GLOBAL
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# Republic of Indonesia

## Solar Home Systems Project

Project Document
December 1996

THE WORLD BANK

## GEF Documentation

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**Report No. 16238-IND**

# Republic of Indonesia

## Solar Home Systems Project

Project Document
December 1996

Indonesia Policy and Operations Division
Country Department III
East Asia and Pacific Region

## CURRENCY EQUIVALENTS

Currency Unit - Indonesian Rupiah (Rp)
(As of September 1996)

| | | |
|---|---|---|
| US$ 1 | = | Rp 2,341 |
| Rp 1 billion | = | US$ 0.427 million |

## FISCAL YEAR

April 1 - March 31

## WEIGHTS AND MEASURES

| | | |
|---|---|---|
| 1 metric ton | = | 1,000 kilograms (kg) |
| 1 liter (l) | = | 0.0063 barrels (bbl) |
| 1 kilometer (km) | = | 0.6215 mile (mi) |
| 1 kilovolt (kV) | = | 1,000 volts (V) |
| 1 megavolt ampere (MVA) | = | 1,000 kilo-volt amperes (kVA) |
| 1 megawatt (MW) | = | 1,000 kilowatts (kW) |
| 1 gigawatt hour (GWh) | = | 1 million kilowatt hours (kWh) |
| 1 terrawatt hour (TWh) | = | 1 billion kilowatt hours (kWh) |

## ABBREVIATIONS

| | | |
|---|---|---|
| BAKOREN | - | National Energy Board |
| BAPPENAS | - | National Development Planning Agency |
| BPPT | - | Agency for the Assessment and Application of Technology |
| $CO_2$ | - | Carbon Dioxide |
| DGEED | - | Directorate-General of Electricity and Energy Development |
| DRE | - | Decentralized Rural Electrification |
| EA | - | Environmental Assessment |
| FCCC | - | The Framework Convention on Climate Change |
| GEF | - | Global Environmental Facility |
| GBHN | - | Garis-Garis Besar Haulan Negara (Outlines of State Policy) |
| GOI | - | Government of Indonesia |
| IERR | - | Internal Economic Rate of Return |
| ISO | - | International Standards Organization |
| LRMC | - | Long Run Marginal Cost |
| LSDE | - | Technical Implementation Unit & Energy Technology Laboratory |
| MME | - | Ministry of Mines and Energy |
| MOC | - | Ministry of Cooperatives and Small Enterprises Development |
| PERTAMINA | - | National Oil and Gas Company |
| PLN | - | State Electricity Corporation |
| PIP | - | Project Implementation Plan |
| PSG | - | Project Support Group |
| PV | - | Photovoltaic |
| RE | - | Rural Electrification |
| REPELITA | - | Five-Year Development Plan |
| SHS | - | Solar Home System |
| TA | - | Technical Assistance |

| | |
|---|---|
| Actg. Vice President: | Ms. Marianne Haug |
| Director: | Ms. Marianne Haug |
| Division Chief: | Mr. Peter R. Scherer |
| Staff Member: | Mr. Arun Sanghvi |

# PART I: Project Summary

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

## LOAN/GRANT AND PROJECT SUMMARY[1]

| | | |
|---|---|---|
| **Borrower** | : | The Republic of Indonesia |
| **Implementing Agency** | : | Private sector firms engaged in the supply and installation of solar photovoltaic home system |
| **Beneficiaries** | : | Rural households without access to grid electricity in the provinces of West Java, South Sulawesi and Lampung (Sumatera) |
| **Poverty** | : | Not applicable |
| **Loan Amount** | : | US$20.0 million equivalent |
| **Terms** | : | Standard variable interest rate for a term of 20 years, including five years of grace for currency pool loans. |
| **Commitment Fee** | : | 0.75 percent on undisbursed loan balances, beginning 60 days after signing, less any waiver. |
| **Grant Amount** | : | GEF Trust Fund Grant of SDR 16.8 million (US$24.3 million equivalent) |
| **Terms** | : | Grant |
| **Financing Plan** | : | See para 3.21 |
| **Economic Rate of Return** | : | 39% including global environmental benefits |
| **Map** | : | IBRD 26570 |
| **Project ID Number** | : | ID-PA-35544 |

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1 GEF and IBRD are financing mutually dependent activities and therefore this document is intended to meet both GEF and IBRD processing requirements. A GEF project document based on the SAR has been prepared to meet GEF Council and Public Information needs.

# 1. THE ENERGY AND POWER SECTORS

**Energy Sector Overview**

1.1 Indonesia is richly endowed with diverse and large energy resources including oil, natural gas, coal, hydropower and geothermal. The oil and gas sectors continue to play a critical role in the Indonesian economy, together accounting for over 85 percent of commercial net energy consumption and for about 20 percent of the country's export receipts.

1.2 Indonesia's basic goals and policies for the future development of the energy sector are described in the Outlines of State Policy (GBHN), promulgated by the People's Consultative Assembly (MPR) in March 1993 to guide the formulation of the Sixth Medium- Term (five-year 1994/95-1998/99) Development Plan (REPELITA VI); and the Second Stage Long-Term (twenty-five year) Development Strategy (PJPT-II). The GBHN highlights the importance for Indonesia's sustained economic and social development of meeting its rapidly growing energy needs efficiently—including through conservation and diversification of primary energy resources and their more efficient utilization—and of minimizing the adverse environmental and social impacts of energy use.

1.3 In the power sub-sector, the GBHN recognizes that an adequate, reliable and reasonably priced electricity supply is essential for the country's continuing development, emphasizing its essential role in serving the productive sectors and in contributing directly to improving the living standards of the people in all regions of the country. Rural electrification (RE) is a key and integral part of the Government's rural development strategy; the long-term goal is to electrify all villages and enable the basic services provided by the modern energy form, electricity.

1.4 The Government of Indonesia (GOI) has also relied on the following policies in support of its objectives for the energy sector:

(a) **diversification:** A central and continuing thrust of the Government's energy strategy is to slow the pace of Indonesia's transition to a net oil importer by diversifying domestic energy consumption towards alternative and more economic and indigenous energy resources that either have a non-exportable surplus (coal, natural gas), or are renewable and non-tradable (hydro, geothermal). In the power sector, a major user of petroleum fuels, the plans are to further reduce oil's share in power generation from about 15 percent in 1995/96 to about 5 percent by the end of this decade.

Considerable potential exists for substituting conventional energy supplies and especially for meeting the decentralized energy needs of the rural sector, by use of cost effective renewable energy supplies, particularly mini-hydro and mini-geothermal power schemes, biomass-based power projects (including cogeneration), and solar power energy systems. The Government has been undertaking several solar photovoltaic (PV) pilot projects for demonstration purposes.

(b) **energy pricing:** On the demand side, the Government's policy has been to maintain average petroleum product prices at or above international parity (efficiency pricing), while cross-subsidizing as necessary the price of kerosene in order to ensure its affordability, with an implicit tax on gasoline. Likewise with electricity, while periodic adjustments have generally maintained the average retail price close to the long-run marginal cost of supply in Java, electricity prices have been maintained below economic cost for small residential and industrial users who account for about 40 percent of sales. The Government's pricing policy has also maintained a uniform price structure for electricity and petroleum products in all parts of the country.

(c) **private sector participation:** The private sector operates significant amounts of captive power capacity, and is expected to play an increasingly important role in the supply of oil, gas and electricity. In oil and gas, Pertamina forms joint ventures with private Production Sharing Contractors (PSCs) for exploration and production; private sector participation is also being welcomed in the emerging gas transmission grid. In power, 55% (11,600 MW) of the additional grid capacity planned for Indonesia between 1994/95 and 2003/04 (excluding captive power) is projected to come from independent power producers (IPPs). To date, over 2,500 MW of IPP capacity is under construction and expected to come on line by 1999-2000. In addition, Power Purchase Agreements (PPAs) have been signed with IPPs for over 3,000 MW of capacity. Private participation in PLN, the national power utility, is also envisaged.

(d) **regionally balanced development:** The GOI has: (i) maintained a uniform price structure for electricity and petroleum products in all parts of the country; and (ii) has plans to extend the supply of electricity in a balanced manner to all parts of the country. This policy entails the subsidization of higher cost energy supply to outside Java and to the rural population.

(e) **environmental protection:** The GOI's environmental policies include support of greenhouse gas reduction, and development of renewable energy resources. The Basic Environment Law of 1982 provides the overall framework. The Government has established and utilizes uniform procedures and guidelines for the preparation, and approval of environmental impact analysis (AMDAL), for issuance of environmental clearances, as well as periodic reporting requirements on environmental management and monitoring during project implementation.

**Sector Institutions**

1.5 The principal agency responsible for implementing Government policies in the energy sector is the Ministry of Mines and Energy (MME); which coordinates all activities in the energy sector and supervises the state enterprises in the sector: PERTAMINA (oil, gas and geothermal), P.T. Bukit Asam (coal), PGN (gas distribution) and PLN (electricity). Other ministries and agencies are also involved in the sector, for example, the Ministry of Public Works is responsible for hydropower resource surveys and the operation of multipurpose hydro plants, the National Atomic Energy commission is responsible for nuclear development, and the Ministry of Cooperatives and Small Enterprises Development (MOC) is responsible for enhancing the role of cooperatives in rural electrification. An inter-ministerial National Energy Board (BAKOREN) coordinates energy policies and development with those of other sectors. BAKOREN is supported by a Technical Committee (PTE) consisting of senior officials in different departments, chaired by the Director General of Electricity and Energy Development (DGEED). The electricity subsector is regulated by the MME through the DGEED. The Rural Electrification (RE) Steering Committee, chaired by the DGEED, is responsible to ensure inter-agency coordination and cooperation in matters related to the Government's rural electrification program. The organization chart of MME is shown in Annex 1.1. Environmental policy development is led by the State Coordinating

Minister for Environment and implementation is led by the national and newly enabled regional Environmental Impact Agencies.

1.6 The Agency for the Assessment and Application of Technology—BPP Teknologi (BPPT)—was established in 1978 as a non-departmental government agency directly subordinated and reporting to the President. The organization chart for BPPT is shown in Annex 1.2. Both DGEED and BPPT have responsibility for solar photovoltaics (PV) project development and implementation; one of BPPT's major responsibilities related to solar PV is the implementation of GOI's "50 MWp" program, under which about one million solar home systems will be installed in rural households. They have assisted other government agencies in project specification, procurement, supervision, monitoring and evaluation. The principal responsibility of DGEED's Directorate of Energy development is to set energy technology policy, although they have also implemented a number of pilot and demonstration projects using solar energy. BPPT is responsible for technology development, and its Technical Operations Unit for Energy Resources (LSDE) is responsible for R&D, demonstration and testing PV systems performance, and assisting both BPPT and DGEED in preparing PV system specifications and proposals. The photovoltaic industry is represented by its trade association, AP Surya.

**Electricity Subsector**

1.7 The Electricity Act (Law No. 15 of 1985) defines the legal framework for electricity sector. Under this Act, PLN, the State Electricity Corporation—established by Government Regulation No. 18/1972— has both the right and obligation to supply power in Indonesia. The provisions of the Electricity Act are amplified in Government Regulation No. 17/1990 for PLN, the State Electricity Corporation; and No. 10/1989 for others. The Electricity Act permits establishment of private power producers, distributors and licensees. Presidential Decree No. 37/1992 specifically authorizes private sector participation under BOO schemes, and permits cooperatives and other legal entities to generate, transmit, and distribute power for public use.

1.8 The power sector has expanded rapidly during the 1980s and 1990s. Electricity sales of PLN grew at an average annual rate in excess of 14% between 1981/82 and 1994/95, from 7,845 GWh to 49,740 GWh. During the same period, the number of customers grew nearly six-fold, from 3.2 million to about 19.5 million. In order to meet this growth, PLN's installed capacity increased nearly five-fold from 3,032 MW in 1981/82 to over 15,000 MW in 1995. Over the same period, PLN's implementation capacity has grown significantly, whereby it is connecting over 1.5 million new customers a year, a pace unmatched by a single utility, and PLN now carries out an investment program of about US$3.5 billion annually.

1.9 **Rural electrification** The primary means for achieving the national development goals for rural electrification (para 1.3), is through the realization of explicit targets set for village electrification in the national Five Year Development Plans (REPELITA), starting with REPELITA III (1979/80-1983/84), and ongoing under REPELITA VI (1994/95-1998/99). The primary agent for implementing the Government's targets for RE is PLN. For nearly the last two decades, PLN has consistently met or exceeded the Government's targets for RE and the record is impressive. Starting around 1978/79, electricity access has reached over 39,000 rural villages—a ten-fold increase from the figure of 3,400 electrified villages in 1980/81—and about 12 million rural households receive PLN supply (Annex 1.3). The interregional variations in village electrification coverage reflect the Government's balancing of two divergent pulls, balanced regional development on the one hand versus economic considerations on the other hand.

**Sector Issues and Strategy**

1.10 **The task ahead** In spite of the rapid growth in electricity generation capacity and in coverage by PLN, there is considerable unmet demand at economic prices. Today, the majority of the households must do without electricity; many industrial establishments must rely on more expensive self generation since PLN has been unable to meet their entire consumption requirements. Electricity consumption today averages about 260 kWh per capita, a level below that in many countries with lower per capita incomes than Indonesia[1]. Furthermore, the rapid pace of sector growth has strained PLN's institutional and management capacities to a point where customer service, and quality—service reliability, power quality and customer responsiveness—have been compromised, while costs remain stubbornly high, especially outside Java[2]. The rural household electrification coverage in Indonesia, about 40 percent, is considerably behind its regional peers; with Thailand reporting a coverage around 80 percent and Malaysia having a coverage of about 98 percent. Moreover, the wide disparities in coverage—urban-rural as well as across Indonesia—pose a direct challenge to the Government's objective of achieving a balanced spatial distribution of development and to reduce the inequality in quality of life.

1.11 **Challenges** Mobilizing sufficient resources—financial, managerial and technical—for ensuring the adequacy and reliability of power supply and at competitive prices, and quickly and efficiently expanding the access of electricity to households throughout the country, poses a formidable challenge to the continued development of the sector. Prospects for attracting the large sums of money required year-in-and-out to just one sector in Indonesia—US$ 5-6 billion per year—must also be viewed against the backdrop that in the future the Government will be hard pressed to maintain past levels of financial contributions to PLN, because of increasing demands on its resources from priority social sectors. The task of financing expansion of RE coverage is daunting, to say the least; due to the geographic dispersion and low energy demand of much of the rural population, the unit costs of conventional means of electrification by grid extension are extremely high (para 2.14).

1.12 **Strategy** To meet the challenges associated with the goal of enhancing service availability and reliability at competitive cost, the Government, with Bank assistance, has formulated and initiated a major reform of the sector. The four pillars of the ongoing reform are: (i) expand entry to private investors and operators to access additional management and finance capacity; (ii) decentralize, corporatize and divest PLN, to improve operating performance and customer service and reliability, and to prepare the company to directly access capital markets; (iii) reform regulatory and sectoral functions to promote high quality service at least cost; and (iv) rationalize tariff levels to strengthen sector finance, while providing incentives to PLN and the private sector to deliver performance more in line with best practices.

1.13 With respect to **rural electrification (RE)**, the Government's strategy until recently has focused on the conventional approach of grid extensions coupled with, where necessary, deployment of isolated

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1/ For example, the average consumption in India is about 300 kWh per capita.

2/ *Indonesia: Economic Consequences of Power Sector Inadequacy in the Manufacturing Sector*, Yellow Cover Report No. 15623-IND, EA3IE, World Bank, June, 1996.

diesel generator(s); for this purpose, GOI, with Bank assistance, has developed a Master Plan for expanding RE coverage. More recently, GOI has begun to recognize the potential role for off-grid/decentralized rural electrification (DRE), such as solar photovoltaic (PV) home systems, as a complement to the least cost grid extension program (para 2.17). Underlying the Government's longer term vision of installing one million solar home systems (the 50 MWp program) is the recognition that increasing penetration of solar PV systems in rural Indonesia will help to: (i) increase the pace of electrification coverage, at a time when PLN's "hands are full" implementing the Master Plan for grid extension; and (ii) reduce the mounting burden of financing expansion and operations of PLN supply to satisfy uneconomic rural loads.

**Climate Change**

1.14 Indonesia has ratified the FCCC on August 23, 1994, so that it is eligible to receive GEF funds under this convention. In order to help fulfill its FCCC national commitments, Indonesia has initiated two greenhouse gas mitigation strategy studies. The Asia Least-Cost Greenhouse Abatement Strategy (ALGAS) project, financed by UNDP/GEF, examines Indonesia's GHG emission reduction options in an Asia regional context. Indonesia is also a participant in the second round of study activities financed under the U.S. Country Studies Program. Although both studies are still under preparation, the relevance of photovoltaics as a greenhouse emissions abatement option for Indonesia is clear. The country is characterized by a large, growing and dispersed rural population, a substantial fraction of whom are not electrified but who presently consume fossil fuel-based energy for lighting and radio and TV services. As a zero greenhouse gas emitting technology, the Solar Home Systems can meet these energy demands while substituting for higher polluting kerosene, diesel and grid-based options.

# 2. DECENTRALIZED RURAL ELECTRIFICATION

## Rural Well Being and Solar Power

2.1 The transition to electricity proceeds at a slow pace for much of rural Indonesia. On the eve of the 21st century, over 115 million Indonesians, out of an estimated 195 million, remain "in the dark", without electricity, and most with little or no hope of getting it in the near future. Most of those without electricity reside in rural areas. The entire 20th century—with its electric lights, radio, TV, recorded music and access to up to date information and communications—has passed them by. For meeting their basic lighting needs, rural households have little choice but to make do with a 19th century energy source-kerosene. This is vastly inferior, costs more and is polluting and dangerous. For example, illumination is dim and causes eye strain if reading is attempted. Further, such forms of lighting produce toxic fumes and particulate matter and pose a fire hazard.

2.2 Against this reality, the backdrop of experience overwhelmingly indicates that sustainable rural development and the accompanying benefits of increases in the quality of life and standard of living of the rural population will not occur without the presence of modern energy forms, in particular, electricity[1].

2.3 Continued sole reliance on the conventional mode of expanding rural electrification, i.e. grid extensions, fossil fuel generation and scattered diesel-generator operations, will neither serve the best interests of the Government and the peoples of Indonesia nor would it be globally sustainable. Even with acceleration of PLN's impressive grid extension program, and setting aside the financial challenge and environmental consequences of doing so, for many rural homes electricity service will be 30 years away.

2.4 Solar power, an environmentally friendly option and a promising renewable energy source, until recently was considered uneconomic. This has now changed. Home sized solar photovoltaic (PV) systems that convert sunlight directly into electricity (Figure 2.1), offer a fast and competitive alternative for improving the quality of life of rural households (Figure 2.2). These systems can meet the demand for the most highly valued electricity end uses: lighting, security, entertainment, and informational and educational services (Figure 2.3). An estimated 35 million people in Indonesia live on remote islands and villages and in rural households that are dispersed and outside the economic reach of a grid in the foreseeable future. For these 8 million households, solar PV systems offer a rapid means to reduce some of the inter-regional and rural-urban differentials in quality of life, and at a lower cost than grid supply.

2.5 Technology is no longer a barrier. Over a quarter million rural households worldwide—over 20,000 in Indonesia—are already using solar home systems (SHS). Success in catalyzing market development of SHS for rural consumers now depends primarily upon two factors: (a) implementing a commercially sustainable financing mechanism that will allow rural households to pay for their SHS on an installment basis, with the initial down payment and monthly payments set at affordable levels, and SHS suppliers/dealers who are responsive in meeting rural household needs can expect to earn an adequate return on investment; and (b) attracting credit worthy businesses led by experienced entrepreneurs interested in this type of business.

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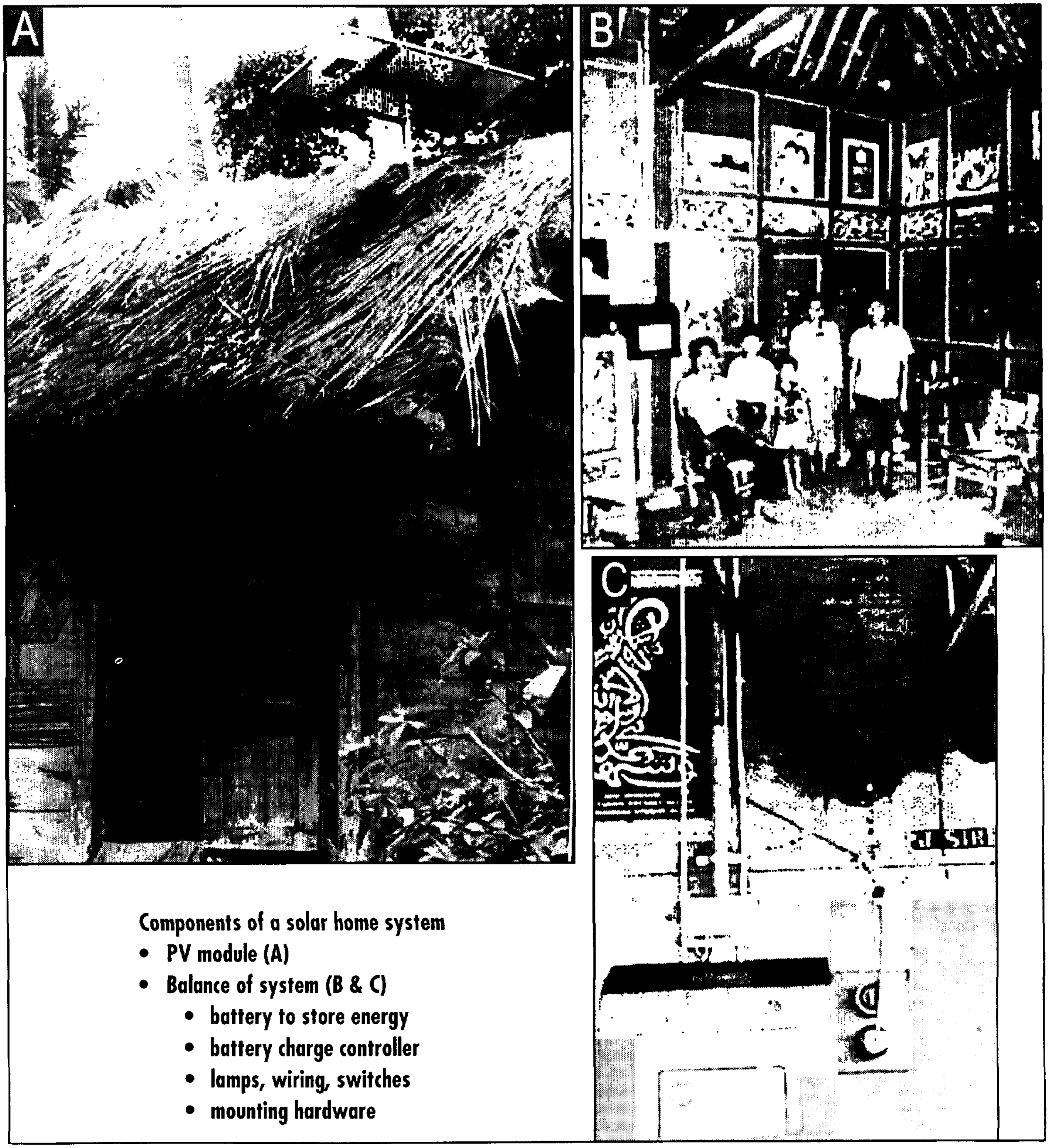
1/ *Rural Energy and Development, Improving Energy Supplies for 2 Billion People* A World Bank Best Practice Paper, Report 15912-GLB, July 1996.

Figure 2-1 : Solar Photovoltaic Systems
Direct Conversion of Sunlight into Electricity




**Components of a solar home system**

- **PV module (A)**
- **Balance of system (B & C)**
  - **battery to store energy**
  - **battery charge controller**
  - **lamps, wiring, switches**
  - **mounting hardware**

Figure 2-2: A Solar Home System Significantly Improves the Quality of Life of Rural Households

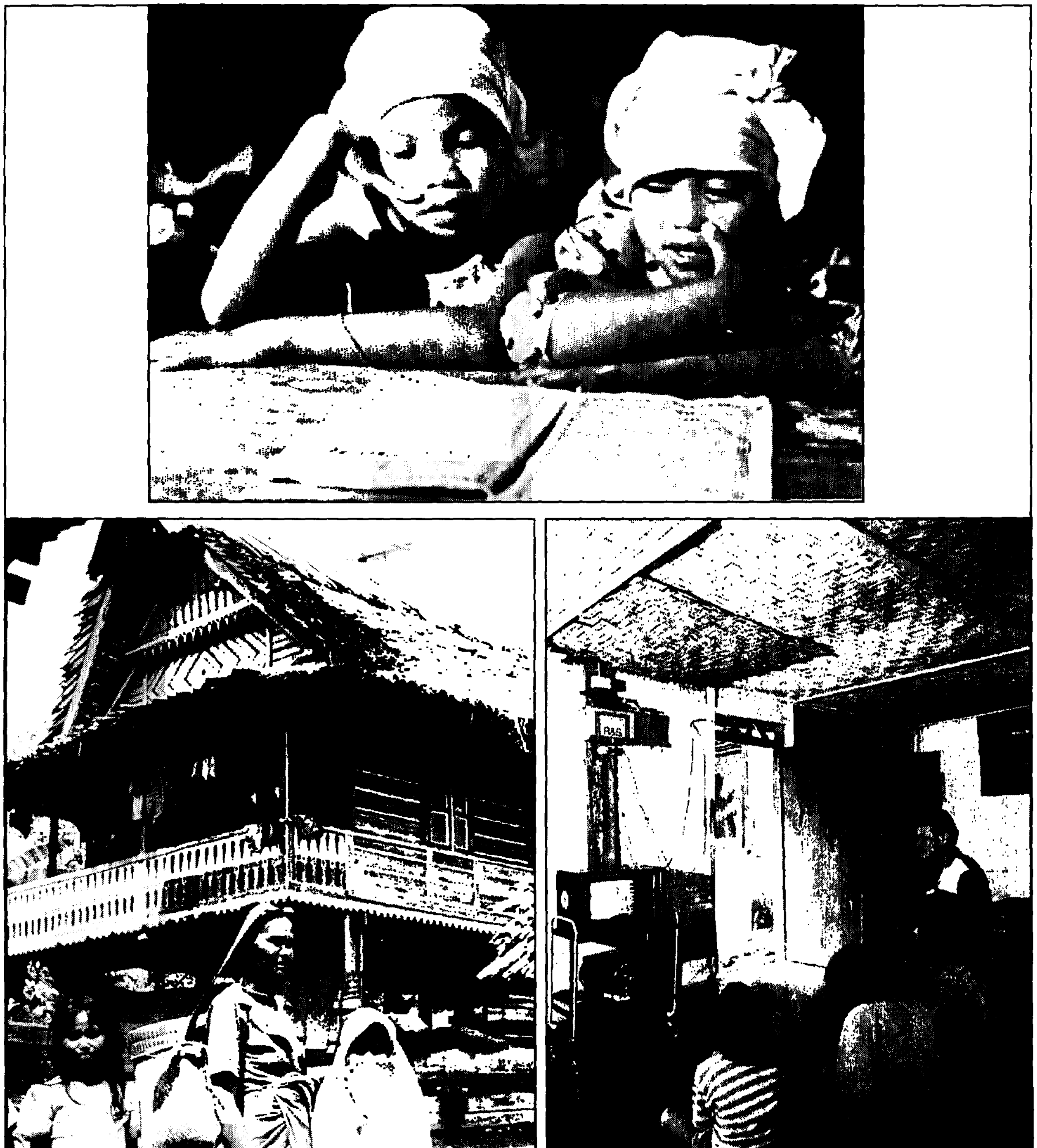
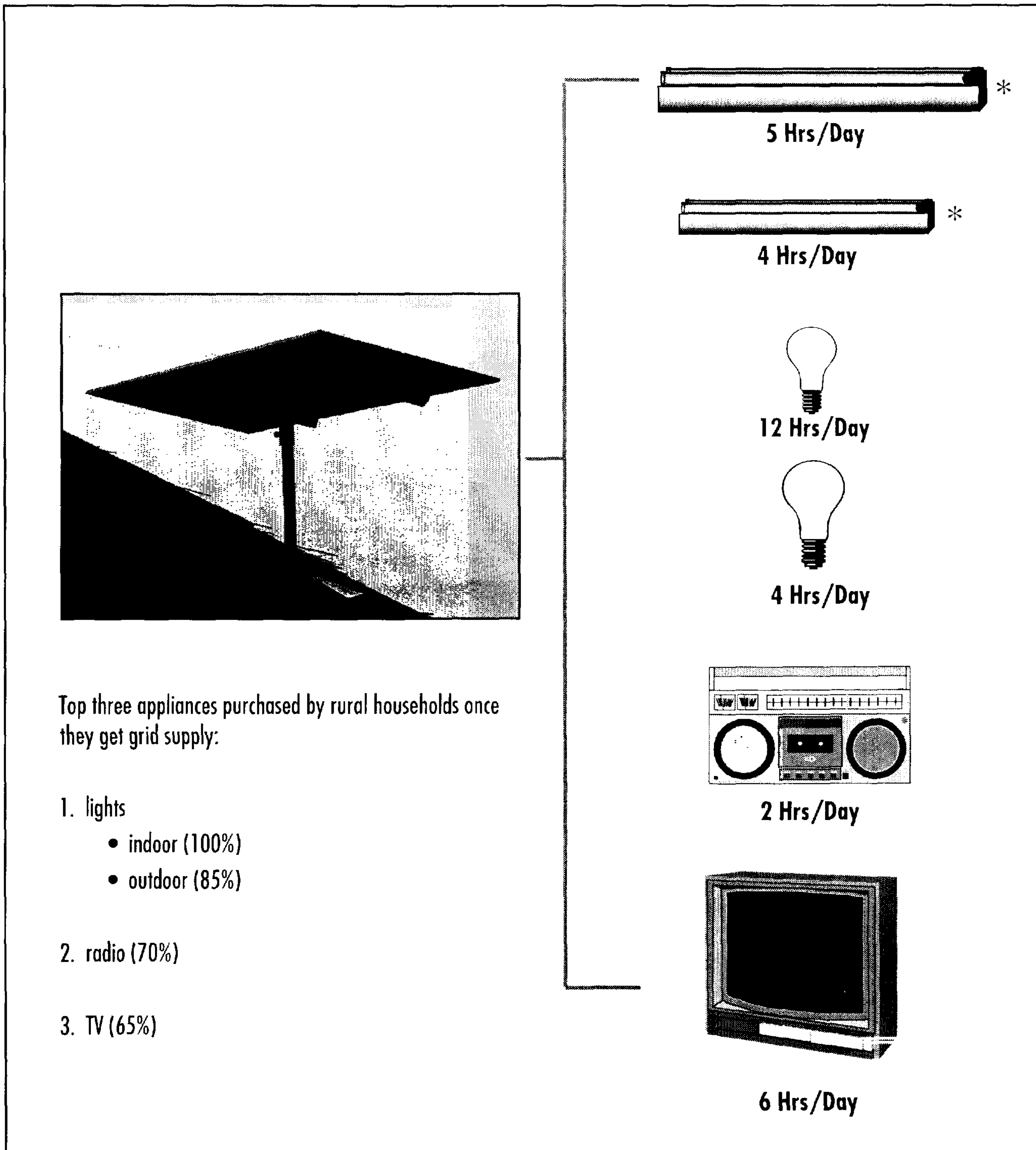


Figure 2-3: A 50-Watt-peak Solar Home System Provides Adequate Energy for the Highest Valued Benefits of Electricity to Rural Households




* Fluorescent tube light

**The Rural Village Environment**

2.6 Indonesia's efforts to provide electricity to all its citizens poses a technical and cost challenge on account of its geography. Nearly 70 percent of Indonesia's population lives in rural areas, comprising about 31 million households. The last census reported 62,000 rural villages, of which 39,000 villages outside Java and Bali are dispersed across an archipelago comprising of over 13,600 islands. These are geographically spread over 5,100 kilometers from east to west and nearly 1,800 kilometers from north to south. Not only are the rural villages often scattered wide and far, so are the rural households within a village. A rural village typically comprises a central core population of households and several scattered hamlets—individual clusters of 5 to 50 households—and isolated farmsteads within the village area boundary. This translates into average densities of about 150 households per square kilometer in Java, and 6 households per square kilometer off-Java.

2.7 **Disparities in development** There is now growing concern about the significant and possibly rising inequality in development across regions (i.e., Java-Bali versus other islands), across demographic groups (e.g., rural versus urban), and across ethnic groups, of which there are over 300. Average per capita monthly expenditures in rural areas are about 50 percent of comparable expenditures in urban areas, and other social development indicators are lagging as well (Table 2.1).

**Table 2.1 Disparities in Rural-Urban Social Development Indicators**

| | Rural | Urban |
|---|---|---|
| Under five child mortality (per thousand units) | 106 | 59 |
| Fertility rates (per woman) | 3.2 | 2.3 |
| Vaccination coverage among children (%) | 44 | 62 |
| Prevalence of child malnutrition (%) | 38 | 27 |
| Junior high school completion rates (%) | 54 | 78 |
| Primary school completion rates (%) | 78 | 89 |

2.8 **Low electricity coverage** While the vast majority of urban households have PLN supply, only about 40 percent of rural households have access to electricity. GOI's strategy for expanding RE accords priority to extensification—increasing village coverage --- over intensification, i.e., increasing household coverage. As a consequence, household electrification ratios are still very low. For example, household electrification ratios projected for year-end 1995/96, and based on the 1989/90 census data for the number of households, are: Java-Bali (53 percent), Sulawesi (35 percent), Sumatra (32 percent), Kalimantan (36 percent), and Eastern Indonesia (20 percent). Within Eastern Indonesia, there is considerable variation; ranging from a high of 40 percent in Maluku to a low of 3 percent in East Timor (Annex 2.1).

2.9 **Rural people are forced to make do with inferior service** Denied access to electricity, Indonesia's rural population resorts to a variety of more expensive and inferior sources for illumination: such as candles, flashlights, and most commonly, kerosene fueled wick lamps, hurricane lanterns and petromax lamps. Besides being more polluting, dangerous and more expensive[2], the traditional sources produce illumination that at best creates a "twilight" effect. The more affluent rural households also use car batteries to power TVs. These batteries usually must be re-charged at least once a week and at considerable time, expense, and inconvenience to the household. Typically, the heavy battery is transported to a battery charging service shop, that could be located as far as 10 to 20+ km away; and must be left there at least overnight to enable charging by an inefficient fossil fuel burning and polluting diesel generator. The household must then make a second trip for pickup or alternately make arrangements to pay another commercial transportation service for the drop off and pickup. This process can deny the household access to the TV for at least two nights a week.

2.10 **Absence of proper lighting restricts far reaching economic and educational benefits to and otherwise denies the empowerment of rural peoples in significant ways** By now it is well known, though perhaps not commonly appreciated by people who have become accustomed to electricity, that the quantum improvement in lighting quality made possible following the introduction of solar or grid electric lighting in rural communities, in homes, schools and streets, leads to:

- **a profound and positive effect on the quality of education and learning experienced by children.** Faster and higher rates of homework completion as well as higher pass rates and improvements in grades are reported;
- **increased productivity and in-home income generation activities made possible for women** by extending available hours for work; and
- **increased freedom of movement and ability for community participation.** Street and community lighting, by affording more flexible work patterns and a sense of security, also make it possible for village residents to spend more time for socializing, and participation in community activities.

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2/ An ESMAP study in Indonesia concluded that access to electricity implies a seven-to-ten fold increase in lighting (lumens), mainly because of increased efficiency of electric lights compared to kerosene lamps. For example, a 60-watt incandescent light bulb produces the same luminous flux (lumens) as about 60 candles, or 20 kerosene wick lamps, or 2 kerosene pressure lamps. Moreover in quality terms, non-electric lighting is far inferior because of a much lower lumen output level and a more limited spatial distribution. It has been estimated that without adjusting for quality difference, rural households without electricity pay a very high unit price for energy for lighting, with the equivalent cost per lumen of light output from kerosene estimated to be 8 to 20-fold or even higher than from electricity. (Source: Robert van der Plas, IENDR).

**Limits to Expanding RE Coverage by Conventional Means**

2.11 The conventional modes of expanding RE coverage by grid extension and diesel mini-grid operations are likely to prove to be too expensive to finish the remaining job of extending coverage to all households, even within the next 30 years. Presently, PLN owns and operates about 3,400 diesel plants scattered throughout Indonesia—over 2,000 MW of diesel generating capacity—as a primary means to supply power for rural electrification. These plants are to be found in: (i) the dozens of mini--grids served by one or more interconnected diesel power plants in the 1 to 12 MW unit size range; and (ii) about 1,000 isolated small diesel plant based operations—in the 20 to 200 kW size range—which are very high cost systems in operations, many supplying power only for a few hours in the evening and night time.

2.12 **Marginal cost of supply** The marginal costs of supply to rural households within proximity of a PLN grid are already very high: about 11.8 cents/kWh in Java-Bali (of which distribution network costs are about 0.8 cents/kWh); 15.5 cents/kWh in the case of regional grids off-Java (of which distribution network costs are about 2.5 cents/kWh); and 15 to 25+ cents/kWh for the scattered diesel-grid operations. These costs are orders of magnitude higher for connecting rural households that are scattered and only a few kilometers from the grid.

2.13 For example, consider Bali, which has achieved 100% village electrification, yet about 40% of rural households do not have access to electricity and a large number of them are unlikely to receive PLN supply for a considerable time, or if they do PLN will be forced to incur very high losses. This situation repeats itself in other provinces. Even in the province of West Java within 150 km of Jakarta, large numbers of rural households are to be found without access to PLN supply even though in many instances there is a grid line a few kilometers away. Typically these households are clustered in hamlets of 5 to 30, as well as isolated homesteads, and situated 2 to 5 km from the nearest connecting point to the 20 kV grid. The costs of conventional schemes for extending the grid to such dispersed clusters or installing an isolated diesel based mini-grid are extremely high. When coupled with low consumer and load densities that result in low capacity utilization, and with a high percentage of consumption during the higher cost peak hours, most such situations pose an uneconomic proposition using conventional approaches.

2.14 **Mounting subsidy burden** Under the present policy of the Government to maintain uniform national electricity tariffs, the cost of PLN supply to many rural households (para 2.12) is well in excess of the average revenue from the typical small rural household, about US 6.5 cents/kWh. Continued and sole reliance on the conventional approach for rural electrification in the instances highlighted by the examples above (para 2.13), will further and seriously aggravate the subsidy burden on PLN's ratepayers and the government for financing such expansion and operations and strike at the very foundations of the sustainability of the RE program.

**Government's Strategy for Decentralized RE using Solar Photovoltaics (PV)**

2. 15 The Government of Indonesia (GOI) has begun to assess the suitability of various supply options for meeting the energy needs of the remaining approximately 30,000 unelectrified villages and households in a least-cost and economic sequence. One element of this assessment is the Rural Electrification (RE) Master Plan—financed under the Bank's first Rural Electrification Project (Loan 3180-IND)—which analyzed the conventional options of grid extensions and use of scattered diesel generation to support isolated mini-grid operations.

2.16 The Government attaches high priority to cost effective renewable-based energy supply as a means of ensuring high and environmentally sustainable rates of economic growth. Increased penetration of renewable based generation will have a significant and positive impact on the environment by reducing local pollutants such as $SO_2$ as well as pollutants of global concern such as emissions of green house gases (GHG). To the extent that this development displaces kerosene consumption and diesel generation, it reduces the negative environmental impacts of transport, waste disposal and burning of these fossil fuels.

2.17 Beginning in 1987, the Government of Indonesia (GOI) has sponsored a series of pilot solar PV demonstration programs. The most recent initiative—"Banpres" (Presidential Aid)—is directly linked to the President of Indonesia, under which about 3,000 units were installed over 1988-1992. Today, in Indonesia about 20,000 SHS units have been installed primarily through Government programs, and more recently by commercial dealers. The Government programs have helped to demonstrate the potential of solar PV technology for meeting the electricity end-use needs that most rural households perceive to be most important. An evaluation of this experience indicates that customers are generally satisfied with the performance of their solar home system (SHS) and there is no evidence of systemic problems or high premature failure rates for critical components such as batteries, panels, and controllers. A few technical problems were reported, primarily in instances where households had modified the systems after installation.

2.18 These early and various Government-agency sponsored programs were primarily geared to technology demonstration; as such, they did not focus on cost recovery or building a base for future product or market development, nor did they offer a means to mainstream private sector delivery and sustainability. Specifically, in Indonesia, the Government/public agency led model is best characterized as a procurement system, not as a commercial market, with the SHS units typically distributed in small lots to homes widely dispersed all over Indonesia. Such a technology distribution mechanism has proved to be incompatible with the development of cost effective and sustainable private dealer chains, given the limited scale and geographic fragmentation.

2.19 It is the GOI's goal to ensure that modern forms of energy become accessible to all rural households in a phased, least-cost manner. In recognition of the role that solar PV can play in meeting the energy needs of rural households, the Government of Indonesia has formulated the outlines of a plan to install solar PV systems with a total capacity of 50 MWp. However, there still remains a need to develop a detailed solar PV strategy and its implementation plan. A technical assistance component of the proposed project will facilitate the preparation of a Decentralized Rural Electrification (DRE) Strategy Study and SHS Action Plan (para 3.16).

2.20 The GOI recognizes that a number of different delivery and financing approaches are required in Indonesia, based on the incomes, energy requirements, and geographic location of the target population. Broadly speaking, the Government's solar PV strategy for decentralized rural electrification has two prongs: (i) Government-based programs targeted at the higher-cost remote areas and for the poorer segments of the population, and (ii) commercially-based private sector led programs initially targeted to the relatively closer-in and more affluent segments of the rural population without PLN supply.

2.21 For example, as part of the first prong, the Government, in association with AusAID, is currently formulating a plan to install about 36,000 solar PV systems in the remote islands of Indonesia. It is recognized that a commercial approach is not appropriate for the target population; though the details of the payment schemes have not yet been finalized, it is likely that there will be a small downpayment, a long repayment period of 8-10 years, low monthly payments, and interest rate subsidies. At the same time, recognizing the heavy and recurrent subsidy burden inevitably associated with such public agency programs, the Government is also keen to promote alternate delivery and financing approaches that are commercially sustainable, private sector based, and that offer the prospect of achieving high levels of penetration at a much faster pace than is feasible with the Government-based approach. In short, the GOI recognizes that Government-based programs will be complementary to the commercially-based programs.

**Solar Home Systems - The Technology**

2.22 A solar home system typically consist of: (i) one or more solar photovoltaic panels; (ii) battery storage; (iii) battery charge/discharge controllers; and (iv) energy-efficient appliances, such as lights and TV that are suitable for use with PV systems (see Annex 2.2). The solar PV panels produce electricity, with the amount of electrical energy produced being directly proportional to the size of the panel and the amount of sunshine falling on the panel. Full sun shine is not required for the solar PV panels to produce a current, though the output of the panel will be reduced in cloudy weather. PV panels usually are rated in Watt-peak (Wp) output, e.g., this Project will use solar PV panels with a 50 Wp rating. The Watt-peak rating of a panel is not directly comparable to the wattage associated with conventional electrical appliances, e.g., a 50 Watt-peak rating cannot be directly compared to the, say, 60-watt rating of a conventional electric light. This type of comparison is misleading, and greatly underestimates the amount of service that a SHS with a 50 Wp rating would normally provide. In particular, the SHS units to be used under this project would permit the use of 3-5 lights and a black-and-white TV for four to five hours a day.

2.23 Batteries, similar to those used in automobiles, are used to store the electricity produced by the PV panels. The battery capacity required depends upon the daily energy load to be met as well as the prevalence of cloudy weather. Battery capacity is usually stated in Ampere-hours (Ah); in this Project, the minimum size will be a 70-Ah 12-Volt battery, which, together with a 50 Wp panel, is expected to permit normal electricity levels of usage by the consumer even when there is a string of 3-5 days of cloudy weather. An automatic cut-off switch, called a discharge controller is used to continually measure the state of the battery charge and disconnect the appliances when battery charge falls below the set limit. Further, to avoid consistent overcharging, an automatic cut-off switch called a charge controller is provided to measure battery charge and reduce or turn off charging current to the batteries before damage can occur. It is common to combine the functions of discharge and charge controllers into a single controller.

**Economic Potential for SHS in Decentralized Rural Electrification**

2.24 **Decentralized rural electrification (DRE) utilizing Solar Home Systems (SHS) offer many advantages** Solar home systems offer the least cost RE solution --cheaper than conventional RE options -- for a large segment of the population, as illustrated in the following, in niche areas where households are dispersed and demand is low. Increased penetration of solar PV home systems in rural Indonesia—on a cost recovery basis—will reduce the tremendous pressures on GOI to require PLN to extend its supply to satisfy uneconomic rural loads as well as reduce the potential demand for subsidized PLN supply. Furthermore, the sale and installation of solar PV systems offer a clear path to increasing private sector participation in the energy markets, a matter of high priority for GOI as well as a matter of priority on the Bank's agenda.

2.25 Solar PV home systems are ideally suited for remote islands and villages and for dispersed households. Even in the case of electrified villages—intensification—there exist a large number of households that are situated in small clusters and scattered throughout the geographical area within the village boundary and that are more than a few kilometers from the grid. In such instances also, solar PV systems provide the most cost effective solution for meeting the basic needs of the community. To illustrate the tradeoffs between a solar PV home system and grid extension in such instances, a comparative cost analysis of SHS versus conventional electrification (Annex 4.1), shows that: (i) a SHS is less expensive than extending grid supply when household density is less than approximately 30 households per square km; and (ii) if the number of households to be served in a cluster is less than 50, then even a 3 km MV extension is more expensive than SHS, regardless of household density. To illustrate a specific cost comparison, consider a cluster of 50 households outside Java with a spatial density of 10 households per square kilometer --almost twice the average for outside Java --and situated 3 kilometers from an MV grid line. The levelized cost of conventional rural electrification by grid extension is estimated at $30 per month per household, and $26 per month per household if the cluster is serviced by an isolated diesel generator. By comparison, the levelized cost of a solar home system providing approximately equivalent service (about 15 kWh) is about $11 per month, based on the present prices in Indonesia.

2.26 One of the main implications of the RE Master Plan for grid extension and diesel operations is that the scope for decentralized rural electrification (DRE) as a complement to economic grid extensions is large. There are about eight million households—consisting of the isolated or scattered rural households for whom it will never be economic to provide grid-based supply, and of the households for whom the least cost supply option is grid extension, but who will not receive grid-based supply during the project duration and even beyond. These households comprise the economic potential for decentralized rural electrification by SHS, a cheaper and environmentally superior alternative to the conventional alternative of diesel-based mini-grids. A detailed study to estimate and more sharply delineate this potential by region and customer segments will be undertaken as part of a technical assistance component of the proposed project (para 3.16).

2.27 **Market Potential** Market surveys and extensive field visits conducted in several provinces during the course of project preparation clearly indicate that a significant segment of today's rural households, without PLN supply, have a high willingness-to-pay for energy to meet the end uses the they value the most - lighting, security, and entertainment and informational services from radios and TV. This revealed preference is reflected by survey data on out-of-pocket expenditures for kerosene for lighting, and battery charging for other uses such as TV[3] (Table 2.2). The survey response data indicate that 26 percent of the houses sampled in Lampung province, that do not have PLN service, spend between $6.67 to $15 per month on kerosene for lighting and batteries and battery charging, to power radios, cassettes and TVs. Very significantly also, another 40 percent of the sample—selected randomly in areas without PLN service—spend between $ 3.33 and $6.66 per month. By way of comparative interest, a small rural household with PLN service, pays a monthly bill of about $1. Rural households in the top quintile segment identified above represent the near term market, and provide a convenient market entry segment for SHS; the size of this market entry segment is sufficiently large to enable SHS dealers establish scale economies in supply and delivery chains.

**Barriers to SHS Market Development**

2.28 The limited sales of solar home systems taking place at present do not provide the base for broader market development, which would be based on the significant number of households who could afford a SHS, provided they can get financing. Today, consumer credit is not widely available and current credit schemes suffer from short repayment periods forcing monthly payments that are not affordable to even the households in the top income quartile.

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3/ A copy of this study is contained in the Project File.

**Table 2.2: Distribution Of Monthly Expenditures On Energy By Rural Households Without PLN Electricity Supply**

| $/Month | Lampung | South Sulawesi | West Java |
|---|---|---|---|
| Under 3.33 | 34% | 28% | 62% |
| 3.33 to 6.67 | 40% | 49% | 23% |
| Over 6.67 | 26% | 23% | 15% |
| **Total** | **100%** | **100%** | **100%** |

2.29 The limited scale of dealer operations today implies that the vendors do not realize the benefits of economies of scale in the establishment of supply-and-service chains to the consumer and in the procurement and assembly of system components. At the same time, there is no possibility of diffusion of solar PV systems from urban markets into rural areas. In many instances, modern consumer goods and services are initially designed for urban mass market consumption and percolate into rural areas over a period of time, by the urban-based dealer and supplier chains linking up with rural entrepreneurs. Solar PV systems are perhaps among the very few exceptions in that they are economic and ideally suited primarily for rural and remote locations. Thus, unlike the case of consumer products such as motorcycles and TV sets, in Indonesia the urban markets for SHS units cannot provide the base for geographically driven diffusion into rural areas. In other words, the market for solar PV is singularly a rural area-based market; and its emergence will depend on removal of the major market failures/barriers unique to such markets, instead of simply waiting for urban-based expansion to arrive.

2.30 The present market conditions can be characterized as a "high price low volume" equilibrium, while an expansion of the market requires a move to a self-sustaining "low price high volume" equilibrium. Three inter-locking factors together form a barrier to market development:

(i) **Lack of established high-volume supplier-dealer chains.** At present, there are only a limited number of supplier-dealer chains, and they operate at low volumes in limited geographical regions within and outside Java. Most of the potential customers are not being offered an opportunity to buy a SHS and therefore consumer awareness is limited;

(ii) **High prices.** At present, the annual volume of SHS direct household sales is low, and the prices are high; at the same time, the dealers are unable to reduce their prices, given the small scale of their operations;

(iii) **Lack of term credit.** At present, the bulk of the potential rural customers, both within and outside Java, are unable to secure the credit they need to buy the SHS. Even if banks were to extend credit for SHS, under current Indonesian banking practices, they would expect repayment over 1-2 years maximum, which would be an insufficient amortization period for the majority of potential customers.

2.31 What this means in practical terms is that the barriers blocking rapid, sustainable expansion of SHS in rural Indonesia are not amenable to simple, single-problem solutions. Rather, a multi-pronged strategy is required to lower the key barriers identified above simultaneously, taking into account affordability of the target market segment of rural households and the terms and conditions under which term credit would be extended by the commercial banks. For instance, by itself, without a reduction in the selling price, making credit available and stretching out the maturity/term of such credit will not eliminate the barriers that presently restrict market development. Without price reductions, affordable levels of downpayment and monthly installments would require installment terms of 6 to 8+ years duration, given current interest rates. However, the maximum loan duration feasible under a sustainable private sector approach, given conditions would be in the 3 to 4 year range. Amortizing the cost of an SHS over 3 to 4 years, without a price reduction, would result in monthly payments that exceed the capacity of most target households.

2.32 In light of this, for a sustainable delivery approach led by the private sector, it would be necessary to design an installment payment mechanism that addresses rural households' cash constraints and the practical system's upper limit of a 3 to 4 year amortization period. Analysis of the data from market surveys (para 2.27), indicates that for target rural households, an affordable down payment would range from $80-125, and that monthly installment payments should be close to potential customers' present monthly expenditures on energy (about $8-10). For these consumer cash flow limits to be compatible with the 3 - 4 year amortization period, it would be necessary to bring down the final price to the household by a "first cost buy down".

**Past Bank Experience and Lessons Learned**

2.33 **Overview.** The Bank has been active in Indonesia's power sector for twenty-five years during which time the Government has borrowed more than US$4.7 billion in Bank loans and IDA credits to undertake 25 power projects (Annex 2.3). Despite some problems with implementation, past Bank-financed PLN projects have in general been very successful and have helped strengthen PLN's capabilities in almost every aspect of its operations. Taken altogether, these projects have assisted in the expansion of generation, transmission and distribution facilities and rural electrification and institutional development of PLN. The technical assistance provided by the Bank has also strengthened PLN's technical and management capabilities in engineering, project management capabilities, distribution and rural electrification planning and management, and corporate and financial planning; as a result of these efforts, PLN's implementation capacity and operational efficiency have increased significantly.

2.34 The positive lessons from the Bank's involvement have been brought out by successive Project Performance Audit Reports (PPARs), Project Completion Reports (PCRs) and Implementation Completion Reports (ICRs). These reports attribute the success of power operations in Indonesia to the facts that: (i) there was a long-term vision for the development of the sector and this vision was shared by the Bank, Government and PLN; (ii) the vision was translated into a long-term strategy which was resolutely pursued; and (iii) a reasonable balance was struck between the physical and institutional development components of the projects. The negative lessons largely concern implementation. Most projects have suffered delays due to extended procurement cycles. Technical assistance for institutional capacity building has in some cases fallen short of expectations due to limited absorptive capacity and inadequate supervision and ownership. In recent years, beginning with the Sumatera-Kalimantan Project in 1994, the Bank and Government have shifted their emphasis towards issues of sector structure, private sector participation and regulation. The Bank is now supporting specific interventions where private sector participation is not readily forthcoming; they are transmission and distribution management and investment, sector expansion outside Java, renewable energy and demand side management, and rural electrification.

2.35 **Experience with rural electrification.** The Bank's first lending operation for rural electrification by grid extension (RE I, Loan 3180-IND), provided US$329 million to finance the bulk of the foreign exchange costs of a time slice of the RE development plan through FY 94/95, and closed in June 1995. In its evaluative memorandum OED noted that the project achieved or exceeded most of its physical objectives, in spite of some delays mainly due to procurement procedures. On the institutional side, RE planning was substantially improved by PLN's development of a RE Master Plan for grid extension to electrify the remaining villages. The project's successes prepared the ground for the more ambitious targets being pursued under the ongoing successor lending operation for grid-expansion-basedrural electrification, the Second Rural Electrification Project ( RE II, Loan 3845-IND approved FY95). The RE II project also aims to reduce the present and future unit cost of RE expansion by grid extensions, and thus address a primary constraint to the long term sustainability of the national RE program as implemented by PLN.

2.36 **Experience with solar PV and decentralized RE** Given the Bank's limited involvement in solar PV projects, there are no relevant Bank reports on past projects. Ongoing experience is limited to the IDA/GEF-supported solar PV component of the India Renewable Resources Development Project (Ln. 3544-IN/Cr. 2449-IN). Key lessons learned from the India project are: (i) timely project implementation is facilitated by pipeline development, i.e., pre-identification and preparation of sub-projects; and (ii) interest rate subsidies do not necessarily attract private sector response. Rather the private sector is far more concerned that the procedures they can use for procurement are in line with commercial business practices and that the process and disbursement of funds is simple, straightforward, and fast..

2.37 **International experience and best practice** To complement the limited Bank experience solar PV projects, the experience of solar PV projects in other countries, including the Dominican Republic Mexico and Kenya, has also been reviewed with a view to improving the design of the proposed Indonesia SHS project. This review shows that in the Dominican Republic, a commercial approach has been successful in delivering SHS to rural households, but the overall scale has been restricted by the limited availability of credit, both to the SHS suppliers as well as the households. In Mexico, nearly 90% of the households are served by grid supply, and the SHS are being supplied on a subsidy basis to the remaining households for whom grid supply is uneconomic, and most of whom cannot afford to pay for the systems. Experience in other countries also points to the ability of the private sector to deliver SHS to rural households, the need for credit, and the benefits of some government involvement especially in promoting and helping ensure quality products. For example, the Kenyan private sector has successfully made cash sales of about 25,000 SHS on a purely commercial basis, but after a few years, in the absence of credit, the sales have slowed significantly, and further, in the absence of technical standards or other forms of support from government agencies, it is reported that about 25% of the systems are no longer functioning.

2.38 The proposed Indonesia SHS Project design (section 3)—central elements of which are a private sector based and market conforming supply, delivery and financing mechanisms, with a key role for the Government in raising technology awareness and promoting quality equipment and performance by setting standards and certification—builds upon the positive experience in Indonesia , while taking account of the lessons learnt from the international experience.

# 3. THE PROJECT

**Project Concept**

3.1 The proposed Solar Home Systems (SHS) Project would assist the market penetration of solar PV systems that are "essentially commercial" but whose initial market development is delayed and constrained, for example, by high transaction costs or perceived commercial risks due to unfamiliarity with this type of investment. Such projects are also hampered by other barriers, including a lack of in-country experience in the organization and financing. Hence, the SHS project would pioneer the earlier introduction of SHS in Indonesia and catalyze the creation of a potential market with critical mass, paving the way for accelerated and wider scale adoption of Solar Home Systems, and over the longer term, an increase in the overall penetration of other types solar of PV systems and to non-residential consumers as well.

3.2 The project implementation strategy is to catalyze in a targeted and phased manner, regional rural markets for solar PV systems. The longer term lending program vision is one of a series of linked projects over time; each seeking to build upon the lessons learnt from the predecessor project, while broadening the regional market and product focus, enhancing the efficiency and reducing the costs of existing delivery and financing mechanisms.

3.3 The target segment for market entry, to establish the necessary initial and sustainable market base for further expansion and broadening of the solar PV systems market, would be primarily the in-filling market segment i.e., rural households and small commercial facilities that are "electrically isolated" from the grid, but that are in reasonable geographical proximity to urban centers. The initial demand is expected to be largely for entry/starter size SHSs (e.g., 50 Watt-peak), and should be sufficient to establish the scale economies for commercial dealer chains to financially sustain themselves, and establish the initial bases in regional operations. Subsequently, and with further cost reductions that are expected—in equipment cost and in dealer operating costs and markup—the market demand for such systems would expand to a broader income base of households as well as to the small commercial facilities segment. Furthermore, once the initial market bases are established, the pace of product development would be expected to accelerate and the range of product offerings broaden considerably; with increased demand likely from the early adopters for "trading up" to larger sized systems, to meet increases in the demand for end-uses (e.g. 75 or 100+watt-peak systems) [1]. In addition, the product lines would be expected to be broadened to meet the demand from shops and to meet community needs, at competitive prices.

**Project Objectives**

3.4 The principal national objectives of the proposed project are to: (i) provide the modern energy form of electricity to rural customers who cannot be served economically or in a timely manner by conventional rural electrification; (ii) facilitate participation by the private sector in advancing renewable energy commercialization; (iii) promote environmentally sound energy resource development in Indonesia and reduce the energy sector's dependence on fossil fuels; and (iv) strengthen Indonesia's institutional capacity to support and sustain decentralized rural electrification using solar photovoltaics.

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1/ These broader product offerings would not be part of the SHS Project, which would support only the products that meet the Project's technical specifications (para 3.18).

3.5 **Global objective** The global environmental objective of the SHS project is to mitigate emissions of $CO_2$ in Indonesia. At present, a significant portion of Indonesia's rural population satisfy their energy needs by fossil fuels in various ways, such as kerosene for lighting or diesel-based power generation, which lead to the emission of $CO_2$. The penetration of SHS would reduce $CO_2$ emissions by displacing the use of the fossil fuels. It is anticipated that the SHS project would directly abate about 1.3 million tons of $CO_2$, with an additional indirect programmatic effect of about 0.9 million tons of $CO_2$, for a total abatement of about 2.2 million tons of $CO_2$.

**Measuring Project Performance**

3.6 **Performance Indicators** The key performance indicators for monitoring achievement of the project objectives outlined above are: (i) the number of SHS units sold per year and the cumulative number of people served by the Project, which are measures of the effectiveness of the Project in serving the rural population; (ii) $C0_2$ emissions abated, which is a measure of the extent to which the global objective has been attained; (iii) fossil fuel conserved, which is a measure of the reduction of the sector's dependence on fossil fuels; (iv) customer timely repayment rates, which is an indicator of customers' satisfaction with their SHS systems and also of the extent of cost recovery; (v) installed price, which is a measure of the cost-effectiveness of the SHS units in meeting the customers' needs; (vi) number of dealers, which is a measure of the extent of market development; (vii) number of dealers considered as having "problem loans" by participating banks, which is a measure of the extent to which the Project is successful in establishing a sustainable delivery mechanism; and (viii) timely completion of the various steps for (a) the decentralized rural electrification study and action plan, and (b) strengthening BPPT's capacity to certify the technical capabilities of solar PV systems as well as to monitor their functioning in the field. Baseline levels and future target levels for each are shown in Table 1 of Annex 3.1. *During negotiations, agreement was reached on these performance indicators and their target levels.*

**Project Description**

3.7 The SHS project consists of two major components: (i) a credit component—comprising an IBRD loan and a GEF grant—to enable purchase of solar home systems by rural households and commercial establishments on an installment plan basis; and (ii) technical assistance, including support of detailed monitoring and evaluation activities during project implementation.

3.8 **Credit component** The proposed project involves the provision of the modern energy form of electricity to about 1 million people in rural areas. This would be achieved by the sale and installation of 200,000 solar PV systems (10 MWp) for homes, and in commercial establishments such as small shops. The geographical scope of the SHS project is three selected regional markets—centered around the provinces of West Java, Lampung, South Sulawesi—in areas where PLN service under the least cost grid expansion plan for rural electrification (the "RE Master Plan") is not expected for at least three years, or where it will be uneconomic for PLN to provide such service. A fourth market area, North Sumatera, would be added if it is assessed during the mid-term review that this would benefit the project.

3.9 The sales of SHS units to rural households will be undertaken by private enterprises. These "SHS dealers" will take responsibility for procurement of components, installation and maintenance, and will enter into hire-purchase-contracts(HPC) with the households. The funding will broadly work as follows. The rural households purchasing solar home systems are the ultimate beneficiaries of the proposed project. They will need credit extended to them by the SHS dealers, to enable them to pay back in regular monthly installments the balance of the purchase price after subtracting the customer's down payment—determined by the dealer but typically in the range of US$ 75 to US$ 100 equivalent—and after the GEF grant payment to be made on the rural household's behalf—US$ 75 per unit installed in Java and US$ 125 per unit installed in Lampung and South Sulawesi. It is expected that, in order to make monthly installment payments affordable to a sizable segment of the population, the dealers would offer loans of about four years, with the actual length of the loan to be determined by the dealers. The SHS dealers would bear the collection risk for customer payments.

3.10 To enable the SHS dealers to sell solar home systems on an installment plan basis as well as to finance their ongoing operations, the SHS dealers will require access to credit from commercial banks of their choosing—the "Participating Banks (PBs)"— for up to five years. Over the period of project implementation, successful SHS dealers will require from time-to-time and on a regular basis, credit to enable them to expand their sales on installment plans. The credit extended by a PB to a dealer would be based on the dealer's cash flow requirements as well as the PB's assessment of the dealer's performance history up to that point and credit worthiness. The loans to the dealers would be made by the PBs, at the prevailing interest rates for similar transactions, since the PBs would bear the responsibility for appraising dealer requests for credit, and for bearing the commercial risk on the credit extended to a dealer. The PBs, in turn, would re-finance 80 percent of the credit extended to SHS dealers from the IBRD credit made available to them at market rates, under onlending arrangements through the Government of Indonesia (GOI). *During negotiations, agreement was reached that, except as the Bank shall otherwise agree, GOI will not provide to the SHS dealers, whether directly or indirectly, in cash or in kind, any loan, subsidy, grant, credit enhancement or financing of any kind other than the GEF grants and the credit extended by the PBs under the SHS Project.*

3.11 To date, a pipeline of thirteen potential SHS dealers (subborrowers)—"Group 1"—has been identified (Annex 3.2), and it is expected that some additional potential dealers—"Group 2"—will be forthcoming over the first next twelve months. Bank-managed grant-financed local consultants have assisted the Group 1 dealers in preparing their business plans and credit applications, which have been submitted to four PBs (para 3.13) that have formally expressed interest in participating in the proposed project. All of the Group 1 dealers are small businesses, which have had, so far, only limited, if any at all, credit extended to them by commercial banks. Most of the Group 1 dealers are engaged solely in the solar PV business, mainly as suppliers to government procurement programs, with limited experience in direct household sales, while the remaining Group 1 dealers also have interests in other lines of business, such as air-conditioning, auto parts, and computers. Eight of the Group 1 dealers are based in Java, three in South Sulawesi, and the remaining two in Lampung; two of the Group 1 dealer businesses are owned and operated by women, one in Java and the other in South Sulawesi.

3.12 The commercial banks have evaluated these plans, and have developed preliminary estimates of credit requirements. The PBs are continuing their discussions with the dealers, and are making best efforts to refine their appraisals and assessment of credit requirements by negotiations. It is expected that in the case of 5 to 7 dealers the discussions with the respective PBs would have advanced sufficiently so as to enable financial closure between the PBs and the subborrowers shortly following loan effectiveness. It is anticipated that up to three more dealers could be added during the first twelve to eighteen months of the project implementation.

3.13 The four PBs identified to date would not be appraised by the Bank, given that these commercial banks that have been classified as financially sound by BI. These PBs have a current "sehat" classification from BI's Bank Supervision Department, and they would be required to maintain throughout the Project [2]. Further, all four of these PBs are among the select group of the strongest and dynamic banks in Indonesia today. Two of these PBs are private commercial banks: Bank Niaga and Bank Bali; the other two PBs are state owned commercial banks: Bank Negara Indonesia (BNI), and Bank Ekspor Impor Indonesia (BankExim). BNI has been identified by GOI as the first among the select group of state owned commercial banks for partial divestiture.

3.14 **Technical assistance** The three TA components of the proposed project are individually identified by category and value in Table 3.1. Draft TORs for all three components have been prepared and agreed to with BPPT and DGEED, and are contained in the Project Implementation Plan (PIP) report (para 3.45).

**Table 3.1: Allocation of Technical Assistance**

| Category | Component | Value $ million /a |
|---|---|---|
| 1. Implementation Support | Project Support Services | **3.10** |
| 2. Policy Support | Decentralized Rural Electrification Strategy Study and SHS Action Plan | **0.70** |
| 3. Institutional Development | Strengthening BPPT's Solar PV Testing and Certification Capabilities | **0.50** |
| **Total** | | **4.30** |

/a Excluding contingencies and taxes (VAT)

3.15 Out of a total value of US$4.3 million equivalent, about 70 percent is accounted for by project implementation support services. A Project Support Group (PSG) will be established and would be responsible for, *inter alia*, (i) for dealers: verifying compliance by the dealers of the equipment installed and proper utilization of the GEF grant, establishing contacts with and assessing any new dealers who wish to participate in the Project; (ii) for customers: consumer protection, such as maintaining two-way links with prospective and actual customers (end-users), making available information about the technical and financial benefits of SHS as well as risks such as the future availability of PLN service; (iii) monitoring and evaluation of the project's progress, including an assessment of the dealers' progress and updated business plans over time; and (iv) limited training -- for selected officials from BPPT, DGEED, and BAPPENAS, as well as private sector organizations involved in the implementation of solar PV systems -- in the form of conferences, seminars, workshops and study tours, in Indonesia as well as in other countries. While the PSG will be contracted by BPPT and will work with BPPT to coordinate Project activities within the framework of the GOI's broader 50 MWp solar PV project, the PSG will report to the Rural Electrification Steering Committee (MME), which will meet on an ad hoc basis as necessary. To safeguard the role of the PSG for purposes of GEF grant related audits and verifications and in its dealings with the dealers and the commercial banks, the PSG will take instructions only from the RE Steering Committee.

2/ Any new PBs would also not be appraised by the Bank, but would be required to maintain a "sehat" rating by BI. Annex 3.3 outlines BI's bank rating system for monitoring and classifying the financial health and overall soundness of state as well as private commercial banks.

3.16 The remaining 30 percent of TA is directed to capacity building that would facilitate the design and implementation of a longer term program for solar PV penetration in Indonesia that is consistent with a least cost and sustainable rural electrification strategy. About $0.7 million equivalent of the TA is for policy support, to assist GOI's Rural Electrification Steering Committee to develop a strategy and corresponding action plan for meeting the modern energy needs of the segments of the rural population for which solar PV systems represent the least-cost strategy. For this purpose, a "Decentralized Rural Electrification Strategy Study and SHS Implementation Plan" will be prepared, which will complement the recently completed least cost grid-based rural electrification plan ("RE Master Plan"), financed under the Bank's first Rural Electrification project (Loan 3180-IND). The decentralized rural electrification (DRE) plan would consider a variety of technological, delivery, and financing options, and develop a 10-year implementation plan for solar PV in the niches for which it is best suited. *During negotiations, agreement was reached that GOI will: (a) undertake and complete a study on "Decentralized Rural Electrification Plan", in accordance with terms of reference and in a manner satisfactory to the Bank, and furnish the draft final report of the study to the Bank for review and comments by no later than September 30, 1998; and (b) based on the said study's results and recommendations and subsequent review, comments and discussions: (i) prepare a draft Decentralized Rural Electrification Plan, with a focus on the niche for solar PV, for Indonesia, (ii) furnish the said draft plan to the Bank for review and comments, by March 31, 1999, and (iii) by November 30, 1999, finalize and adopt the same taking into account the comments, if any, thereon by the Bank.* Further, *during negotiations, agreement was reached that DGEED, MME would form and activate, no later than November 30, 1997, a SHS Working Group, headed by the Director of the Directorate of Electric Power Planning, DGEED, with representation from other Government agencies concerned with rural electrification policy, including BAPPENAS, BPPT, MOF, Ministry of Cooperatives and Small Enterprise Development, and PLN.* The SHS Working Group will report to the Rural Electrification Steering Committee, DGEED, and will be the local working counterpart to the consultants who will undertake the preparation of the Decentralized RE Strategy Study and SHS Action Plan.

3.17 About US$ 0.5 million equivalent of TA is for capacity building to assist GOI in building Indonesia's institutional capabilities for the dissemination of solar PV technology. Specifically, this component will help strengthen BPPT-LSDE's capability to technically certify SHS systems by carrying out type testing as well as product testing, and to monitor systems in the field; staff from DGEED's subdivision of Electricity and New Energy Testing would also benefit by participating in the training. The focus would be on testing and certifying PV systems, and not on PV module testing and qualification. The long-term goal is that, with the assistance of this TA as well as support from other sources, BPPT-LSDE would attain ISO 25 status. *In order to reach this goal in a timely manner, during negotiations, agreement was reached that BPPT-LSDE would: (i) initiate and undertake without delay all steps necessary to ensure that the consultants are mobilized no later than October 31, 1997, in accordance with TOR acceptable to the Bank; (ii) submit, by no later than February 28, 1998, a time-bound action plan -- acceptable to the Bank -- including major intermediate milestones to achieve ISO 25 status by December 31, 2001, with this date subject to revision based on the consultant's report; and (iii) ensure that the TA work under this Project would be completed by no later than October 31, 1999.*

**Technical Specifications**

3.18 Each SHS system to be sold under the proposed project would consist of one or more solar photovoltaic (PV) modules with an output of 50 Wp or more, a 12 volt DC lead-acid battery (minimum capacity of 70 Ah), a battery charge/discharge controller, provision for at least three fluorescent light fixtures, and related components such as wiring, switches and mounting hardware. All SHS units supported by the project will have to meet rigorous technical specifications, which have been developed by BPPT in cooperation with solar PV dealers, reviewed by several international research laboratories, and acceptable to the Bank. *During negotiations, agreement was reached that the participating SHS dealers will be required to furnish certifications -- to the PSG -- from testing facilities acceptable to the Bank, that their components meet or exceed the selected specifications.* Assistance is being provided to a subset of dealers, who have reached an advanced stage in the consideration of their credit applications by the PBs, in getting their equipment certified from international laboratories. Annex 3.4 provides further details of the technical specifications and the means for verification of the selected standards.

**Dealer Eligibility Criteria**

3.19 *During negotiations, agreement was reached that a participating dealer must demonstrate an ability and intent to: (i) undertake installment payment based sales of SHS to rural customers in the target markets, including taking responsibility for collecting installment payments; (ii) offer the customers a comprehensive consumer protection package, including warranties and adequate after-sales service; (iii) agree to the establishment of an escrow account, based on the GEF grant funds due to the dealer, to be used solely to assist the dealer's customers to whom the dealer was unwilling or unable to provide adequate service; (iv) use certified equipment and components only; (v) agree to abide by a dealer conduct code; and (vi) provide the operational and financial information required by the PSG for project monitoring and evaluation (Annex 3.5, para 3.51).* The Bank, after reviewing information provided by a dealer and the PSG, would inform a PB of the dealer's choice of the dealer's eligibility to participate in the Project; the financial and credit appraisal of a dealer's business plan would be undertaken only by a PB, and not by the Bank or the PSG.

**Project Cost**

3.20 The total project cost, inclusive of duties and taxes and price contingencies is estimated at US$ 118.1 million equivalent, with a foreign exchange cost component of US$ 85.0 million equivalent, or about 72 percent of the total, arising primarily from the direct costs of the imported solar PV panels as well as the significant imported content in locally made components such as batteries and battery controllers. Cost estimates are in June 1996 prices and utilizing an exchange rate of US$1 = Rp. 2,341. Price contingencies for foreign costs are assumed to be 2.4 percent per year during the project implementation period, and for local costs at 8.7 percent per year. A summary of the project cost estimates is presented in Table 3.2.

**Table 3.2: Project Cost Summary**

| | (Rp billion) | | | (US$ million) | | | Foreign |
|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | as % of total |
| 1. **Credit Component** | **53.9** | **161.7** | **215.6** | **23.0** | **69.1** | **92.1** | **75%** |
| 2. **Technical Assistance** | **4.7** | **10.1** | **14.7** | **2.0** | **4.3** | **6.3** | **68%** |
| *of which* | | | | | | | |
| - Implementation Support | 2.3 | 7.3 | 9.6 | 1.0 | 3.1 | 4.1 | 76% |
| - Policy Support | 1.2 | 1.6 | 2.8 | 0.5 | 0.7 | 1.2 | 58% |
| - Institutional Development | 1.2 | 1.2 | 2.3 | 0.5 | 0.5 | 1.0 | 50% |
| **Base Cost** | **58.6** | **171.8** | **230.3** | **25.0** | **73.4** | **98.4** | **75%** |
| **Duties and Taxes** | 5.9 | 17.2 | 23.0 | 2.5 | 7.3 | 9.8 | |
| **Price Contingencies (Credit Component)** | 13.0 | 10.1 | 23.1 | 5.5 | 4.3 | 9.8 | |
| **Total Project Cost** | **77.4** | **199.0** | **276.4** | **33.1** | **85.0** | **118.1** | **72%** |
| **Interest During Construction** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| **Total Financing Required** | **77.4** | **199.0** | **276.4** | **33.1** | **85.0** | **118.1** | **72%** |

Exchange Rate US$1 = 2,341

**Financing Plan**

3.21 The financing plan is shown in Table 3.3. A proposed Bank loan of US$ 20.0 million equivalent, combined with a GEF grant of SDR 16.8 million (US$ 24.3 million equivalent), would finance about 38 percent of the project cost. The GEF grant would finance the "incremental costs" of the SHS Project (para 3.24)

**Table 3.3: Financing Plan**

| | (US$ million) | | | % of |
|---|---|---|---|---|
| | Local | Foreign | Total | Total |
| **Credit Component** | | | | |
| IBRD | 0.0 | 20.0 | 20.0 | 17% |
| GEF | 0.0 | 20.0 | 20.0 | 17% |
| Participating Banks | 1.2 | 3.8 | 5.0 | 4% |
| Subborrowers/Endusers | 29.9 | 36.9 | 66.8 | 57% |
| ***Subtotal*** | **31.1** | **80.7** | **111.8** | **95%** |
| **Technical Assistance** | | | | |
| - ***Implementation Support*** | | | | |
| GEF | 0.0 | 3.1 | 3.1 | 3% |
| GOI/BPPT | 0.5 | 0.0 | 0.5 | 0% |
| Subborrowers/Endusers | 0.5 | 0.0 | 0.5 | 0% |
| ***Subtotal*** | **1.0** | **3.1** | **4.1** | **3%** |
| - ***Policy Support*** | | | | |
| GEF | 0.0 | 0.7 | 0.7 | 1% |
| GOI/DGEED | 0.5 | 0.0 | 0.5 | 0% |
| ***Subtotal*** | **0.5** | **0.7** | **1.2** | **1%** |
| - ***Institutional Development*** | | | | |
| GEF | 0.0 | 0.5 | 0.5 | 0% |
| GOI/BPPT | 0.5 | 0.0 | 0.5 | 0% |
| ***Subtotal*** | **0.5** | **0.5** | **1.0** | **1%** |
| **Total** | **33.1** | **85.0** | **118.1** | **100%** |
| IBRD | 0.0 | 20.0 | 20.0 | 17% |
| GEF | 0.0 | 24.3 | 24.3 | 21% |
| GOI/BPPT | 1.5 | 0.0 | 1.5 | 1% |
| Participating Banks | 1.2 | 3.8 | 5.0 | 4% |
| Subborrowers/Endusers | 30.4 | 36.9 | 67.3 | 57% |

Note: Subborrowers are dealers, who will be providing equity and reinvested profits; endusers are the households, who will be providing the downpayments

3.22 The total cost of the credit component is US$ 111.8 million equivalent; of this amount, the subborrowers (SHS dealers) would provide an estimated US$ 66.8 million equivalent, consisting of equity infusions and profit reinvestments by the private dealers selling solar home systems and the endusers' (SHS customers) down payments. The balance of the financing of US$ 45.0 million equivalent would be provided by: (i) a GEF grant of US$ 20.0 million equivalent, which is the incremental cost of this component (para 3.24), and (ii) with the remainder (US$ 25.0 million equivalent) provided as loans on the basis of 80 percent (US$20.0 million equivalent) from the Bank, and 20 percent (US$ 5.0 million equivalent) from the PBs.

3.23 The TA component (US$ 6.3 million equivalent) would be financed by: (i) GOI/BPPT, which would provide US$ 1.5 million equivalent, (ii) a GEF grant in the amount of US$ 4.3 million equivalent, which is the sum of the incremental costs of the implementation support, policy support, and institutional development, with the purpose of reducing the implementation barriers obstructing the wider use of solar PV systems in Indonesia, and (iii) subborrower contributions of US$ 0.5 million equivalent for implementation support.

3.24 The GEF grant would finance all the incremental costs of the proposed project. At present, which forms the baseline scenario, most of the target households for SHS units use a combination of kerosene for lighting and diesel-based battery charging for other activities such as powering a black-and-white TV. The costs of the SHS units are currently higher than those of the baseline scenario on a lifecycle basis, with the difference between the two being the incremental cost. Based on the available data, the unit incremental cost is $75/SHS in Java and $125/unit off-Java. For total project sales of 200,000, split about equally between the new Java areas and off-Java, the total incremental cost for the SHS units is $20 million. In addition, there is an incremental cost of $4.3 million associated with the TA component of the project. The detailed incremental cost analysis, with information on the costs of the baseline scenario and the GEF alternative, is presented in Annex 3.6.

3.25 Whereas the full GEF grant amount of US$24.3 million would be committed upon Board approval, disbursements would be authorized in two phases. The first phase grant amount of US$15.75 million equivalent would be available for disbursement upon loan effectiveness, and would cover grant payments for the sale and installation of 120,000 units (US$ 12 million equivalent) over the entire project duration period as well as the bulk of the TA (US$ 3.75 million equivalent). The second phase amount of US$ 8.55 million equivalent would cover the remaining 80,000 units (US$ 8 million equivalent) and the residual TA costs (US$ 0.55 million equivalent); the second phase grant funds could be disbursed only after written authorization by the GEF Chief Executive Officer, based on the outcome of the mid-term review (paras 3.52 and 3.53).

**Lending and Funds Allocation Arrangements**

3.26 The proposed Bank loan and GEF grant would be made to the Republic of Indonesia. The Bank loan would be provided to GOI, denominated as a standard multi-currency pool loan at the Bank's standard variable interest rate, with a commitment fee of 0.75 percent per annum or such other percentage as established by the Bank on the undisbursed amount under the Loan Agreement from time to time. The term would be 20 years, including five years grace period.

3.27 The Government would channel and allocate the total loan and grant proceeds to the PBs as follows:

(i) For the state-owned PBs, loan funds would be lent and grant funds channeled by MOF through a Subsidiary Loan Agreement (SLA), while for the private PBs, loan and grant funds would go in the first instance from the Government to BI, through a separate SLA between MOF and BI. BI would then re-lend the loan funds and channel the grant funds to the private PBs through the respective Onlending Loan Agreements (OLAs) between BI and the respective PBs. The SLAs between MOF and the state owned PBs and OLAs between BI and the private PBs will also incorporate provisions governing the flow and use of the GEF grant.

*During negotiations, agreement was reached that signing of: (a) the SLA between MOF and BI; (b) at least two SLAs/OLAs between MOF/BI and the PBs, on terms and conditions acceptable to the Bank, would be conditions of loan effectiveness. Further, signing of an SLA/OLA, acceptable to the Bank, between MOF/BI and a PB would be a condition of disbursement of the IBRD loan and GEF grant for each PB.*

(ii) *During negotiations, agreement was reached that in the event of a PB losing its "sehat" status: (a) BI would require the concerned PB to take remedial measures within a prescribed period of time to regain a "sehat" status; (b) BI would notify the Government, and the Government would notify the Bank that a situation has arisen that may require the reallocation of the uncommitted portion of funds previously allocated to the PB; and (c) in the event the PB fails to regain "sehat" status after the prescribed period, funds which have been allocated to the concerned PB but have not been committed, would on request of GOI, be reallocated to those PBs which continue to be classified as "sehat" and which have requests for subloans in excess of their allocations.*

(iii) The <u>loan allocation</u> to each PB will be part of its SLA/OLA, and will be based upon the PB's estimates of its credit requirements for this Project. *During negotiations, agreement was reached that: (a) MOF/BI would amend, at the request of a PB and with the Bank's approval, the amount of such PB's loan allocation once every calendar year; and (b) each PB would pay to the Government, at the same rate as the Government would pay to the Bank, commitment fee on the portion of its loan allocation that has not been disbursed to the PB.*

(iv) <u>Loan reallocations</u> *During negotiations, agreement was reached that in order to provide flexibility and to respond to unforeseen fluctuations in demand for credit[3], the Bank would approve, on the request of GOI, reallocation of funds from PBs that would not be able to utilize their allocated funds.* This would happen for example, in the case of PBs that have: (a) fully committed, or are likely to fully commit, their allocation to their subborrowers; (b) used up all the loan funds available on a "first-come, first served basis"; and (c) have requests for additional subloans from their subborrowers. Further, upon the Bank's request, GOI would be willing to review the need for such reallocations. From the date of a reallocation, the PBs would be obligated to pay commitment fee on the undisbursed amount of their respective new allocations.

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3/ Primarily driven by variances that will unfold over time between the SHS dealers' initial business plans for the entire project implementation period and modifications thereof in response to the degree of success achieved in realizing such plans, and by the financial health of the enterprises and future prospects thereof.

**Subproject Review**

3.28 After assessing the credit application, when a PB is satisfied that it is willing to extend credit to an eligible dealer (para 3.19), the PB would submit to the Bank for review the particular subproject, along with a summary information report (Annex 3.7), as well as a copy of the subborrower's (SHS dealer's) business plan; Annex 3.8 provides details of the information required in a subborrower's business plan.

3.29 *During negotiations, agreement was reached that the Bank, after reviewing the PB's submission, will approve a particular subproject, i.e., dealer, to participate in the Project, with the maximum amount of the IBRD loan to be extended to the particular subproject to be determined by the PB.* The approval would be sent by the Bank to the PB and MOF.

**Grant Authorization**

3.30 For the GEF grant, the Bank would authorize the ceiling amounts that each dealer could claim from MOF on a year-by-year basis. *During negotiations, agreement was reached that: (i) For the initial calendar year, the grant authorization for each dealer would take place along with the approval by the Bank of the dealer to participate in the Project; (ii) in subsequent years, the PSG would submit to the Bank, by no later than October 1 of each calendar year, for Bank review and clearance each dealer's grant authorization for the next calendar year, based upon PSG's review of each dealer's historical performance and future expectations; and (iii) the Bank would inform the PBs and MOF, of each dealer's grant authorization for the next calendar year.* In the event that a dealer's actual claims for grant payments in a particular year are less than the authorized amount, the unclaimed amounts would lapse and could not be carried over to the next calendar year.

**Onlending Terms**

3.31 **GOI to PBs** Loan proceeds would be on-lent to the PBs in rupiahs for a term of 20 years including five years of grace. The onlending rate for the Bank loan to the PBs would reflect the market rate for domestic term funds in Indonesia. This rate will be a variable interest rate equal to BI's domestic money market certificate (Sertifikate Bank Indonesia - SBI). This rate would be adjusted on January 1 and July 1 of each year, based on the average of the 3-month SBI maturity quotations, during the preceding six months. In addition, the PBs will pay to GOI a commitment fee of 0.75 percent per annum or at such other percentage rate as the Government shall pay to the Bank on the undisbursed amount of the Subsidiary Loan from time to time. *During negotiations, agreement was reached that GOI would not levy any administration fee on the IBRD loan.* While the Government would bear the foreign exchange risk, it would be compensated for the cost of bearing this risk as the cost of funds from GOI to PBs includes an implicit premium reflecting market expectations regarding exchange rate changes, since deposit rates in Indonesia are market-determined and capital flows are generally unrestricted. In order to protect PBs from possibly excessive volatility in the reference rate, or otherwise, on July 1 of each year, commencing July 1, 1997, the basis for determining the onlending rate from GOI to the PBs would be reviewed with the objective of either ensuring that the 3-month SBI rate appropriately reflects the cost of domestic term funds or agreeing on an alternative that does reflect this cost.

3.32 **PBs to subborrowers (SHS dealers)** *During negotiations, agreement was reached that proceeds of the Bank loan, along with financing out of the PBs own resources, would be on-lent to the subborrowers by the PBs, at market rates, using interest rate spreads charged for similar loans. The terms for sub-loans would be up to five years.* The terms and conditions of subloans would be freely negotiated between the PBs and sub-borrowers.

3.33 **GEF Grant** *During negotiations agreement was reached that no fees for administering the GEF grant would be charged by GOI and the PBs.*

**Procurement**

3.34 Procurement arrangements for the proposed project are summarized in Table 3.4. International or national competitive bidding for equipment and services—such as procurement of solar panels, batteries, light fixtures, electronic controllers—would not be feasible for the SHS dealers because the size of individual procurement would be too small, and the grouping of contracts is not practical due dispersal in time and location. All of the contract packages would be under $ 5.0 million, with the typical package in the range of $ 0.25-0.50 million. The typically small sizes of the individual procurement packages offer several advantages to the dealers: (i) just-in-time procurement reduces inventory carrying costs; (ii) smaller packages reduce the incremental borrowings from the PBs and the associated need for injecting fresh equity and collateral, a critical constraint; (iii) the dealers have an opportunity to buy panels on the spot market, where good deals are commonly available; and (iv) given that the prices of solar PV panels are expected to continue to decline over time, smaller packages provide an opportunity to take advantage of lower prices over time. Efficient procurement in the private sector in Indonesia is ensured through a competitive market operating in an open economy where commercial purchasers normally solicit various bids to obtain reasonable quotes (prices and terms of suppliers' credit), since it is in their best commercial interests to do so.

3.35 Although the PBs do not have formal procurement requirements, they do require their clients to justify their procurement decisions, and often require them to provide comparative price quotations. Under the proposed project, the PBs would require participating SHS dealers to show that their procedures for procuring goods and services are appropriate. The PBs would ensure that the goods and services are procured at reasonable prices, taking account of efficiency, economy, reliability, and other relevant factors such as terms of supplier credit, availability of spare parts, backup technical assistance, warranty arrangements. These procedures are consistent with the principles of Bank financing to the private sector through financial intermediaries; the Bank would conduct *ex-post* reviews to ensure that procurement is economic and efficient.

3.36 **Technical assistance** Consultants to be financed under the technical assistance component of the proposed project—Table 3.1—would be selected in accordance with the Bank Guidelines for the Use of Consultants, August 1981 and use the Bank's standard contract for Consultant's Services. All consulting services above US$ 100,000 equivalent provided by firms, and above US$ 50,000 equivalent to be provided by individuals would be subject to the Bank's prior review; further, for contracts below US$ 100,000 equivalent provided by firms, and below US$ 50,000 equivalent to be provided by individuals, there would be prior review of: (a) the terms of reference, (b) single-source selection of consulting firms, (c) assignments of a critical nature, as reasonably determined by the Bank, (d) amendments to contracts for the employment of consulting firms raising the contract value to US$ 100,000 equivalent or above; and (e) amendments to contracts for the employment of individuals raising the contract value to US$ 50,000 equivalent or above. This would result in prior review of 100 percent of the TA contracts.

**Table 3.4: Procurement Arrangements**
**(US$ million)**

| | Procurement Method | | |
|---|---|---|---|
| | **Other /a** | **N.B.F. /b** | **Total** |
| **A. Credit Component** | 101.9 | 0.0 | 101.9 |
| | (20) | | (20) |
| | [20] | | [20] |
| **Taxes** | 0.0 | 9.8 | 9.8 |
| **Subtotal** | **101.9** | **9.8** | **111.8** |
| | **(20)** | **(0.0)** | **(20)** |
| | **[20]** | **[0.0]** | **[20]** |
| **B. Technical Assistance** | | | |
| Implementation Support | 4.1 | 0.0 | 4.1 |
| | [3.1] | | [3.1] |
| Policy Support | 1.2 | 0.0 | 1.2 |
| | [0.7] | | [0.7] |
| Institutional Development | 1.0 | 0.0 | 1.0 |
| | [0.5] | | [0.5] |
| **Subtotal** | **6.3** | **0.0** | **6.3** |
| | **(0.0)** | **(0.0)** | **(0.0)** |
| | **[4.3]** | **[0.0]** | **[4.3]** |
| **Total** | **108.2** | **9.8** | **118.1** |
| | **(20.0)** | **(0.0)** | **(20.0)** |
| | **[24.3]** | **[0.0]** | **[24.3]** |

Note: Terms in ( ) and [ ] are amounts financed by IBRD and GEF, respectively
/a Goods and services to be procured by limited international bidding or established commercial practice
/b Not Bank financed

**Disbursement**

3.37 Table 3.5 shows the allocation of loan and grant proceeds to each Category and the percentage of expenditures to be financed in each Category. The Bank loan would be disbursed against 80 percent of the subloan amounts extended from time-to-time by the PBs to the SHS dealers. The grant would be disbursed as follows: (a) US$ 75 equivalent per SHS unit installed in Java and US$ 125 equivalent per SHS unit installed in the project areas outside Java; and (b) 100 percent of expenditures for consultancy services under the technical assistance component. Withdrawal applications for consulting firm contracts above US$100,000 equivalent and individual consultant contract cost above US$50,000 equivalent would be based on the Bank's full documentation requirements; others would be on SOE procedures. Documents supporting SOEs would be retained by the PBs, SHS dealers and DG-Budget, and made available for review by the Bank supervision missions.

3.38 In order to facilitate timely disbursement, two Special Accounts (SA) would be maintained by MOF at BI, one for the IBRD loan, in the amount of $1.4 million, and a second SA for the GEF grant, in the amount of $1.6 million, under terms and conditions satisfactory to the Bank. These SAs will be maintained in the name of Director General of Budget, Ministry of Finance, using established procedures as discussed in the following. After initial deposits by the Bank into these accounts, further replenishment would take place upon the Bank receiving applications for withdrawals from GOI/MOF. Replenishment to the SAs will be made on a monthly basis, or when 20 percent of an SA's balance has been used, whichever comes first.

**Table 3.5: Allocation of Loan and Grant Proceeds**

| Category | Amount of Loan and Grant Allocated (US$ mill. equiv.) | % of Expenditures to be Financed /a |
|---|---|---|
| **A. IBRD Loan** | | |
| **- Sub-loans** | 20.0 | Refinance 80% of the sub-loans made by participating banks to dealers |
| **B. GEF Grant** | | |
| **- SHS Installation** | 20.0 | 100% /b |
| **- T.A.** | 4.3 | 100% /c |

/a Expenditures financed are exclusive of value-added-tax (VAT)
b $ 75/SHS unit installed in Java, and $ 125/SHS unit installed outside Java
c In addition, GOI/BPPT will finance $1.5 million equivalent TA for implementation support, policy support and institutional development, and the subborrowers would finance $ 0.5 million equivalent for implementation support.

3.39 **IBRD loan** Disbursements from the SA for the IBRD loan would be triggered by the actions of the SHS dealers (Annex 3.9). The PBs would disburse subloan credit to the SHS dealers, based on a demonstration of their credit requirements, backed up by the documentation required by the PBs. The PBs would periodically submit a request for re-financing 80 percent of the subloan credit amounts to MOF, which would issue a payment authorization to BI. In turn, BI would transfer the loan funds from the SA to the PBs. MOF officials have indicated that the time from the receipt of the payment request at MOF from a PB to the time of payment by BI would be under two weeks. *During negotiations, agreement was reached about the procedures and the supporting documentation to be utilized by MOF for disbursement of the IBRD loan and the GEF grant (para 3.40).*

3.40 **GEF grant** Disbursement of the GEF grant would follow essentially the above scheme for disbursement of the IBRD loan, with one significant difference; unlike the loan, disbursement of the GEF grant would be based on the sale and installation of SHS units. *During negotiations, agreement was reached that: (i) the grant would be disbursed only after the dealer has installed a SHS unit and provided documentation of acceptance of installation and a duly executed hire-purchase-contract (HPC) with the buyer; (ii) in the initial instance, grant disbursement to a particular dealer would take place only after the Bank notifies MOF that the PSG has conducted a satisfactory audit of the dealer's initial 50 installed units.* The SHS dealers would submit this documentation to the PBs, along with their request for a grant disbursement. The PBs would forward this request to MOF, and ultimately, BI would transfer the grant funds to the PBs from the grant SA. For the TA, the consultants would submit invoices to BPPT, which will forward them with a payment request to MOF, which will then issue a payment authorization to BI, which will transfer the funds from the grant SA to the consultant's account.

3.41 **Disbursement Schedule** The estimated disbursement schedule is shown in Annex 3.10. Disbursements are expected to be relatively slow in the first two years, primarily because the SHS dealers will need to establish themselves before undertaking rapid expansion of sales in the latter half of the project. The PBs also favor this "start small, finish big" strategy, as it allows the PBs to incrementally exercise control of their risk exposure to the SHS dealers, by modulating their scale of operations and rate of growth along a trajectory outlined in the dealers' five year business plans, but at the same time conditioned as time progresses on their respective performance and creditworthiness at each future decision point on extending additional term credit.

**Implementation**

3.42 The credit component will be executed by qualified private dealers, who will take the responsibility for procurement, sales, installation and maintenance of the solar PV systems to rural customers, and who will also be responsible for collection of installment payments for the systems sold under a hire-purchase-contract arrangement. Contracting for the technical assistance components of implementation support and institutional development (Table 3.1) as well as contractor management would be the responsibility of BPPT, while DGEED would have responsibility for the technical assistance component of policy support. In particular, the Directorate of Energy Technology within BPPT would administer and provide counterpart support for the TA related to the Project Support Group (PSG), while BPPT's LSDE unit would have lead responsibility for hosting, providing counterpart support and facilities, and otherwise ensuring successful implementation of the TA on "Strengthening BPPT's Capabilities in Solar PV Testing and Certification".

3.43 A project implementation schedule depicting major milestone dates is contained in Annex 3.11. The schedule assumes a loan effectiveness date of May 1, 1997, project completion date of October 31, 2001, and a loan closing date of April 30, 2002. A more detailed implementation schedule of the proposed project is contained in the Project Implementation Plan (para 3.45).

3.44 **Accounting and Audit** The project accounts of all PBs and BPPT would be audited by independent auditors acceptable to the Bank. *During negotiations, agreement was reached that BPPT and the PBs would submit their project audit reports to the Bank no later than six months after the end of their respective fiscal years.* Specifically, the following audit reports would be required: (i) the SOE documentation for BPPT and the SAs maintained by MOF; (ii) the SOE documentation maintained by the PBs; and (iii) the project accounts for BPPT. All PBs would provide, through MOF, the relevant information on disbursements and balances to the Project Support Group (PSG) -- see para 3.15 -- to enable the PSG to maintain the project monitoring and management information system (MIS).

**Project Management and Monitoring**

3.45 **Project Implementation Plan (PIP)** A PIP has been prepared and is available in the Project files. The PIP recognizes that this Project has a number of innovative elements and risks, so that careful monitoring and, possibly, corrective actions are required for successful implementation. The PIP describes the: (i) critical success factors; (ii) strategy and implementation plan for catalyzing sales and installations of SHS units and capacity building (iii) management structure; (iv) milestones and performance indicators; (v) details of mid-term review; (vi) monitoring and reporting requirements; and (vii) procedures related to compliance by dealers of their responsibilities under the Project.

3.46 **Project management** On an overall basis, the Rural Electrification Steering Committee (MME) is responsible for overseeing the implementation and impact of the Project. In undertaking this responsibility, the RE Steering Committee will largely rely upon the PSG (para 3.15), which will provide regular progress monitoring reports.

3.47 The PSG will have a Director, acceptable to the Bank, with substantial and relevant international and Indonesian experience, a Manager with local experience, and a small technical and support staff. The PSG will subcontract to NGOs and local companies much of its dissemination, audit, and business advisory services. *During negotiations, agreement was reached that: (i) PSG would be established in accordance with TOR, membership, staffing and resources acceptable to the Bank; and (ii) BPPT will undertake contracting in a timely manner so that the PSG can be mobilized no later than May 15, 1997.*

3.48 **Project monitoring** The project's performance will be monitored by the PSG, the Bank's supervision missions, and a mid-term review that would be undertaken by a panel of experts (para 3.52). For this purpose, it is essential that PSG have easy and timely access to the relevant project information directly from the participating dealers and through MOF from the PBs to enable it to maintain its MIS. Some of the key elements of the monitoring would be to verify that: (i) the private dealers are using the credit and grant funds provided to them under the project in accordance with the project design, (ii) the dealers are complying with the pre-designated technical, after-sales service and consumer protection standards, and (iii) that customers are satisfied with their SHS units. The PSG would prepare an annual report and an additional report for the mid-term review (para 3.52)

3.49 **Actions to be taken on non-compliance by dealers** If any dealer is found to be not in compliance with the Project rules, immediate action would be taken, the nature of which would depend upon which of two categories the problem fell in (Annex 3.5). First, there may be isolated and contained incidents of non-compliance, resulting, for example, from management, internal control or quality control deficiencies. For this type of non-compliance, the PSG would give the dealer an opportunity to remedy the problem within a given time period. If the PSG finds that the dealer does not meet the timetable, or if there are repeated incidents of non-compliance, the PSG may classify the non-compliance to be in the second category.

3.50 The second category of non-compliance comprises those in which the dealer has committed fraud, or has an extensive incidence of non-compliance with project rules, such technical specifications or after-sales service standards. In this case, after receiving the report and recommendations of the PSG, the Bank would take appropriate steps to exercise the remedies available to it, including suspending or terminating disbursements in respect of specific dealers. Should the Bank determine that a dealer is no longer eligibility to participate in the Project, it would immediately notify the MOF and the concerned PB. *During negotiations, agreement was reached that the PBs will not make loans to dealers that are no longer eligible to participate in the Project.* It is envisioned that the concerned dealer would no longer be entitled, as of the date of notification to MOF and the concerned PB, for further grant disbursements or refinancing of the credit extended by the PB .

3.51 **Escrow account** An escrow account, based on the GEF grant funds due to a dealer, will be established for each dealer, with the purpose of assisting any customers who are adversely affected by a dealer's non-compliance with the Project rules (Annex 3.5). These escrow accounts would be terminated at the end of the Project, with any funds in the accounts transferred to the respective dealers. *During negotiations, agreement was reached these escrow accounts would be established, utilized and terminated in the manner specified in Annex 3.5.*

3.52 **Mid-term review** A mid-term review will be conducted to assess the Project's progress and take any corrective actions required to facilitate implementation of the Project. As part of the mid-term review, an independent panel of experts will assess the Project from the perspective of the release of second phase of the GEF grant (para 3.25). The central issue to be considered by the panel is whether there is any scenario that could be successfully implemented under which the SHS Project's target of attaining total sales of 200,00 SHS units over the life of the Project could be attained. While there may be one or more scenarios under which the target of 200,000 units would not be met, this question relates on the existence of one or more reasonable scenarios under which the target could be met, because the intent would be to focus implementation on the scenarios under which the target would be met. Hence, a positive answer to the above question would be the basis for the release of Phase 2 of the GEF grant. In the event that the panel concludes that there is no reasonable scenario under which the target of 200,000 units could be met, the panel would provide its judgment of the maximum unit sales that could occur over the life of the

SHS Project. The composition and terms of the reference for the independent panel as well as the manner of the processing of its report are described in Annex 3.12.

3.53 *During negotiations, agreement was reached that GOI would: (i) as per agreed TOR (Annex 3.12), convene an independent technical panel that will conduct and complete a mid-term review and submit its report to the GOI by no later than June 30, 1999; (ii) submit its report to the Bank, with the independent panel's report included as an attachment, to the Bank by no later than July 31, 1999; and (iii) not disburse grants in excess of an aggregate amount of US$ 15.75 million equivalent, unless notified by the Bank that the GEF Chief Executive Officer has authorized the release of part or all of the residual US 8.55 million equivalent.*

3.54 **Bank supervision** The supervision schedule is shown in Annex 3.13. The supervision will be relatively heavy up to the midterm review, and will require assistance from the Bank's Resident Mission in Indonesia (RSI), specially on matters related to disbursements and audits and accounts. It is expected that this would help to reduce any implementation problems as well as ensure that the dealers' activities are in compliance with project design and standards.

**Environment and Resettlement**

3.55 SHS are considered to be one of the most environmentally benign form of energy generation. There are no air or water emissions associated SHS; in addition, there is replacement of fossil fuels which lead to emissions of green house gases and other pollutants. Since SHS are usually located on roof tops, they avoid any environmental or resettlement impacts derived from land use, and the two dimensional flat shape of the collectors minimizes any potentially adverse aesthetic impacts. Further, the lead batteries are located inside the house and do not affect aesthetics or environment in any way.

3.56 Investigations made with the Directorate for Hazardous and Toxic Substance Management of BAPEDAL, and the Association of Waste Metal Recycling in Indonesia clearly indicate that there is recycling of used batteries in Indonesia. At present, the large scale modern battery manufacturers have to compete vigorously with small "pirate type" primitive battery recycling operations in the market of used batteries. The severe shortage of used batteries is responsible, in part, for the partial capacity utilization of the three large battery manufacturers in Indonesia. In response, the government has changed its rules (regulation PP/19) to allow, on a case by case basis, the import of used batteries. Further, the life of a battery used in the SHS is about three years, which is longer than the life of the battery under the present system of charging batteries at a central station (about two years) because the daily partial discharge/charge cycle under the SHS leads to slower depreciation than the weekly near full discharge/charge cycle common with central charging schemes. Thus, the number of batteries required under the SHS scheme will be significantly less than under the present system of centralized battery charging.

3.57 There are no resettlement issues since there will be no land transactions under this project, given that the solar PV systems will be installed on existing homes or commercial establishments.

# 4. PROJECT JUSTIFICATION

## Rationale for World Bank Involvement

4.1 **Links to Country Assistance Strategy** The Bank is committed to supporting renewable energy development in Indonesia, as stated in the Indonesia Country Assistance Strategy (CAS) that was presented to the Bank's Board on March 21, 1995, and the CAS Progress Report that was discussed on June 4, 1996. The proposed project design and implementation strategy typify the defining characteristics of the transition that is underway in the assistance strategy for Indonesia: (i) achieving poverty reduction through increased funding for regional development, and a shift towards smaller and regionally oriented projects targeted at reducing urban-rural disparities in the quality of life; and (ii) striking the appropriate balance between public and private roles in energy distribution.

4.2 **Links to Economic and Sector Work** The proposed project draws upon general economic and sector work related to renewable energy as well as analyses undertaken specifically for this project. In particular, the project design and strategy are consistent with the findings and recommendations in: (i) the Bank's rural energy policy paper[1], (ii) an ASTAE best practices paper on solar PV[2], (iii) the Bank's report on the challenges Indonesia faces in sustaining development[3], (iv) OED's review of Rural Electrification in Asia[4], (v) a review of the BANPRES solar PV project in Indonesia[5], and (vi) demand surveys conducted specifically for this project.

4.3 **Links to ongoing Bank activities in Indonesia** The Bank continues to actively support implementation of an efficient and sustainable Rural Electrification (RE) program, initiated in the Rural Electrification I project (Loan 3180-IND) and now through the successor Rural Electrification II project (Loan 3180-IND), primarily by financing extension of the various regional grids, and related institutional capacity building. Solar home systems are one of the key elements of the overall least cost decentralized RE strategy in Indonesia, and they complement the least cost grid extension program for RE. The SHS project will provide a means to continue the Bank's dialogue with the Government of Indonesia and to influence the implementation of a sustainable and environmentally sound RE development program, while encouraging private sector participation and the creation of commercial markets for alternative energy, and continue the process of improving the policy and institutional environment, all matters of high priority on the GOI's as well as the Bank's agenda.

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1/ *Rural Energy and Development: Improving Energy Supplies for 2 Billion People*, A World Bank Best Practice Paper, Report 15912-GLB, 1996.

2/ Cabraal, A., M. Cosgrove-Davies and L. Schaeffer, *Best Practices for Photovoltaic Household Electrification Programs*, World Bank Technical Paper Number 324, Asia Technical Department Series, 1996.

3/ *Indonesia: Sustaining Development*, A World Bank Country Study, 1994.

4/ *Rural Electrification in Asia: A Review of Bank Experience*, Operations Evaluation Department, World Bank, 1994 Report No. 13291.

5/ Wade, H., I. H. Sejahtera, and T. Ball, *Evaluation of the Indonesian Photovoltaic Household Electrification Project*, Consultant report, EA3IE, 1993.

4.4 **Rationale for credit component** The Project's credit component requires a combination of IBRD credit and GEF grant in order to facilitate the sale and installation of 200,00 SHS units to be paid for by rural customers on an installment payment basis. At present, the commercial viability of lending for SHS in rural areas has not been established, and no commercial bank has extended credit either to dealers or households for the sale of SHS. Further, the combination of current high SHS costs and the high share of initial costs in lifetime SHS costs makes it unlikely that the viability of this type of lending would be established on its own. Hence, initial Bank/GOI support is justified to demonstrate and establish the commercial viability of this type of lending.

**Eligibility for GEF Support**

4.5 The SHS project is fully consistent with the: (i) the guidance from the Convention of the Parties (COP), and (ii) GEF Operational Strategy, in particular with Operational Program 6, which has the aim of *promoting the adoption of renewable energy by removing barriers and reducing implementation costs.* The barriers targeted by this project are (i) the lack of established high-volume supplier dealer chains, high prices, and (iii) lack of term credit (paras. 2.29-2.32). The SHS project is expected to help lower the unit costs of solar PV technologies in Indonesia, given the downward sloping technology cost learning curve. In addition, the SHS project is expected to set a new lower global benchmark price for SHS, thereby stimulating further penetration and global environmental benefits from abatement of GHG emissions in other countries as well.

**Alternatives to SHS Project**

4.6 The baseline alternative to the SHS project is the business-as-usual scenario under which the households would continue to use a combination of kerosene for lighting and diesel-based battery-charging for other end-uses. The costs of this baseline alternative were used, *inter alia,* to develop the incremental costs (para 3.24).

4.7 The counter-factual scenario used in the least-cost analysis is the provision of electricity to the households by conventional means, i.e., grid electrification and decentralized diesel generation. The costs of this counter-factual scenario are discussed in Annex 4.1.

4.8 Several alternatives were considered in the design of the SHS project. For the executing agency, the alternatives considered included PLN, BPPT, NGOs and cooperatives, and it was concluded that none of them offered better prospects than the private sector for an efficient delivery mechanism targeted at the commercial end of the solar PV market. In particular, PLN's "hands are full" implementing the grid-based RE program, while BPPT is focused on the non-commercial end of the solar PV potential market. Indonesian NGOs or cooperatives are not precluded from participating in this project, provided they meet the eligibility criteria (para 3.19).

4.9 For the provision of credit, the alternative of bank-financing directly to households was considered, but it was found that, even though Indonesia has a relatively well-spread rural bank network, that it would be difficult for the households to obtain bank-financing for the required term, and that there would be significant transaction costs and delays in getting whatever credit was made available. By contrast, under the dealer-financing scheme, the credit will be extended at the household's doorstep without any delays; in addition, the implicit rates of interest charged by the dealers are competitive with the rates of the organized banking sector.

4.10 The alternative mechanism considered for the GEF grant was to buy down the interest rate. However, this was rejected as this would introduce an unnecessary distortion, and would also provide an incentive for excessive borrowing, some of which could possibly be channeled to non-Project activities. By contrast, the proposed mechanism does not introduce any distortions, provides no incentives for excessive borrowing, and is performance-based, i.e., the grant is made available only after a unit has been installed.

**Fiscal Impact Analysis**

4.11 Since the credit component of the proposed project is to be executed entirely by the private sector, there are no public expenditures for this purpose. While there is an element of subsidy in the project, this is being funded entirely by GEF grants. Further, the commercial risk of the subloans to the private dealers is being borne entirely by the commercial banks. Thus, the only possibility of any adverse fiscal consequences would arise from a default by a PB on its loan obligation to the GOI, which is considered unlikely since the PBs have been classified as financially sound by BI, and assessed to be among the well-managed banks in Indonesia. Hence, the proposed Project does not have any adverse fiscal consequences for the Government; further, by providing an alternative to PLN supply, the Project tends to reduce the subsidy required by PLN for conventional rural electrification (para 2.14).

**Project Benefits**

4.12 **Least-cost analysis** When the SHS costs are compared with an alternative modern form of energy that provides a comparable level of service, i.e., conventional rural electrification options, there are a large number of rural households for whom the SHS costs are lower (Annex 4.1), i.e., for the target households, the SHS is least-cost in the provision of a comparable, modern form of energy [6]. The principal reason for the cost advantage enjoyed by SHS is that, given the relatively small loads that are typical of rural households in Indonesia, it is uneconomical to extend or develop a grid even over relatively short distances (Annex 4.1).

4.13 **Benefits** The fundamental benefits from this project are: (i) the improvement in the quality of life of the rural households as they switch to a clean, modern form of energy for high-value end-uses such as lighting, security, and education, and (ii) global environmental benefits. Within the rural households, the primary beneficiaries of the SHS will be women and children, as the burden of the low quality, polluting lighting associated with kerosene lamps falls mainly on them. In particular, the light from kerosene lamps is far less suitable for reading than the electric lighting provided by the SHS, and the exposure to the fumes from these lights is typically higher for women and children, who tend to stay indoors (paras. 2.9-2.10). Specifically, the benefits of the proposed project are:

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6/ While the present value of the expenditures of the target households on lighting and battery charging is less than the present value of the cost of the SHS, the service from kerosene and battery charging is inferior to the service from SHS (para 2.9).

**A. Direct benefits to the households:**

- There would be a quantum improvement in lighting quality and quantity, which is expected to lead to: (i) a profound and positive effect on the quality of education and learning experienced by children; (ii) increased productivity and potential for in-home income generation activities, made possible by extending available hours of work, particularly for women; and (iii) increased freedom of movement and ability for community participation.

- The households would have access to the information flow, and outreach provided by television, which is one of the few channels to the external world available to rural Indonesian women and children.

**B. Global environmental benefits:**

- There are global environmental benefits from the reduction in $CO_2$ emissions (about 2.2 million tons) as a result of the switch from fossil fuels to solar energy [7]. This mitigation in emissions is the rationale for the GEF grant.

**C. Regional development benefits:**

- The project scope includes two provinces (Lampung and South Sulawesi) outside Java, in view of the fact that rural household electrification ratios are particularly low off-Java, and there is an urgent need to initiate development of sustainable means of providing service to the households in these areas. Further, the higher GEF grant for SHS units installed off-Java ($125/unit for Lampung and South Sulawesi compared to $75/unit for West Java) recognizes the higher costs that have to be incurred off-Java, and thus provides an incentive for regionally-balanceddevelopment of the solar PV market.

4.14 **Cost-benefit analysis** As indicated above, there are two types of benefits associated with the project: (i) global environmental benefits, which are given by the international community's willingness-to-pay (WTP) and (ii) local benefits that accrue directly to the participating households, which are given by the households' WTP.

4.15 In this analysis, in accordance with Bank guidelines[8], the global environmental benefits are taken to be equal to the value of the GEF grant; this grant payment represents the international community's willingness-to-pay (WTP) for $CO_2$ abatement as well as for the positive externalities of expected

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7/ The estimates of the emissions avoided include both the emissions avoided as a result of the SHS units directly installed under the SHS project ("project effect")—about 1.3 million tons of CO2,—as well as the acceleration of SHS market penetration in Indonesia ("programmatic effect") as a result of the SHS project—about 0.9 million tons of CO2. With a total GEF grant of $24.3 million, the unit cost of abatement is about $11/ton CO2, including project and programmatic benefits, and about $18/ton CO2, when only project benefits are considered. As a point of comparative interest, in the IBRD-GEF financed India Renewable Resource Development Project (Ln. 3544-IN/Cr. 2449-IN), the unit costs were estimated to be about $ 105/ ton CO2, for the windfarm component, and between $102-294/ ton CO2, for the solar PV component.

8/ Bank OP 10.04, Paragraph 8 (revised September, 1994).

innovations and cost reductions in solar panels, whose production is characterized by a declining cost curve.[9]

4.16 The typical household's WTP for the SHS is more complex to estimate. Conceptually,

WTP = "actual payments made by the household" plus "consumer's surplus"

While the household's actual expenditures are readily available, there are no reliable estimates available of the consumer's surplus associated with SHS. For this reason, only the household's actual expenditures on the SHS (excluding the GEF grant co-downpayment made on behalf of the consumer) are used as a measure of the household's benefits. This use of the household's expenditures as a measure of the benefits is similar to the practice in conventional power projects of treating "tariff payments" as a measure of the benefits.

4.17 In the case of SHS, over fifteen years, the household's expenditures consist of four elements: (i) the initial downpayment, (ii) the monthly payments to amortize the loan, (iii) the replacement costs for batteries, controllers, etc., depending upon their economic lives, and (iv) the routine monthly O&M expenditures, essentially for replenishing the water in the battery. The last two categories of expenditures reflect the fact, unlike in a conventional power system, the household acts as both the producer and the consumer, so that these costs are also a measure of the benefits accruing at that time to the household.

4.18 Based on this analytical framework, the internal economic rate of return (IERR), including the global environmental benefits, is 39%; if the global environmental benefits are excluded, then the IERR is 12% (Annex 4.2). These rates of return are biased downwards because of the exclusion of the consumer's surplus from the benefits.

**Project Risks and Sensitivity Analysis**

4.19 **Risks** This Project faces a number of implementation risks that would adversely affect the outcomes. Specifically, Objectives A (sales of SHS to rural households) and B (establishment of dealers selling SHS to rural customers)—see Annex 3.1 for details—face the following inter-related risks:[10]

- **Market demand risk**, i.e., the potential customers buy less than the target number of 200,000 systems even though the dealers are willing and able to make the sales. The resultant lower penetration of SHS could be due to lack of affordability of the SHS, lack of confidence in or information about the SHS, or concerns that PLN service would become available in the near future.

- **Dealer failure risk**, i.e., the dealers are unable to make sales of 200,000 systems or only 2-3 dealers are able to establish themselves even though, in principle, there is sufficient demand for SHS. This could happen due to factors such as lack of management skills, or poor installment collection mechanisms.

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9/ D. Anderson, "Cost Effectiveness in Addressing the 'CO2' problem, with Special Reference to the Investments of Global Environmental Facility," *Annual Review of Energy and Environment* (1994), Volume 19, pp. 423-455.

10/ The implementation risks that would affect Objective C (capacity building of key sector institutions) have been addressed by strong participation and involvement of the concerned agencies during project preparation (para 4.23).

- **Consumer dissatisfaction risk**, i.e., the customers who buy the SHS are not satisfied with their systems. This could happen because of a number of reasons, such as a failure of the systems to function properly, poor after-sales service, an inability of the systems to meet the customers' energy needs, or a perception that SHS do not offer "good value for the money."

4.20 **Steps to mitigate risks** Apart from the steps that have been taken in Project preparation to mitigate these risks, the Project's supervision will be relatively heavy in the initial years (Annex 3.13), so that problems can be identified and corrective actions taken in a timely manner. The key actions already taken, or already identified for the future, are:

- **Facilitating sales** Some of the steps taken to facilitate sales are:

  * Prior to the commencement of sales in a region, the PSG would undertake an **informational campaign** to provide the potential customers with the technical and financial information they need to make an informed decision about the purchase of a SHS. The materials for this campaign are being prepared by Bank-managed grant-financed local consultants as part of project preparation.

  * In case of insufficient demand in the target markets, the dealers would be allowed to operate in **extended market areas**, which in the first instance would be the rural areas of the adjacent districts (kabupatens) of the provinces adjoining W. Java, Lampung, and S. Sulawesi; and possibly into a fourth province (North Sumatera).

  * The option of **adding new dealers** would be kept open.

- **Facilitating dealer success** Some of the steps taken to facilitate dealer success are:

  * A strategy of "**good dealer**" selection has been adopted by: (i) explaining the risks to the dealers, while requiring them to have a large stake in the business. This approach has led a number of potential dealers, who were not sure of themselves, to opt out from participating in the project; and (ii) asking the PBs to use their normal commercial appraisal criteria in extending credit to the dealers. This approach has led the PBs to undertake a detailed investigation of the dealers' past, present and future operations, as a result of which one of the PBs has already rejected the credit applications of some dealers.

  * The dealers have been encouraged to adopt a "**start small, finish big**" strategy so that they have sufficient time to identify and resolve any weaknesses in their management or operational systems.

  * The dealers are free to "**seek stronger partners**," whose managerial and financial strengths would assist the dealers. These partners are likely to be larger private sector firms that are interested in entering this business, or subsidiaries of multinational companies involved in renewable energy.

- **Facilitating consumer satisfaction** Some of the key steps taken to facilitate consumer satisfaction are:

* The dealers are required to install only the equipment that is certified, by world-class laboratories, to meet the Project's "**technical specifications,**" which will greatly reduce the odds of equipment failure.

* The dealers are required to develop **comprehensive consumer protection packages**, including return policies, warranties, and after-sales service.

* The PSG will **maintain two-way links with the customers**, including (i) auditing installations on a purposive as well as random sample basis to ensure that only the certified equipment is used and verify that there are no problems in the installation, and (ii) providing the customers convenient means of bringing any issue that they have to the attention of the PSG.

4.21 **Sensitivity analysis** The sensitivity of the IERR has been analyzed with respect to the three risks discussed above (para 4.19). Specifically, two alternative scenarios are considered (Annex 4.2):

- **Scenario A,** under which sales of only 160,000 SHS are achieved, i.e., 80% of the target of 200,000 sales, which reflects both the market demand and dealer failure risks. Under a number of reasonable assumptions (Annex 4.2) related to the higher costs and prices under this scenario, the IERR is found to decline from 39% to 32%, including the global environment benefits, and from 12% to 8%, excluding the global environmental benefits.

- **Scenario B**, under which SHS units fail to provide benefits after they have been installed, which represents the consumer dissatisfaction risk. It is assumed that the customers stop making monthly payments or incurring replacement expenditures if their SHS units fail. The analysis shows that the failure rate (i.e., these units would not provide any economic or environmental benefits at all) of the SHS units would have to be 19% for the IERR, including the global environment benefits, to fall to 10%. Such a high system failure rate has not been experienced in Indonesia's Government sponsored programs (para 2.17), and it is unlikely that failures on this scale would occur in the proposed Project, given the risk mitigation measures outlined above. Furthermore, a leading indicator of customer dissatisfaction, customer loan repayment rates, is a key performance indicator for the proposed project (para. 3.6).

**Post-Project Sustainability and Participation**

4.22 **Post-Project Sustainability** In the post-project phase, when the GEF first cost buydown would end, it is expected that the dealers will be able to maintain themselves in business as a result of a combination of the following outcomes:

- **Cost reductions in real terms,** stemming from: (i) economies of scale, particularly in sales-and-service chains and assembly of balance-of-system components, (ii) expected long-term world-wide trend reductions in solar PV panel prices, and (iii) the ending of the need to incur the high initial costs of establishing sales-and-service chains.

- **Increases in consumer affordability**, arising from the expected continued rapid growth of the Indonesian economy as a whole and of rural incomes in particular.

- **Elimination of other key barriers**, such as lack of commercial banks' familiarity with the SHS business, limited customer awareness of SHS, lack of an official plan for decentralized rural electrification plan that defines a clear role for solar PV products, lack of a local testing facility, and the absence of well-defined world-class technical standards specifically suited for Indonesia.

4.23 **Participation** Within the Government of Indonesia, the primary stakeholders in the SHS project are: the Agency for the Assessment and Application of Technology (BPPT), the Directorate-General of Electricity and Energy Development (DGEED), and the Planning Agency (BAPPENAS) These agencies have been involved to varying degrees in project preparation. In particular, BPPT has played a very active role, and has been involved in activities such as conducting market surveys, developing technical specifications, publicizing the SHS project within Indonesia, and providing office facilities for project preparation work. The SHS project would strengthen BPPT's institutional capabilities.

4.24 Within the private sector, the primary stakeholders include the Indonesian Solar Energy Association and individual solar PV systems dealers and suppliers. A number of presentations related to the SHS project have been made to and extensive discussions held with the Solar Energy Association as well as all interested dealers on an individual basis. The dealers have been active participants in the process of finalizing equipment technical specifications, and the project design has benefited from their comments and suggestions.

# 5. AGREEMENTS REACHED AND RECOMMENDATION

## Agreements with the Borrower

5.1 The following agreements were reached during negotiations with the Government of Indonesia:

(i) Terms and conditions of the BI Subsidiary Loan Agreement (para 3.27);

(ii) Terms and conditions of the respective Onlending Agreements for the private PBs and Subsidiary Loan Agreements for the State owned PBs (paras 3.27 and 3.31);

(iii) Terms and conditions of the Subloan Agreements between PBs and SHS dealers (para 3.32);

(iv) Terms and conditions for the authorization and channeling of GEF subgrants (paras 3.27, 3.30 and 3.33);

(v) Loan allocation and reallocation amounts and procedures for the PBs (para 3.27);

(vi) No additional Government finance or support for the dealers (para 3.10);

(vii) SHS equipment technical specifications and certification requirements (para 3.18);

(viii) Scope of and arrangements for mid-term review (para 3.53);

(ix) Performance indicators to be utilized for monitoring (para 3.6);

(x) Establishment, use and termination of escrow accounts designed to assist customers who are adversely affected by a dealer's non-compliance with Project rules (para 3.51);

(xi) Borrower shall: (a) undertake and complete a study on "Decentralized Rural Electrification Plan", in accordance with terms of reference and in a manner satisfactory to the Bank, and furnish the draft final report of the study to the Bank for review and comments by no later than September 30, 1998; and (b) based on the said study's results and recommendations and subsequent review, comments and discussions: (i) prepare a draft Decentralized Rural Electrification Plan, with a focus on the niche for solar PV, for Indonesia, (ii) furnish the said draft plan to the Bank for review and comments, by March 31, 1999, and (iii) by November 30, 1999, finalize and adopt the same taking into account the comments, if any, thereon by the Bank (para 3.16);

(xii) Borrower shall activate, no later than November 30, 1997, a SHS Working Group, headed by the Director of the Directorate of Electric Power Planning, DGEED, with representation from other Government agencies concerned with rural electrification policy, including BAPPENAS, BPPT, MOF, Ministry of Cooperatives and Small Enterprise Development, and PLN. The SHS Working Group will report to the Rural Electrification Steering Committee, DGEED, and will be the local working counterpart to the consultants who will undertake the preparation of the Decentralized RE Strategy Study and SHS Action Plan. (para 3.16);

(xiii) **Borrower shall ensure that BI shall** inform the Borrower, and the Borrower inform the Bank, that a situation has arisen that may require the reallocation of the uncommitted balance of funds allocated to a PB if that PB fails to meet BI's requirements for "sehat" classification (para 3.27);

(xiv) **Borrower shall ensure that the PBs shall**:

(a) utilize the specified eligibility criteria for subborrowers (para 3.19);

(b) utilize the specified subproject review criteria and process (paras 3.28-3.29);

(c) take reasonable steps to ensure that the goods and services procured by the subborrowers are at reasonable prices taking account of efficiency, economy, reliability and other pertinent factors (para 3.35); and

(d) submit their project audit reports to the Bank no later than six months after the end of their respective fiscal years (para 3.44).

(xv) **BPPT shall**:

(a) With respect to the technical assistance component for strengthening BPPT-LSDE capabilities for testing and technical certification of SHS equipment, BPPT shall: (i) initiate and undertake without delay all steps necessary to ensure that the consultants are mobilized no later than October 31, 1997, in accordance with TOR acceptable to the Bank; (ii) submit, by no later than February 28, 1998, a time-bound action plan -- acceptable to the Bank --including major intermediate milestones to achieve ISO 25 status by December 31, 2001, with this date subject to revision based on the consultant's report; and (iii) ensure that the TA work under this Project would be completed by no later than October 31, 1999 (para 3.17).

(b) With respect to the technical assistance consultancy contract for the Project Support Group (PSG), that: (i) PSG would be established in accordance with TOR, membership, staffing and resources acceptable to the Bank; and (ii) BPPT will undertake contracting in a timely manner so that the PSG can be mobilized no later than May 15, 1997 (para 3.47).

(c) Submit its audit reports to the Bank no later than six months after the end of its fiscal year (para 3.44).

**Condition of Effectiveness**

5.2 The condition of loan effectiveness is:

(a) Execution of subsidiary loan agreement between MOF and BI, and at least two SLAs/OLAs between MOF/BI and the PBs, which include provisions governing the channeling of GEF grant funds, satisfactory to the Bank (para 3.27).

**Actions to be taken before Withdrawal of Loan and Grant Proceeds**

5.3 The conditions of disbursement for each PB are:

(a) signing of an SLA/OLA between MOF/BI and the PB, satisfactory to the Bank (para 3.27);

(b) obtaining prior authorization from the Bank for the subborrower (3.29) and continuing dealer eligibility (para 3.50); and

(c) obtaining prior authorization from the Bank (para 3.30 and para 3.40) for ceiling amounts on the grants to a dealer, and continuing dealer eligibility (para 3.50).

5.4 The condition for disbursement for part or all of the Phase 2 GEF grant funds is the written authorization by the GEF Chief Executive Officer (para 3.53).

**Recommendation**

5.5 With the above agreements and conditions, the proposed project is suitable for a loan of US$ 20.0 million equivalent and a GEF grant of SDR 16.8 million (US$24.3 million equivalent), to the Republic of Indonesia.

Schedule A

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

**Estimated Costs and Financing Plan**
(US$ million)

| | Local | Foreign | Total |
|---|---|---|---|
| Credit Component | 23.0 | 69.1 | 92.1 |
| Technical Assistance | 2.0 | 4.3 | 6.3 |
| *of which* | | | |
| - Implementation Support | 1.0 | 3.1 | 4.1 |
| - Policy Support | 0.5 | 0.7 | 1.2 |
| - Institutional Development | 0.5 | 0.5 | 1.0 |
| Base Cost | 25.0 | 73.4 | 98.4 |
| Duties and Taxes | 2.5 | 7.3 | 9.8 |
| Price Contingencies (Credit Component) | 5.5 | 4.3 | 9.8 |
| Total project Cost | 33.1 | 85.0 | 118.1 |
| Financing Plan: | | | |
| IBRD | 0.0 | 20.0 | 20.0 |
| GEF | 0.0 | 24.3 | 24.3 |
| GOI/BPPT | 1.5 | 0.0 | 1.5 |
| Participating Banks | 1.2 | 3.8 | 5.0 |
| Subborrowers | 30.4 | 36.9 | 67.3 |
| Total | 33.1 | 85.0 | 118.1 |

# INDONESIA

# SOLAR HOME SYSTEMS PROJECT

## Procurement and Disbursement
## A. Summaries of Procurement Arrangements
(US$ million)

| | Procurement Method | | |
|---|---|---|---|
| | Other /a | N.B.F. /b | Total |
| **A. Credit Component** | 101.9<br>(20)<br>[20] | 0.0 | 101.9<br>(20)<br>[20] |
| **Taxes** | 0.0 | 9.8 | 9.8 |
| **Subtotal** | **101.9**<br>**(20.0)**<br>**[20.0]** | **9.8**<br>**(0.0)**<br>**[0.0]** | **111.8**<br>**(20.0)**<br>**[20.0]** |
| **B. Technical Assistance** | | | |
| Implementation Support | 4.1<br>[3.1] | 0.0 | 4.1<br>[3.1] |
| Policy Support | 1.2<br>[0.7] | 0.0 | 1.2<br>[0.7] |
| Institutional Development | 1.0<br>[0.5] | 0.0 | 1.0<br>[0.5] |
| **Subtotal** | **6.3**<br>**(0.0)**<br>**[4.3]** | **0.0**<br>**(0.0)**<br>**[0.0]** | **6.3**<br>**(0.0)**<br>**[4.3]** |
| **Total** | **108.2**<br>**(20.0)**<br>**[24.3]** | **9.8**<br>**(0.0)**<br>**[0.0]** | **118.1**<br>**(20.0)**<br>**[24.3]** |

Note: Terms in ( ) and [ ] are amounts financed by IBRD and GEF, respectively

/a Goods and services to be procured by limited international bidding or established commercial practices

/b Not Bank financed

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

### B. Disbursement Arrangements

| Category | Amount of Loan and Grant Allocated (US$ mill. equiv.) | Percentage of Expenditures to be Financed /a |
|---|---|---|
| **A. IBRD Loan** | | |
| - Sub-loans | 20.0 | Refinance 80% of the sub-loans made by participating banks to dealers |
| **B. GEF Grant** | | |
| - SHS Installation | 20.0 | 100% /b |
| - T.A. | 4.3 | 100% /c |

/a Expenditures financed are exclusive of value-added-tax (VAT).

/b $75/SHS unit installed in Java, and $125/SHS unit installed outside Java.

/c In addition, GOI/BPPT will finance $1.5 million equivalent TA for implementation support, policy support and institutional development, and the subborrowers would finance $ 0.5 million equivalent for implementation support.

### Estimated Disbursements ($million)

| Bank Fiscal Year | | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| IBRD | Annual | 0.3 | 2.2 | 4.5 | 7.0 | 6.0 | 0.0 |
| Loan | Cumulative | 0.3 | 2.5 | 7.0 | 14.0 | 20.0 | 20.0 |
| GEF | Annual | 0.3 | 3.5 | 5.2 | 6.2 | 7.3 | 1.8 |
| Grant | Cumulative | 0.3 | 3.8 | 9.0 | 15.2 | 22.5 | 24.3 |

# INDONESIA

## Solar Home Systems Project

## TIMETABLE OF KEY PROJECT PROCESSING EVENTS

| | |
|---|---|
| (a) Time taken to prepare the project: | 2 years[1] |
| (b) Prepared by: | BPPT, but mostly with assistance from Bank-managed grant financed consultants- local and foreign |
| (c) First Bank mission: | June 1994 |
| (d) Appraisal mission departure: | May 1996 |
| (e) Negotiations: | December 1996 |
| (f) Planned date of effectiveness: | May 1997 |
| (g) List of relevant PCRs and PPARs: | Loan 3180-IND, Rural Electrification ICR<br>Date: December 1995, Report No. 15210 |

[1] Project processing took more time than the norm for power projects in Indonesia, since preparation for this project has led the Bank's power operations into new areas -- decentralized rural electrification, renewable energy, private sector, rural markets -- that entailed the laying of considerable ground work to collect the baseline data, and to seek out stakeholder views and commitments. Furthermore, there is no single agency/Ministry that has as its mandate the filling of this preparatory void. In addition to ensuring quality at entry, the additional time was required to pre-identify several private sector dealers that would qualify for sub-loans and grants under the project; a process that could normally have been undertaken following loan effectiveness, but that would also delay actual implementation. Increased processing time also resulted from having to comply with two sets of reviews and procedures - IBRD and GEF.

The report is based on an appraisal mission undertaken in June 1996 comprising Mr. Arun P. Sanghvi (Task Manager), Messrs. Subodh Mathur and Jim Finucane (consultants), and Mr. Anil Cabraal (ASTAE). Peer reviewers were Messrs./Mmes. Magdalena Manzo (SA2EI), Khalid Siraj (FSD), and Ernesto Terrado (IENPD). The GEF external technical reviewer was Mr. Scott Sklar (Executive Secretary, Council of International Solar Electric Industries Association). Mr. Javad Khalilzadeh-Shirazi, Acting VP (EAP), Mrs. Marianne Haug, Director (EA3DR) and Mr. Peter R. Scherer, Division Chief (EA3IP) have endorsed the project.

# IBRD Loans and IDA Credits in the Operations Portfolio
## Status of Bank Group Operations in Indonesia

| Project ID | Loan or Credit No. | Fiscal Year | Borrower | Purpose | Original amount in US$ millions: IBRD | IDA | Cancellations | Undisbursed | Difference between expected and actual disbursements[a] |
|---|---|---|---|---|---|---|---|---|---|
| Number of Closed Loans: 147/ Credits: 48 | | | | | | | | | |
| Active Loans | | | | | | | | | |
| ID-PE-3923 | L2932 | 1988 | GOI | Jabotabek Urban Transport | 150.00 | | | 7.83 | 7.83 |
| ID-PE-3946 | L3112 | 1990 | GOI | Public Works Institutional Dev. & Trng | 36.10 | | | 0.01 | 0.01 |
| ID-PE-3873 | L3158 | 1990 | GOI | Second Secondary Education | 154.20 | | | 25.24 | 25.24 |
| ID-PE-3973 | L3182 | 1990 | GOI | Third Telecommunications | 350.00 | | 37.50 | 23.23 | 60.73 |
| ID-PE-3960 | L3209 | 1990 | GOI | Gas Utilization | 86.00 | | | 42.53 | 42.53 |
| ID-PE-3868 | L3219 | 1990 | GOI | Second Jabotabek Urban Development | 190.00 | | | 33.07 | 32.11 |
| ID-PE-3977 | L3246 | 1991 | GOI | Third Jabotabek Urban Development | 61.00 | | | 21.64 | 20.36 |
| ID-PE-3959 | L3282 | 1991 | GOI | Fertilizer Restructuring | 221.70 | | 0.24 | 10.71 | 8.05 |
| ID-PE-3981 | L3302 | 1991 | GOI | Provincial Irrigated Agriculture Dev. | 125.00 | | 20.50 | 22.70 | 43.20 |
| ID-PE-3943 | L3304 | 1991 | GOI | East Java/Bali Urban Development | 180.30 | | | 28.01 | 28.01 |
| ID-PE-3912 | L3305 | 1991 | GOI | Yogyakarta Upland Area Development | 15.50 | | | 3.51 | 3.23 |
| ID-PE-3922 | L3340 | 1991 | GOI | Sulawesi-Irian Jaya Urban Development | 100.00 | | | 11.65 | 8.87 |
| ID-PE-3975 | L3349 | 1991 | GOI | Power Transmission | 275.00 | | 103.40 | 19.24 | 117.14 |
| ID-PE-4002 | L3385 | 1991 | GOI | Technical Assistance for Infrastructure | 30.00 | | | 11.33 | 11.33 |
| ID-PE-3928 | L3402 | 1992 | GOI | Agricultural Financing | 106.10 | | | 54.03 | 48.73 |
| ID-PE-3966 | L3431 | 1992 | GOI | Third Non-Formal Education | 69.50 | | | 14.17 | 2.47 |
| ID-PE-3940 | L3448 | 1992 | GOI | Primary Education Quality Improvement | 37.00 | | | 21.20 | 11.90 |
| ID-PE-4012 | L3454 | 1992 | GOI | BAPEDAL Development | 12.00 | | | 2.16 | 0.66 |
| ID-PE-3860 | L3464 | 1992 | GOI | Treecrops Smallholder | 87.60 | | | 46.19 | 20.09 |
| ID-PE-3997 | L3482 | 1992 | GOI | Fourth Telecommunications | 375.00 | | | 222.24 | 42.24 |
| ID-PE-3949 | L3490 | 1992 | GOI | Third Kabupaten Roads | 215.00 | | | 5.06 | 5.06 |
| ID-PE-3969 | L3496 | 1992 | GOI | Primary School Teacher Development | 36.60 | | | 15.34 | 10.04 |
| ID-PE-3916 | L3501 | 1992 | GOI | Suralaya Thermal Power | 423.60 | | | 232.21 | 13.11 |
| ID-PE-3970 | L3526 | 1993 | GOI | Financial Sector Development | 307.00 | | 39.81 | 45.14 | 84.95 |
| ID-PE-3914 | L3550 | 1993 | GOI | Third Community Health & Nutrition | 93.50 | | | 50.63 | 7.13 |
| ID-PE-4006 | L3579 | 1993 | GOI | E. Indonesia Kabupaten Roads | 155.00 | | | 41.82 | 17.81 |

| Project ID | Loan or Credit No. | Fiscal Year | Borrower | Purpose | Original amount in US$ millions: IBRD | IDA | Cancellations | Undisbursed | Difference between expected and actual disbursements[a] |
|---|---|---|---|---|---|---|---|---|---|
| ID-PE-4009 | L3586 | 1993 | GOI | Integrated Pest Management | 32.00 | | | 23.62 | 13.12 |
| ID-PE-3999 | L3588 | 1993 | GOI | Groundwater Development | 54.00 | | | 36.53 | 2.73 |
| ID-PE-4018 | L3589 | 1993 | GOI | Flores Earthquake Reconstruction | 42.10 | | | 8.96 | 8.96 |
| ID-PE-4007 | L3602 | 1993 | GOI | Cirata Hydroelectric Phase II | 104.00 | | | 78.51 | 52.71 |
| ID-PE-3990 | L3629 | 1993 | GOI | Water Supply & Sanitation for Low Income | 80.00 | | | 57.70 | 22.70 |
| ID-PE-3985 | L3658 | 1994 | GOI | National Watershed Mgmt and Consvation | 56.50 | | | 49.37 | 5.07 |
| ID-PE-3945 | L3712 | 1994 | GOI | Second Highway Sector Investment | 350.00 | | | 244.10 | 74.10 |
| ID-PE-3952 | L3721 | 1994 | GOI | Skills Development | 27.70 | | | 22.80 | 17.85 |
| ID-PE-3998 | L3726 | 1994 | GOI | Surabaya Urban Development | 175.00 | | | 152.34 | 54.24 |
| ID-PE-4020 | L3732 | 1994 | GOI | Fifth Kabupaten Roads | 101.50 | | | 56.68 | -2.81 |
| ID-PE-4010 | L3742 | 1994 | GOI | Dam Safety | 55.00 | | | 45.92 | 8.52 |
| ID-PE-3890 | L3749 | 1994 | GOI | Semarang-Surakarta Urban Development | 174.00 | | | 136.27 | 22.37 |
| ID-PE-4017 | L3754 | 1994 | GOI | University Research for Graduation Study | 58.90 | | | 47.60 | 6.20 |
| ID-PE-3937 | L3755 | 1994 | GOI | Integrated Swamps | 65.00 | | | 53.47 | 6.22 |
| ID-PE-3910 | L3761 | 1994 | GOI | Sumatera & Kalimantan Power | 260.50 | | | 244.36 | 43.86 |
| ID-PE-3954 | L3762 | 1994 | GOI | Java Irrigation Improvements and Wtr Resource | 165.70 | | | 137.29 | 21.49 |
| ID-PE-3984 | L3792 | 1995 | GOI | Land Administration | 80.00 | | | 72.66 | 8.64 |
| ID-PE-4019 | L3801 | 1995 | GOI | Second Accountancy Development | 25.00 | | | 22.14 | 9.94 |
| ID-PE-3988 | L3825 | 1995 | GOI | Second Professional Resource Development | 69.00 | | | 52.85 | -0.16 |
| ID-PE-3979 | L3845 | 1995 | GOI | Second Rural Electrification | 398.00 | | | 380.29 | 46.63 |
| ID-PE-3951 | L3854 | 1995 | GOI | Kalimantan Urban Development | 136.00 | | | 115.77 | 25.27 |
| ID-PE-3972 | L3886 | 1995 | GOI | Second Agriculture Research Management | 61.00 | | | 61.00 | |
| ID-PE-3968 | L3887 | 1995 | GOI | Book & Reading Development | 132.50 | | | 130.22 | -2.24 |
| ID-PE-34891 | L3888 | 1995 | GOI | Village Infrastructure | 72.50 | | | 39.37 | 5.63 |
| ID-PE-4001 | L3904 | 1995 | GOI | Telecommunications Sector Modernization | 325.00 | | | 325.00 | |
| ID-PE-3965 | L3905 | 1995 | GOI | Fourth Health | 88.00 | | | 86.72 | -1.25 |
| ID-PE-39754 | L3913 | 1995 | GOI | Second Technical Assistance for Infrastructure | 28.00 | | | 28.00 | |
| ID-PE-3978 | L3972 | 1996 | GOI | Industrial Technology Development | 47.00 | | | 46.00 | 3643.45 |
| ID-PE-4021 | L3978 | 1996 | GOI | Second Power Transmission and Distribution | 373.00 | | | 373.00 | |
| ID-PE-4003 | L3979 | 1996 | GOI | Second Teacher Training | 60.40 | | | 59.60 | 5.65 |
| ID-PE-39643 | L3981 | 1996 | GOI | STD/AIDS | 24.80 | | | 24.30 | 1.50 |
| ID-PE-4008 | L3984 | 1996 | GOI | Nusa Tenggara Agriculture Development | 27.00 | | | 26.20 | 1.30 |
| ID-PE-4011 | L4007 | 1996 | GOI | Sulawesi Agriculture Area Development | 26.80 | | | 26.80 | 0.75 |
| ID-PE-4014 | L4008 | 1996 | GOI | Kerinci Seblat ICDP | 19.10 | | | 19.10 | |
| ID-PE-39312 | L4017 | 1996 | GOI | Second E. Java Urban Development | 142.70 | | | 142.70 | 14.00 |
| ID-PE-41896 | L4030 | 1996 | GOI | Human Resource Capacity Building | 20.00 | | | 20.00 | 0.51 |
| ID-PE-37097 | L4042 | 1996 | GOI | E. Java Junior Secondaraya Education | 99.00 | | | 99.00 | |
| ID-PE-4004 | L4043 | 1996 | GOI | Higher Education Support | 65.00 | | | 65.00 | 1.50 |

| Project ID | Loan or Credit No. | Fiscal Year | Borrower | Purpose | Original amount in US$ millions: IBRD | IDA | Cancellations | Undisbursed | Difference between expected and actual disbursements[a] |
|---|---|---|---|---|---|---|---|---|---|
| ID-PE-4016 | L4054 | 1996 | GOI | Strategic Urban Roads | 86.90 | | | 86.90 | |
| ID-PE-3987 | L4062 | 1997 | GOI | C. Indonesia Secondary Education | 104.00 | | | 104.00 | |
| ID-PE-41894 | L4095 | 1996 | GOI | Sumatra Secondary Education | 98.00 | | | 98.00 | |
| ID-PE-40521 | L4100 | 1997 | GOI | Second Village Infrastructure | 140.10 | | | 140.10 | |
| TOTAL | | | | | 8,443.40 | 0.00 | 201.45 | 5,051.13 | 4,791.28 |

| | Active Loans | Closed Loans | Total |
|---|---|---|---|
| Total disbursed (IBRD and IDA) | 3,190.83 | 14,219.69 | 17,410.52 |
| Of which repaid | 65.78 | 6,159.40 | 6,225.18 |
| Total now held by IBRD and IDA | 8,176.16 | 8,082.91 | 16,259.07 |
| Amount sold | 0.00 | 88.08 | 88.08 |
| Of which repaid | 0.00 | 82.35 | 82.35 |
| Total undisbursed | 5,051.12 | 22.63 | 5,073.75 |

a. Intended disbursements to date minus actual disbursements to date as projected at appraisal.

Note:
Disbursement data are updated at the end of the first week of the month.

# Indonesia
## STATEMENTOF IFC's
**Committed and Dispursed Portfolio**
As of 08/31/96
In Millions US Dollars

| | | Committed | | | | Disbursed | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | IFC | | | | IFC | | | |
| FY Approval | Company | Loan | Equity | Quasi | Partic | Loan | Equity | Quasi | Partic |
| 1971 | Unitex | 0.00 | .35 | 0.00 | 0.00 | 0.00 | .35 | 0.00 | 0.00 |
| 1980 | Semen Andalas | 10.35 | 10.02 | 0.00 | 10.98 | 10.35 | 10.02 | 0.00 | 10.98 |
| 1982 | Saseka Finance | 0.00 | .32 | 0.00 | 0.00 | 0.00 | .32 | 0.00 | 0.00 |
| 1984 | Saseka Finance | 0.00 | .06 | 0.00 | 0.00 | 0.00 | .06 | 0.00 | 0.00 |
| 1986 | PT Bali | .44 | 0.00 | 0.00 | 0.00 | .44 | 0.00 | 0.00 | 0.00 |
| 1987 | Semen Andalas | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1988 | Manulife | 0.00 | .32 | 0.00 | 0.00 | 0.00 | .32 | 0.00 | 0.00 |
| 1989 | PT Agro Muko | 3.78 | 2.20 | 0.00 | 4.09 | 3.78 | 2.20 | 0.00 | 4.09 |
| 1989 | PT Astra | 0.00 | 11.62 | 0.00 | 0.00 | 0.00 | 11.62 | 0.00 | 0.00 |
| 1990 | PT Indo-Rama | 1.84 | 0.00 | 0.00 | 4.91 | 1.84 | 0.00 | 0.00 | 4.91 |
| 1991 | LYON-MLF-Ibis | 2.30 | 0.00 | 0.00 | 2.30 | 2.30 | 0.00 | 0.00 | 2.30 |
| 1991 | PT Argo Pantes | 16.88 | 13.00 | 0.00 | 26.50 | 16.88 | 13.00 | 0.00 | 26.50 |
| 1991 | PT Astra | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1991 | PT Indaci | .80 | 0.00 | 1.83 | 0.00 | .80 | 0.00 | 1.44 | 0.00 |
| 1991 | PT Indo-Rama | 10.31 | 6.18 | 0.00 | 0.00 | 10.31 | 6.18 | 0.00 | 0.00 |
| 1991 | PT RIMBA | 8.67 | .60 | 0.00 | 5.00 | 8.67 | .60 | 0.00 | 5.00 |
| 1991 | SEAVI Indonesia | 0.00 | 1.50 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 |
| 1992 | PT Bakrie Kasei | 21.56 | 0.00 | 9.63 | 85.73 | 21.56 | 0.00 | 9.63 | 85.73 |
| 1992 | PT KIA Keramik | .94 | 1.70 | 0.00 | 6.18 | .94 | 1.57 | 0.00 | 6.18 |
| 1992 | PT Mitracorp | 0.00 | 15.87 | 0.00 | 0.00 | 0.00 | 15.87 | 0.00 | 0.00 |
| 1992 | PT Swadharma | 24.89 | 0.00 | 0.00 | 44.47 | 24.89 | 0.00 | 0.00 | 44.47 |
| 1992 | PT Viscose | 7.92 | 0.00 | 0.00 | 16.58 | 7.92 | 0.00 | 0.00 | 16.58 |
| 1993 | PT BBL Dharmala | .79 | 0.00 | 0.00 | 1.27 | .79 | 0.00 | 0.00 | 1.27 |
| 1993 | PT Indo-Rama | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

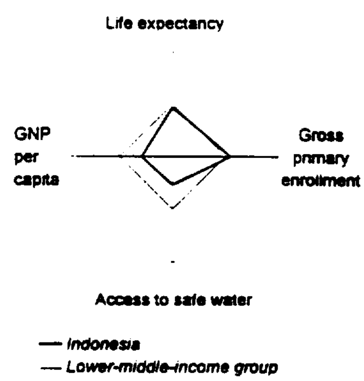
| FY Approval | Company | Committed IFC Loan | Committed IFC Equity | Committed IFC Quasi | Committed Partic | Disbursed IFC Loan | Disbursed IFC Equity | Disbursed IFC Quasi | Disbursed Partic |
|---|---|---|---|---|---|---|---|---|---|
| 1993 | PT Nusantara | 4.00 | 0.00 | 0.00 | 12.00 | 3.58 | 0.00 | 0.00 | 11.67 |
| 1993 | PT Samudera | 2.45 | 5.00 | 0.00 | 8.05 | 2.45 | 5.00 | 0.00 | 8.05 |
| 1993 | Saseka Finance | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1994 | KDLC Bali | 15.00 | 1.14 | 0.00 | 0.00 | 15.00 | 1.14 | 0.00 | 0.00 |
| 1994 | Prudential Asia | 0.00 | 6.75 | 0.00 | 0.00 | 0.00 | 4.19 | 0.00 | 0.00 |
| 1994 | PAMA (Indonesia) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1994 | PT Astra | 0.00 | 10.67 | 0.00 | 0.00 | 0.00 | 10.67 | 0.00 | 0.00 |
| 1994 | PT KIA Keramik | 0.00 | 1.40 | 0.00 | 0.00 | 0.00 | 1.40 | 0.00 | 0.00 |
| 1994 | PT Mitracorp | 2.54 | 4.12 | 0.00 | 0.00 | 2.54 | 4.12 | 0.00 | 0.00 |
| 1994 | PT PAMA | 0.00 | .71 | 0.00 | 0.00 | 0.00 | .71 | 0.00 | 0.00 |
| 1994 | PT Saripuri | 8.00 | 0.00 | 0.00 | 22.00 | 8.00 | 0.00 | 0.00 | 22.00 |
| 1995 | PT Bakrie Kasei | 30.00 | 3.00 | 0.00 | 0.00 | 30.00 | 3.00 | 0.00 | 0.00 |
| 1995 | PT Bakrie Pet | 12.00 | 2.00 | 0.00 | 0.00 | 12.00 | 2.00 | 0.00 | 0.00 |
| 1995 | PT Bakrie Pipe | 20.00 | 0.00 | 9.50 | 0.00 | 20.00 | 0.00 | 9.50 | 0.00 |
| 1995 | PT Bunas Finance | 10.00 | 0.00 | 0.00 | 6.00 | 10.00 | 0.00 | 0.00 | 6.00 |
| 1995 | PT Citimas Captl | 0.00 | 2.59 | 0.00 | 0.00 | 0.00 | 1.31 | 0.00 | 0.00 |
| 1995 | PT Hotel Santika | 9.00 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1995 | PT Indo-Rama | 28.33 | 4.71 | 0.00 | 62.68 | 28.33 | 2.54 | 0.00 | 62.68 |
| 1995 | PT KIA Serpih | 15.00 | 6.35 | 0.00 | 55.00 | 15.00 | 6.24 | 0.00 | 55.00 |
| 1995 | PT Panin Finance | 6.00 | 1.93 | 0.00 | 8.00 | 6.00 | 1.93 | 0.00 | 8.00 |
| 1995 | PT Viscose | 25.00 | 0.00 | 0.00 | 35.00 | 25.00 | 0.00 | 0.00 | 35.00 |
| 1996 | PT BBL Dharmala | 15.00 | 0.00 | 0.00 | 35.00 | 15.00 | 0.00 | 0.00 | 35.00 |
| 1996 | PT Dharmala | 20.00 | 0.00 | 0.00 | 0.00 | 20.00 | 0.00 | 0.00 | 0.00 |
| 1996 | PT Gleneagles | 8.30 | 0.00 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1996 | PT KIA Keramik | 25.00 | 6.22 | 0.00 | 81.00 | 9.43 | .65 | 0.00 | 30.57 |
| 1996 | PT Pramindo Ikat | 25.00 | 7.35 | 25.00 | 300.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| FY Approval | Company | Committed IFC Loan | Committed IFC Equity | Committed IFC Quasi | Committed Partic | Disbursed IFC Loan | Disbursed IFC Equity | Disbursed IFC Quasi | Disbursed Partic |
|---|---|---|---|---|---|---|---|---|---|
| Pending Commitments | | | | | | | | | |
| 1997 | * KSP | 20.00 | 15.00 | 0.00 | 15.00 | | | | |
| 1996 | * PANIN FINANCE II | 6.00 | 0.00 | 0.00 | 4.00 | | | | |
| 1996 | * PANIN II - BLINC | 0.00 | 0.00 | 0.00 | 4.00 | | | | |
| 1996 | * PT ASIANAGRO | 40.00 | 0.00 | 0.00 | 40.00 | | | | |
| 1995 | * PT INDO-RAMA RI | 0.00 | 2.50 | 0.00 | 0.00 | | | | |

# Indonesia at a glance

| POVERTY and SOCIAL | Indonesia | East Asia | Lower-middle-income |
|---|---|---|---|
| Population mid-1995 *(millions)* | 193.3 | 1,709 | 1,154 |
| GNP per capita 1995 *(US$)* | 980 | 840 | 1,700 |
| GNP 1995 *(billions US$)* | 190.5 | 1,436 | 1,962 |
| **Average annual growth, 1990-95** | | | |
| Population *(%)* | 1.6 | 1.3 | 1.4 |
| Labor force *(%)* | 2.5 | 1.4 | 1.7 |
| **Most recent estimate** *(latest year available since 1989)* | | | |
| Poverty: headcount index *(% of population)* | 14 | .. | .. |
| Urban population *(% of total population)* | 34 | 32 | 56 |
| Life expectancy at birth *(years)* | 63 | 68 | 67 |
| Infant mortality *(per 1,000 live births)* | 56 | 35 | 36 |
| Child malnutrition *(% of children under 5)* | 39 | 17 | .. |
| Access to safe water *(% of population)* | 42 | 67 | 73 |
| Illiteracy *(% of population age 15+)* | 23 | 16 | .. |
| Gross primary enrollment *(% of school-age population)* | 114 | 118 | 104 |
| Male | 116 | 119 | 105 |
| Female | 112 | 115 | 101 |

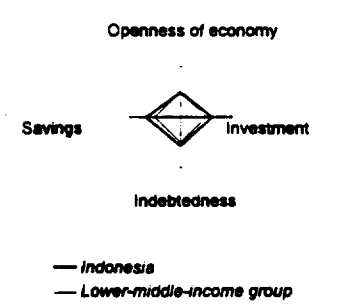
Development diamond*




| KEY ECONOMIC RATIOS and LONG-TERM TRENDS | 1975 | 1985 | 1994 | 1995 e/ |
|---|---|---|---|---|
| GDP *(billions US$)* | 32.1 | 87.2 | 175.5 | 198.1 |
| Gross domestic investment/GDP | 23.7 | 26.2 | 30.1 | 31.5 |
| Exports of goods and non-factor services/GDP | 23.2 | 22.6 | 25.8 | 25.5 |
| Gross domestic savings/GDP | 25.9 | 29.1 | 31.5 | 31.8 |
| Gross national savings/GDP | .. | 24.2 | 27.6 | 28.2 |
| Current account balance/GDP | -3.5 | -2.1 | -1.9 | -3.4 |
| Interest payments/GDP | 1.0 | 2.3 | 2.5 | 2.7 |
| Total debt/GDP | 35.8 | 42.1 | 55.3 | 53.6 |
| Total debt service/exports | 15.1 | 28.8 | 31.5 | 31.0 |
| Present value of debt/GDP | .. | .. | 51.3 | .. |
| Present value of debt/exports | .. | .. | 181.8 | .. |

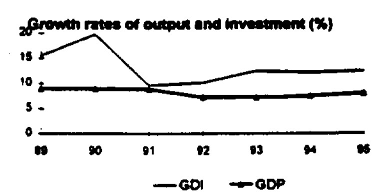
| *(average annual growth)* | 1975-84 | 1985-95 | 1994 | 1995 e/ | 1996-04 |
|---|---|---|---|---|---|
| GDP | 7.2 | 7.1 | 7.5 | 8.1 | 8.0 |
| GNP per capita | 4.5 | 5.5 | 5.4 | 6.4 | 6.2 |
| Exports of goods and nfs | -0.6 | 7.8 | 7.7 | 7.2 | 11.1 |

Economic ratios*



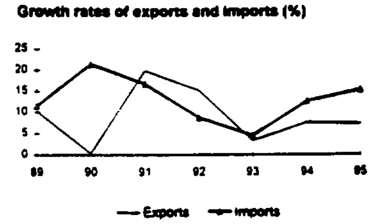

| STRUCTURE of the ECONOMY | 1975 | 1985 | 1994 | 1995 e/ |
|---|---|---|---|---|
| *(% of GDP)* | | | | |
| Agriculture | 30.2 | 23.2 | 17.4 | 17.2 |
| Industry | 33.5 | 35.9 | 40.7 | 41.5 |
| Manufacturing | 9.8 | 16.0 | 23.5 | 24.3 |
| Services | 36.3 | 40.9 | 41.9 | 41.3 |
| Private consumption | 65.1 | 59.1 | 60.2 | 59.8 |
| General government consumption | 9.0 | 11.8 | 8.2 | 8.2 |
| Imports of goods and non-factor services | 21.0 | 19.8 | 23.8 | 24.8 |

Growth rates of output and investment (%)




| *(average annual growth)* | 1975-84 | 1985-95 | 1994 | 1995 e/ |
|---|---|---|---|---|
| Agriculture | 4.3 | 3.4 | 0.5 | 4.0 |
| Industry | 7.1 | 9.4 | 11.2 | 10.3 |
| Manufacturing | 14.4 | 10.9 | 12.5 | 11.1 |
| Services | 9.5 | 8.1 | 7.1 | 7.4 |
| Private consumption | 9.1 | 6.5 | 7.7 | 9.9 |
| General government consumption | 11.4 | 4.8 | 2.3 | 3.4 |
| Gross domestic investment | 14.5 | 9.6 | 12.2 | 12.5 |
| Imports of goods and non-factor services | 9.9 | 7.6 | 12.7 | 15.3 |
| Gross national product | 6.7 | 8.0 | 7.3 | 8.1 |

Growth rates of exports and imports (%)

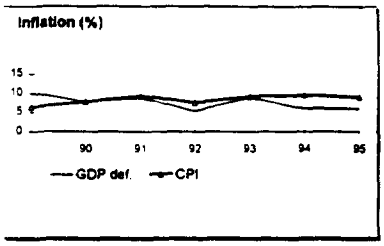



Note: 1995 data are preliminary estimates.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

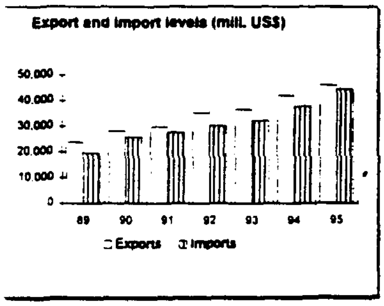
## PRICES and GOVERNMENT FINANCE

| | 1975 | 1985 | 1994 | 1995 e/ |
|---|---|---|---|---|
| ***Domestic prices*** | | | | |
| ***(% change)*** | | | | |
| Consumer prices | 19.1 | 4.4 | 9.6 | 9.0 |
| Implicit GDP deflator | 11.5 | 4.3 | 6.0 | 6.0 |
| ***Government finance*** | | | | |
| ***(% of GDP)*** | | | | |
| Current revenue | .. | 19.2 | 15.9 | 15.5 |
| Current budget balance | . | 6.0 | 6.6 | 6.0 |
| Overall surplus/deficit | .. | -3.2 | 0.3 | 0.8 |



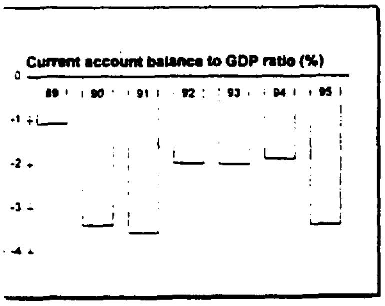

## TRADE

| | 1975 | 1985 | 1994 | 1995 e/ |
|---|---|---|---|---|
| *(millions US$)* | | | | |
| Total exports (fob) | .. | 18,823 | 42,050 | 46,019 |
| Fuel | . | 12,804 | 10,344 | 9,749 |
| Rubber | .. | 714 | 1,316 | 1,554 |
| Manufactures | .. | 2,287 | 20,272 | 23,636 |
| Total imports (cif) | .. | 14,056 | 37,736 | 44,477 |
| Food | .. | 812 | 782 | 942 |
| Fuel and energy | .. | 2,870 | 3,988 | 3,845 |
| Capital goods | .. | 5,394 | 15,062 | 18,135 |
| Export price index *(1987=100)* | .. | 120 | 135 | 140 |
| Import price index *(1987=100)* | .. | 85 | 89 | 90 |
| Terms of trade *(1987=100)* | .. | 141 | 153 | 155 |



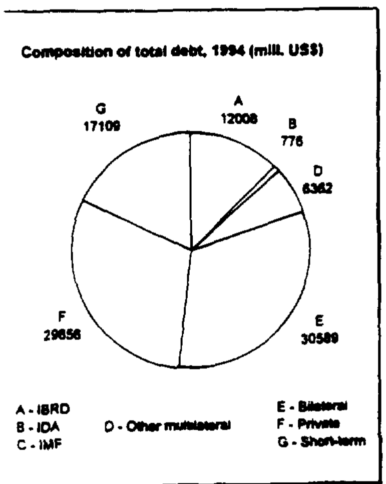

## BALANCE of PAYMENTS

| | 1975 | 1985 | 1994 | 1995 e/ |
|---|---|---|---|---|
| *(millions US$)* | | | | |
| Exports of goods and non-factor services | 6,981 | 19,371 | 46,899 | 51,644 |
| Imports of goods and non-factor services | 6,775 | 17,840 | 43,392 | 51,052 |
| Resource balance | 206 | 1,531 | 3,507 | 592 |
| Net factor income | -1,342 | -3,542 | -6,994 | -7,535 |
| Net current transfers | 0 | 88 | 0 | 0 |
| Current account balance, before official transfers | -1,135 | -1,923 | -3,488 | -6,943 |
| Financing items (net) | 284 | 962 | 2,233 | 10,059 |
| Changes in net reserves(+=increase) | 851 | 961 | -1,255 | 3,116 |
| ***Memo:*** | | | | |
| Reserves including gold *(mill. US$)* | 592 | 5,794 | 12,290 | 13,869 |
| Conversion rate *(local/US$)* | 415.0 | 1,110.6 | 2,160.8 | 2,248.6 |




## EXTERNAL DEBT and RESOURCE FLOWS

| | 1975 | 1985 | 1993 | 1994 |
|---|---|---|---|---|
| *(millions US$)* | | | | |
| Total debt outstanding and disbursed | 11,507 | 38,709 | 89,477 | 96,500 |
| IBRD | 57 | 3,590 | 11,283 | 12,008 |
| IDA | 318 | 844 | 798 | 776 |
| Total debt service | 1,060 | 5,824 | 14,267 | 14,792 |
| IBRD | 2 | 384 | 1,620 | 2,156 |
| IDA | 2 | 12 | 24 | 26 |
| Composition of net resource flows | | | | |
| Official grants | 69 | 136 | 219 | 218 |
| Official creditors | 515 | 1,003 | 2,339 | 1,487 |
| Private creditors | 1,749 | 154 | -3,365 | 1,627 |
| Foreign direct investment | 476 | 310 | 2,004 | 2,109 |
| Portfolio equity | 0 | 0 | 1,836 | 3,672 |
| World Bank program | | | | |
| Commitments | 311 | 1,068 | 924 | 1,538 |
| Disbursements | 164 | 777 | 1,195 | 1,184 |
| Principal repayments | 0 | 133 | 782 | 1,259 |
| Net flows | 164 | 644 | 413 | -76 |
| Interest payments | 3 | 262 | 881 | 922 |
| Net transfers | 160 | 382 | -448 | -998 |




International Economics Department

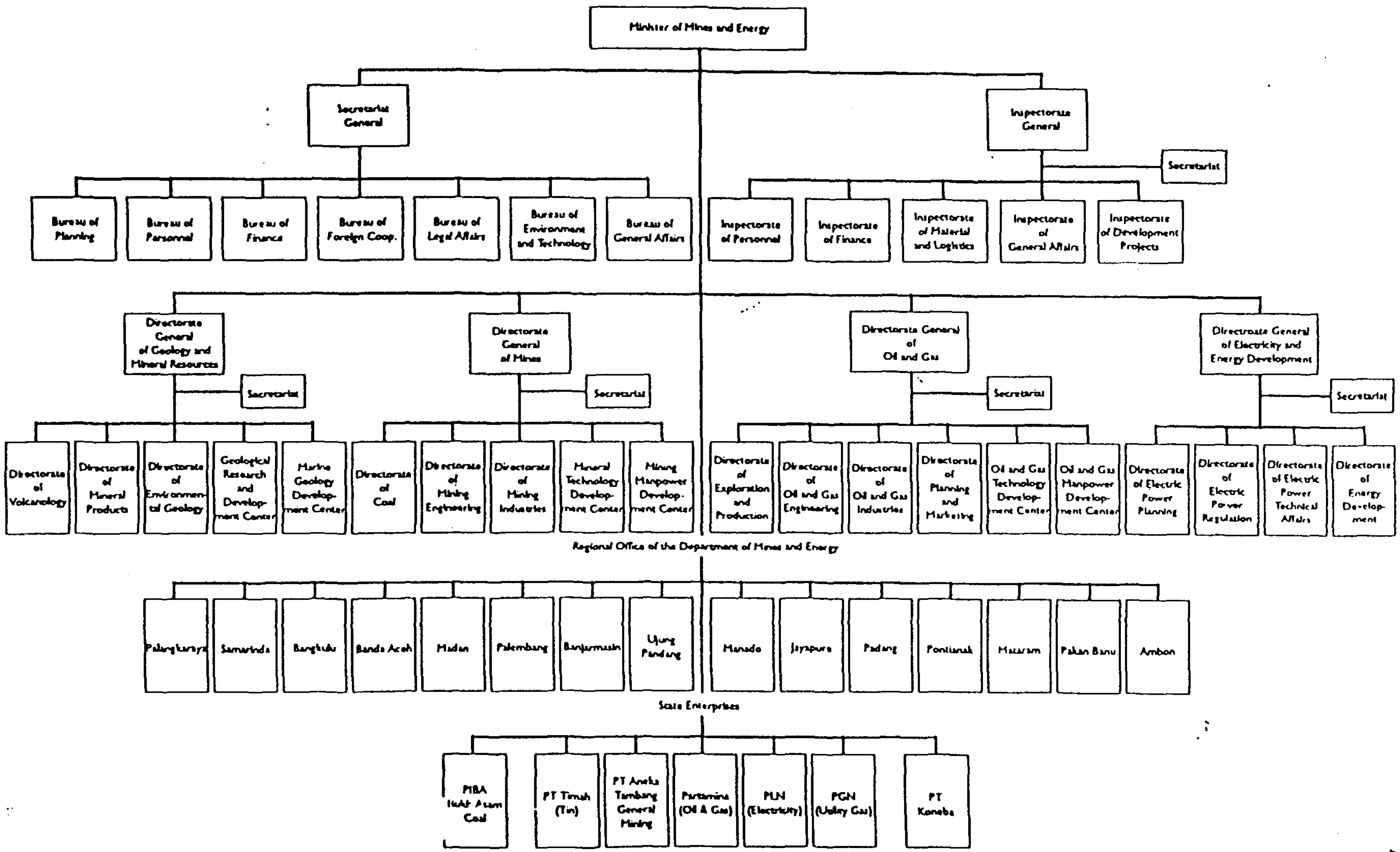
Note:

1. Government finance and trade fiscal year (April to March).
2. New National Accounts Series has been used
3. e/ indicates estimates for 1995

# PART II: Technical Annexes

## List of Annexes

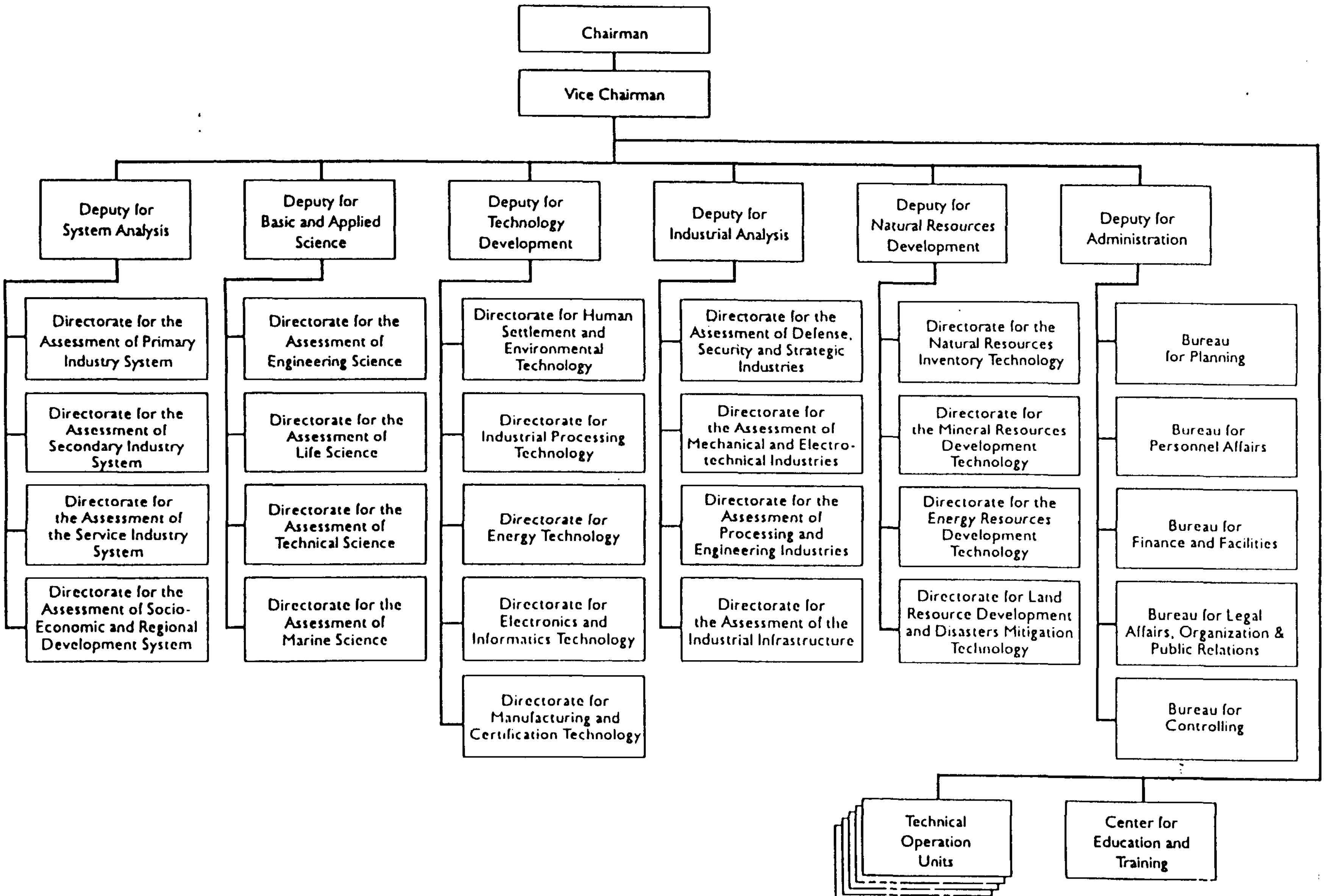
# INDONESIA
## SOLAR HOME SYSTEMS PROJECT
### Organization Chart of the Ministry of Mines and Energy





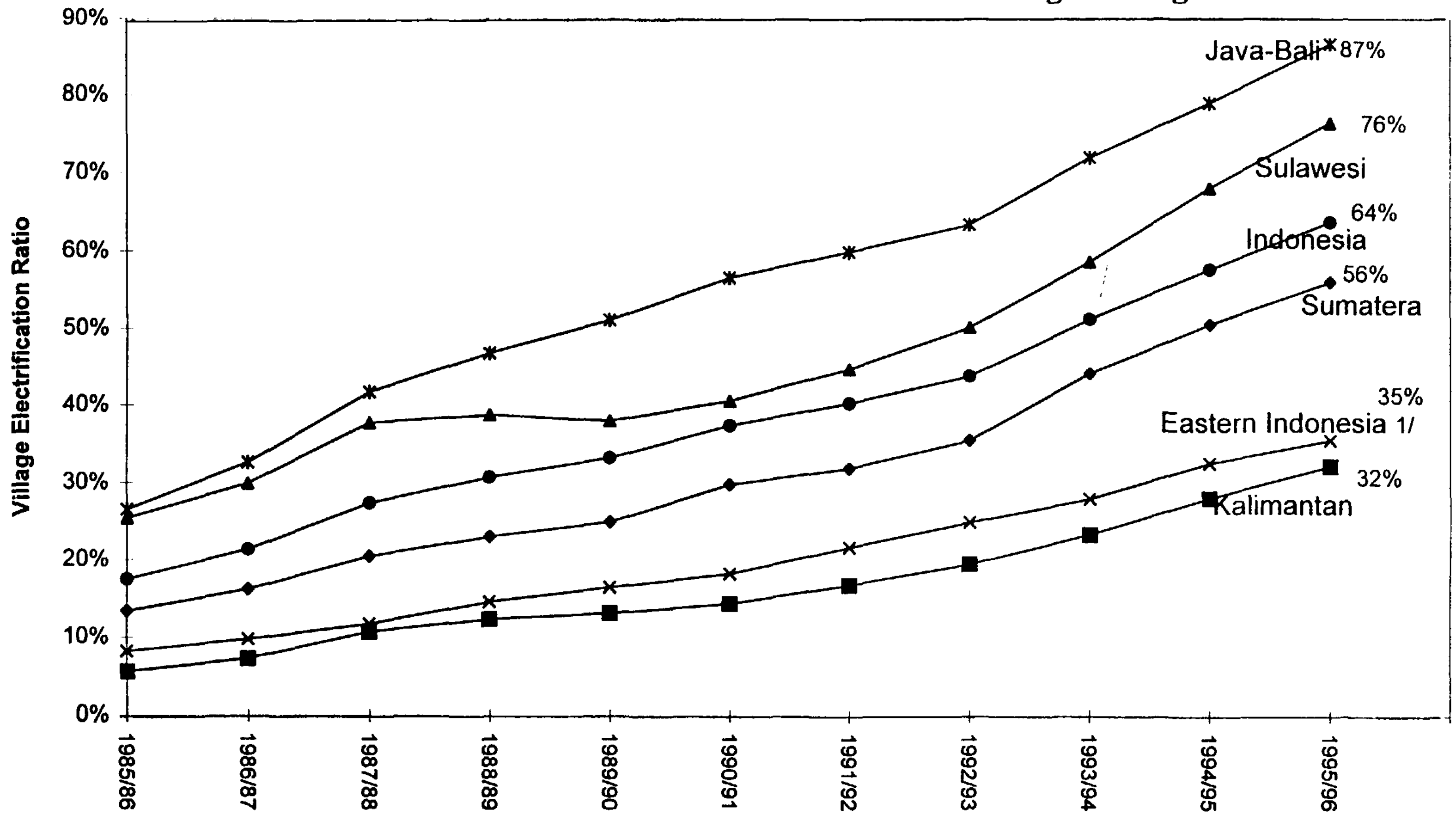

Annex 1.1

# INDONESIA
## SOLAR HOME SYSTEMS PROJECT
### Organization Chart of the Bureau for the Assessment and Application of Technology (BPPT)




Annex 1.2

## INDONES!A
## SOLAR HOME SYSTEMS PROJECT
## Historical Growth in Rural Electrification Coverage: Villages

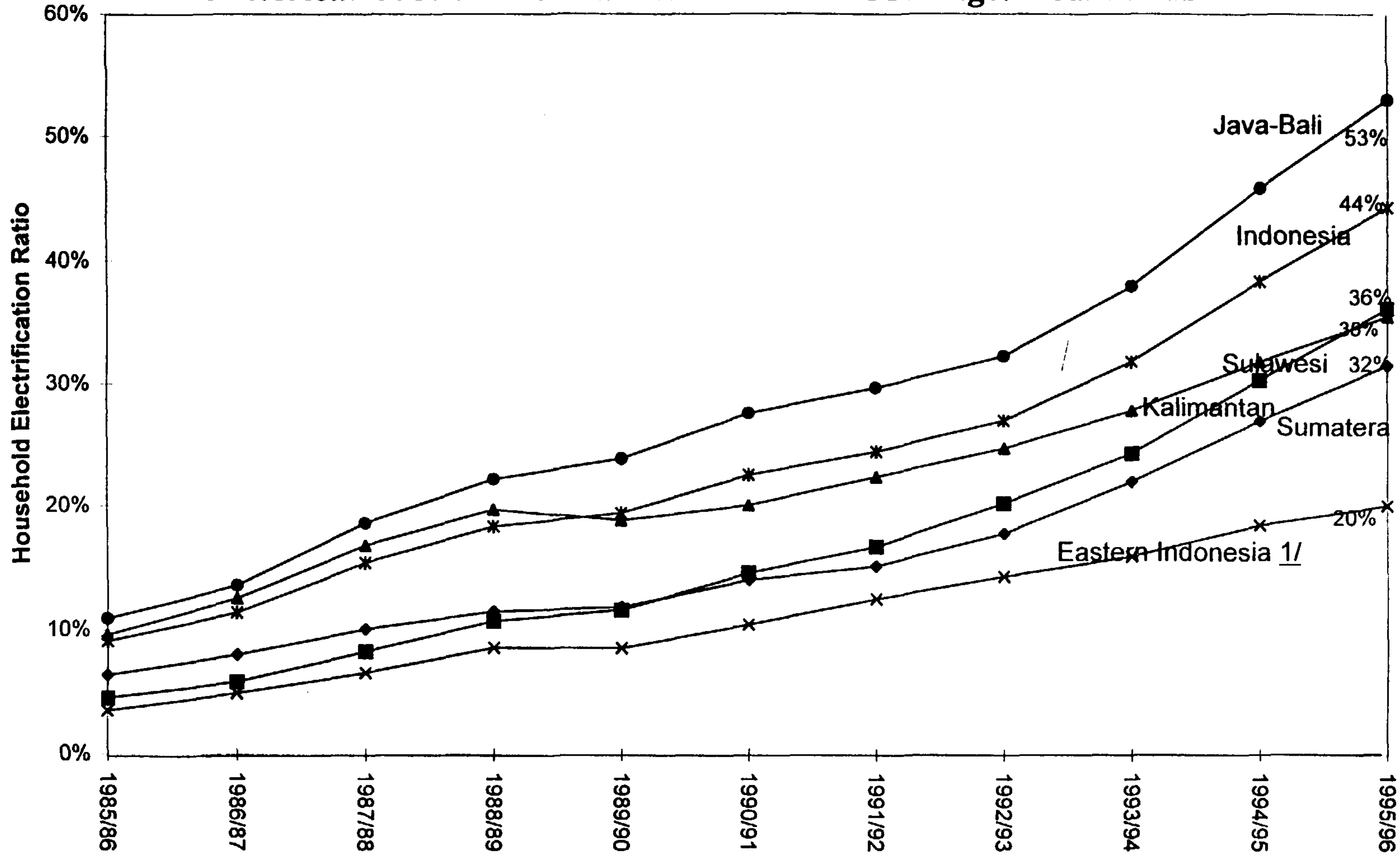



*1/ Maluku 46% Irian Jaya 24% West Nusa Tenggara 89%*
*East Nusa Tenggara 26% East Timor 19%*

*Note; For all years after 1989/90, number of villages is based on 1989/90 data*

# INDONESIA
# SOLAR HOME SYSTEMS PROJECT

## Historical Growth in Rural Electrification Coverage: Households




*1/ Maluku 40 % Irian Jaya 14% West Nusa Tenggara 25% East Nusa Tenggara 11% East Timor 3%*

*Note: For all years 1989/90, number of households is based on 1989/90 data*

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

## Technical Details of Solar Photovoltaic Systems[1]

This annex presents a brief description of the technical details of solar PV systems; the exact technical specifications to be used under this Project are presented in Annex 3.4.

Solar photovoltaic (PV) systems directly convert sunlight into electricity using solid-state physical principles similar to those of transistors and integrated circuits. The electricity produced by PV systems is direct current (DC). The use of solar PV systems is being facilitated by the increasing availability of common appliances, such as light bulbs, TVs, etc. that (i) operate on DC, and (ii) are energy efficient. Thus, a 6 watt light used with a SHS can provide the same amount of light as a conventional 40-Watt bulb. For this reason, the appliances often used in rural areas, such as lights, TV, and radios, can be powered by PV systems.

PV systems used for rural electrification typically consist of the following five components (see Figure 1):

(i) Solar Photovoltaic Panels
(ii) Storage Batteries
(iii) Battery Controllers
(iv) Wiring, Fuses, Switches
(v) Appliances

**Solar Photovoltaic Panels**

The solar PV panels produce electricity, with the amount of electrical energy produced being directly proportional to the amount of sunshine falling on the panel surface and upon the area of the panel exposed to the sun.

A PV panel is made up of a number of cells. Individual silicon PV cells, no matter how large, produce an output of about 0.5 Volts when exposed to sunlight. In order to generate an output sufficient to charge a 12 Volt (V) battery, many cells (usually 33-36 in number) have to be connected in series[2] to form a panel whose output is rated to exceed the voltage of the battery.

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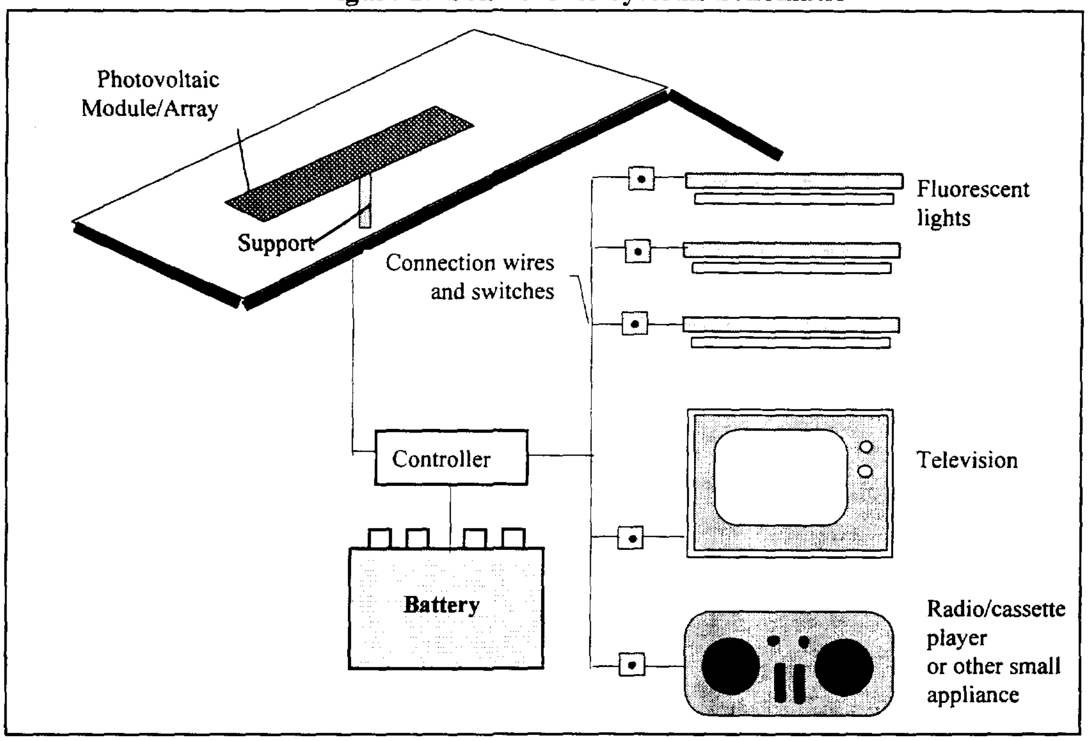
1 This annex is based, in part, on Liebenthal, A., S. Mathur, and H. Wade, *Solar Energy: Lessons from the Pacific Island Experience*, World Bank Technical Paper Number 244, Energy Series, 1994.

2 Cells are said to be connected in series when the positive terminal of one cell is connected to the negative terminal of another cell; the overall voltage is the sum of the voltages of each of the cells. Connection in series is the usual method in which batteries are connected in household appliances, e.g., four batteries of 1.5 volts each may be placed in a flashlight to produce 6 volts.

PV panels usually are rated in Watt-peak ($W_p$) output, e.g., this Project will use solar PV panels with a 50 $W_p$ rating. This Watt-peak rating may be considered the maximum power that a panel can produce under the prescribed conditions, e.g., a 50 $W_p$ panel will produce a power output of 50 watts.

**Figure 1: Solar Home Systems Schematic**




*Source:* Cabraal, A., M. Cosgrove-Davies and L. Schaeffer, "Best Practices for Photovoltaic Household Electrification Programs," World Bank Technical Paper Number 324, Asia Technical Department Series, September 1996.

It is important to realize that this Watt-peak rating is not directly comparable to the wattage associated with conventional electrical appliances, e.g., a 50 Watt-peak rating cannot be directly compared to the, say, 60-watt rating of a conventional electric light; if this type of comparison is made, that would greatly underestimate the amount of service that a SHS with a 50 $W_p$ would normally provide. For example, suppose at a particular location, 8 hours of full sun are available; under ideal conditions, a 50 $W_p$ panel would provide 400 (=50*8) watt-hours of power to the storage battery. Later, at night, in theory, these 400 watt-hours stored in the battery could be used to power, say, appliances to adding up to 100 watts for four hours, leaving aside losses.[3]

At present, there are no solar PV manufacturing facilities in Indonesia, and it is expected that the imported panels will used under the SHS Project.

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[3] In practice, this type of complete draining of the battery is not recommended as it greatly reduces the life of the battery, and also fails to provide the consumer with any fall-back in case there is less sunshine the next day.

**Storage Batteries**

Electrical storage is usually provided by lead-acid batteries similar to those used in automobiles. Battery capacity is usually stated in Ampere-hours (Ah), which can be converted into Watt-hours (the most common measure of electrical energy) by multiplying the Ah value by the battery voltage. Thus, a 70-Ah 12 V battery stores 840 Watt-hours of electrical energy when fully charged.

From a technical point of view, automobile batteries are not ideally suited for SHS units, since these batteries are designed to produce a high current for a short period of time to start the engine, while consumer appliances typically require a steady current for a longer period of time. Thus, strictly from a technical point of view, it is preferable to use so called "deep-discharge" batteries, which are specifically designed for solar PV systems; in practice, field experience has shown that high quality automotive batteries are capable of delivering good service. The wider availability and lower price of automotive batteries also support the use of automotive batteries.

In Indonesia, while automotive batteries are locally manufactured and widely available, at present, there is no production of deep-discharge batteries. However, the leading Indonesian battery manufacturers have indicated that they would consider producing these batteries once the SHS Project becomes operational, provided that there is sufficient demand.

**Battery Charge/Discharge Controllers**

Since batteries can be damaged by consistent overcharging, an automatic cut-off switch called a charge controller is usually provided to sense battery charge and reduce or turn off charging current to the batteries before damage can occur. Further, batteries can also be damaged by excessive discharging. To prevent this damage an automatic cut-off switch, called a discharge controller, similar in operation to a charge controller, is usually installed. This electronic device continually senses the state of the battery charge and disconnects the appliances when battery charge falls below the set limit. Small systems in particular need the protection of a discharge controller since it is easy to over discharge the battery through excessive use of appliances. It is common practice to combine the functions of charge and discharge controllers in a single device.

Charge/discharge controllers are manufactured in Indonesia, and it is expected that they will be used in the SHS Project, though some imported controllers may also be used.

**Wiring and Fuses**

These components are interconnected with wiring of the same type as is used in grid connected homes although a larger size of wire is generally needed due to the lower voltage and higher currents being delivered to the appliances. Fuses or circuit breakers are used to protect the equipment against short circuits.

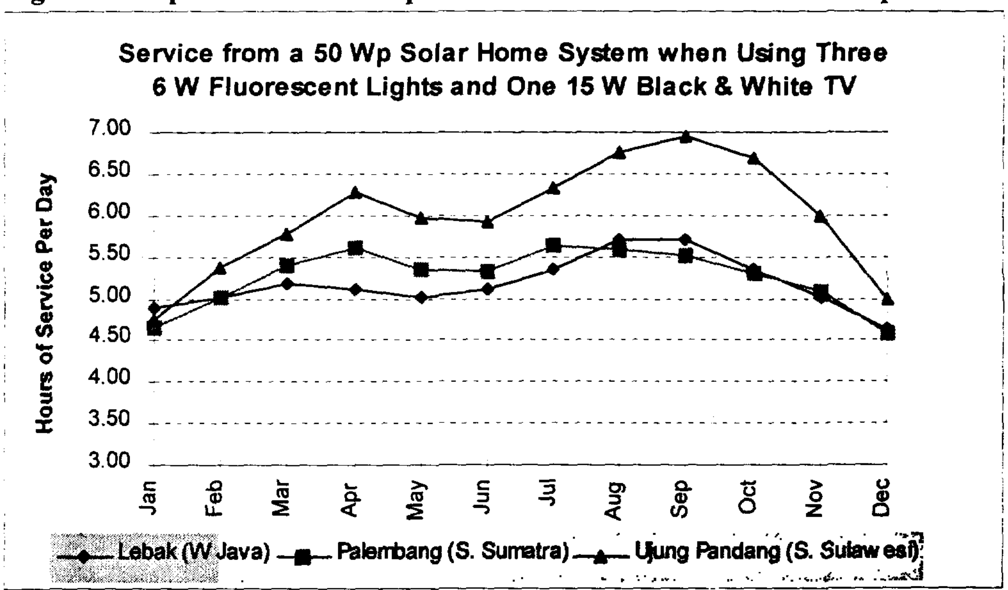
**Appliances and Service Provided**

The reason for installing a solar PV system is to power appliances. In domestic systems, these usually are limited to lights, radio, TV, VCR, and fans, although other small appliances such as computers, pumps or radio-telephones may be connected as well. In general, it is preferable to use appliances specifically designed for use with solar PV systems, because they are energy efficient and can be connected directly to the battery. These types of appliances are locally manufactured in Indonesia.

A typical SHS will provide power for three fluorescent lights and a black and white 14-inch TV or similar appliance for about five hours a day. The level of service provided is comparable to that obtained by a rural household in Indonesia which consumes 15 kWh/month of AC electricity, typically with conventional incandescent lights; the lights used in SHS are three to five times more efficient than incandescent lights

The hours of service will vary by time of year and by location depending on the available sunlight conditions; Figure 2 shows the average daily hours of service available when three lights and one TV are used in three representative locations in the proposed SHS Project area. The available hours of service range from nearly seven hours per day in September in Ujung Pandang to a low of 4.5 hours of service per day in Palembang in December.

**Figure 2: Representative Examples of Service Available from a 50 Wp SHS**



ANNEX 2.3

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

Power Subsector - List of IDA Credits and Bank Loans

| *Bank FY* | *Credit or Loan No.* | *Date Closed/Closing* | *Project Title* | *Amount $ Million* | *PPAR/PCR/ICR. Report No.* | *Date* |
|---|---|---|---|---|---|---|
| 70 | Credit 165 | 1975 | Jakarta Power Distribution | 15.81 | 2741 | Nov 1979 |
| 72 | Credit 334 | 1978 | Jakarta Power Distribution II | 40.00 | 2741 | Nov 1979 |
| 73 | Credit 399 | 1980 | Thermal Power | 46.00 | 5104 | May 1984 |
| 75 | Loan 1127 | 1980 | Power IV | 41.00 | 5104 | May 1984 |
| 76 | Loan 1259 | 1981 | Power V | 90.00 | 5300 | Oct 1984 |
| 77 | Loan 1365 | 1984 | Power VI | 116.00 | 6238 | Jun 1986 |
| 78 | Loan 1513 | 1985 | Power VII | 78.40 | 6762 | Apr 1987 |
| 79 | Loan 1708 | 1986 | Power VIII | 158.10 | 7902 | Jun 1989 |
| 80 | Loan 1872 | 1987 | Power IX | 224.80 | 7902 | Jun 1989 |
| 81 | Loan 1950 | 1987 | Power X | 250.00 | 7902 | Jun 1989 |
| 82 | Loan 2056 | 1988 | Power XI | 167.00 | 8701 | Jun 1990 |
| 83 | Loan 2214 | 1991 | Power XII | 278.63 | 11014 | Sep 1992 |
| 83 | Loan 2300 | 1990 | Power XIII (Cirata) | 270.32 | 11014 | Sep 1992 |
| 84 | Loan 2443 | 1991 | Power XIV | 205.11 | 11014 | Sep 1992 |
| 85 | Loan 1950-1 | 1990 | Power X Supplemental | 49.20 | 7902 | Jun 1989 |
| 87 | Loan 2778 | 1992 | Power Transmission & Distribution | 222.81 | 14725 | Jun 1995 |
| | Loan 3097 | 1995 | Power Sector Efficiency | 337.00 | 15876 | June 1996 |
| 89 | Loan 3098 | 1995 | Paiton Thermal Power | 354.00 | 15762 | June1996 |
| 89 | Loan 3180 | 1995 | Rural Electrification | 329.00 | 15210 | Dec 1995 |
| 90 | Loan 3349 | 1996/a | Power Transmission | 275.00 | | - |
| 91 | Loan 3501 | 1999/a | Suralaya Thermal Power | 423.60 | | - |
| 92 | Loan 3602 | 1999/a | Cirata Hydroelectric Phase II | 104.00 | | - |
| 93 | Loan 3761 | 2000/a | Sumatera-Kalimantan | 260.50 | | - |
| 94 | Loan 3845 | 1998/a | Second Rural Electrification | 398.00 | | - |
| 96 | Loan 3978 | 2000/a | Second Power Transmission & Distribution | 373.00 | | |
| | | | **Total** | **5107.28** | | |

/a Ongoing project

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

### Performance Indicators

This annex consists of two tables. Table 1 provides the key performance indicators to be used to monitor the progress of the project, while Table 2 provides additional information about inputs, outcomes, risks and impact.

For the purposes of measuring the Project's performance, the national and global objectives (paras 3.4-3.5) are expressed more concisely as:

- **Objective A:** Provide the modern energy form of electricity, in an environmentally sustainable manner, to rural customers who cannot be served economically or in a timely manner by conventional rural electrification.

- **Objective B:** Establish private sector based efficient and sustainable delivery, financing and loan collection mechanism for providing quality solar PV products to rural customers

- **Objective C**: Capacity building of key sector institutions.

**Approximate nature of targets** The value of the indicators in Table 1 has been generally derived on the basis of the best possible estimates of the outcomes[1], which are dependent upon the future behavior of potential SHS customers as well as the actions of SHS dealers who have yet to become fully established in this business. For this reason, the targets have been stated as approximate values rather than as precise numbers.

**Relative weights for evaluation purposes** While the bulk of the resources under this Project will be devoted to Objectives A and B (Table 2), Objective C is equally important as the other two objectives, since capacity building is a key element of the long-term development of the solar PV business.

- For **Objective A**, a "satisfactory" rating would require that, as of the ICR year, the actual sales be within 80% of the targets, and the timely repayment rates be within 200 basis points of the target, and a "highly satisfactory" rating would require that the actual sales are within 90% of the targets and the timely repayment rates be above the target value.

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1 The exceptions are: (i) the cumulative number of people served by the Project, which is derived by multiplying the number of SHS units sold by the average family size (4.4), (ii) the environmental benefits, which are the "project benefits" for the mid-term and ICR years, and the "programmatic benefits" for the Full Impact Year (Annex 3.6), and (iii) cumulative fossil fuel conserved, which is found by multiplying the number of SHS units sold by the average fossil fuel consumption of the target households..

- For **Objective B**, the price indicator is relativley less important, in the sense that the continued existence of SHS dealers without problem loans willing and able to serve rural customers goes a long way towards meeting Objective B, regardless of the price decline experienced as a result of the Project. A "satisfactory" rating would require that the actual values of the indicators related to the dealers be within 80% of the targets, and a "highly satisfactory" rating would require that the indicators be within 90% of the targets.

- For **Objective C**, the assessment would be based on the timeliness of the completion of the tasks. A "satisfactory" rating would require that the delays in completion not extend six months beyond the target dates, and a "highly satisfactory" rating would require that the completion dates be within three months of the targets dates

- Given the pilot nature of this Project, the **Overall** rating should be based on the two best objectives. For example, if a satisfactory number of dealers becomes established, and the capacity building is also successfully implemented, then adequate progress has been made towards the goal of decentralized rural electrification, so that an overall rating of "satisfactory" would be justified, even if the sales performance was "unsatisfactory." Similarly, a rating of "highly satisfactory" on at least two of the three objectives would imply an overall rating of "highly satisfactory" for the Project.

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## SOLAR HOME SYSTEMS PROJECT

### Table 1: Key Performance Indicators

| Project Objective | Performance Indicators | Baseline Year\1 | Mid-term Year\2 | ICR Year\3 | Full Impact Year\4 |
|---|---|---|---|---|---|
| A. Provide modern energy form of electricity, in an environmentally sustainable manner, to rural customers who cannot be served economically or in a timely manner by conventional rural electrification | **Outcome Indicators** | | | | |
| | - Number of units sold per year on credit | 4,000 | About 24,000 | About 55,000 | 110,000 |
| | - Cumulative number of SHS units sold under Project | Not applicable | About 34,000 | 200,000 | Not applicable |
| | - Customer timely payment rates | Not applicable | About 95% | About 95% | About 95% |
| | **Impact Indicators** | | | | |
| | - Cumulative number of people served by SHS Project | Not applicable | 150,000 | 880,000 | - |
| | - Cumulative environmental benefits ('000 tons $CO_2$ emissions abated)* | Not applicable | 228 | 1,334 | 2,204 |
| | - Cumulative fossil fuel conserved (kilo-liters)* | Not applicable | 92,940 | 546,720 | 903,277 |
| B. Establish private sector based efficient and sustainable delivery, financing and loan collection mechanism for providing quality solar PV products to rural customers | **Outcome Indicators** | | | | |
| | - Installed SHS Price Java (constant 1996 dollars) | $550-$650 | About $425 | About $425 | About $400 |
| | off Java (constant 1996 dollars) | $700-$800 | About $500 with GEF grant | About $500 without GEF grant | About $450 |
| | - Dealers with "problem loans" | Not applicable | 2 or less | 2 or less | - |
| | **Impact Indicator** | | | | |
| | - Number of dealers selling to households on credit basis | 2 | 5 or more | 5 or more | 8 or more |
| C. Capacity building of key sector institutions | **Outcome Indicators** | | | | |
| | - Decentralized rural electrification strategy study | Not applicable | Completed | | |
| | - Procurement of equipment for BPPT's laboratory | Not applicable | Completed | | |
| | - Attainment of ISO 25 status for BPPT's laboratory | Not applicable | Action plan adopted | Completed** | |
| | **Impact Indicator** | | | | |
| | - GOI adoption of decentralized rural electrification strategy and action plan | Not applicable | - | Completed | |

\1 1995-1996 \2 1999 (assuming loan effectiveness May 1, 1997) \3 2001 \4 2005
* Over 15 years ** Subject to revision, based on consultant report.

# Table 2: PERFORMANCE MONITORING : Outcomes, Risks and Impacts

| Objectives | Inputs | Output | Outcomes | Targets | Risks | Impacts |
|---|---|---|---|---|---|---|
| A. Provide modern energy form of electricity, in an environmentally sustainable manner, to rural customers who cannot be served economically or in a timely manner by conventional rural electrification | • IBRD loan (US$20.0 m)<br>• GEF grant ($23.1 m)<br>• Private sector ($72.8 m)<br>• IBRD and private sector funds will be used to finance the establishment of private dealers' service and delivery chains and the procurement of SHS components. | • Sale, installation, financing, and after-sales service of SHS units in three provinces by private sector dealers. | • Increased rural consumer familiarity with and acceptance of SHS<br>• Enhanced private markets for supply of solar PV systems as part of least-cost rural electrification<br>• Reductions in installed cost of SHS units<br>• Reduced fossil fuel consumption | • Electrification of 200,000 households<br>• High on-time consumer installment loan repayment rates<br>• Significant real reductions in SHS price from pre-project prices | • Low sales arising from factors such as poor dealer performance, consumer income reductions, unanticipated PLN grid extension<br>• Low on-time repayment rates arising from factors such as sales to non-credit-worthy customers, poor after-sales service, consumer income declines | • Improved quality of life for SHS customers through increases in security, lighting, education and entertainment.<br>• Reduction in prospects for global warming. |
| B. Establish private sector based efficient and sustainable delivery, financing and loan collection mechanism for providing quality solar PV products to rural customers | • GEF funds will be used to finance a first cost buydown of the SHS cost and paid as a co-downpayment on behalf of the consumer | • Provision of term credit and other support for twelve dealers | • Establishment of credit-worthy dealers who offer quality solar PV products to rural households on installment payments | • Establishment of a significant number of dealers selling and financing SHS units in rural markets | • Dealers fail to establish themselves due to factors such as poor management, or are attracted to other activities. | • Establishment of service and delivery chains that may be used in the future to serve poorer customers<br>• Development of competitive, commercially viable SHS market<br>• Establishment of manufacturers of solar PV product components |
| C. Capacity building of key sector institutions | • GEF grant ($1.2 m)<br>• GOI funds ($1.0 m) | • Long-term solar PV strategy study and implementation plan<br>• Equipment for BPPT, and training for GOI officials | • Delineation of potential future role of solar PV in meeting modern energy needs of all rural households<br>• Development of plan to realize the potential role<br>• Increased institutional capacity to support solar PV development | • Completion of study within two years<br>• Equipment purchase for BPPT within two years<br>• Completion of training within three years<br>• ISO 25 certification for BPPT | • Contractual delays could delay completion of study, equipment purchase and training<br>• Errors in selection of consultants could lead to poor results<br>• Lack of sustained effort could hinder ISO 25 status | • Improved prospects of realizing Indonesia's solar PV potential |

**INDONESIA**

**SOLAR HOME SYSTEMS PROJECT**

**Dealers Interested in Participating in the Project**

| Dealer | Based in | Plans to Operate in | | | Comments |
|---|---|---|---|---|---|
| | | Java | Lampung | Sulawesi | |
| | | | | | |
| Bianglala Jala | W. Java | Y | - | - | Some experience in government solar PV procurement programs |
| Dharma Nuranti | W. Java | Y | Y | - | Woman owned /operated; engaged in government solar PV procurement programs |
| Jermindo | W. Java | Y | Y | - | Engaged in government solar PV procurement programs |
| Kyocindo | W. Java | Y | Y | Y | Engaged in government solar PV procurement programs |
| Lingsing | W. Java | - | Y | - | Engaged in government solar PV procurement programs |
| Padi | W. Java | Y | - | Y | Some experience in government solar PV procurement programs |
| Sudimara | W. Java | Y | Y | Y | Engaged in direct households SHS sales in Java |
| Walet | W. Java | Y | - | - | Engaged in government solar PV procurement programs |
| | | | | | |
| Daitron | Lampung | - | Y | - | Engaged in air-conditioning business |
| Mustika Sari | Lampung | - | Y | - | Engaged in government solar PV procurement programs; limited number of direct SHS sales |
| | | | | | |
| Bina Pison | S. Sulawesi | - | - | Y | Engaged in government solar PV procurement programs |
| Nia's Data | S. Sulawesi | - | - | Y | Woman owned/operated; Engaged in computer business; some experience in renewable energy |
| Tritunggal | S. Sulawesi | - | - | Y | Engaged in auto parts business; some experience in government solar PV procurement programs |

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

### Bank Indonesia's Bank Rating System

The criteria used by Bank Indonesia (BI) to assess the financial soundness of banks is based on an evaluation of five factors -- capital adequacy, asset quality, earnings, liquidity and management -- considered crucial to the soundness of a financial institution. Ratios, calculated from data provided in monthly reports submitted by banks, are compared to the norms see below established by BI for each of the five areas of evaluation. An overall rating is then computed and banks informed of their rating by BI as appropriate.

The soundness of a bank is determined on the basis of a reward system for each of the above five areas of evaluation. In order to compute the total reward points, the following rule is applied:

Capital (25 percent): capital adequacy based on a risk-weighted assets as defined under the BIS guidelines for the G-10 countries. All financial institutions are required to reach a minimum 5 percent capital ratio by March 1992, increasing to 7 percent by March 1993 and 8 percent by December 1993. If a bank is below and/or up to the minimum capital required, there are no (or zero) reward points. With every increase of 0.01 percent over the minimum capital requirement, a bank is awarded on reward point;

Asset quality (30 percent): classified assets as a proportion of total earnings assets of a bank. If classified assets are 15.5 percent or above of total earnings assets, there are no (or zero) reward points. With every decrease of 0.15 percent from the 15.5 percent classified assets to total earning assets ratio, a bank is awarded one reward point;

Earnings (10 percent): consists of two factors: return on total assets and the ratio of operational cost to operational income. If return on total assets is zero or negative, there are no (or zero) reward points. With every increase of 0.015 percent in return on total assets, a bank is awarded one reward point. If the ratio of operational cost to operational income is one, there are no (or zero) reward points. With every decrease of 0.08 percent in this ratio, a bank is awarded one reward point;

Liquidity (10 percent): ratio of total current liabilities to total current assets. If this ratio is one, there are no (or zero) reward points. With every decrease of 1 percent in this ratio, a bank is awarded one reward point; and

Management (25 percent): a qualitative factor, is reviewed from many aspects, including a bank's internal control systems, MIS, capital position, asset quality, liquidity, lending policy, compliance with Bank Indonesia regulations, reporting requirements, etc. Every positive aspect of a bank's management is awarded with four-tenths of a reward point.

The soundness of a bank is rated on the basis of total reward points as follows:

a. SEHAT (Sound) - if its reward points range from 81 to 100
b. CUKUP SEHAT (Fairly Sound) - if its reward points range from 66 to 80
c. KURANG SEHAT (Unsatisfactory) - if its reward points range from 51 to 65
d. TIDAK SEHAT (Poor) - if its reward points range from 0 to 50.

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# SOLAR HOME SYSTEMS PROJECT

## Summary Solar Home Systems Technical Specifications and Verification Procedures

**Background**

A participatory process involving BPP Teknologi, Indonesian PV dealers, the Indonesian PV trade association and international experts was used to develop the SHS specifications. Final SHS technical specifications were issued in June 1995 to prospective suppliers in Indonesia and overseas, to give adequate time to develop and produce products that can meet the performance requirements. This annex describes the specifications and the verification procedures in general terms, while the detailed technical specifications are available in the Project Implementation Plan (PIP).

**Product Description**

The SHS units sold under the Project would consist of : (i) one or more photovoltaic (PV) modules with an output of 50 Wp or more, (ii) a 12 Vdc lead-acid battery with a minimum capacity of 70 Ah, (iii) a battery charge/discharge controller, (iv) at least three fluorescent light fixtures, and (v) related components, such as wires, switches and mounting hardware. Appliances such as televisions and radios would have to be purchased separately by the customers.

**Technical Specifications**.

The **PV module** is required to meet internationally recognized standards. The PV module must have peak power output of at least 50 Wp (with an allowable tolerance of 5 percent), under Standard Test Conditions (STC) as defined in IEC (International Electrotechnical Committee) Specification No. 904-series.[1] The peak power output for thin film modules should be the value after light soaking. The single-crystalline or poly-crystalline modules must meet the requirements of IEC Specification No. 1215 or ESTI No. 503 issued by the Joint Research Committee of the European Commission.[2] If thin-film photovoltaic modules are used, they must be in accordance with ESTI Specification No. 701 issued by the JRC, SERI/TR-213-3624 issued by the National Renewable Energy Laboratory, USA.[3]

The **battery** is sized to permit the loads to be served even during extended periods of inclement weather. The battery has three days of autonomy, so that a fully charged battery can service the loads for three days even with no sunlight. The use of automotive lead-acid batteries is allowed as experience in Indonesia has shown that locally-made batteries have functioned reliably and their life has exceeded three years. The battery is required to meet or exceed Indonesian Standard SII 0160-77. The batteries are also required to have a specified minimum plate thickness.

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1 International Electrotechnical Committee (IEC) No. 904-1 (1987), "Photovoltaic Devices - Measurements of Photovoltaic Current-Voltage Characteristics," through 904-9 (1995), "Photovoltaic Devices - Solar Simulator Performance Requirements."

2 IEC 1215 (1993), "Crystalline Silicon Terrestrial Photovoltaic Modules - Design Qualification and Type Approval." European Solar Test Installation (ESTI), Specification No. 503 (1991), "Qualification Test Procedures for Crystalline Silicon Photovoltaic Modules."

3 ESTI 701 (1990), "Recommended Qualification Test Procedures for Thin Film Photovoltaic Modules." National Renewable Energy Laboratory SERI/TR-213-3624 (1993), "Interim Qualification Tests and Procedures for Terrestrial Photovoltaic Thin Film Flat Plate Modules."

There are no internationally accepted standards for **charge regulators, load controllers and Direct Current (dc) fluorescent lights**. Therefore, operating parameters for regulators/controllers were specified to permit the SHS to operate reliably and safely and to ensure that the battery life is maximized. The fluorescent light fixture specifications defined energy efficiency (more than 35 lumens/W, including inverter losses) and minimum light output (200 lumens per lamp) standards. Two hundred lumens is equivalent to the light output of five kerosene lanterns.

In addition, there are **additional specifications** to ensure that the SHS is protected against short and open circuits, transient voltage surges and reverse polarity voltages. The entire system must be built to withstand Indonesian environmental conditions - temperatures of +10 to +40 degrees Celsius and humidity levels of 90 percent. The PV module and support structure must be corrosion resistant and able to withstand wind gusts up to 100 km/hour without damage. All wiring, enclosures and fixtures that are mounted indoors must be resistant to high humidity conditions and insect and dust intrusion.

**Verification of SHS Standards**

Participating suppliers must certify that their products meet or exceed these specifications. Certifications must be issued by testing laboratories with ISO 25 accreditation, or other facilities acceptable to the Bank. The documentation to be provided by the supplier must include the following: (1) Photovoltaic module certification obtained from the module manufacturer; (2) Battery certification, battery charge/discharge voltage and battery cycle life vs. state of charge curves obtained from the battery manufacturer; and (3) Battery charge regulator and load controller and fluorescent light fixture certifications, supplied by the manufacturer of the regulator and load controller and light fixture, as per testing procedures developed by BPP Teknologi. This certification is provided by a certification laboratory acceptable to the World Bank.

**Post Installation Monitoring.**

After the SHS are installed, the systems will be randomly audited. The purpose of the audits is to verify that the components used are in accordance with the specifications. If any products are found to be in non-compliance, procedures are in place that require the supplier to correct the deficiencies and/or face penalties (Annex 3.5).

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# SOLAR HOME SYSTEMS PROJECT

## Subborower Eligibility Criteria, Dealer Obligations, Enforcement and Penalties

**Eligibility Criteria** In order to qualify for participation in the SHS Project, an applicant must initially meet, and continue to meet, the following criteria. The subborower must:

(i) have current operations that include sales of SHS or other products in the rural areas of Indonesia;

(ii) prepare a business plan acceptable to the Bank that demonstrates that:

(a) there would be an increase in SHS sales through direct household sales under the installment payment plan in the selected target areas beyond an estimated "baseline level" that would be achieved without the Project's support;

(b) the SHS systems sold would meet the Project's technical specifications;

(c) the subborrower's operations would be commercially viable;

(d) the subborrower has made adequate arrangements for hire-purchase based SHS purchases by households;

(e) procurement practices would be based on good commercial practices;

(f) the subborrower has developed adequate consumer protection plans, including a returns policy, warranties, and after-sales service;

(g) the subborrower agrees to establish escrow accounts that would be used in the event of the subborrower's failure to comply with the Project rules; and

(h) the subborrower has developed a system for collecting and providing to the PSG the data required for project monitoring and evaluation. The subborrower would agree to retain all supporting documentation for the period of the warranty of each customer's solar panels. Each subborrower would also agree to allow access, upon request, to representatives of the PSG or others designated by the Bank, to their business premises and to disclose, upon request, their customer data base, including records of sales, installations, collections, complaints, repairs and warranties.

(iii) prepare and submit a credit application that is acceptable to a commercial bank eligible to participate in the SHS Project.

(iv) agree to abide by competitive code of norms for dealing with customers, employees, and other dealers, including:

(a) providing customers with complete and correct information about products, services and prices;

(b) competing openly, not engaging in actions that might prevent competitors from entering particular market areas; and,

(c) not engaging in collusive behavior that may harm the business of competitors.

**Enforcement authority** - The authority to enforce is the government of Indonesia and the World Bank. In practice, the World Bank retains or has assigned to it the responsibility of monitoring conformance with the rules and for taking appropriate actions.

**Delegation of enforcement authority.** For purposes of efficient, independent and professional execution, there is a limited delegation of authority to the PSG under which it collects and reports data on compliance, presents diagnostic data about compliance of individual dealers, provides formative evaluation reports on compliance to dealers, advises dealers on actions and timetables to remedy deficiencies in compliance and recommends actions to be taken by the Rural Electrification Steering Committee and World Bank. The process of enforcement is an early warning system based on error detection, acknowledgment, correction and flexibility.

**Compliance monitoring approach.** The PSG reviews the performance of dealers to verify conformance with the rules. The compliance methods adopted are ones which are transparent and cost effective in providing pertinent, accurate, reliable, user friendly and timely information to all involved. In each of the rule areas (technical, financial, competition), the PSG develops specific requirements, measures and monitoring methods. These methods, based on the principles established in this document, are made available to all dealers and participating banks. Highly specific methods facilitate all the stakeholders agreeing on the basic rules of evidence and help to minimize the potential risks of having too much scope for discretion. Higher specificity can be achieved for the technical and financial rules than for the competition rules. Multiple compliance monitoring methods are used to meet a range of stakeholders' views on appropriate rules of evidence, which is especially useful in the area of the lower specificity competition rules.

**Compliance monitoring methods.** The methods used for monitoring compliance on an on-going basis include:

i) end-user level audits of the first 50 installations of each dealer;[1]

ii) random sample based, blind (i.e., auditor is not informed of the correct information such as the expected serial number of the panel), unannounced, independent end-user level audits of all subsequent installations;[2]

iii) customer surveys using simple, short questionnaires linked with dummy tables;[3]

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[1] The initial audits are to be completed with satisfactory results prior to the initial grant disbursement to a dealer.

[2] These are *ex-post* verifications done on a routine basis. This permits disbursements to continue without hindrance. The sampling methodology is determined by the PSG.

[3] The customer surveys are included as part of the end-user audits. They are useful in assessing customer satisfaction and, along with the complaint based audits, serve as a mechanism for incorporating customer participation and feedback into continual improvements in dealer operations.

iv) complaint based end-user level audits and other data gathering in response to customer complaints or other information received from customers or other stakeholders;

v) reviews of documentation and reports provided by dealers, international suppliers and others;

vi) direct observation and verification during regular field visits;

vii) direct observations during unannounced site visits to check accuracy of data;

viii regular performance reviews with individual dealers and commercial banks; and,

ix) annual meetings with dealers to discuss ways to improve the compliance monitoring system

**Dealing with cases of non-compliance** The process of dealing with non-compliance is based on fully and immediately informing the dealers of adverse findings resulting from the compliance monitoring and, secondly, providing a reasonable time for a dealer to respond, to correct deficiencies and to demonstrate that they have come into compliance. In the most serious cases of non-compliance, the process includes immediate PSG reports to the relevant participating commercial bank, the Rural Electrification Steering Committee and the World Bank and a recommendation, if appropriate, for the suspension of grant disbursements. A finding of non-compliance results in the following sequence of actions:

i) PSG immediately notifies the dealer of the deficiencies found;

ii) PSG discusses the findings with the dealer and others who may be involved;

iii) PSG reviews information which the dealer or others may make available;

iv) PSG advises the dealer of a program of actions and a timetable for the dealer to correct the deficiencies;

v) the dealer carries out the actions and demonstrates to the PSG that the deficiencies have been corrected;

vi) if the PSG determines that the deficiencies are not corrected within the established timetable, it again advises the dealer of a program of actions and a new timetable for the dealer to correct the deficiencies and, simultaneously, may inform the dealer's participating commercial bank, the Rural Electrification Steering Committee and the World Bank, recommending appropriate actions.

**Remedies - Category One**. There are two types of non-compliance. Category One cases are isolated incidents of non-compliance, resulting, for example, from management, internal control or quality control deficiencies. There is no penalty for these cases as long as the dealer came into compliance by taking actions in accordance with the timetable advised by the PSG. If the PSG finds that the dealer does not meet the timetable, or if there are repeated incidents of Category One type cases of non-compliance, the PSG may consider the dealer as a case to be treated in the Category Two group of cases.

**Remedies - Category Two**. The second category of non-compliance comprises those in which the dealer is in default of the rules. These include cases of possible fraud or of the extensive incidence of non-compliance, resulting, for example, from systemic weaknesses in the management or other aspects of the dealers operations. In these cases, after receiving the report and recommendations of the PSG, the World Bank takes appropriate steps to exercise the remedies available to it for this loan and grant, including suspending or terminating disbursements of grants and loans in respect of specific dealers. The status of Category Two cases is reviewed by the regularly scheduled Bank supervision missions.

**Reports**. The PSG reports to the World Bank immediately on all cases of Category Two non-compliance by a dealer. These reports include an opinion on the materiality and impact of the deficiencies on the Project and recommended actions. In its quarterly reports to the Rural Electrification Steering Committee and the World Bank, the PSG provides information on cases of Category One and Category Two non-compliance and their resolution. The PSG provides information to the commercial banks immediately in cases of Category Two non-compliance by dealers financed by them and quarterly in cases on Category One non-compliance. The PSG immediately provides dealers reports of their non-compliance.

**Escrow account**. Each dealer agrees to establish and maintain an interest earning escrow account in his commercial bank. The escrow account is to be used solely to assist specifically those customers who have been adversely affected by the dealer's non-compliance with the dealer obligations; the escrow funds may be utilized for this purpose only after the Bank has declared that the concerned dealer is no longer eligible to participate in the Project. Authority over this escrow account is delegated by the dealer to the RE Steering Committee, which would authorize expenditures based on reports and recommendations produced by the PSG. The escrow account would be funded by 5% of each grant disbursement to the dealer during 1997, 4% in 1998, 3% in 1999, 2% in 2000 and 1% in 2001. The escrow account would terminate at the loan closing date. On this date, all funds in the escrow account of a dealer who has remained eligible to participate in the Project, i.e., whose eligibility to participate has not been suspended or terminated by the Bank, would automatically revert to the concerned dealer.

# INDONESIA

# SOLAR HOME SYSTEMS PROJECT

## Incremental Costs and Global Environmental Benefits

**Broad Development Goals**

1. Indonesia's basic goals and policies for the development of the energy sector highlight the importance of meeting Indonesia's rapidly growing energy needs in an efficient manner, including through conservation and diversification of primary energy resources, and minimizing the adverse environmental and social impacts of energy use. A key and continuing thrust of the Government's energy strategy is to slow down Indonesia's transition to net oil importer status by diversifying energy supply for domestic consumption towards alternative and economic indigenous resources that have a non-exportable surplus or are non-tradable, such as renewable energy. Rural electrification (RE) is a key and integral part of the Government's rural development strategy.

**Baseline**

2. In Indonesia today, a significant number of isolated rural households use kerosene laps for lighting and automobile batteries -- charged at diesel-based generating stations -- for other energy needs, such as watching (black-and-white) TV sets. While these households have the potential resources to pay for grid-based electricity supply, this supply is not available to them now, nor is it likely to be available to them in the medium term. Further, most of these households are not able to buy Solar Home Systems, either because SHS are simply not offered to them for sale, or because of other factors such as high prices, lack of credit, and lack of familiarity. Thus, the baseline course of action is that these households will continue to rely on fossil fuels for their energy needs.

**Global Environmental Objective**

3. The baseline course of action will lead to significant emissions of greenhouse gases ($CO_2$). Thus, the global environmental objective of the SHS project is the mitigation of GHG emissions.

**GEF Alternative**

4. Under the SHS project, the GEF alternative to the baseline scenario is the installation and sales of 200,000 SHS units in selected markets in Indonesia over a period of five years. The GEF Alternative would also include program support (such as dissemination of technical, financial, and operational information to customers and dealers) and capacity building activities that would contribute to the removal of market and institutional barriers to the adoption of SHS. There are no $CO_2$ emissions for the SHS units, so that there will be a total replacement of the fossil fuel use that would have taken place under the baseline scenario. It is estimated that the SHS project will lead to an abatement of about 2 million tons of $CO_2$, at a GEF cost of about $11/ton $CO_2$.

**Additional Domestic Benefits**

5. Apart from progress towards least-cost provision of electricity to rural consumers, the SHS will reduce the exposure of household members to the smoke and pollution associated with kerosene lighting.

**Costs**

6. At present, most of the target households for SHS units use a combination of kerosene for lighting and diesel-based battery charging for other activities such as powering a black-and-white TV. Based on survey data and secondary information about prices, the monthly economic expenditures of the target households on kerosene and battery charging are $9.32 on Java and $9.99 off-Java. These expenditure patterns reflect the fact that in Indonesia: (i) kerosene consumption levels in Indonesia are higher than in many other countries, and (ii) off-Java, the kerosene and battery costs are higher, The costs of kerosene and battery charging are lower on Java than off-Java, primarily due to transportation and logistical differences, and their consumption level lower than on Java. Correspondingly, the present value of the target household's baseline expenditures on kerosene and battery charging (for 15 years at a discount rate of 10%) is $867 on Java and $930 off-Java.

7. The GEF incremental costs arise from: (i) the additional costs, over the baseline expenditures, of the SHS units in the market areas to be developed under the SHS project, including the need to increase potential customer familiarity with SHS, to assist dealers, and to maintain links with actual customers under the SHS project, (ii) institutional capacity strengthening, and (iii) monitoring and evaluation.

8. For the parts of Java where SHS dealers are not yet established ("the new Java areas") the initial cost of an SHS unit is estimated to be Rp 1.4 million ($636), based on the costs of Government procurement programs. For off-Java, the SHS costs are estimated to be Rp 1.65 million ($750), based on the prices of scattered cash sales in Lampung and Sulawesi. These estimates of costs compare favorably with the prices of similar SHS in many other countries.

9. Based on the prevailing prices, the monthly economic cost of a SHS unit in the new Java areas is $10.10, which implies a present value of $940 for 15 years at a 10% discount rate. For off-Java, the SHS monthly economic cost is $11.38, with a present value of $1,059.

10. When the present value of the GEF alternative is compared with the baseline expenditures of the typical target household, the **incremental costs** are estimated to be about $73 per SHS unit in the new Java areas and about $129 per SHS unit off-Java.[1] For total project sales of 200,000, split about equally between the new Java areas and off-Java, the total incremental cost for the SHS units is about $20 million.

11. A small Project Support Group (PSG) will be established to provide customers and dealers with the technical, financial and operational information. It is expected that potential customers will use this information, in part, to make informed decisions about the suitability of SHS. The total cost of these activities are expected to be $4 million. In the baseline scenario, it is estimated that BPPT/GOI would have undertaken some of these activities, at an estimated cost of $1.5 million. Hence, the GEF incremental cost is $2.5 million.

---

[1] The incremental costs are negative for the limited regions of Java where solar PV is already cheaper than the costs of kerosene lighting and battery charging. Consequently, no GEF funds will be made available for sales and installations of SHS systems in these limited regions of Java.

12. The capacity building component includes institutional strengthening of BPPT, as well as a SHS Strategy and Implementation Study. The total costs of these activities are estimated to be $2 million. However, in the baseline scenario, it is expected that BPPT/GOI would have undertaken some similar activities, whose cost is estimated to be $0.5 million. Hence, the GEF incremental cost is $1.5 million.

13. The costs of the SHS project monitoring and evaluation activities by the national working group, including the first phase review by the independent panel of experts, are estimated at $0.3 million. As these activities would not have been undertaken in the baseline scenario, these expenditures are part of the GEF incremental cost.

14. Together, the overall GEF incremental cost is $24.3 million.

**Global Environmental Benefits**

15. The overall avoided emissions are about 2.2 million tons of $CO_2$, with a total GEF grant of $24.3 million, leading to a GEF unit cost of about $11/ton $CO_2$. The estimates of the emissions avoided include both the emissions avoided as a result of the SHS units directly installed under the SHS project ("project effect") -- about 1.3 million tons of $CO_2$, -- as well as the acceleration of SHS market penetration in Indonesia ("programmatic effect") as a result of the SHS project -- about 0.9 million tons of $CO_2$. Thus, the GEF unit cost is about $18/ ton $CO_2$ when only the direct project benefits are considered.

16. The estimation of total emissions avoided starts with an estimate of the unit emissions avoided factor. The unit avoided emissions factors are multiplied by the estimated penetration of the technology to arrive at the total emissions avoided. Specifically, the **first** step is to calculate the SHS output; it is assumed that the output of a SHS unit (50 Watt-peak) is 170 watt-hours per day, which implies an output of 62,050 watt-hours per year, or an undiscounted lifetime output of 931 kWh over 15 years. The **second** step is to calculate the emissions from the substitute technologies. It is assumed that kerosene lighting has associated with it emissions of 10,000 tons of $CO_2$ per GWh-equivalent and diesel-based battery charging has associated with it emissions of 1,100 tons of $CO_2$ per GWh-equivalent. In calculating the weighted average of the substitute technologies, the for kerosene lighting is assumed to be 70%, and 20% for battery charging, with the remaining 10% associated with zero emissions, so that weighted average is 7,220 tons of $CO_2$ per GWh-equivalent. **Finally**, on multiplying 931 kWh by 7,220 tons of $CO_2$ per GWh-equivalent, the result is that the lifetime undiscounted emissions directly abated by one SHS are 6.72 tons of $CO_2$.

**Incremental Cost Matrix (excluding Technical Assistance)**

17. The incremental cost matrix, excluding Technical Assistance, is presented below.

| | **Costs** | **Domestic Benefits** | **Global Environmental Benefits** |
|---|---|---|---|
| Baseline | $ 867/ household on Java<br>$ 930/household off Java | lighting and other appliances with smoke and fumes | 2.2 million tons of CO2 emissions |
| Alternative | $ 940/household on Java<br>$ 1,059/household off Java | lighting and other appliances without smoke and fumes | 0 million tons of CO2 emissions |
| Increment | $ 100/household average<br>$ 20 million for 200,000 households | | 2.2 million tons CO2 emissions |

Annex 3.7

**INDONESIA**

**SOLAR HOME SYSTEMS PROJECT**

**Summary Information Sheet For Subborrower**

## I. Applicant

Name Borrower/Owner of Firm; address of Borrower/Firm; Location of project (city/province); Products; Annual Sales/Production -- last fiscal year; New or old client

## II. Projected SHS Unit Sales

By Province by year

## III. Estimated Total Cost

Local, Foreign, Total

## IV. Projected Financing Plan

1. Borrower's contribution
2. Participating bank loan
3. GEF
4. Customers

## V. Proposed Ceiling for IBRD Loan Refinancing

**INDONESIA**

**SOLAR HOME SYSTEMS PROJECT**

**Information Required in a Subborower's Business Plan**

The initial business plan should contain the financial, technical and operational information indicated below.

I. SUMMARY

II. BACKGROUND OF THE COMPANY

III. PROJECT PLAN

Description of Project
Production
Schedule of Project Implementation
The Product
Location
Building
Machinery and Equipment
Human Resources
Panel and Components

IV. MARKETING

Introduction
Market Development of SHS
Present Supply
Demand Estimation
Competitions, Quality and Price
Planned Production and Market Share

V. PROJECT COST AND FINANCING

Total Project Cost
Fixed Assets
Working Capital
Financing Plan
The Size of Loan from Bank
The Term of Loan
Disbursement of Loan & GEF

VI. OPERATING AND FINANCIAL PROJECTIONS

Projected Sales, Prices and Revenues
Cost to Make and Sell
Profitability
Liquidity
Projected Internal Rate of Return

**Annex I Technical**

**Components to be used**

including details of source of components, accompanied by certification from acceptable laboratories that the components meet the prescribed technical specifications.

**Annex II Operational**

**Arrangements for Hire-Purchase Sales**

including details of manner of collection of downpayment and monthly installment payments, sample contract form between dealer and consumer.

**Procurement Practices**

including details of manner in which the main components (panel, battery, controller) will be procured.

**Consumer Protection Plans**

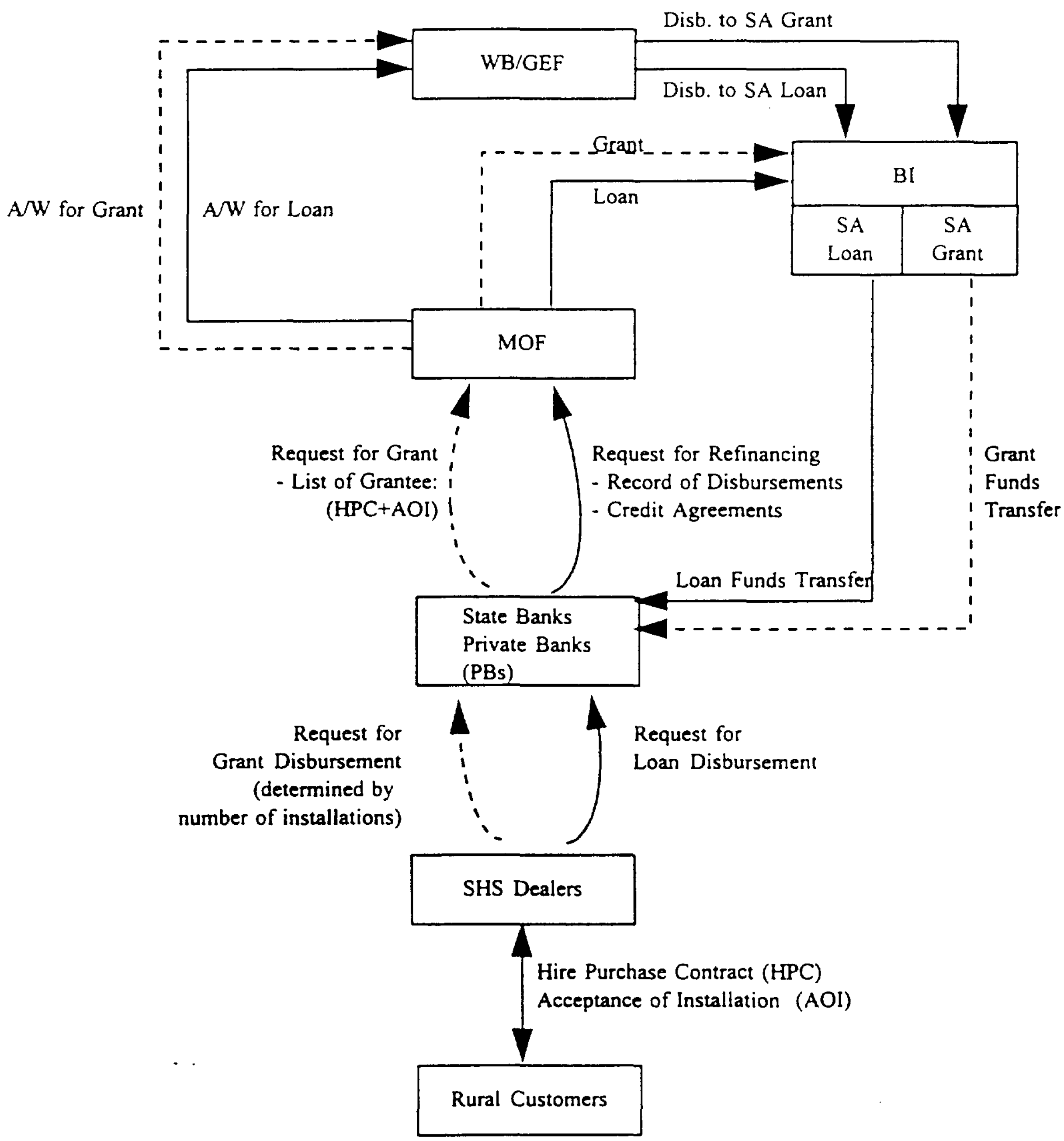
including details of technical/financial information to be provided to customers, returns policy, warranties, after-sales service.

**Competitive Conduct Code**

including details of code of conduct to be followed with respect to competitors.

Annex 3.9

# INDONESIA
# SOLAR HOME SYSTEMS PROJECT
## Disbursement of Grant and Loan Funds for Credit Component Only




**Note:** HPC - Hire Purchase Contract between dealer and customer
AOI - Acceptance of Installation of SHS by customer

Annex 3.10

# INDONESIA
## SOLAR HOME SYSTEMS PROJECT
### Estimated Disbursement Schedule
### (US$ '000)

| Bank FY- | IBRD Loan | | | GEF Grant | | |
|---|---|---|---|---|---|---|
| Semester | Semester | Cumulative | % | Semester | Cumulative | % |
| 1997-II | 0.3 | 0.3 | 2% | 0.3 | 0.3 | 1% |
| 1998-I | 1.1 | 1.4 | 7% | 1.4 | 1.7 | 7% |
| 1998-II | 1.1 | 2.5 | 13% | 2.1 | 3.9 | 16% |
| 1999-I | 1.5 | 4.0 | 20% | 2.1 | 6.0 | 25% |
| 1999-II | 3.0 | 7.0 | 35% | 3.1 | 9.1 | 37% |
| 2000-I | 3.5 | 10.5 | 53% | 2.9 | 12.0 | 49% |
| 2000-II | 3.5 | 14.0 | 70% | 3.3 | 15.2 | 63% |
| 2001-I | 3.0 | 17.0 | 85% | 3.3 | 18.5 | 76% |
| 2001-II | 3.0 | 20.0 | 100% | 4.0 | 22.5 | 93% |
| 2002-I | 0.0 | 20.0 | 100% | 1.8 | 24.3 | 100% |

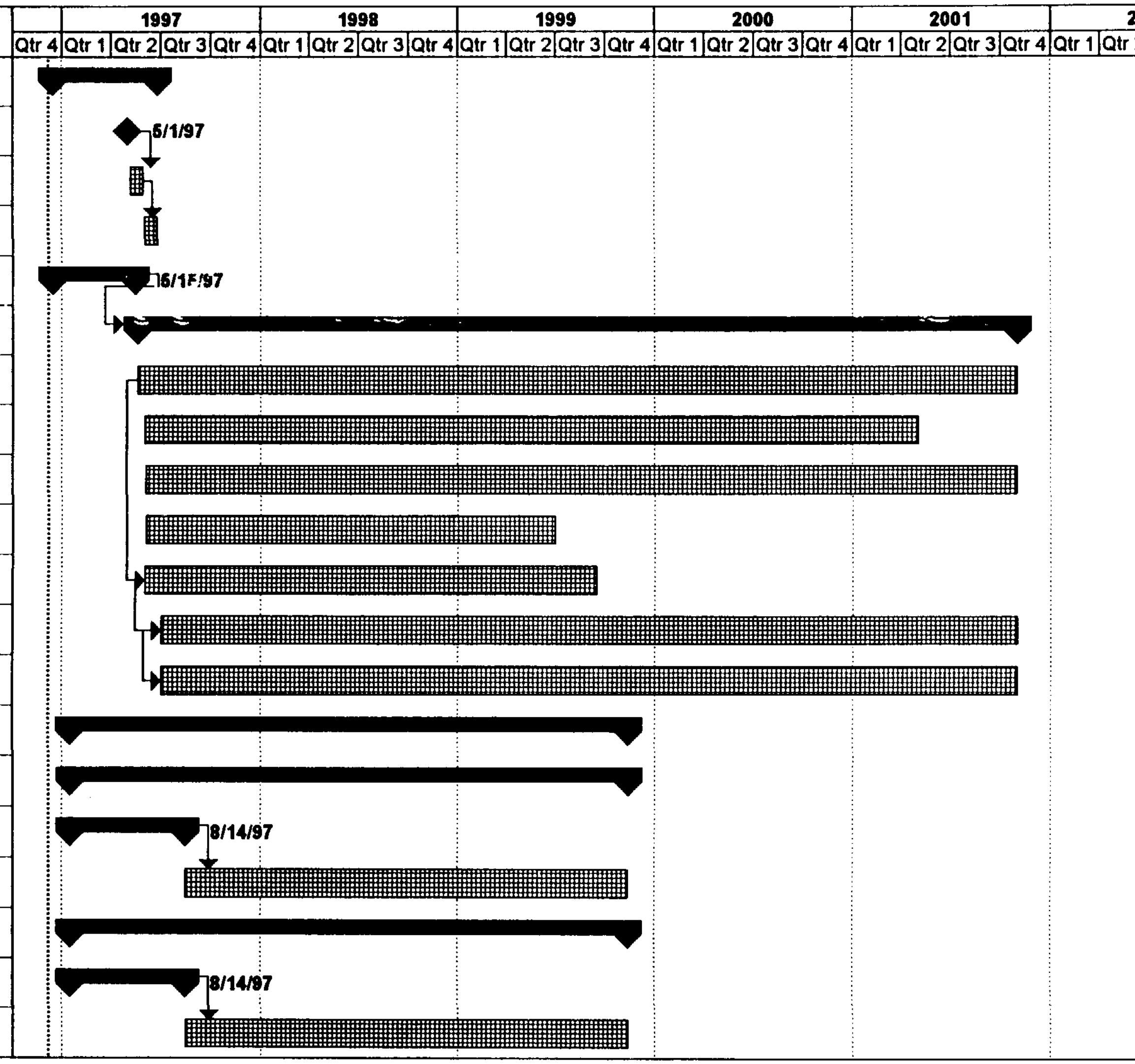
/a Assumed Loan Effectiveness Date is May 1, 1997
Project Closing Date is October 31, 2001
Loan Closing Date is April 30, 2002

# INDONESIA

## Solar Home Systems Project

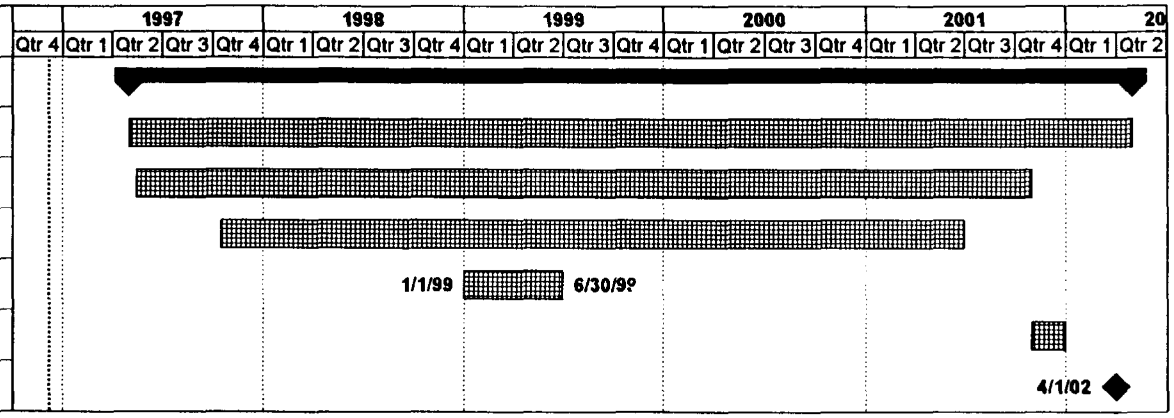
### Project Implementation Schedule

| ID | Name | Start | Finish |
|---|---|---|---|
| 1 | **START UP PROJECT** | **12/16/96** | **6/25/97** |
| 2 | **Achieve loan effectiveness** | 5/1/97 | 5/1/97 |
| 3 | **Make initial SA deposits** | 5/7/97 | 5/30/97 |
| 4 | **Sign initial SHS dealer sub-loan** | 6/2/97 | 6/25/97 |
| 5 | **Complete procurement of PSG services** | **12/16/96** | **5/15/97** |
| 17 | **CATALYZE SHS SALES AND INSTALLATIONS** | **5/20/97** | **10/31/01** |
| 18 | Disburse PB sub-loans to SHS dealers | 5/20/97 | 10/31/01 |
| 19 | Conduct PB launch and periodic review workshops | 6/2/97 | 5/1/01 |
| 20 | Operate 2-way consumer information program | 6/4/97 | 10/31/01 |
| 21 | Develop dealers' capabilities | 6/4/97 | 6/30/99 |
| 22 | Audit each dealer's first 50 installations for compliance | 6/2/97 | 9/15/99 |
| 23 | Disburse first cost buy-down grants for rural customers | 7/2/97 | 10/31/01 |
| 24 | Audit SHS installations on regular basis; verify compliance | 7/2/97 | 10/31/01 |
| 25 | **BUILD CAPACITY OF SECTOR INSTITUTIONS** | **1/17/97** | **11/12/99** |
| 26 | **Prepare decentralized RE strategy and plan** | **1/17/97** | **11/12/99** |
| 27 | **Complete procurement of assistance services** | **1/17/97** | **8/14/97** |
| 39 | **Conduct study, discuss findings, adopt plan** | 8/15/97 | 11/12/99 |
| 40 | **Strengthen BPPT** | **1/17/97** | **11/12/99** |
| 41 | **Complete procurement of assistance services** | **1/17/97** | **8/14/97** |
| 53 | **Procure and install equipment; train staff** | 8/15/97 | 11/12/99 |



# INDONESIA
## Solar Home Systems Project
### Project Implementation Schedule

| ID | Name | Start | Finish |
|---|---|---|---|
| **54** | **MANAGE, MONITOR AND SUPERVISE PROJECT** | **5/2/97** | **4/30/02** |
| **55** | Conduct RE Steering Committee oversignt | 5/2/97 | 4/30/02 |
| **56** | Operate PSG services | 5/16/97 | 10/31/01 |
| **57** | Conduct IBRD supervision missions | 10/16/97 | 6/30/01 |
| **58** | Conduct Mid-term Review | 1/1/99 | 6/30/99 |
| **59** | Complete the Project and issue Project Completion Report | 10/31/01 | 12/31/01 |
| **60** | Close the Project | 4/1/02 | 4/30/02 |



**INDONESIA**

**SOLAR HOME SYSTEMS PROJECT**

**Terms of Reference for Mid-term Review Panel**

1. **Scope of Work** The independent panel's mandate is to use its professional experience and judgment to consider the following question:

> *Is there any scenario that could be implemented successfully under which the SHS Project's target of attaining total sales of 200,00 SHS units over the life of the Project could be attained ?*

While there may be one or more scenarios under which the target of 200,000 units would not be met, this question relates on the existence of one or more successfully implementable scenarios under which the target could be met, because the intent would be to focus implementation on the scenarios under which the target would be met. Hence, a positive answer to the above question would be the basis for the release of Phase 2 of the GEF grant. In the event that the panel concludes that there is no successfully implementable scenario under which the target of 200,000 units could be met, the panel would provide its judgment of the maximum unit sales that could occur over the life of the SHS Project.

In formulating its judgment, the panel would take account of:

- **Sales** as measured by (a) the extent to which the Project's mid-term targets for sales of SHS units have been met and (b) the short-term trend of SHS sales under the Project;

- **Customer satisfaction** as measured by (a) customer timely loan repayment rates, which is an indicator of the customers' satisfaction with their units, and (b) the extent to which customer complaints about problems with their SHS have been received by the PSG, and the manner in which these complaints have been resolved;

- **Dealers' progress** as measured by (a) the extent to which the dealers have established their creditworthiness, as measured by their timely loan repayment rates to the banks; and (b) the future business plans of the participating dealers; and

- **Future changes** or corrective actions that would facilitate the successful implementation of the SHS Project.

2. **Panel composition** The independent panel will consist of six members, as follows:

- Three experts to be nominated by BPPT, acceptable to the Bank, one of whom will be an Indonesian, while the remaining two will be from other countries. One of these two international experts will be designated as the Chair of the mid-term review panel, and will be responsible for co-ordinating the activities of the panel. These experts will have a minimum of five years, preferably ten, of experience on the use of solar PV systems in the developing countries. The combined expertise of these experts would span areas such as rural finance, market and enterprise development, solar PV economics, and solar PV technology.

- Three experts to be nominated by the GEF Implementing Agencies, one each by UNDP and UNEP, and the World Bank. (Within the World Bank, ENVGC would nominate the expert to participate in the mid-term review panel).

3. **Information sources available to the panel** Prior to starting its work in Indonesia, the panel would be provided with a progress report prepared by the PSG, which would focus on the central question stated above. The panel will have full access to all the information available to the PSG. In addition, the panel will be able to, at its option: (i) undertake field visits to the Project areas to inspect SHS installations and meet with the customers, (ii) meet with the participating dealers and banks, (iii) visit the dealers' head offices; and (iv) meet the concerned officials at BPPT and MME.

4. **Panel's Activities and Processing of Mid-Term Report** The panel would visit Indonesia for around ten days, about 24 months after loan effectiveness. The panel would discuss its major findings with the Rural Electrification Steering Committee (RESC) prior to its departure from Indonesia, and later submit its report to the RESC. Following this, the Government of Indonesia would submit its report to the World Bank, with the panel's report included as an attachment. In turn, the World Bank would submit its report to the GEF CEO, with GOI's report included as an attachment. Finally, the GEF CEO would make a decision about the release of Phase 2 grant funds. The schedule of activities is shown below.

| Activity | Date |
|---|---|
| 1. Identification of Panel Members and Chair | By end February, 1999 |
| 2. Preparation of PSG's Report on Project | By end April, 1999 |
| 3. Panel visit to Indonesia | May-June 1999 |
| 4. Submission of Panel's Report to GOI | By end June 1999 |
| 5. Submission of GOI Report to World Bank | By end July 1999 |
| 6. Submission of World Bank Report to GEF CEO | By end August 1999 |
| 7. GEF CEO's Decision on Release of Phase 2 Funds | By end September 1999 |

Assumes a loan effectiveness date of May 1, 1997.

5. **Costs of the panel's activities** The relevant costs -- compensation, international and local travel and subsistence, and other incidental expenses -- of the three experts nominated by BPPT would be borne by the PSG. For the other three experts, only the travel and subsistence costs would be borne by the PSG, with all other costs to be borne by their nominating agencies. The total PSG expenditure on the panel's activities is expected to be about $ 75,000.

Annex 3.13

# INDONESIA
# SOLAR HOME SYSTEMS PROJECT

## Supervision Activities and Schedule *

| Approximate Dates/ Duration | Activity - Major Focus | Skills Needed | Staff Weeks |
|---|---|---|---|
| 10/97<br>2 weeks | Performance and allocation of grants to dealers. Arrangements for PSG, credit and grant disbursements, technology certification, consumer information, dealer support, audits, monitoring and reporting. Bid documents for capacity building activities. Site visits Lampung, W. Java. | EC, ED, PV | 6 |
| 2/98<br>2 weeks | Review PSG's annual report and Project's next year's plan. Disbursement procedures. Certification, consumer information, dealer support and audit activities. Site visits Sulawesi as well as another area relevant for strategy study.. | EC, ED, PV | 6 |
| 5/98<br>2 weeks | Performance of dealers. Site visits Sulawesi, Lampung. | EC, ED, PV | 6 |
| 10/98<br>2 weeks | Performance and allocations of grants to dealers. Site visits W. Java BPPT equipment purchases. | EC, ED, PV | 6 |
| 2/99<br>2 weeks | Performance of dealers. Project's eligible market areas. Site visits Lampung, as well as another area relevant for strategy study. Equipment purchases and BPPT training. Review PSG's annual report and Project's next year's plan and mid-term review arrangements. | EC, ED, PV | 6 |
| 5/99<br>3 weeks | Mid-term review. Site visits to all areas.. Decentralized rural electrification plan. BPPT training. | EC, ED, PV | 6 |
| 10/99<br>2 weeks | Performance and allocations of grants to dealers. Site visits W. Java. BPPT training and ISO certification. | EC, ED, PV | 4 |
| 5/00<br>2 weeks | Review PSG's annual report and Project's next year's plan. Review Project's eligible market areas. Performance of dealers. Site visits Lampung. | EC, ED, PV | 4 |
| 10/00<br>2 weeks | Performance and allocations of grants to the dealers. Site visits Sulawesi. BPPT ISO certification activities. | EC, ED, PV | 4 |
| 5/01<br>2 weeks | Review PSG's annual report and Project's plan Allocations of grants to dealers. Site visits Lampung. ISO certification for BPPT. | EC, ED, PV | 4 |
| 10/01<br>3 weeks | Implementation Completion Report (ICR) | EC, ED, PV | 6 |
| **Total** | | | **58** |

In addition, it is anticipated that 13 SW of time for ongoing supervision from RSI (on disbursement and audits) would be required as follows: FY 97 - 3 SW, FY 98 - 4 SW, FY 99 - 3 SW, FY 00 - 1 SW, and FY 01 - 2 SW

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EC - Economist; Enterprise and Market Development Specialist; PV - Solar PV Specialist

* Assumes loan effectiveness date of May 1, 1997, project completion date of October 31, 2001, and loan closing date of April 30, 2002.

## INDONESIA

## SOLAR HOME SYSTEMS PROJECT

### Comparison of Solar PV and Conventional Rural Electrification Costs

1. This annex compares the costs of Solar Home Systems (SHS) to the costs of provision of conventional electricity supply, whether by grid extension or decentralized diesel generation. In general, solar PV has an advantage over conventional electrification when:

(i) **There is no existing power grid**. The cost savings of not having to build an expensive grid, particularly for communities with widely separated houses, make solar PV competitive with conventional electrification.

(ii) **Access to land is a problem**. Solar PV does not require land for equipment or right-of-way for transmission and/or distribution lines.

(iii) **Diesel fuel is costly** and/or reliable transportation for fuel is unavailable or costly. Solar PV requires no fuel.

(iv) **There is a high peak load for a short time.** Individual solar PV systems, operating from batteries, can provide very high power levels for a short period of time; for example, an individual PV system with 100 Watt-peak ($W_p$) panel capacity can power a movie projector drawing 1,500 Watts for a few hours per week since the battery has been accumulating power for a week before power is withdrawn. In contrast, a conventional system must be sized to generate and distribute the full 1,500 Watts even though it is only used a few hours at a time.

(v) **The number of customers is likely to increase over time.** Solar PV systems are modular, and individual solar PV systems can be added as needed, while conventional systems usually have to be sized larger than initially necessary in anticipation of future load growth.

(vi) **Noise or air pollution is a concern.** Solar PV does not create either, while conventional systems generate both.

(vii) **Qualified maintenance workers are not readily available.** Training for solar maintenance is less complex, lower in cost and is more likely to succeed than training for diesel system maintenance when rural persons with limited formal education are involved.

2. The cost comparisons in this annex are based on lifetime economic costs. The assumptions underlying the cost comparison are presented in Tables 1 and 2. Two characteristics of the assumptions related to the SHS costs are worth noting: (i) the SHS costs are based on the relatively high costs prevailing at present, and do not reflect the cost declines that are expected to take place in the future, and (ii) the SHS costs includes the initial as well as replacement costs of the lights and light fixtures, though such costs are excluded from the lifetime costs of conventional electrification.

**Table 1: SHS Cost Assumptions**

| | Java | Outside Java |
|---|---|---|
| Initial System Costs | $636 | $750 |
| Present Value of Replacements (Batteries, Controllers, Lights, O&M, etc.) | $304 | $309 |
| Present Value Total | $940 | $1,059 |
| **Equivalent Levelized Monthly Cost at 10% over 15 years** | **$10.10** | **$11.38** |

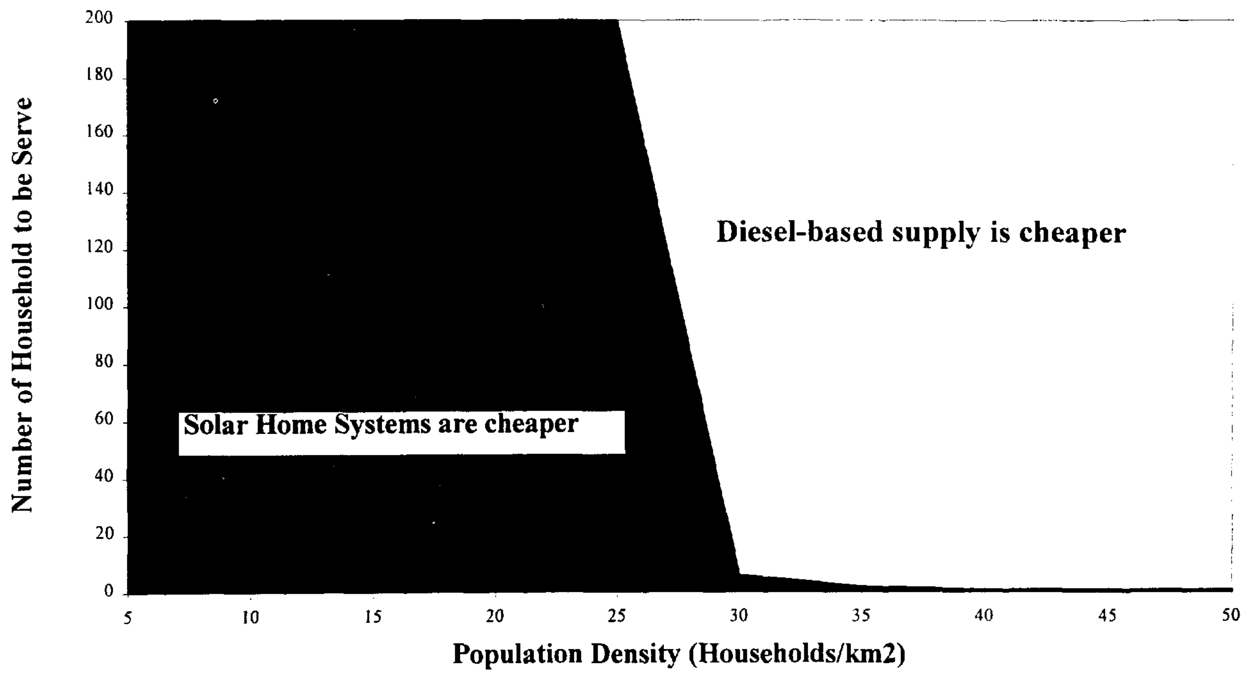
**Table 2: Conventional Rural Electrification Cost and Need Assumptions**

| | Java | Outside Java | |
|---|---|---|---|
| | Grid Extension | Grid Extension | Decentralized Diesel |
| **GENERATION COST (¢/kWh)** | 10.8 | 12.7 | 20 |
| **NETWORK COSTS AND NEEDS** | | | |
| **MV Line** | | | |
| Cost ($/kmc) | 10,000 | 10,000 | N.A. |
| Length Needed (km) | 3 | 3 | N.A. |
| Life (years) | 25 | 25 | N.A. |
| **LV Line** | | | |
| Cost ($/kmc) | 5,000 | 5,000 | 5,000 |
| Length needed ($km/km^2$) | 5 | 5 | 5 |
| Life (years) | 25 | 25 | 25 |
| **Distribution Transformer** | | | |
| Cost ($/kVA) | 40 | 40 | 40 |
| Life (years) | 15 | 15 | 15 |
| Need (kW/household) | 0.09 | 0.09 | 0.09 |
| Power Factor | 0.80 | 0.80 | 0.80 |
| Minimum Size (kVA) | 10 | 10 | 10 |
| **HOUSEHOLD USE (kWh/month)** | 15 | 15 | 15 |

3. The results of the cost comparisons are presented in the form of charts that show the combination of (i) number of households to be served, and (ii) the population density under which SHS are cheaper than conventional rural electrification options -- isolated diesel generator operations and grid extension; Figures 1 and 2 show the cost comparisons for outside Java for isolated diesel systems and grid extension, respectively, while Figure 3 shows the comparison for Java for grid extension.

4. Two qualitative results arise from this comparison. First, the population density, measured in this analysis as the number of households per sq. km., is a critical factor, as it represents the geographical density of the load to be served. Essentially, if the load density is low, i.e., the load is dispersed, then the costs of grid extension tend to be higher than that of SHS. Second, if the number of consumers to be served is small, then even a 3 km MV extension makes grid supply more expensive than SHS.

**Figure 1: Cost Comparison Outside Java**
**Decentralized Diesel-based Electrification and Solar Home Systems**




5. In quantitative terms, SHS are less expensive than grid supplies when household density is less than approximately 30 households/sq. km., which represents a population density of between 120-150 persons/sq. km in Indonesia, where household size is in the range of 4-5 persons. Further, if the number of households to be served in a particular cluster is less than 50, then even a 3 km MV extension is more expensive than SHS, regardless of population density.

6. These conditions prevail both outside Java, where overall populations densities are in the range of 30-60 persons/sq. km, as well as in the less dense parts of Java, where overall population density is about 600 persons/sq. km. Further, in Indonesia, villages ("desas") are frequently large in geographic terms, and consist of a number of "dusun", each of which in turn consists of a number of "kampungs," which are clusters of 20+ households. Thus, even within an electrified desa, there could remain still remain a significant number of households for whom SHS would be less expensive than grid supply with MV line extension.

7. **Sensitivity analysis** For grid supply, it is assumed that the household's monthly energy consumption is 15 kWh/month, given that the service provided by the SHS is roughly equivalent to this level of service. However, it is recognized that the actual energy consumption of the typical remote household connected to PLN's supply is about 35 kWh/month. In order to test the robustness of the least-cost comparison, the analysis was repeated with monthly consumption set at 35 kWh/month in place of 15 kWh/month; correspondingly, the assumed monthly SHS cost was doubled from the values shown in Table 1. As expected, the increase in the load density increased the relative attractiveness of grid supply but did not change the fundamental nature of the result that SHS are cheaper than grid extension in conditions of low load density and small number of households to be served.

**Figure 2: Outside Java Grid Extension and Solar Home Systems**

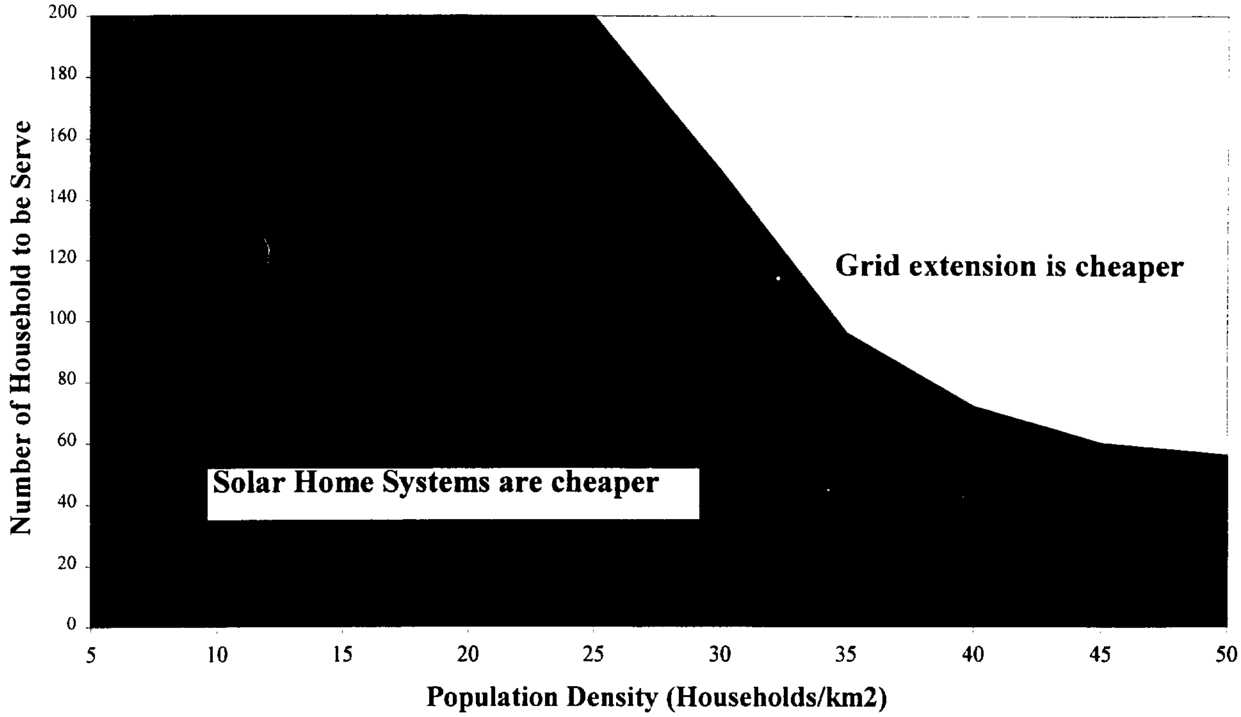
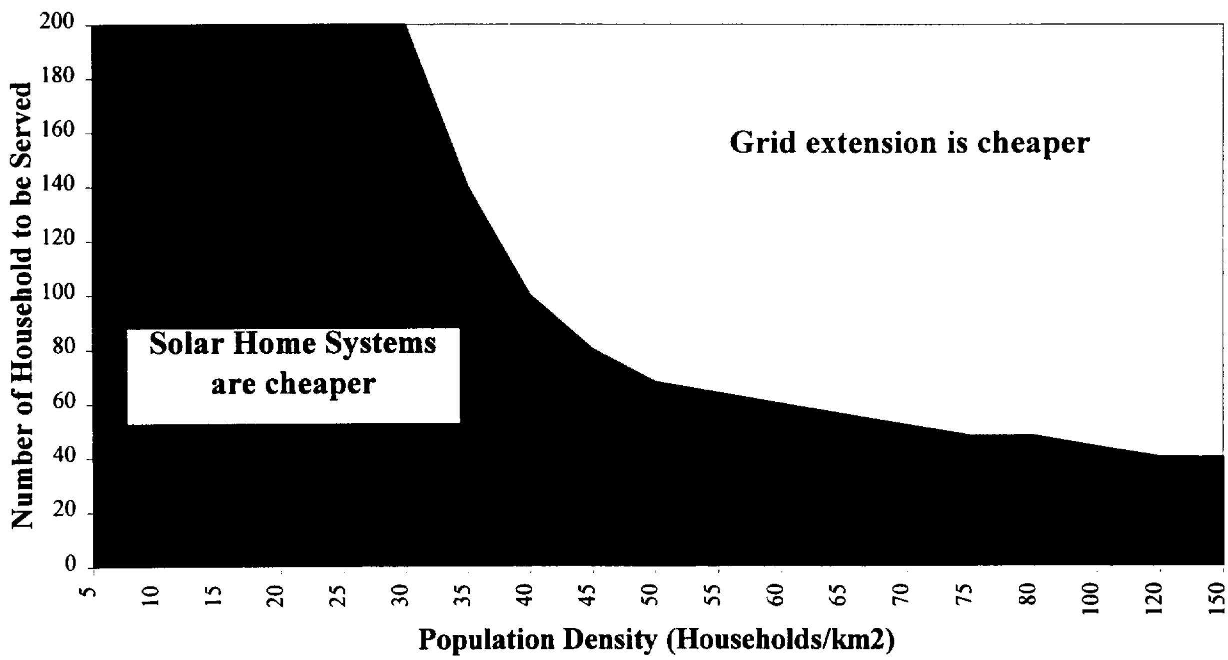



**Figure 3: Java-Bali Grid Extension and Solar Home Systems**



# INDONESIA

# SOLAR HOME SYSTEMS PROJECT

## Economic Cost Benefit Analysis

| | COSTS (US$ mill) | | | | BENEFITS (US$ mill) | | | | | | | NET BENEFITS ) (US$ mill) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL | Consumer Expenditures | | | | | GEF | TOTAL | Including | Excluding |
| Year | Investment Costs | Replacement Costs | O&M Costs | COSTS | Down Payments | Monthly Payments | Replacement Expenditures | O&M Expenditures | Consumer Subtotal | Investment Grant | BENEFITS | GEF Grant | GEF Grant |
| 1 | 6.07 | 0.00 | 0.03 | 6.09 | 0.81 | 1.19 | 0.00 | 0.03 | 2.03 | 0.83 | 2.85 | -3.24 | -4.07 |
| 2 | 12.45 | 0.02 | 0.11 | 12.57 | 2.36 | 4.15 | 0.02 | 0.11 | 6.64 | 2.45 | 9.09 | -3.49 | -5.94 |
| 3 | 23.25 | 0.07 | 0.26 | 23.58 | 4.38 | 9.70 | 0.07 | 0.26 | 14.40 | 5.00 | 19.40 | -4.17 | -9.17 |
| 4 | 27.18 | 0.51 | 0.44 | 28.13 | 5.35 | 16.29 | 0.51 | 0.44 | 22.59 | 6.13 | 28.71 | 0.58 | -5.54 |
| 5 | 23.15 | 1.28 | 0.60 | 25.03 | 4.63 | 20.77 | 1.28 | 0.60 | 27.28 | 5.60 | 32.88 | 7.85 | 2.25 |
| 6 | 0.00 | 2.84 | 0.60 | 3.44 | | 17.81 | 2.84 | 0.60 | 21.25 | 0.00 | 21.25 | 17.81 | 17.81 |
| 7 | 0.00 | 4.62 | 0.60 | 5.22 | | 12.26 | 4.62 | 0.60 | 17.48 | 0.00 | 17.48 | 12.26 | 12.26 |
| 8 | 0.00 | 6.44 | 0.60 | 7.04 | | 5.67 | 6.44 | 0.60 | 12.71 | 0.00 | 12.71 | 5.67 | 5.67 |
| 9 | 0.00 | 5.96 | 0.60 | 6.56 | | | 5.96 | 0.60 | 6.56 | 0.00 | 6.56 | 0.00 | 0.00 |
| 10 | 0.00 | 6.30 | 0.60 | 6.90 | | | 6.30 | 0.60 | 6.90 | 0.00 | 6.90 | 0.00 | 0.00 |
| 11 | 0.00 | 3.98 | 0.60 | 4.58 | | | 3.98 | 0.60 | 4.58 | 0.00 | 4.58 | 0.00 | 0.00 |
| 12 | 0.00 | 3.86 | 0.60 | 4.46 | | | 3.86 | 0.60 | 4.46 | 0.00 | 4.46 | 0.00 | 0.00 |
| 13 | 0.00 | 6.06 | 0.60 | 6.66 | | | 6.06 | 0.60 | 6.66 | 0.00 | 6.66 | 0.00 | 0.00 |
| 14 | 0.00 | 7.10 | 0.60 | 7.70 | | | 7.10 | 0.60 | 7.70 | 0.00 | 7.70 | 0.00 | 0.00 |
| 15 | 0.00 | 5.54 | 0.60 | 6.14 | | | 5.54 | 0.60 | 6.14 | 0.00 | 6.14 | 0.00 | 0.00 |
| 16 | 0.00 | 2.70 | 0.57 | 3.27 | | | 2.70 | 0.57 | 3.27 | 0.00 | 3.27 | 0.00 | 0.00 |
| 17 | 0.00 | 2.38 | 0.50 | 2.88 | | | 2.38 | 0.50 | 2.88 | 0.00 | 2.88 | 0.00 | 0.00 |
| 18 | 0.00 | 0.23 | 0.35 | 0.58 | | | 0.23 | 0.35 | 0.58 | 0.00 | 0.58 | 0.00 | 0.00 |
| 19 | 0.00 | 0.11 | 0.16 | 0.27 | | | 0.11 | 0.16 | 0.27 | 0.00 | 0.27 | 0.00 | 0.00 |
| PV at 10% | $66.21 | $21.84 | $3.57 | $91.62 | $12.50 | $54.81 | $21.84 | $3.57 | $92.73 | $14.19 | $106.92 | $15.30 | $1.10 |
| **IERR** | | | | | | | | | | | | **39%** | **12%** |

M:\SHS-SAR\BUFF\ANNEXES\ANX4-2BF.XLS Tab:Base-ecanal

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

### Sensitivity Analysis -- Actual Sales are 80% of Target Sales

| | COSTS (US$ mill) | | | | BENEFITS (US$ mill) | | | | | | | NET BENEFITS ) (US$ mill) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL | Consumer Expenditures | | | | | GEF | TOTAL | Including | Excluding |
| Year | Investment Costs | Replacement Costs | O&M Costs | COSTS | Down Payments | Monthly Payments | Replacement Expenditures | O&M Expenditures | Consumer Subtotal | Investment Grant | BENEFITS | GEF Grant | GEF Grant |
| 1 | 4.85 | 0.00 | 0.02 | 4.87 | 0.67 | 0.98 | 0.00 | 0.02 | 1.67 | 0.66 | 2.33 | -2.55 | -3.21 |
| 2 | 10.59 | 0.01 | 0.08 | 10.69 | 1.95 | 3.42 | 0.01 | 0.08 | 5.47 | 1.96 | 7.43 | -3.26 | -5.22 |
| 3 | 19.97 | 0.06 | 0.20 | 20.23 | 3.61 | 8.00 | 0.06 | 0.20 | 11.86 | 4.00 | 15.86 | -4.37 | -8.37 |
| 4 | 23.56 | 0.42 | 0.35 | 24.33 | 4.41 | 13.43 | 0.42 | 0.35 | 18.60 | 4.90 | 23.50 | -0.83 | -5.73 |
| 5 | 20.29 | 1.06 | 0.48 | 21.82 | 3.82 | 17.12 | 1.06 | 0.48 | 22.47 | 4.48 | 26.95 | 5.13 | 0.65 |
| 6 | 0.00 | 2.34 | 0.48 | 2.82 | | 14.68 | 2.34 | 0.48 | 17.50 | 0.00 | 17.50 | 14.68 | 14.68 |
| 7 | 0.00 | 3.81 | 0.48 | 4.29 | | 10.10 | 3.81 | 0.48 | 14.39 | 0.00 | 14.39 | 10.10 | 10.10 |
| 8 | 0.00 | 5.31 | 0.48 | 5.79 | | 4.67 | 5.31 | 0.48 | 10.46 | 0.00 | 10.46 | 4.67 | 4.67 |
| 9 | 0.00 | 4.91 | 0.48 | 5.39 | | | 4.91 | 0.48 | 5.39 | 0.00 | 5.39 | 0.00 | 0.00 |
| 10 | 0.00 | 5.19 | 0.48 | 5.67 | | | 5.19 | 0.48 | 5.67 | 0.00 | 5.67 | 0.00 | 0.00 |
| 11 | 0.00 | 3.28 | 0.48 | 3.76 | | | 3.28 | 0.48 | 3.76 | 0.00 | 3.76 | 0.00 | 0.00 |
| 12 | 0.00 | 3.18 | 0.48 | 3.66 | | | 3.18 | 0.48 | 3.66 | 0.00 | 3.66 | 0.00 | 0.00 |
| 13 | 0.00 | 4.99 | 0.48 | 5.47 | | | 4.99 | 0.48 | 5.47 | 0.00 | 5.47 | 0.00 | 0.00 |
| 14 | 0.00 | 5.85 | 0.48 | 6.33 | | | 5.85 | 0.48 | 6.33 | 0.00 | 6.33 | 0.00 | 0.00 |
| 15 | 0.00 | 4.57 | 0.48 | 5.05 | | | 4.57 | 0.48 | 5.05 | 0.00 | 5.05 | 0.00 | 0.00 |
| 16 | 0.00 | 2.23 | 0.46 | 2.68 | | | 2.23 | 0.46 | 2.68 | 0.00 | 2.68 | 0.00 | 0.00 |
| 17 | 0.00 | 1.96 | 0.40 | 2.36 | | | 1.96 | 0.40 | 2.36 | 0.00 | 2.36 | 0.00 | 0.00 |
| 18 | 0.00 | 0.19 | 0.28 | 0.47 | | | 0.19 | 0.28 | 0.47 | 0.00 | 0.47 | 0.00 | 0.00 |
| 19 | 0.00 | 0.09 | 0.13 | 0.22 | | | 0.09 | 0.13 | 0.22 | 0.00 | 0.22 | 0.00 | 0.00 |
| PV at 10% | $56.85 | $18.00 | $2.86 | $77.71 | $10.30 | $45.18 | $18.00 | $2.86 | $76.34 | $11.35 | $87.70 | $9.98 | ($1.37) |
| **IERR** | | | | | | | | | | | | **32%** | **8%** |

Key Assumptions

First, It is assumed that under this scenario (Scenario A) the cost reductions achieved are only 85% of the cost reductions achieved in the base case.
Thus, the Scenario A SHS unit costs are higher than the base case SHS unit costs.
The assumed value of the Scenario A cost reductions reflects the notion that the a significant portion of the cost reductions along a learning curve take place at lower quantities, where the learning curve is relatively steep, so that an achievement of 80% of the sales target would lead to cost reductions of proportionately more than 80%.

Second, It is assumed that under Scenario A, the dealers would increase the customers' down payments and installment payments to reflect the higher costs.
Thus, the Scenario A prices would be higher than the base case prices.
It is assumed that the dealers would absorb the bulk of the higher costs in the form of lower profit margins; specifically, it is assumed that the dealers would absorb 60% of the higher costs under Scenario A.

# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

### Switching Value Analysis

**Switching Value Failure Rate of SHS Units 19%**

| Year | COSTS (US$ mill) Investment Costs | Replacement Costs | O&M Costs | TOTAL COSTS | Down Payments | Monthly Payments | Replacement Expenditures | O&M Expenditures | Consumer Subtotal | GEF Global Benefits | TOTAL BENEFITS AFTER REDUCTION /a | NET BENEFITS (US$ mill) Including GEF Grant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.07 | 0.00 | 0.02 | 6.09 | 0.66 | 0.97 | 0.00 | 0.02 | 1.64 | 0.67 | 2.32 | -3.77 |
| 2 | 12.45 | 0.01 | 0.09 | 12.55 | 1.92 | 3.37 | 0.01 | 0.09 | 5.39 | 1.99 | 7.38 | -5.17 |
| 3 | 23.25 | 0.06 | 0.21 | 23.51 | 3.55 | 7.88 | 0.06 | 0.21 | 11.70 | 4.06 | 15.76 | -7.75 |
| 4 | 27.18 | 0.42 | 0.36 | 27.95 | 4.34 | 13.23 | 0.42 | 0.36 | 18.35 | 4.98 | 23.32 | -4.62 |
| 5 | 23.15 | 1.04 | 0.49 | 24.68 | 3.76 | 16.87 | 1.04 | 0.49 | 22.16 | 4.55 | 26.71 | 2.03 |
| 6 | 0.00 | 2.31 | 0.49 | 2.79 | | 14.47 | 2.31 | 0.49 | 17.26 | 0.00 | 17.26 | 14.47 |
| 7 | 0.00 | 3.75 | 0.49 | 4.24 | | 9.96 | 3.75 | 0.49 | 14.20 | 0.00 | 14.20 | 9.96 |
| 8 | 0.00 | 5.23 | 0.49 | 5.72 | | 4.61 | 5.23 | 0.49 | 10.32 | 0.00 | 10.32 | 4.61 |
| 9 | 0.00 | 4.84 | 0.49 | 5.33 | | | 4.84 | 0.49 | 5.33 | 0.00 | 5.33 | 0.00 |
| 10 | 0.00 | 5.12 | 0.49 | 5.61 | | | 5.12 | 0.49 | 5.61 | 0.00 | 5.61 | 0.00 |
| 11 | 0.00 | 3.23 | 0.49 | 3.72 | | | 3.23 | 0.49 | 3.72 | 0.00 | 3.72 | 0.00 |
| 12 | 0.00 | 3.14 | 0.49 | 3.62 | | | 3.14 | 0.49 | 3.62 | 0.00 | 3.62 | 0.00 |
| 13 | 0.00 | 4.92 | 0.49 | 5.41 | | | 4.92 | 0.49 | 5.41 | 0.00 | 5.41 | 0.00 |
| 14 | 0.00 | 5.77 | 0.49 | 6.26 | | | 5.77 | 0.49 | 6.26 | 0.00 | 6.26 | 0.00 |
| 15 | 0.00 | 4.50 | 0.49 | 4.99 | | | 4.50 | 0.49 | 4.99 | 0.00 | 4.99 | 0.00 |
| 16 | 0.00 | 2.19 | 0.47 | 2.66 | | | 2.19 | 0.47 | 2.66 | 0.00 | 2.66 | 0.00 |
| 17 | 0.00 | 1.93 | 0.40 | 2.34 | | | 1.93 | 0.40 | 2.34 | 0.00 | 2.34 | 0.00 |
| 18 | 0.00 | 0.19 | 0.28 | 0.47 | | | 0.19 | 0.28 | 0.47 | 0.00 | 0.47 | 0.00 |
| 19 | 0.00 | 0.09 | 0.13 | 0.22 | | | 0.09 | 0.13 | 0.22 | 0.00 | 0.22 | 0.00 |
| PV at 10% | $66.21 | $17.74 | $2.90 | $86.85 | $10.15 | $44.53 | $17.74 | $2.90 | $75.33 | $11.53 | $86.85 | $0.00 |
| **IERR** | | | | | | | | | | | | **10%** |

/a It is assumed that failed units provide no benefits at all.

Annex 5.1

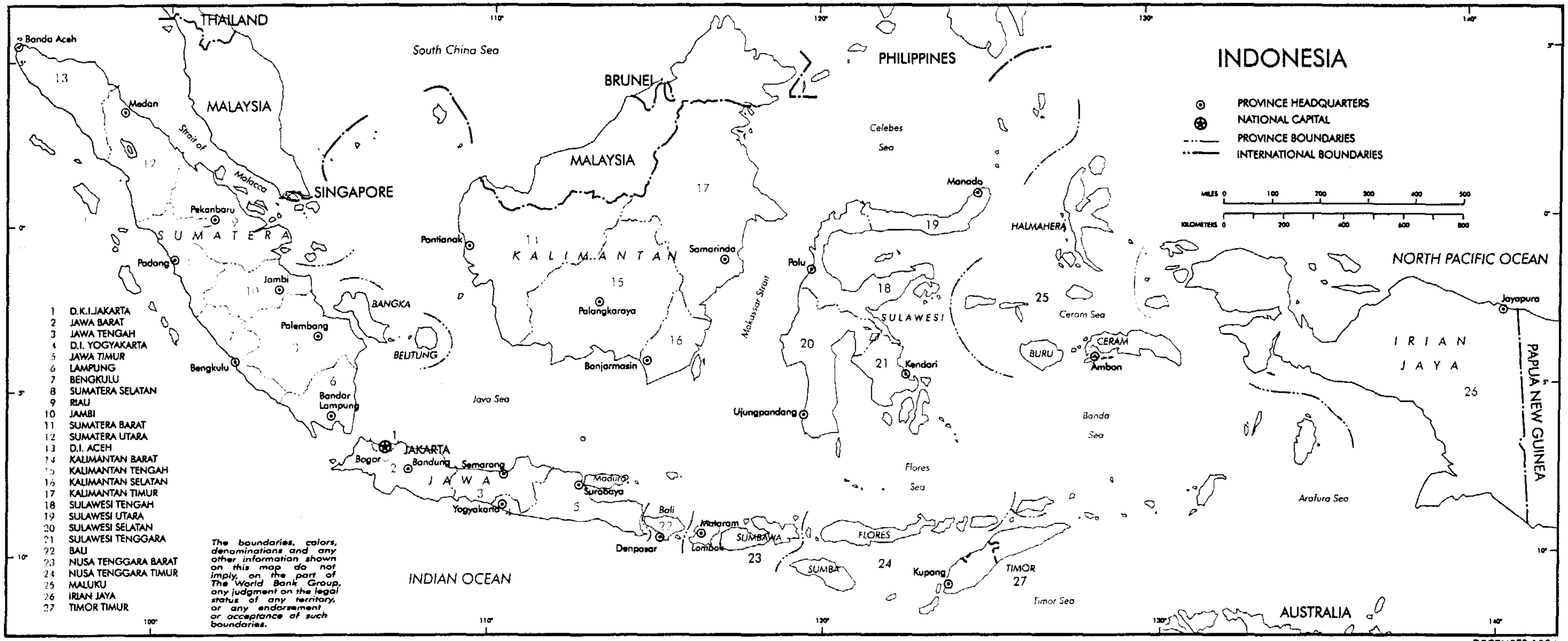
# INDONESIA

## SOLAR HOME SYSTEMS PROJECT

**Selected Documents in the Project File**

1. Project Implementation Plan (PIP)
2. Market Survey Study

IBRD 26570




DECEMBER 1994

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