) promote environmentally sound investments to prevent depletion of India's limited forest resources and reduce the energy sector's dependence on fossil fuels. The objectives of the Global Environment Facility (GEF) project were to demonstrate commercialization of and catalyze wind energy and solar photovoltaic (PV) investments by strengthening IREDA's capacity to promote and finance private investments.

In evaluating this project, an attempt was made to assess project outcomes within the context of India's broader power sector reforms, on which the sustainability of renewable energy development and commercialization depends.

Overall, the project's outcome was rated *satisfactory*. Its physical objectives were achieved and, in the case of small hydro and wind farm power, they were even exceeded. The project succeeded in promoting the commercialization of renewable energy technologies (RETs) through IREDA's financing for private developers, training, and promotional activities. From a sector perspective, however, the project did not fully succeed in developing marketing and financing mechanisms based on cost recovery principles, or in reaching the *rural* market, as called for under the GEF financing and in the Bank's current Energy Business Renewal Strategy, thus limiting the project's benefits to the rural poor. None of the three RETs have yet reached full commercial status, as they continue to depend on infusions of grants and/or subsidies, and fiscal and regulatory incentives at the state and national level, to be financially viable to private developers.

Institutional development impact of the project is rated *modest*. At the project level, IREDA has been successful in promoting the commercialization of renewables, but it continues to have a high proportion of non-performing assets -- loans with zero or low repayment rates. Moreover, while IREDA continues to be cast in its traditional role of soft loan financing, some of its lending terms and processes are in fact not competitive. IREDA needs to compete in order to remain relevant. From a sector viewpoint, institutional development for renewables in India has been uneven, given the continuing regulatory unpredictability in some states (which deters new investments and threatens the financial viability of existing ones), and the lack of a renewable energy policy, hence the mixed signals to private investors from government and state regulatory agencies.

The sustainability of the process of commercialization catalyzed by the project is rated *likely* on balance, although benefits over time may be undermined by IREDA's

persistent non-performing assets; its limited capital availability and higher financial risks; the continued dependence of renewable energy technologies on incentives, grants, and subsidies; and broader state-level regulatory risks and uncertainties.

Bank performance is rated *satisfactory*. Pre-investment studies, technical assistance, and adequate supervision at most stages of the project contributed to satisfactory quality at entry and successful implementation of RRDP's physical targets. From a sector perspective, however, the Bank underestimated the challenges of creating marketing and financing mechanisms suitable to serving rural markets. Moreover, having focused on project inputs and outputs, the Bank missed an opportunity to leverage RRDP's resources to address sector policy issues (particularly state-level regulations) that directly influence RRDP's own outcomes. Finally, the Bank did not press strongly enough for the establishment of a strong monitoring and evaluation (M&E) capacity within IREDA, which is especially critical for renewables to compete.

Borrower performance is rated *satisfactory* overall. But the government showed weakness in (i) rationalizing lending rates and state-level regulatory frameworks; (ii) promoting more widespread adoption of renewable energy technologies in rural areas; and (iii) coordinating the various agencies involved with renewable energy development.

The main lessons of this project are:

- Power sector reforms and renewable energy commercialization should be part of an integrated strategy.
- The Bank and its client countries should incorporate provisions to level the playing field between conventional and renewable energy technologies *while* legal/regulatory and other *sector-level reforms* are being designed and implemented.
- Monitoring and evaluation (M&E) systems should be developed for both project- and sector-level outcomes, which should distinguish between efficiency and equity indicators. This is essential in setting subsidies, designing output-based aid, and mitigating investor risk in renewables-based capacity expansion, since the sector indicators would provide clearer signals to investors whether transparency and predictability in the regulatory framework for renewables are being achieved.
- Grant support from GEF and other donors operate within a larger sector reform setting, and thus should also pursue *sector outcome indicators*. Otherwise, focusing only on project inputs, processes and outputs fosters a culture of dependence on grants and subsidies, which ironically works against the full commercialization of renewables and hinders their ability to compete in the market when these financial incentives are reduced or withdrawn.
- Renewable energy development and commercialization involves much learning-by-doing, which re-emphasizes the importance of effective M&E systems.

Gregory K. Ingram
Director-General
Operations Evaluation

BACKGROUND

1. Since its independence in 1947, India's electricity demand has grown on average at a rapid 7 percent per year, thus doubling every 10 years. Since 1980, electricity supply has fallen short of demand, resulting in supply-demand gaps of between 5 to 8 percent, with peak power shortages often at double or triple these rates. The duration and number of blackouts and brownouts are frequently beyond acceptable limits. This has led to increases in captive generation, which currently amounts to more than 13 percent of total generation capacity.¹

2. India's power sector has been in a persistent state of financial and physical crisis. It is predominantly based on fossil fuels, with about three-fourths of the country's power generation capacity sourced from vast indigenous coal reserves, and a minute but growing share of renewable energy from solar, wind, and small hydro resources. In response to the macro-economic and fiscal crises of the Indian power sector, and following the shift in World Bank policy on energy sector lending set out in its 1993 policy,² the Bank, from 1993, refrained from financing or guaranteeing "power sector projects for states that were not undertaking full-scale restructuring, including unbundling, commercialization, and privatization of distribution systems and real tariff reform with an independent regulatory mechanism."³ This condition encouraged many of India's states, starting with Orissa and subsequently Andhra Pradesh, Haryana, Karnataka, Rajasthan, and Uttar Pradesh, to pursue Bank-supported energy sector reforms, which are now backsliding. During this period, bilateral donor assistance for renewable energy development expanded rapidly in parallel — but not jointly — with the broader power sector reform operations supported by the World Bank, as well as the Asian Development Bank. Thus, while there was a Bank policy and strategy governing its support for (or withdrawal from) the Indian power sector, there is still no coherent strategy for supporting renewable energy development, despite two large projects to date.

3. India's renewable energy program was launched in the 1970s primarily as a response to the perceived rural energy crisis. It was initiated as a target-oriented, supply-driven approach and sought to develop niche applications, such as in rural areas where grid-based electricity was not available.⁴ At that time (unlike today), the technologies were not mature and there was little international experience in implementation. Yet, renewables were promoted as a cure-all for the country's energy problems, resulting in doing "too much too soon" and unrealistic expectations that led to failures. With the economic liberalization in the early 1990s, the renewable energy program shifted emphasis from being centrally managed and supply-driven to an approach based on commercializing

1. International Energy Agency (2002) *Electricity in India: Providing Power for the Millions*. International Energy Agency/Organization for Economic Cooperation and Development.

2. World Bank (1993a).

3. OED (1999: 5). See also World Bank (1993b).

4. Ghosh et al. (2002).

proven technologies. Today, renewable technology capacity⁵ accounts for almost 3.5 percent of the overall generation capacity and 1 percent in the overall power generated.⁶

4. The rationale for Renewable Energy Resources Development Project (RRDP) originated from the joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP) review of the government's program on non-conventional energy sources in 1988, and the follow-up pre-investment studies in 1991 and 1992. The UNDP/ESMAP review concluded that grid-interfaced power generation from irrigation-based mini-hydro and windfarm systems offer near-term opportunities for commercialization, as well as solar PV systems for selected applications. Further, the studies concluded that wind energy, although not least-cost compared to conventional coal-based grid alternatives, can become economically competitive when the environmental cost of the fossil-based generation is considered. The studies noted that PV lighting and selected applications are economically viable in non-electrified areas, but consumer awareness of the benefits of PV systems has to be developed through more efficient marketing and financing schemes.⁷

5. Economic liberalization and the success of the Ministry of Non-conventional Energy Sources in getting states to adopt supportive energy policies and incentives, set the stage for the RRDP. Several southern states (Andhra Pradesh, Gujarat, Karnataka, Kerala, and Tamil Nadu) opened up to private investments and announced policies for licensing, pricing of power purchases, as well as alternative power sales arrangements for renewable energy-based generation. Other states followed in actively promoting private sector investments in renewable energy.⁸ To attract more investors, some states supplemented the national incentives with generous state-specific incentive packages, including deferral of sales tax payments.

Renewable Energy Subsector Institutions

6. The Ministry of Non-Conventional Energy Sources (MNES) is the principal agency responsible for the development of renewable energy resources.⁹ MNES formulates policies and programs and coordinates research and development (R&D) activities in the sector. It administers a variety of programs, including biogas development, improved chulas (stoves), solar thermal coolers, solar photovoltaics (PV), wind energy, and small hydro, which are funded mainly through central and state grants, and subsidies.¹⁰

7. In 1987, the Indian Renewable Energy Development Agency Limited (IREDA) was established as an affiliate of MNES to promote emerging non-conventional energy

5. Includes small hydro, wind, solar, cogeneration, and biomass-based power generation technologies.

6. MNES Annual Report 2001-2002 (MNES, 2002).

7. GEF project document, (World Bank, 1992).

8. Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh, and West Bengal.

9. The original department established in 1982 was converted to a full ministry in 1992, making India the only country in the world with a ministry dedicated to renewable energy technologies.

10. Cash subsidies were provided for promoting renewable energy technologies. Ghosh et al. (2002).

(NCE) technologies with two broad activities: (i) the organization and financing of entrepreneurial development and information campaigns; and (ii) the operation of a revolving fund to provide financing to producers, manufacturers, and users of NCE systems. IREDA is headed by a Managing Director and its Board is chaired by the MNES Secretary. The Board includes three appointed directors, as well as five ex-officio members including the Chairmen of the Central Electricity Authority, the Rural Electrification Corporation, and the Industrial Development Bank of India, and officials from the Finance Ministry and the Planning Commission.

THE PROJECT

Project Objectives

8. The project originally had five objectives, including a component for the Tamil Nadu Paper Limited (TNPL) to produce newsprint from bagasse. The TNPL loan closed on December 31, 1995, and a separate ICR¹¹ and Evaluation Memorandum¹² were issued in May 1996. This component was very successful in proving the economic viability of bagasse-based newsprint production. The OED mission visited TNPL in March 2003 and verified the continuing financial and economic sustainability of this industrial operation. Consequently, taking into account the well-prepared ICR¹³ associated with the TNPL component, this PPAR evaluates RRDP's remaining four components related specifically to renewable energy, as set out below:

- Promote commercialization of renewable resources technologies by strengthening IREDA's capacity to promote and finance entrepreneurial investments in alternative energy.
- Create marketing and financing mechanisms for the sale and delivery of alternative energy systems based on cost-recovery principles.
- Help set up an institutional framework for encouraging entry of private sector investments in small-scale power generation.
- Promote environmentally sound investments to prevent depletion of India's limited forest resources and to reduce the energy sector's dependence on fossil fuels.

9. The objectives of the grant cofinancing from the Global Environment Facility (GEF) were to promote the commercialization of wind energy and solar PVs by strengthening IREDA's capacity to promote and finance private investments in the sector. These were consistent with and subsumed under the Bank project. With respect to the windfarm component, the GEF grant was to help reduce the project's cost comparable to that of conventional alternatives and equivalent to displacing carbon dioxide emissions valued at about US\$30 per ton. GEF financing would also stimulate a commercial market that would help bring down the cost of solar PV production and consequently reduce the cost of displacing carbon dioxide emissions. Compared to the Bank loan, the GEF project

11. Report No. 15619, May 9, 1996.

12. December 31, 1996.

13. Report No. 23489 prepared by the South Asia Region, issued on June 21, 2002.

document was more specific regarding the objective of reaching the rural poor, specifically by targeting the household lighting market.¹⁴

10. Project cofinancing also included US\$4 million equivalent from the Swiss Development Cooperation (SDC). Parallel cofinancing of US\$50 million equivalent in mixed credits was also provided by the Danish government through the Danish International Development Agency (DANIDA). The Dutch government in 1996 provided US\$0.4 million, which was not part of the original project, to strengthen the technical assistance program. Given the slow project disbursement, DANIDA in 1997 withdrew its participation after disbursing US\$3.94 million when it decided to finance wind turbines instead of wind farms through its direct lending window; the SDC also reduced its funding to SFr 3.75 from SFr 6 million in FY 1999-2000.

Project Costs and Financing

Table 1: Costs per component

<i>Component</i>	<i>Appraisal (\$ million)</i>	<i>Actual (\$ million)</i>	<i>Actual Percentage Share</i>
Small hydro	94	166.0	58.5%
Wind farms	125	87.7	30.9
Solar PV systems	55	23.8	8.4
TA	6	6.4	2.2
Total Project Costs	280	283.9	100

11. The higher actual cost of the small hydro component can be attributed to: (i) the financing of more hydro capacity (i.e., 153 MW compared to the 100 MW envisaged at appraisal); (ii) higher costs of civil works, compared to appraisal estimates, because of unworkable low-cost solutions and underestimation of civil works cost in the ESMAP pre-investment study; (iii) additional works on canal lining upstream and downstream of the power plant; and (iv) higher-than-expected inflation. The lower actual cost for windfarms was due to cost reductions resulting from significantly lower local content than envisaged at appraisal. Actual Bank and GEF funding played a secondary role to domestic financing (51.8 percent of total project cost), which included contributions from IREDA, promoters and consumers, and other loans. Bilateral financing had a larger share at appraisal than what actually materialized.

14. GEF Project Information Document, (World Bank, 1992: 2).

Table 2: Distribution of project costs by funding source (Actual, as of December 31, 2001)

<i>Component</i>	<i>IDA</i>	<i>GEF</i>	<i>IREDA</i>	<i>DANIDA</i>	<i>SDC</i>	<i>GON</i>	<i>Promoters/ Consumers</i>	<i>Other Loans</i>	<i>Total</i>
Small Hydro	61.5	0.0	36.1	0.0	0.0	0.0	56.0	12.4	166.0
Wind	41.6	13.5	3.6	3.9	0.0	0.0	25.0	0.0	87.7
Solar PV	7.3	9.0	0.0	0.0	1.0	0.0	6.5	0.0	23.8
TA	0.0	3.6	1.0	0.0	1.3	0.0	0.0	0.0	6.4
Total	110.4	26.2	40.7	3.9	2.3	0.4	87.5	12.4	283.8

Implementation Arrangements

12. As outlined in the Staff Appraisal Report (SAR),¹⁵ various entities were to be involved in project implementation. IREDA was responsible for the overall management of the energy components. It was to be re-organized to ensure that tasks of appraising, supervising, and monitoring all the project's energy subprojects were effectively managed. IREDA would lend to private companies, nongovernmental organizations, cooperatives, and public sector companies that meet IREDA's minimum lending requirements. State Electricity Boards and state generating companies in participating states were expected to promote the project and assist developers in securing all the necessary state clearances for qualified investment proposals.

Implementation Record

13. The project was approved in April 6, 1993, and was implemented for almost nine years. The project's original closing date of December 31, 1999, was extended twice, to December 31, 2001, when it closed.

14. **Implementation and disbursements were slow** due to three important shortcomings in project design and preparation. *First*, there was poor prior understanding and hence weak development of the renewables market. Access to solar PV financing was slow, especially at project start-up, due in part to the condition set in the Staff Appraisal Report which stipulates that solar PV proposals from the IDA Credit/GEF grant would be considered by IREDA *only after* the completion of a market assessment and promotions campaign study. The study was completed only in 1994, more than a year after project approval, when it should have been part of project appraisal. *Second*, there was a lack of coordination between MNES and IREDA. Subsidies for solar PV programs at the national level (through MNES and IREDA) and state level have not been harmonized. Early on, mixed signals were given to investors: IREDA was the executing agency for a 1994 MNES program to disseminate 1,000 solar PV water pumps that offered high subsidies and technical requirements that did not conform with IREDA's own norms under the IDA/GEF-assisted solar PV component.¹⁶ Also, private developers wanted lower interest rates from IREDA in view of concurrent government announcements on interest rate rollbacks due to lower inflation rates. A reduction in

15. See p. 17 of the Staff Appraisal Report.

16. June 22, 1994 aide-memoire of the Bank supervision mission.

interest rate from 10.3 percent to 2.5 percent, coupled with relaxation in procurement procedures, brought in only 14 applications for solar PV by November 1995.¹⁷ *Third*, the slow development of commercial suppliers for the solar PV component can be largely attributed to the dominant role that the government played in PV procurement. *Fourth*, further delays in the implementation of the PV component occurred as the financial intermediaries earlier accredited by IREDA were unable to comply with the Reserve Bank of India's new prudential norms for non-banking institutions.

15. By 1999, the IDA/GEF-financed solar PV component was clearly unsuccessful. IREDA indicates (see Annex D) that this was the result of (i) high initial costs of renewable energy technologies, (ii) procurement delays, (iii) slow market reaction, and (iv) delays in the creation of solar PV delivery systems. Of the original US\$45 million allocation (including the GEF grant), only about 30 percent was committed and 10 percent disbursed. Based on project records, an imbalance occurred between the original allocation and use of funds among the small hydro, wind, and solar PV components, following a Bank decision to transfer mature subprojects (proposed under the Second Renewable Energy Project) into RRDP, in order to yield additional disbursements. There was also an imbalance (relative to original targets) between technical assistance (TA) and market development for the solar PV component: only 10 percent was disbursed under the critical activity of market development, whereas 75 percent was disbursed for TA, of which 45 percent was for media publicity alone. Much media publicity was carried out while market development (e.g., brokering and resolving issues among entrepreneurs, private lenders, consumer groups, and regulators) lagged significantly.¹⁸

16. The foregoing design shortcomings also affected project components other than solar PV. There were implementation delays in the small hydro component when MNES announced its subsidy support prompting some developers to pull out of IREDA's program, only to return later when the MNES subsidy program did not materialize.

17. In 1997, windfarm targets were scaled down to 30.5 MW when DANIDA withdrew its funding support for the project and decided to finance wind turbines through direct lending, reportedly due to the less-than-competitive rates of concessional Bank/GEF financing through IREDA, compared to alternative resources available in the domestic market. Based on the OED mission's interviews with commercial banks, this issue persists today.

RATINGS

18. The RRDP's sectoral objective of helping commercialize renewables should be evaluated within the context of the larger reforms that were taking place in the Indian power sector. Power reforms have important impacts on the development and commercialization of renewable energy technologies (RETs). Sector-level reforms can result in greater transparency as well as subsidy and tariff rationalization, which can

17. November 1995 mission aide-memoire.

18. IREDA states (see Annex D) that their Solar PV Market Development Programme has been relatively successful – both in terms of increasing awareness amongst urban *and* rural populations, and in terms of providing financing for more than 50,000 PV systems. According to IREDA, the main barrier to developing the market for Solar PV products remains the relatively high cost of Solar PV systems.

provide spaces and opportunities for RETs within which to better and more fairly compete. The broader transformation of power sector structure and ownership led by the World Bank in India — by emphasizing corporatization, commercialization, competition, and private-sector initiatives — have to a certain extent offered new *opportunities* and *potential* for renewable energy services to compete more fully for a market share. Unbundling the energy sector — by allowing prices to reflect costs, reducing if not eliminating cross-subsidies, and increasing transparency and insights into cost structures — has underscored the comparative advantage of decentralized and renewable energy services in serving the electricity needs of remote and dispersed communities and consumers.¹⁹ At the same time, the financial viability and sustainability of RET investments depend significantly on stable and predictable regulations at the state level, which in turn are consistent with an explicit renewable energy development policy at the national level (as in Germany, Denmark, and the Netherlands) that creates and fosters “market space” for renewables.

19. Since the RRDP is one of the first renewable energy projects financed by the IDA and GEF, this PAR takes into account the extent to which project implementation has been well integrated within the larger power sector reform framework, on which renewable energy commercialization depends. Consequently, this PPAR evaluates outcomes vis-à-vis the project’s specific objectives as appraised *and* the renewable energy-related indicators of the Bank’s 2001 Energy Business Renewal Strategy (EBRS) and the 2002 Private Sector Development Strategy. This is in line with OED’s “Guidelines and Criteria for Project Evaluations” (July 1, 2000), which requires that a project’s development impact be measured vis-à-vis the continuing relevance of the project’s objectives at the time of evaluation (“otherwise, there is a significant risk that the Outcome rating would not reflect results on the ground, but rather only the achievement of outdated objectives”). Three (out of 4) main goals of Bank’s EBRS are relevant for the RRDP: environmental mainstreaming, helping the poor directly, and private sector development. As performance indicators, these EBRS goals respectively call for renewable energy development, promoting community-managed systems, creating nondiscriminatory regulatory mechanisms, and strengthening financial institutions to provide long-term financing for rural energy business.

20. The OED ratings below raise some key sector-level concerns that deter RET commercialization, particularly regulatory frameworks and good governance. Evidence for the ratings is based on mission findings, portfolio and literature reviews, and interviews at headquarters and in the field among a large number of informants. The PPAR also took into account the findings and lessons learned from OED’s May 2003 study to evaluate the World Bank Group’s performance in promoting Private Sector Development in the Electric Power Sector.

19. Cabraal and Fitzgerald (2001: 5-8).

Outcome

OED definition: Based on three sub-criteria of relevance, efficacy, and efficiency — to what extent were the RRDP's major relevant objectives achieved, or are expected to be achieved, efficiently? Has the commercialization of renewable energy technologies been promoted, based on cost recovery principles, and with private sector participation?

21. **The project's outcome is rated satisfactory.** The project achieved its physical objectives, and in the case of small hydro power and wind farms components, exceeded its targets. It should be clarified, however, that the project's direct physical achievements are small compared to the total MW from renewables already installed in India, which in turn is very small relative to the country's renewables potential (see Table 3 below, based on technical potential, as data on the potential market is not available).²⁰ It is not feasible to quantify the proportion of total installed renewable energy capacity that has been catalyzed (but not financed) by the project.

22. Based on interviews and a literature review, there is widespread consensus that IREDA and the project did contribute to the development and rapid growth of a private sector wind, small hydro, and solar renewable energy lines of business in India. IREDA enlarged the space for renewables in the Indian energy sector debate, and engaged many State Electricity Boards in planning with renewables factored in. However, while the RRDP did promote renewables, there are still many risks because of the lack of a Bank and borrower strategy that integrates the commercialization of renewables within the design and implementation of power sector reforms. Moreover, there is a continued reliance on soft consumer credit as the key driver in upscaling renewables, without being adequately supported by product diversification targeted toward demographically and geographically well-defined markets.

20. According to standard usage, *gross potential* refers to the total amount of renewable energy available for extraction; and *technical potential* refers to the amount of energy that may be extracted from the available resource, using known technologies. Statistics on *gross* versus *technical* potential for renewable energy sources in India were very unclear. A 2001 TERI Report suggests that the data on *gross* potential reported above were in fact figures for *technical* potential. The 2001/02 MNES Annual Report list these same figures in its Table 1.1, but do not clarify whether the estimates are for gross or technical potential.

Table 3: Degree of Commercialization, Potential, and Installed Capacity for Small Hydro, Wind, and Solar PV in India

<i>RET</i>	<i>Degree of Commercialization (PPAR and ICR)²¹</i>	<i>Technical Potential (est. MW)</i>	<i>Total Installed Capacity (MW)</i>	<i>Project's Objectives (MW)</i>	<i>Actual MW Under RRDP</i>	<i>Additional MW Funded from Other Sources</i>
Small Hydro	PAR: Commercialization slowed down; current investments at risk ICR: Fully commercialized	10,071 ^{a)}	1423	100	117.9	155 ^{e)}
Wind	PAR: Commercialization progress is uneven ICR: Commercialization is advancing rapidly	13,000	1507 ^{c)}	85	87.2	184 ^{e)}
Solar PV	PAR: Commercialization is stalled/declining ICR: Market being developed	4200 (MWp) ^{b)}	82 (MWp) ^{d)}	2.5 to 3.0 (MWp)	2.145	4 (MWp) ^{f)}

a. This figure is based on the aggregated estimated technical potential capacity of 4096 identified sites in India.

b. The figure of 4200 MWp is based on 50 Wp SHS for 65 percent of households currently without electricity, assuming 5 people per household.

c. According to IREDA, total installed wind capacity as of March 31, 2003, was 1870 MW.

d. Of this, 29 MWp SPV products were exported.

e. Using other sources, including domestic market borrowings.

f. Using MNES funds.

Source: For estimates of gross potential as well as total capacity installed in India, see Table 1.1, MNES (2002: 4). Technical potential estimates for small hydro and wind were from MNES (2002) Table 5.14, pp. 100, and pp. 7, respectively. Technical potential estimates for SPV were derived from International Energy Agency (1999). All other data were derived from the ICR.

23. Moreover, “cost recovery” remains an issue. The financial viability, commercial sustainability, and readiness for upscaling of renewable energy in India continue to depend on the infusion of grants, subsidies, and other government incentives (see “Efficiency” section below). Given this continuing grant/subsidy dependence, this review modifies the ICR assessment that small hydro and wind generation are fully or nearly commercialized (see Table 3 above). While the project reduced business risks to marketability and competitiveness, many barriers to full-scale commercialization remain, such as persistent regulatory uncertainties and unclear policy framework in support of renewables. There are significantly varying regulatory regimes for renewables at the state level, and conflicting policy signals have been sent at the national level (during OED’s PPAR mission, for example, MNES announced that provisions on specific targets for renewables as a percentage of total generation capacity were deleted from the draft

21. IREDA (see Annex D), however, agrees with the estimates of the degrees of commercialization of renewable energy technologies provided by the ICR.

Electricity Bill — which indicates backsliding from the strong government support in previous years that have already been lauded by renewables stakeholders and foreign donors). Moreover, as discussed under the section below on Institutional Development Impact, much more needs to be done in strengthening IREDA's institutional capacity to (i) promote a more sustainable commercialization of renewables based on cost-recovery principles and (ii) ensure greater energy access for the poor.

Relevance of Objectives

OED definition: To what extent are the objectives of the RRDP consistent with the country's current development priorities and with current Bank country and sector assistance strategies (such as the Energy Business Renewal Strategy) and corporate goals?

24. **The relevance of the project's objectives is rated substantial.** RRDP's objectives are consistent with the Bank's Country Assistance Strategy (CAS) priorities throughout the 1990s; they remain relevant to the present CAS, which calls for increased private sector participation and improved environmental protection.²² The project's objectives are also in line with the GEF's Operational Program No. 5 on removing market barriers to large-scale application and implementation of energy efficiency services, products, and technologies. The project's push for commercialization of renewables is also relevant to Goal 7 of the Millennium Development Goals ("Ensure Environmental Sustainability") and its accompanying Target 9 ("Integrate sustainable development into country policies and reverse loss of environmental resources." RRDP's objectives are also supportive of India's Environmental Action Plan, promulgated in December 1993, which includes the promotion of renewable energy as a key element.²³ The priority conferred by the government on renewable energy program and energy efficiency is articulated in its five-year development plans since the 1980s.²⁴ Renewable energy is also supposed to play an important role in achieving the MNES medium-term (and ambitious) goal to ensure electrification of 18,000 remote villages by 2012, by representing a minimum of 10 percent, or 10,000 MW, of the total power generation capacity.²⁵

25. The project, however, falls short of meeting the poverty reduction objective of the Bank's 2001 Energy Business Renewal Strategy (EBRS). (As explained in paragraph 19, an assessment of *current* relevance is required by OED's project evaluation guidelines.) The RRDP supported two EBRS objectives, namely, environmental protection (by promoting the commercialization of renewables) and private sector development (by strengthening IREDA and providing concessional financing to private developers for renewables). But it has not facilitated energy access for the poor to the scale originally envisaged, especially in the case of solar PVs in rural areas. As explained immediately

22. The call for private sector participation was first enunciated in the Country Economic Memorandum of 1993 as part of the country's move towards economic liberalization. Greater private sector participation is a key component of India's power sector reform as indicated in a series of Country Assistance Strategies (1996, 1998, 2001). Emphasis on environmental protection was first enunciated in the 1996 CAS.

23. ICR; 1996 CAS.

24. Project Appraisal Document, Second Renewable Energy Project, 1998.

25. MNES (2002).

below, IREDA's credit policy tended to favor well-established industrial and commercial enterprises, and had limited impact on the development of smaller scale entrepreneurs that could serve the rural poor.²⁶

Efficacy

OED definition: To what extent were the objectives of the RRDP achieved, or are expected to be achieved, taking into account their relative importance?

26. **The project's physical objectives were achieved**, but mainly for the small hydro and wind farm components, for which employment and productivity impacts have been high, as noted in the ICR. RRDP succeeded in promoting the commercialization of these RETs through IREDA's financing for private developers, and training and promotional activities.

27. The solar homes systems (SHS) component, which received 34 percent of GEF's support, was much less successful. IREDA's complex procedures and requirements (which were subsequently streamlined) discouraged small- to medium-size start-up companies, which should have played a pivotal role in the early introduction of SHS, as they have done historically in other countries.^{27 28} The Bank's policies on credit lines exacerbated this IREDA bias for larger-scale companies, thus keeping smaller entrepreneurs out of the SHS market. Those policies insisted that there be no direct working capital loans to public or private developers, preferring to provide concessional financing directly to the consumer instead.

28. Moreover, a key project design weakness was that both IREDA and the Bank, due to time pressures for project appraisal and completion, did not make a credible effort to design the project so that strong rural credit organizations could be tapped to manage rural credit risk. In addition, the Bank did not use its leverage to press for business advisory services and the elimination of import duties on PV modules. Consequently, the large rural market was not tapped, rural sector SHS delivery mechanisms were not developed, and rural energy access was not improved, as called for by the Bank's current Energy Business Renewal Strategy.²⁹

29. This weakness in developing the rural SHS market infrastructure is exacerbated by the already strong bias against rural energy markets resulting from the Indian

26. In Annex D, IREDA states that their credit policy did not favor well-established industrial and commercial enterprises, to the relative neglect of meeting the needs of smaller scale entrepreneurs that could serve the rural poor. IREDA indicates that, as a public financial institution, it cannot approach rural financing agencies due to the non-availability of essential commercial banking institutions and infrastructure, etc. Attempting to overcome this barrier, IREDA has sanctioned lines of credit to commercial enterprises for distribution of SHS through local/rural agencies, including small scale entrepreneurs.

27. See Miller and Hope (2000) for this paragraph and subsequent ones.

28. See the footnoted objection by IREDA above, in paragraph 25.

29. However, in Annex D, IREDA notes that SPV systems financed by IREDA are installed in the rural and hilly areas where there is no grid or quality grid power available. In these cases, rural credit organizations were involved, although the rural market has yet to be tapped to the fullest extent.

government's protectionist policies dating from the early 1980s. Overall, the more than two decades of strong solar energy industry development in India, with Bank/GEF support in the 1990s, has mainly benefited corporate and industrial markets with low credit risks, to the relative neglect of the poor.

Efficiency

OED definition: To what extent has the RRDP achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared to alternatives?

30. **RRDP's economic and financial rates of return are rated modest.** Based on the ICR, the economic internal rates of return (EIRRs) for the three components are above the opportunity cost of capital (12 percent) and are comparable with those estimated at appraisal, particularly for solar PV applications as a result of large unit cost reductions. However, EIRRs for some of the early wind projects were below the 12 percent rate due to lower-than-expected capacity utilization factors.³⁰ As the ICR correctly indicates, the project should have given more attention to maximizing energy output (i.e., the actual project economic benefits) rather than installed capacity. The project's EIRRs and financial internal rates of return (FIRRs) at appraisal and completion (by component) are presented in Annex B.

31. FIRRs for all the three components are also comparable to or sometimes even higher than appraisal estimates, but they are mainly due to generous incentives for either producers and/or end-users.³¹ This is most evident in the wind energy component. The generally high FIRRs for wind farms can be attributed to many incentives, including a 100 percent depreciation benefit in year one at the national level, and the deferral of sales tax payments in some states, such as Maharashtra. Some of the early wind projects in Andhra Pradesh, Gujarat, and Tamil Nadu had poor economic and financial returns because their capacity utilization had been about half that expected at appraisal. Most of the later wind farm projects achieved high returns due to improved wind farm performance and to sales and tax deferment offered by some states. Further, the average FIRR on equity after tax on wind projects is on the high side due to 10 projects in Maharashtra which were exceedingly profitable due to generous sales tax deferment incentives.³²

Institutional Development Impact

OED definition: To what extent has the RRDP improved the ability of India and the project areas to make more efficient, equitable, and sustainable use of their human, financial and natural resources — through better definition, stability, transparency, enforceability, and predictability of institutional arrangements for renewables? Has the project strengthened IREDA's capacity to promote renewable energy commercialization?

30. The economic analysis was based on 13 small hydro sub-projects of 33 projects representing a sample of the best, worst, and average projects; and 27 wind-projects. The ICR did not mention the number of samples for the PV analysis.

31. Based on the ICR.

32. Ibid.

32. **The project's institutional development impact is rated modest.** RRDP strengthened IREDA and enabled it to mobilize greater private participation and attract additional multilateral and bilateral support for commercializing renewables. RRDP's TA was effective in strengthening IREDA's subproject sanction procedures and international competitive bidding processes, which contributed to RRDP's successful physical outcomes. Subproject approval to commissioning time went down significantly, ranging from 15 to 30 months, compared to 40 to 65 months, previously. However, RRDP's objective of creating marketing and financing mechanisms based on cost recovery principles was not fully achieved. IREDA continues to have non-performing assets, i.e., payment defaults or delinquency. Networking with rural credit institutions continue to be weak or absent and rural renewables markets continue to be untapped. Most RRDP clients are commercial and industrial, and in urban areas, thus raising doubts whether the project really improved broader energy access, especially by the poor.

33. Finally, as shown in Figure 1 below, IREDA has not evolved fast enough to be an effective "broker" in the current highly competitive capital markets environment. It is still restrained to the traditional role of receiving soft loans/grants and dispensing subproject financing to applicants. IREDA has had little impact in bridging entrepreneurs with state-level regulatory and development agencies (the incentive is for IREDA to have its own projects rather than act as a broker). Presently, however, there is a larger number of strong stakeholders, compared to when RRDP was designed. Commercial banks have emerged with a range of lending instruments and more competitive terms than IREDA's higher-cost financing terms. The sectoral context for commercializing renewables has also become much more complex: state regulators' response to appeals from renewable energy investor associations have become more unpredictable; many states have been backsliding on power sector reforms; the government has been sending conflicting signals on its support for renewables; generous incentives are being phased out or withdrawn; and public demand for accountability has increased dramatically.

Figure 1: IREDA's Required Function and Institutional Development Over Time

<i>Time</i>	<i>Energy Sector Context</i>	<i>Competitive Environment</i>	<i>IREDA's Required Function</i>	
Late 1980s/Early 1990s	Public Sector Dominance	Few private developers. Renewables mostly under government control. Subsidies on petroleum products.	Financing of all renewables development.	
	↓	↓	↓	
Late 1990s	Energy sector liberalization and restructuring	Increasing private participation. Greater cost-transparency. Better public awareness. Increasing competition.	Financing. Catalyzing private investments. Market Assessment.	← IREDA's Actual Level of Institutional Development
	↓	↓	↓	
2000 and beyond-	Reform Stability in some states; reform backsliding in other states; regulatory uncertainty	Competition from other sources of financing; greater diversity of lending terms. Multiple powerful stakeholders (commercial Banks; investment firms; non-governmental organizations). Decrease or phase-out of public incentives.	Financing of selected technologies (solar PV and off-grid systems). Market Development. Risk Mitigation (advisory services and new instruments).	

Sustainability

OED definition: To what extent are RRDP's net benefit flows resilient to risks over time?

34. **The sustainability of RRDP is rated likely**, but only marginally so. There are high risks, as commercialization of renewables continues to be threatened by regulatory instability, and have many constraints, notably its continued dependence on incentives, grants, and subsidies. IREDA itself continues to face important financial issues that threaten the sustainability of the project's achievements.³³

35. **Portfolio performance.** IREDA's sustainability depends strongly on its ability to make reasonable profit margins. While IREDA has seen considerable growth in subproject approvals and disbursements, this growth has been accompanied by a significant increase in non-performing assets (NPAs), for which loan servicing is deficient or at default. As noted in the ICR, IREDA's NPA levels have tended to be higher than some other comparable Indian institutions, though IREDA's NPA levels – relative to other institutions - have improved somewhat over the last couple of years.³⁴ Nevertheless, as Annex C of this PPAR suggests, the absolute value of NPAs has increased significantly over the years. NPAs for renewables in general — as a percentage of total loans outstanding — have tended to decrease toward the end of the project, but this trend is less clear if disaggregated by component.

33. See the Price Waterhouse Coopers Study (2000).

34. See comparative NPA data provided by IREDA in Annex D.

36. For the solar PV component, NPAs have decreased over the past couple of years.³⁵ The trend is less clear for the small hydro and wind power components: NPAs of loans outstanding for these two increased over the duration of the project, peaking in 1999-2000 and 2000-2001, respectively. Figures for 2001-2002 show that the NPAs for both components have decreased, although the small hydro NPAs only dropped by one percentage point. For 2002-2003, only aggregate NPA figures for renewables in general were available, but these actually indicate an overall slight increase in NPAs. This further tempers the claim that NPAs for renewables have recently been decreasing. Review of the IREDA's loan portfolio and NPAs reveals a concentration of loans across states/regions and sectors [see IREDA's additional comments in Annex D].³⁶ Moreover, a Bank supervision mission also indicated deteriorating collection performance, especially for the wind portfolio, with 11 percent of loan outstanding.³⁷ Ability to contain NPAs, better collection performance, and an improved capacity for screening and appraising project proposals, will be critical determinants of IREDA's growth in the future.³⁸

37. Limited capital availability and higher financial risks. Financial forecasts for IREDA suggest that fresh equity would have to more than double from the level currently available. This equity requirement would go up further if recovery levels deteriorate further. But the availability of equity from the government and concessional debt funding is limited. IREDA also faces higher technological and financial risks compared to more diversified and commercially oriented financial institutions. IREDA's ability to manage these risks will have implications for continued support from the government and international financial institutions and its access to capital markets for raising debt and equity in the future.

38. Based on the financial projections and analysis of trends in recovery and NPAs, IREDA's future growth could be curtailed, unless it adopts a higher degree of commercial orientation in its operations, that would include changes in processes and systems, especially on the financial analysis of many projects that are marginally viable on a stand-alone basis.

39. Regulatory risks and uncertainty.³⁹ Ad hoc and inconsistent policy and regulatory revisions — such as bans on third-party sales, increased wheeling charges, and unfavorable changes in power banking terms, and restrictions on captive generation in some states — eroded and continues to undermine investor confidence. Indeed, neither Andhra Pradesh, Karnataka, nor Tamil Nadu, three of the states that received the most project funding, allow third-party sales. Moreover, although Andhra Pradesh complies

35. In percentage terms since 1998-1999, and in absolute terms since 2000-2001.

36. Based on March 2000 data, 86 percent of loan outstanding of the wind sector NPAs were in Tamil Nadu, and 79 percent of the small hydro NPAs were in Karnataka.

37. The Bank supervision mission aide-memoire of April 2001 indicates a low collection rate (73% for 2001, 55% on aggregate).

38. IREDA states that it has taken various steps to address these issues. For a list of these efforts, see Annex D.

39. This section draws on interviews with staff from the Small Hydro Power Developers Association of Andhra Pradesh, as well as documentation provided by IREDA "Brief Description of Policies Announced by Various States," during the OED mission in March 2003. See also ICR, pp. 16-17.

with the MNES guidelines related to tariff escalation under the PPAs with renewable energy producers, in 2002-2003 the Andhra Pradesh Energy Regulatory Commission hiked the wheeling charges from the initial 2 percent of electricity generated to 28.4 percent, adding also a further charge of Rs 0.50 per kWh as grid support charges. The inflexible approach to power banking in some of these states, particularly in Tamil Nadu where banking is now banned and in Andhra Pradesh where it is limited to 8-12 months, further threatens the financial viability of existing renewable energy investments as well as discourages future investments in the sector.

Bank Performance

OED definition: To what extent did the services provided by the Bank ensure quality at entry and support implementation through appropriate supervision, including ensuring adequate transition arrangements for regular operation of the RRDP?

40. Overall, **the Bank's performance is rated satisfactory**, at least at the project level. As explained in the remainder of this PPAR, the main risks to the project stem from the lack of an integrated renewables and power sector strategy.

41. Quality at entry. Quality at entry was substantial, both in terms of sector work, analytical and advisory assistance, and preparatory studies financed by grants from the GEF, the Energy Sector Management Assistance Program (ESMAP), and the Japanese Policy and Human Resources Development (PHRD) Fund. Three ESMAP-funded studies on conventional energy systems, mini-hydro development, and windfarms provided the basis for the project formulation while studies funded by GEF and PHRD provided the basis for designing project components. Project files at the design stage show ample debate on whether to implement the project through the State Electricity Boards or through local private entrepreneurs, and decisions in favor of the latter.

42. Early during implementation, however, the project files also showed that some pre-investment studies were deficient (e.g., small hydro prototypes led to high civil works costs). The Bank also did not push for networking with rural credit institutions and developing rural energy markets, and was not fully effective in bridging early enough the interest rate differential between MNES and IREDA programs.

43. Supervision. Bank supervision was satisfactory. The Bank showed flexibility in allowing design changes and modification of procurement requirements to accommodate needs of small private developers. Still, while substantial improvements were made in procurement simplification, the transaction costs and paperwork requirements of the RRDP's loan-instruments have proven to be prohibitive for smaller businesses and entrepreneurs from rural areas.⁴⁰

44. Monitoring and Evaluation (M&E) Systems. Overall, based on the indicators from the belated M&E capacity that is only now being initiated at IREDA, the Bank focused on project inputs and outputs, and did not effectively use the leverage that the RRDP could have provided to address sector-level policy issues that directly influence RRDP's

40. Miller and Hope (2000).

own outcomes. This is a missed opportunity that is discussed in more detail in the section below on PPAR findings, lessons, and outlook.

45. In conjunction with integrating renewables with the overall power sector strategy, the Bank could have also pressed (and under the Second Renewable Energy Project, should press) for the development of a strong M&E capability, both for sector-level and project-level outcome and impact indicators. This need can be illustrated by questions on the Bank's role and issues of project accountability (discussed in the next two paragraphs) that remain unclear. Moreover, these outcome and impact data are essential for designing output-based aid schemes, setting grid versus off-grid subsidies, and defining measures to mitigate the risks of serving rural, off-grid markets.

46. Given the large presence of other renewable energy donors in India, it is important to distinguish what is attributable to the Bank and GEF involvement, from what is not. For any future involvement, this will help to build on the comparative advantage(s) of the Bank — as only one player among many other important ones — and promote better leveraging of public-private partnerships. However, while tracking the RRDP's physical outputs was adequate, monitoring of sector-level achievements was less so, partly due to the lack of a strategy that clearly provides a road map for addressing the issues that constrain renewable energy development, despite broad objectives that give renewables an important role.

47. On accountability, although no direct evidence was provided, a significant number of informants volunteered the fiduciary management issue that some IDA/GEF-financed windpower investments were only “on paper,” i.e., given the GEF grant and government incentives, the transactions were concluded mainly for the purposes of reducing taxes and benefiting from accelerated depreciation, but the facilities were never built, or were built but not really used or maintained. Potential over-invoicing to create margins for middlemen was also raised. While clearly outside the scope of this PAR, these “phantom installations” are an issue of fiduciary accountability on the part of the borrower that merits further investigation. Preliminary answers would have been available had the Bank insisted on an M&E system from the very start. IREDA was asked to conduct surveys of post-commissioning performance for the three components (small hydro, wind, solar PV), but met some difficulty because of (i) lack of data due to the absence of M&E systems, and (ii) the inability or unwillingness of developers to provide required information.

48. Implementation Completion Report (ICR). The quality of the ICR is high, but it did not discuss adequately the project's outcomes related to reaching rural households, which was embedded in the GEF's objectives, and made only anecdotal references to helping the poor. A major component of the GEF-funded TA was intended to promote and increase awareness of solar PV use by rural consumers; and to support improvements in product quality, marketing, and after-sales service for products funded by the GEF/IREDA revolving credit.⁴¹ Further, the GEF revolving credit for solar PV implicitly favored rural consumers, with its promotional campaign directed at rural consumers. But the ICR discussion on the solar PV component only focused on its physical accomplishments; there was no mention on whether (i) rural markets were served and (ii) after-sales service centers

41. GEF Project Document (World Bank, 1992).

were in fact established. The Bank did not provide adequate ex-post accounting on whether the GEF funds (allocated for wind, solar PV and TA) were used as planned.

Borrower Performance

OED definition: To what extent did the borrower assume ownership and responsibility to ensure quality of preparation and implementation, and comply with covenants and agreements, toward the achievement of the RRDP's objectives and sustainability?

49. **Borrower performance is rated satisfactory.** However, during project implementation, project supervision records show that the government was weak in supporting the rationalization of lending rates, and in coordinating various agencies involved with renewable energy development. Particularly at the critical phase of project start-up, the government, MNES, and IREDA were not fully effective in their respective roles; at times, they worked at cross-purposes, by providing parallel financing (i.e., more advantageous MNES terms compared to IREDA) and lacking coordination in regulatory and fiscal incentives between the central and state levels. For example, the imposition of a uniform sales tax on renewables by various state governments effective January 1, 2000 had serious implications on the development of renewables markets, especially for solar PV, which are considered to be the most expensive among all the RETs. To date, there are unresolved policy and regulatory issues, including the realignment of incentives at the central and state levels, which the government has not addressed. Some states (e.g., Andhra Pradesh) have retroactively applied ad hoc policy and regulatory revisions that are discouraging investors because of increased financial risks (see paragraph 39).

50. Renewable energy development and commercialization — and energy access by the rural poor — is ultimately the government's responsibility, in line with its stated goal of electrifying 18,000 villages by 2012 (the earlier goal of 6 percent of generation capacity from renewables by 2002 has not been met). Based on a 2002 ESMAP study, there is little evidence that renewable energy plays a significant role in India's rural energy situation. Rural people do not own or are largely unaware of various renewable energy devices. While the government's renewable energy program has made progress in the area of technology trials and pilot projects, it has had difficulty in promoting a more widespread adoption of technologies in rural areas.⁴² Pilot schemes to promote renewables have created a subsidy-oriented mindset among rural consumers and government programs have created unrealistic consumer expectations.

FINDINGS, LESSONS LEARNED AND OUTLOOK

Major Findings

51. The PPAR's main finding is that RRDP's potential gains are at risk of being undermined by the lack of a coherent strategy that integrates the establishment of an enabling investment climate for renewables *within* the overall framework of power sector reforms. The RRDP tended to focus on MW installed and did not address policy issues on which project sustainability depended. Still missing are consistent national and state-level policies, and a clear road map specific to renewable energy commercialization. This is

42. ESMAP (2002).

especially lacking for rural and remote energy markets where RETs — with their comparative cost-advantage — could play a significant role in addressing both equity and environment concerns. In the absence this strategy, much of the potential and limitations of renewables in achieving the government’s ambitious electrification goals remains unclear and hence risky, particularly for private investors.

52. **While the RRDP’s grant component helped promote private investments, the project was only minimally successful in leveraging Bank and GEF funds to address fundamental regulatory and market barriers constraining renewables.** Bank-sponsored reforms addressed grid electricity, and largely neglected off-grid power, where renewables could play a strong role. Even for grid power, the Bank and GEF cannot keep “blinders” on power sector reforms, which directly influence the outcomes and sustainability of RRDP subprojects intended to feed the network. Renewables and power reform project teams should not operate and conduct country-sector dialogues in isolation from each other. Regulatory uncertainty, lack of transparency, as well as an uneven playing field between conventional energy and RETs, continue to hinder the commercialization of RETs. Ad hoc and inconsistent policy and regulatory revisions — such as bans on third-party sales, increased wheeling charges, reductions in power banking, and restrictions on captive generation in some states — undermined investor confidence.⁴³ The Bank has not played an “honest broker” role to resolve these issues (and neither has IREDA), and little effort is being made to achieve harmonization with other states where regulatory practices conducive to renewables and energy efficiency have been initiated. These risks continue to discourage entry of private developers in the renewables market and threaten the financial viability of existing small hydro and wind energy investments. Informants to this evaluation have been critical of the Bank/GEF focus on MW of renewables installed, without simultaneously addressing critical regulatory and policy issues that directly affect their replicability and sustainability.

53. **The main focus of the Bank’s power sector reform work in India has been to pursue power sector *efficiency*, and have only recently addressed *equity* concerns.** The Bank’s reform approach in India relied on price and market signals, and did not adequately address market and regulatory barriers to renewables and energy efficiency investments. RRDP would have been a key vehicle to pursue EBRs objectives — such as facilitating access and creating pro-poor energy enterprises — as well as greater financial sustainability for RETs, but these have not been sufficiently realized. Only Rajasthan, one of the six states engaging in Bank-supported policy reforms, has explicitly addressed renewable energy development within broader sector-level reforms. (Even there, however, the poor’s energy access has not been addressed effectively: a minimum tariff of Rs150/month for up to 5 hours daily of electricity was mandated although many villages do not even use those many units; lifeline rates and competitive bidding for the off-grid market have not been tried; the rules for private provision to off-grid markets remain unclear; and reforms and system planning treats grid and off-grid demand as if these were two separate subsectors, relegating the off-grid to GEF and donor financing.) Moreover, while recently the Bank has been shifting its emphasis increasingly toward

43. Some of this is noted also by ICR, pp. 16-7.

reforming distribution systems,⁴⁴ a prerequisite for expanding access, the main emphasis is still on improving the efficiency of *existing* assets and utilities.

54. **Improvements in rural energy access was only minimally achieved, particularly for the solar PV component financed by GEF.** While the government and many Indian states (Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu) have put in place policies for attracting private development and operation of certain types of non-conventional energy projects, these have mostly been limited to small hydro and windfarm systems that are expected to help generate power for the main grids and networks to address capacity shortages. Less attention has been given to ensuring an enabling environment for rural and off-grid provisioning of electricity services. To the extent that social issues and equity concerns have been raised by this sector-level reform process, they tend to be considered “through the lens of better fiscal management.”⁴⁵

55. This is most evident in RRDP’s solar PV component, where equity concerns were apparent based on the GEF project objective aimed to “stimulate penetration in the household lighting market through prudent subsidization of PV alternatives.”⁴⁶ But the project did not reach rural consumers and households due to the absence of a concrete “road map” and the lack of networking with rural credit institutions. The loan instruments of RRDP were geared toward the corporate sector and larger companies, rather than the smaller businesses and “entrepreneurial poor.” The transaction costs and paperwork requirements of IREDA loans and procedures were deemed as too high.⁴⁷ Given IREDA’s steep credit norms and security arrangements to support PV set-up, it is unlikely that the GEF’s implicit objective of reaching the poor will be sustainable, which does not serve the EBRS goal of helping the poor directly.⁴⁸

56. **There is a lack of strategic coordination within the World Bank Group (WBG) and among donors with respect to renewable energy assistance for India.** Many key informants — ranging from concerned government officials to private investors and consumers — do not see the coherence and complementarity of RRDP and the Second Renewable Energy Project with the WBG’s own Global Village Energy Program (GVEP), Photovoltaic Market Transformation Initiative (PVMTI), and Solar Development Group Project, which are GEF-financed and managed by the International Finance Corporation (IFC). At least from the private stakeholders’ perspective (specifically the Small Hydro Power Developers’ Association of Andhra Pradesh), how the Bank and IFC coordinate sector policy and operations within a reform framework in India are not apparent: recent regulatory unpredictability (see paragraph 39) is feeding strong concerns among the private small hydro developers that – despite MNES guidelines to the contrary – power purchase rates will be slashed (and other more

44. See World Bank (2002).

45. Dubash and Rajan (2002: 64).

46. World Bank (1992: 3).

47. Miller and Hope (2000).

48. See IREDA’s objection footnoted in paragraph 25. Additionally, IREDA notes that due to the rising level of NPAs and given that IREDA is a profit making financial institutions, compliance with strict security norms is essential due to the high risks in lending to the sector.

disadvantageous charges imposed) when the Andhra Pradesh Energy Regulatory Commission and the IFC-financed AP Transco review the rates in March 2004. Even less clear are the linkages among the numerous renewables programs being provided and contemplated by several multilateral and bilateral donors. This lack of strategic coherence, when added to IREDA's weaknesses, presents significant reputational risk and aid inefficiency for all concerned, and could eventually discredit the progress that has been made by renewables. Finally, worth noting are questions raised by several high-level informants regarding the WBG and donor focus on *electricity*, when as far as expanding rural energy access and poverty reduction are concerned, the delivery of a broad range of *energy* services may be more relevant.

57. **Learning From Past Experience with Renewables Projects is Lacking.** A key question is whether lessons were learned and applied between RRDP and its follow-up project, the India-Second Renewable Energy (RE2) Project, which consists of small hydro and energy efficiency components. This does not appear to be the case. RE2 was conceptualized and appraised between January to June 1997, midway through the implementation of RRDP, when its solar PV component was running into problems, and the wind and small hydro components have just started taking off (note that most of the small hydro and wind generating capacity were installed during the end-1990s, toward RRDP's closing date). As in RRDP, RE2's physical targets may be met, but the promotion of end-use efficiency and demand side management are lagging behind. RE2's risks (rated as "high" by the March 2003 Project Status Report) are similar to those that should have been learned from RRDP. These sector-level risks include unpredictable regulatory shifts, arbitrary changes in incentives, inability of State Electricity Boards to comply with Power Purchase Agreements, and the lack of an over-arching framework to promote energy efficiency and integrated energy solutions, among others. (The same lack of learning can be said of the PVMTI, whose biggest drawback was the competition between the immediate, 50% MNES subsidy on solar home systems and PVMTI's credit and leasing scheme. But this was already well known under RRDP: whenever MNES had capital subsidies, it was hard for RRDP to woo consumers to interest rate buy-downs. Consumers wanted immediate subsidies, and are not used to paying over time.)

Lessons Learned

58. The main lessons from this evaluation are as follows:
- Power sector reforms and renewable energy commercialization should be part of an integrated strategy.
 - The Bank and its client countries should incorporate provisions to level the playing field between conventional and renewable energy technologies *while* legal/regulatory and other *sector-level reforms* are being designed and implemented. Relegating this to later fine-tuning poses serious risks to the commercialization of renewable energy, as regulatory unpredictability and tariff uncertainties discourage local private investments.
 - Monitoring and evaluation systems should be developed for both project- and sector-level outcomes, which should distinguish between efficiency and equity indicators. This is essential in setting grid versus off-grid subsidies, designing output-based aid schemes, and promoting investments as well as mitigating risks

in capacity expansion based on renewables, since the sector indicators would send clearer signals to investors whether transparency and predictability in the regulatory framework governing renewables are being achieved.

- The GEF and other grant support operate in a power sector reform setting, and thus should also be keyed to *sector outcome indicators*. Otherwise, focusing only on project inputs and processes (e.g., buying down the commercial interest rate) and output indicators (e.g., quantities of solar PV units sold) fosters a culture of dependence on grants and subsidies, which ironically works against the full commercialization of renewables and hinders their ability to compete in the market when these financial incentives are reduced or withdrawn.
- Much “learning-by-doing” is involved in non-conventional projects such as renewable energy development and commercialization, which underlines once more the importance of monitoring and evaluation systems.

Outlook

59. IREDA needs to go beyond being a soft financing institution to *brokering* the development of viable renewable energy and energy efficiency projects among multiple stakeholders, including private investors (both local and foreign), banking institutions, state regulatory agencies and electricity boards, renewable energy commercial associations, research agencies, and consumer groups. Today, IREDA’s role is challenged even further to grow into risk mitigation, which requires the identification of new financial and advisory instruments. IREDA needs to compete if it is to remain relevant.

60. In the future, the government needs to focus on creating market conditions for promoting renewables, including commercial pricing and private involvement in distribution and retailing, creating innovative and effective incentives for banking and micro-finance schemes, and assuring the quality of RETs.⁴⁹ Moreover, the government should take steps to clarify, simplify, harmonize, and stabilize the regulatory framework for renewables. This can be achieved not by trying to match the subsidies of other programs, but by treating renewables more like typical energy sources, such as grid electrification and petroleum products.

61. The Bank needs to develop an overall strategy that integrates its approaches for reforming the power sector and fully commercializing renewables in India. This joint strategy should complement the emphasis to date on macro-fiscal balancing with the equity considerations pertinent to renewable energy development, e.g., by further reforming state-level regulatory agencies, improving energy access for the poor, employing “smart subsidies”, and piloting output-based aid schemes.

62. The excellent ICR was correct in its recommendations. The renewable energy sector program should be consistent with and embedded into the plan for power sector reform and restructuring (however, this – and future ICRs – should follow this recommendation and analyze project achievements within a sector reform framework). Supportive and predictable policies and regulatory frameworks are essential for market

49. According to IREDA, as stated in Annex D, it has recently revised its financing guidelines to enable promoters/developers to venture into RETs.

development. Tariffs and power sales should be fair to all parties for sustainable development of the sector. Although a specialized institution such as IREDA was essential at the beginning as new technologies were commercialized, broader participation by the financial sector is essential if market growth is to expand, which presents new special challenges for IREDA. With respect to solar PVs, similar to rural electrification the world over, affordable financing accessible to rural consumers is essential for selling PV products in rural areas. Delivering rural PV services needs a partnership between key actors: rural financing institutions, product/service suppliers, and preferably, organized consumer groups.⁵⁰

50. IREDA notes that it has launched a Village Electrification Programme to address some of these issues.

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Annex A. Basic Data Sheet

INDIA: RENEWABLE RESOURCES DEVELOPMENT PROJECT (CREDIT 2449-IN)

Key Project Data (amounts in US\$ million)

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
Total project costs	280	283.8	101
Loan amount (IDA)	115	110.4	96 ¹
GEF grant amount	26	26.2	101 ²
IREDA	17	40.7	239
DANIDA Cofinancing	50	3.9	8
SDC Cofinancing	4	2.3	57
GON Cofinancing	0	0.4	N/A
Promoters/Consumers	68	87.5	129
Other Loans	0	12.4	N/A

¹ IDA disbursements is 96% in US\$ but expected to be 100% in SDR.

² GEF disbursements in US\$ is 101% but 100% in SDR.

Note: Totals may not add up exactly due to rounding.

Cumulative Estimated and Actual Disbursements (US\$ millions)

	<i>FY93</i>	<i>FY94</i>	<i>FY95</i>	<i>FY96</i>	<i>FY97</i>	<i>FY98</i>	<i>FY97</i>	<i>FY00</i>	<i>FY01</i>	<i>FY02</i>
Appraisal estimate	23.0	69.0	58.0	38.0	11.0	9.0	8.0	0	0	0
Actual	16.1	9.1	47.9	11.6	16.9	6.5	9.7	3.9	27.8	32.4
Actual as % of estimate	70	13	24	83	154	72	121	N/A	N/A	N/A

Project Dates

	<i>Original</i>	<i>Actual</i>
Negotiations		06/29/1992
Board approval	-	12/17/1992
Effectiveness	-	04/06/1993
Closing date	12/31/1999	12/31/2001

Staff Inputs (staff weeks)

	<i>Actual No. Staff Weeks</i>	<i>Actual US\$</i>
Preappraisal	109.8	260.7
Appraisal/Negotiation	31.8	86.9
Supervision	153	308.6
ICR	11	32.5
Total	305.6	688.7

Mission Data

	<i>Date (month/year)</i>	<i>No. of persons</i>	<i>Specializations represented</i>	<i>Implementation Progress</i>	<i>Development Objective</i>
Identification/ Preparation	06/91				
Appraisal	06/92 11/92				
Supervision	05/93	2	Energy Specialist, Environmental Consultant		
	07/93	5	Energy Specialist, Renewable Energy Specialist, Power Engineer, Procurement Engineer, Procurement Assistant		
	10/93	7	Renewable Energy Specialist, Power Engineer, Procurement Engineer, Pr. Financial Analyst, Sr. Operations Advisor, Research Assistant, Dutch DGIS		
	11/95	5	Task Manager, Renewable Energy Specialist, Hydro Specialist Engineer, Finance, Project Assistant	S	S
	11/96	4	Mission Leader, Climate Change, Financial Analyst Consultant, Solar PV Consultant	S	S
	12/97	5	Task Leader, Financial Analyst, Economist, Engineer, Procurement Engineer	S	S
	07/98	3	Task Leader, Private Sector Development Specialist, Project Assistant	S	S
	12/98	4	Sr. Operations Officer, Anthropologist, Sr. Power Engineer, Solar PV Engineer	S	S
	11/99	4	Sr. Operations Officer, Financial Analyst, Solar Engineer, Sr. Renewable Energy Specialist	S	S
	4/00	3	Sr. Operations Officer, Sr. Renewable Energy Specialist, Procurement Engineer	S	S
	11/00	5	Sr. Operations Officer, Sr. Financial Specialist, Social Development Specialist, Energy Specialist, Hydropower Specialist	S	S
	4/01	4	Sr. Operations Officer, Sr. Financial Specialist, Energy Specialist, Hydropower Specialist	HS	HS
Completion	11/01	4	Sr. Operations Officer, Sr. Renewable Energy Specialist, Renewable Energy Consultant/Economist, Procurement Engineer	HS	HS

Performance Ratings: S=Satisfactory; HS=Highly Satisfactory

Other Project Data

Borrower/Executing Agency: Government of India/Indian Renewable Energy Development Agency

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Credit no.</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Second Renewable Energy Project	Loan No. 33960-IN; Credit No. 45710-IN; GETF 20169	135.0	06/27/2000

Annex B. Economic Costs and Benefits⁵¹

Economic Internal Rates of Return (EIRR) at Appraisal and Completion, by Component

<i>Component</i>	<i>Without GEF</i>		<i>With GEF^{a)}</i>	
	<i>Appraisal</i>	<i>Actual^{b)}</i>	<i>Appraisal</i>	<i>Actual^{b)}</i>
Small Hydro (dam-toe)	13 to 65%	28%	GEF not provided for small hydro	
Small Hydro (canal and run-of-river)	12 to 29%	33%		
Wind Farms	5 to 10%	11%	12%	14%
Solar PV Lanterns		19%		33%
Solar PV Home Systems		30%		108%
Solar PV Power Packs	1.5 to 3.3%	-23%	14 to 14.6%	21%
Solar PV Village Power		-3%		19%
Solar PV Water Pumping ^{c)}		6%		43%

a) Economic benefits including global environmental benefits, in the case of wind and PV include the GEF grant, which is \$155/kW (10% of initial capital cost at appraisal) for wind, and \$4.2/Wp (19% of initial capital cost at appraisal) for PV.

b) Wind farm average EIRR is weighted by annual energy output. Similar weighting is not done for small hydro as one large successful sub-project skews the results. Solar lighting benefits include the consumer surplus from improved lighting. Benefits from PV pumping for irrigation includes additional income gained from irrigated crops. Wind and small hydro economic benefits are taken as economic cost of avoided diesel generation as this was the basis of the economic analysis in the SAR.

c) At appraisal, only the community drinking water option was considered. The application financed was for irrigation.

51. This Annex summarizes tables “Comparison of Actual and Appraised Economic Internal Rates of Return” and “Comparison of Financial Rates of Return and Financial Net Present Value of Investments,” on pages 7 and 8, respectively, as well as “Annex 3. Economic Costs and Benefits” of the ICR. In two instances, however, the data provided in the EIRR table on page 7 were inconsistent with those provided in Annex 3. Specifically, the table on page 7 stated that the EIRR for Wind Farms at completion (without GEF) was 9%, whilst the corresponding figure in Annex 3 was 11%. Similarly, the EIRR for SPV Village Power at completion (with GEF) was in the table on page 7 14% as opposed to the 19% stated in Annex 3. As Annex 3 provided more complete information, we decided to use the figures provided there.

Financial Internal Rates of Return (FIRR) at Appraisal and Completion, by Component:

<i>Component</i> ^{f)}	<i>Appraisal</i>		<i>Actual</i>
	<i>Without GEF</i>	<i>With GEF</i>	
Small hydro	45 to 75%	N/A	35% (range: 24-67%) ^{g)}
Wind farm projects	6 to 23%	10 to 41%	94% (range: 5% to >100%) ^{h)}
Solar PV lanterns			>100%
Solar PV home systems			48%
Solar PV power packs	1.2 to 5.3%	7.6% to 13.3%	>50%
Solar PV village power schemes			29%
Solar PV water pumping ⁱ⁾			17%

f) Solar PV applications are evaluated from the point of view of the end user. Because of the wide variety of PV projects financed, they should be considered as examples.

g) Average FIRR on equity *before* tax, based on the analysis of 13 of the 33 projects considered by the ICR as a representative sample (including the best, worst and average projects).

h) Average FIRR on equity *after* tax, though weighted by annual energy output. Similar weighting was not done for small hydro as one large successful sub-project skews the results.

The average FIRR for wind is still skewed to the high side, however, due to the ten projects in Maharashtra which were exceedingly profitable due to the generous sales tax deferment incentives.

i) At appraisal, only the community drinking water option was considered. The application financed was for irrigation.

Annex C. IREDA Non-Performing Assets (NPA) Outstanding between 1994-5 and 2002-3⁵²

Renewable Energy Technology	1994-5		1995-6		1996-7		1997-8		1998-9			1999-0		
	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s
Small Hydro	0	0.00	0	0.00	2.90	0.47	2.90	0.39	177.06	1.64	43.30	4.14	255.80	16.93
Wind	0	0.00	5.63	1.51	84.83	13.74	81.90	11.01	24.93	11.63	93.09	8.89	428.31	21.73
Solar ^{a)}	0.05	0.03	0.69	0.18	2.85	0.46	2.90	0.39	358.61	22.84	4.00	0.38	36.00	11.11
Other ^{b)}	3.31	1.89	9.39	2.52	42.62	6.90	42.64	5.73	183.58	23.23	40.94	3.91	368.82	11.10
TOTAL	3.36	1.91	15.71	4.21	133.20	21.57	130.34	17.52	744.18		181.33	17.32	1046.93	
Total Loan O/s (Rs in Crs)	175.54		373.21		617.61		744.18				1046.93			

Renewable Energy Technology	2000-1			2001-2			2002-3 ^{c)}		
	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	Loan O/s by RET (Rs in Crs)	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	Loan O/s by RET (Rs in Crs)	NPA Loan O/s (Rs in Crs)	% NPA to Total Loan O/s	Loan O/s by RET (Rs in Crs)
Small Hydro	67.26	4.53	300.08	75.52	3.92	352.14	21.40		
Wind	108.55	7.31	526.05	90.97	4.72	659.79	13.79		
Solar ^{a)}	5.97	0.40	80.24	5.21	0.27	128.91	4.04		
Other ^{b)}	40.03	2.7	578.25	49.19	2.55	784.99	6.27		
TOTAL	221.81	14.94	1484.62	220.89	11.46	1925.83		247.51	2038.78
Total Loan O/s (Rs in Crs)	1484.62			1925.83				2038.78	

^{a)} Figures for Solar includes Solar Thermal as well as SPV.

^{b)} 'Other' refers to biomass power, briquetting, co-generation, HBS/gassifier, methane recovery, as well as energy efficiency investments, etc

^{c)} Provisional figures. Data for 2002-3 are based on estimates as of 03.31.2003. Only figures for overall renewables, and not disaggregated by RET, were provided.

52. The Table is derived from figures provided by IREDA during the OED mission in March 2003. Figures for 2002-3, which originally showed a provisional estimate of 30.24% NPA to Total Loan Outstanding based on data as of 13.31.2002, now are estimated based on data as of 03.31.2003 provided by IREDA in Annex D.

Annex D. Borrower Comments