International Survey of Low-Income and Rural Development Programs for the Electricity Sector

For the Development of the Indonesian Social Electricity Development Fund

Policy Paper

Prepared by:
The Regulatory Assistance Project
Mercados Energéticos, S.A.

In cooperation with:
Institute of International Education
Electricity Sector Restructuring Activities Group

Prepared for:
The Directorate General of Electricity and Energy Utilization

Ministry of Energy and Mineral Resources

Government of Indonesia

IIE/ERAG

DGEEU

Sponsored by:
The United States Agency for International Development
Jakarta, Indonesia

9 July 2002

International Survey of Low-Income and Rural Development Programs for the Electricity Sector

For the Development of the Indonesian Social Electricity Development Fund

Policy Paper

Prepared by:
The Regulatory Assistance Project
177 Water St., Gardiner, Maine, USA 04345
Telephone: (207) 582-1135

– And –
Mercados Energéticos, S.A.
Leandro N. Alem 584, Piso 11
(C1001AAN) Buenos Aires, ArgentinaTelephone: (54-11) 4314-4799

In cooperation with:
Institute of International Education, Electricity Sector Restructuring Activities Group
Suite 1005, ASPAC Building, Jl. H.R. Rasuna Said Blok X-2 Kav. 4, Jakarta,
Indonesia 12950
Telephone: (62-21) 522-8781

Prepared for:
The Directorate General of Electricity and Energy Utilization
Jl. H.R. Rasuna Said Blok X-2 Kav. 07-08 Kuningan, Jakarta, Indonesia 12950
Telephone: (62-21) 522-5180

– And –

The United States Agency for International Development, American Embassy Jakarta
Jl. Medan Merdeka Selatan 3-5, Jakarta Pusat, Indonesia 10110
Telephone: (62-21) 3435-9000

Pursuant to:
USAID Task Order No. OUT-LAG-I-804-98-00012-00

Contact:
Jim Lazar, Consulting Economist, Regulatory Assistance Project
Henry Yoshimura, Chief of Party, IIE-ERAG

9 July 2002

Low-Income and Rural Development Policy

Directorate General of Electricity and Energy Utilization
MINISTRY OF ENERGY AND MINERAL RESOURCES OF REPUBLIC OF INDONESIA

TABLE OF CONTENTS

1. INTRODUCTION

1. Electricity is a vital ingredient for both economic and social development. Making electricity available to low-income and rural households at an affordable price can transform the lives of the people and improve the prospects of the nation's children.

2. The Government of Indonesia has given the power sector very high priority in development plans, and PLN today provides electric service at very low prices to the majority of the population of Indonesia. However, the power sector is in a state of crisis at the present time, with insufficient investment capital available to fund expansion, and with prices significantly below the marginal cost of adding power supplies. This is both constraining economic development and placing at risk the provision of low-cost service to meet the essential needs of low-income and rural households.

3. The purpose of this Policy Paper is to explain the Government's approach to supporting continued electricity assistance to low-income households and to expanding the reach of electric service into currently un-served areas. The foundation of this approach is to dedicate the limited amount of low-cost power produced at Government-owned hydroelectric facilities to meet the essential needs of low-income households, and as a source of funding to finance continued expansion of electricity service into unserved areas.

4. First, this paper provides some background on the historical approach to these issues in Indonesia, and to define the scope of the problem that this policy addresses. Second, this paper quantifies how hydroelectric resources can serve as the foundation of future low-income assistance and electrification assistance. Third, this paper addresses the creation and operation of the Social Electricity Development Fund (SEDF) as defined in the Draft Law of the Republic of Indonesia Concerning Electric Power (Draft Electricity Law). Fourth, this paper discusses how this approach can work equally well regardless of the structure of the power sector in the future – whether that structure continues to be a government-owned, vertically-integrated monopoly to an open-access multi-buyer, multi-seller structure. Finally, this paper discusses implementation steps toward achieving these goals over the years following passage of the Draft Electricity Law.

2. BACKGROUND

5. Indonesia has provided below-cost electric service to meet the needs of residential and other consumers, and funded system expansions into unserved areas for many years. Much of this has been achieved through direct appropriation of Governmental funds, a situation that is no longer desirable or sustainable given current economic conditions.

2.1. Historical Funding of Energy Assistance

6. Historically, PLN has included the costs of energy assistance in its budget, and the budget shortfall has been met through Governmental appropriations. These appropriations have come principally from the Government's general revenue sources instead of revenues from electricity sales.

7. In the current economic environment, it is unlikely that this can or will continue. Because PLN's total costs exceed revenue from sales of electricity, it is unable to raise capital and cannot attract new Independent Power Producers (IPPs). Further, the Government of Indonesia is unable and/or unwilling to guarantee PLN's debt service and contractual obligations because of the increasing debt burden on the Central Government's balance sheet. Additionally, Government subsidies to PLN take funds away from other essential Government services such as public health and education. Further, the under-pricing of electricity service has contributed to the inefficient use of electricity. Given this situation, the primary objective of this policy paper is to establish a durable form of support for essential electricity services in the face of potential major changes in the form, organization, and funding of the energy sector.

2.2. Anticipated Changes in the Energy Sector

8. The Draft Electricity Law anticipates a number of fundamental changes in the energy sector. These include at least converting the Java/Bali operations of PLN from a Government-funded public entity to a self-funding commercial enterprise. It further anticipates additional changes over time, such as the potential separation of commercially-viable sections of the PLN system into private ownership, and to permit new entrants into the power sector to engage in wholesale and/or retail energy transactions.

9. The options for preserving low-income electricity and electrification assistance were developed in consideration of the uncertainty regarding the future structure of the electricity industry and how long such reforms would take to implement. Therefore, it is necessary to set forth an approach that will assure the continuation of vital energy services regardless of the future of power sector reform.

2.3. Options Considered For Funding Energy Assistance

10. In developing this policy paper, many alternatives were considered, and a very large number of international examples were examined. A Final Research Report was prepared in February 2002[1], and a Draft Policy Report was prepared in April 2002. A multi-agency educational forum was held in early May 2002, which was attended by the DGEEU, PLN, and other Government agencies. Additionally, public forum was also held in May 2002, with representation from consumer and low-income advocates, from private sector power suppliers, and other interested parties

11. The principal options considered, in addition to the proposed policy of dedicating the low-cost hydroelectric power sources to fulfill the objectives of the SEDF, included the following:

- Low-Income and Rural Energy Efficiency Assistance
- Discounted Rate Programs
- Bill Payment Assistance Programs
- Creation of a Universal Service Fund
- Creation of a Rural Electrification Administration
- Continued Cost-Averaging Across Different Sections of the Utility System

[1] International Survey of Low-Income and Rural Development Programs for the Electricity Sector, prepared by Regulatory Assistance Project in cooperation with the Institute of International Education, February 2002.

12. Each of these options may have value and should be included in the total package of energy sector reform in order to provide low-income and electrification assistance. However, the principal policy discussed herein deals with the manner in which the existing Government investment in hydroelectric resources can provide a foundation for sustained and long-term assistance to needy populations and regions.

3. USING LOW-COST GOVERNMENT-OWNED RESOURCES AS THE FOUNDATION OF ENERGY ASSISTANCE

13. The principal policy to provide continued assurance that low-income households will be able to obtain affordable electrical energy to meet their essential needs will be to dedicate the available supply of low-cost hydroelectric generating resources to meet these essential needs. Because the available supply of low-cost hydroelectric energy exceeds the essential needs level of consumption for low-income households at the present time, this pool of resources also provides a source of funding for continued expansion of electric service into currently un-served areas.

14. The current output from hydroelectric facilities provides approximately 9 - 10 billion kWh per year into the PLN system (dependent upon precipitation levels), at an average cost of Rp. 76 per kWh, consisting of approximately Rp. 35 per kWh in operating costs, plus approximately Rp. 41 per kWh in debt service costs. This is less than one-third the average cost of generating resources on the PLN system, and about one-fifth of the cost of new fossil-fired or renewable generating resources. This limited supply of very low-cost power creates a unique opportunity for the Government to provide a sustainable source of low-cost electricity to support defined social needs, including the essential usage of low-income consumers and the continued expansion of electric power into un-served areas.

15. It is recognized from the outset that not all of the hydroelectric resources are geographically located in places that can serve all customers. It is also recognized that the seasonal output from hydroelectric resources is not constant – thus, hydroelectric generation may be inadequate at certain times to meet all essential needs in every season. As a practical matter, however, this policy dedicates the ***economic value*** of the hydroelectric resources for the purpose of providing low-income energy assistance and electrification funding assistance. It does not assume that the physical output of specific hydroelectric facilities can be directed to meet specified customer energy demands. The manner in which this economic value is directed to the target purposes is explained in detail in Sections 11 to 14 of this paper.

3.1. Hydroelectric Resources are Unique and Should Remain Publicly Owned

16. Hydroelectric resources are unlike any other form of generation resource, because they use falling water along public rivers as the source of power to generate electricity.

17. These rivers are expected to continue to be publicly-controlled bodies of water. Most of these hydroelectric dams perform multiple functions, such as water supply, flood control, navigation, irrigation, fishing, and recreation. These other functions are essential Governmental responsibilities. Experience in many other countries indicates that transferring dams to private ownership could create conflicts between the private interest in maximizing

profits from electric power production and the public interest associated with these other functions. There are no plans to restructure these other functions, or to transfer them to the private sector at the present time.

18. This expectation that ownership and control of these resources will remain in Government control and ownership regardless of the future form or structure of the power sector creates a unique opportunity. The Government will continue to own and control a very valuable resource that generates low-cost electricity. The Government, therefore, is well situated to dedicate that resource to meeting specific societal needs, which are identified in the Draft Electricity Law.

3.2. The Economic Value of these Resources Match the Social Need for Assistance

19. The amount of low-cost hydroelectric power produced by Government-owned dams happens to be a close match to the long-term need for low-income and electrification assistance. First, each small-use residential consumer would be allocated up to 30 kWh per month of low-cost power. This allocation would not be available to customers with connections greater than 450 VA, on the basis that larger users have more appliances, and, therefore, apparently more income.[2]

20. The table below compares the current supply of low-cost hydroelectric power to the basic, essential needs consumption level of PLN residential consumers. It further calculates the market value (in excess of cost) that could be obtained by selling the portion of hydroelectric output that is NOT currently needed to meet the essential needs of residential consumers at a market price. Since the market value of hydroelectric power exceeds its cost, the net difference between market value and cost can be used to create a fund that can be dedicated to further electrification:

Figure 1
Hydropower Capability Relative to Essential Needs of Low-Income Consumers

	2000 Actual	2002 Estimated
Hydroelectric Production (MWh)	9,109,000	
Cost of Hydroelectric Generation[3]	Rp. 76/kWh	
Number of R-1, 450 VA Consumers		23,000,000
Energy Needed to Provide Block of 30 kWh/Customer[4]		6,900,000 MWh
Available to Support Electrification		2,200,000 MWh
Surplus Value of Excess Energy @ (Rp. 300/kWh value – Rp. 76/kWh cost)		Rp. 500 billion/year

[2] There are a small number of customers connected at higher capacity levels who would prefer to be connected at 450 VA, but were denied this option due to budget constraints in providing 450 VA service. These customers should be permitted to revert to 450 VA service if they desire. We do not think that this would measurably impact the amount of low-cost hydroelectric power required to meet essential needs.

[3] Source: PLN transmittal to IIE/ERAG, May 2002; PLN Statistics 2000; includes debt service plus operating costs.

[4] If a block of 30 kWh is available, not all customers will use the entire allocation in every month. These calculations are based on an assumption that the average usage will be about 25 kWh/customer/month.

3.3. This Policy Works Under Any Form of Utility Sector Reform

21. One unique attribute of this proposal is that it works equally well regardless of the form of utility ownership and regulation, and regardless of whether a single-buyer or a fully competitive, open-access market model is pursued for future administration of electric power in all or any portion of Indonesia. This will be discussed at greater length in Sections 6 to 9 of this paper.

4. DEFINING "LOW INCOME CONSUMERS"

22. The objective of creating the SEDF and the low-income support provisions of the Draft Electricity Law are directed at "low-income" consumers. Many low-income consumers have no electricity service at all, and these are the focus of the electrification provisions of this paper. Among customers who currently have electric service, we will assume that all customers served at the 450 VA connected load level are low-income, and are appropriate targets for this program.

23. Not quite every customer served at 450 VA is a low-income consumer, but all are low-use consumers. Nearly every low-income consumer who has electricity service is served at 450 VA, as this is the lowest cost service offered by PLN. This level of electrical connection permits only the use of a ceiling fan, a few lights, and periodic use of a clothes iron and a television. A customer with extremely efficient fan and only fluorescent lighting might also be able to power a high-efficiency small refrigerator. It is not possible to use electrical appliances associated with higher income levels with 450 VA of connected capacity. Larger refrigerators, air conditioners, microwave ovens, and similar items require a larger connected load. While it is undoubtedly true that customers with 450 VA connections span a range of economic classes and income levels, none of these customers would be considered "middle class" in any contemporary definition of the term.

24. As customers gain more income and wealth, and acquire more appliances, they will need to increase their electrical connected load. Once they request and receive a 900 VA or larger connection, this program will assume they are no longer "low income" and are, therefore, no longer eligible for the support of this program. This element, having customers "graduate" from the program and its financial support, is essential to permit a limited source of funding to continuously be able to supply new low-income electricity consumers, with the objective of ultimately providing basic electric service to virtually all Indonesian households.

25. Currently, some PLN customers are served at a 900 VA connected load because the appropriation needed to provided 450 VA service was insufficient to extend service such service at this level. Rather than going without electricity, some customers elected to pay additional connection charges to secure service at 900 VA. These customers should be given an option to reduce their connection to 450 VA, but we anticipate that most have adapted to their current level of service and will not convert.

26. One alternative worthy of consideration is to require that low-income consumers register to be eligible for assistance. For simplicity, this could be done without verification of the customer's income level. If the list of persons choosing this service were known publicly (for example, with a different color electric meter), it would provide a very simple but

effective means of self-selection. This would probably reduce the number of customers served under the hydropower allocation. Thus, the amount of the financial benefits of the hydropower system that could be directed to further electrification would be somewhat larger.

5. DEFINING "ESSENTIAL NEEDS" FOR LOW-INCOME CONSUMERS

27. Defining the "essential needs" of low-income residential consumers is an essential element of this policy. Currently, PLN provides an initial, low-cost block of power to residential and social consumers. Those served at the 450 VA level receive a low-cost block of 30 kWh. This rate design form will be preserved through this policy.

28. If consumers use high-efficiency lighting and a high-efficiency fan, this amount of electrical capacity (450 VA) and energy (30 kWh) will also provide sufficient power to serve clothes ironing and television usage. These are the four most universal elements of residential consumption in Indonesia, according to survey research prepared during year 2000. This policy defines these end-uses as residential essential needs, and is designed to provide low-cost power to these end-uses, provided that the power is used efficiently. While the rate design resulting from this policy will be one tool to encourage efficiency, other policies will provide additional mechanisms to encourage the efficient use of electricity.

29. Experience with utility rate designs where the size of the initial block is based on essential needs is that not all customers use the entire amount of energy allocated to the initial block, while many use far more energy than the size of the initial block. Currently, the average usage of customers served at 450 VA is about 40 kWh per month, with many customers using less than 20 kWh/month. Therefore, we assume that most customers will use the entire first block allocation of 30 kWh, but many will not use this total amount in every month.

30. For analytical purposes, we have assumed that the average usage in this block will be 25 kWh per customer per month. Over time, however, we also anticipate that economic growth will result in many households now connected at 450 VA having increased incomes. Some of these customers will desire to upgrade to higher connected loads in order to be able to use additional electrical appliances. Under this policy, a customer that decides to upgrade to a higher connected load will give up their low-cost hydroelectric power allocation. However, this would also permit additional low-income consumers to be served with the limited amount of low-cost hydroelectric power available.

31. Initially, not all of the hydroelectric power will be required to serve the essential needs of residential consumers. This additional power can be sold to other consumers at market prices in order to create a funding source for electrifying currently unserved areas.

32. As electrification continues and more customers are served by PLN, more and more of the low-cost hydroelectric power will be needed to serve low-income consumer essential needs. Ultimately, we expect that as electrification goals are reached, that all of the low-cost power coming from then available hydroelectric sources will be needed to serve the essential

needs of low-income consumers. Once electrification is "complete," all of the available hydroelectric assets can be directed to low-income assistance.

33. To summarize, the goal of this low-income energy assistance program is:

a) To provide each residential consumer the opportunity to connect to the system at the 450 VA level of service through a program to fund electrification, and
b) To provide each 450 VA consumer with 30 kWh per month of power at prices that reflect the costs incurred to produce power from hydroelectric sources, plus a pro-rata share of transmission and distribution costs.

6. DEFINING GOALS FOR ELECTRIFICATION

34. PLN reports electrification ratios for each of its operating districts. These range from 74% in the District of Jaya and Tangerang to as little as 22% in East Nusa Tenggara[5] and 21% in Irian Jaya.[6] Overall, PLN estimates that about 52% of Indonesian residences are served with electricity.

35. The extreme difficulty and expense of providing electric service in remote areas, islands, and small isolated villages makes universal electrification economically infeasible[7], but extending service into additional populated areas within a reasonable definition of economic feasibility is an ongoing goal of the GOI and of PLN.

36. Currently, 82% of Indonesian villages now have electric service.[8] For the purpose of this paper, expanding service to reach 95% of villages – about a 13% increase in the number of villages served – is considered to be an achievable of the goal of electrification. Over the period 1995 – 1999, PLN extended service to about 13,000 villages, an increase in village electrification from 57% to 82%, at a cost of approximately 3.9 trillion Rupiah. If this level of cost can be maintained in moving from 82% to 95%, an additional 2 trillion Rupiah will be required; we are cautiously optimistic that this program will enable electrification of more than 90% of villages.

37. Simply providing service in each village, however, does not provide service to each household within that village. Even when electric service is available within a community, not all customers will immediately receive service. First, there is a current waiting list of 700,000 customers in the various districts currently served by PLN due to budget constraints for distribution system expansion. Second, even when electric service becomes available, not all customers will immediately choose to be connected, or be able to afford even minimal service. Over time, it is reasonable to anticipate that economic growth (in part facilitated by electrification) will cause growth in income, and a corresponding increase in the percentage of households within each village that will avail themselves of electric service.

38. To summarize, the goal of this electrification program is to extend service to at least 95% of Indonesian villages, at an estimated infrastructure cost of approximately 2 trillion Rupiah.

---

5 PLN Statistics, 2000, p. 18
6 Empowering the Indonesian Village, PLN, 2000, p. 21
7 Even in the wealthiest countries, electrification does not reach the most remote communities.
8 Empowering the Indonesian Village, PLN, 2000, p. 4

7. HOW THE HYDROELECTRIC COMMITMENT MEETS PROGRAM OBJECTIVES

39. As shown in Table 1 above, the approach of funding low-income energy assistance and electrification will initially require a commitment of about 80% of the hydroelectric generation in the system to providing an initial low-cost block of power to 450 VA consumers. The remaining economic benefit of the low-cost hydroelectric power can be committed to funding electrification efforts.

40. As shown in Table 1, selling this power at market prices will generate a surplus of approximately 500 billion Rupiah above the cost of the hydropower. If we could simply divide the 2 trillion Rupiah cost of electrification by this amount, it would theoretically be possible to fund the remaining electrification goals in a four-year period. However, this is not practical for several reasons.

41. First, at the present time, none of the block rates for small-use residential consumers cover cost. In order to actually make 500 billion Rupiah/year available for electrification, it would be necessary to immediately move the tariff for all usage above 30 kWh/month up to a commercial level for new power generation resources of approximately 300 Rupiah/kWh.[9] A rapid increase in tariffs of this magnitude is not practical within the experience of utility regulation. Efforts to move tariffs this quickly have resulted in serious unrest in many places in the world. The movement to a commercial level must be done in a more gradual fashion, and this will mean a longer period before the full benefits of the hydropower become available to support electrification.

42. Second, it is likely that the remaining villages to be electrified will be more expensive to reach than those already reached, simply because PLN has expanded service to the most easily served villages first.

43. However, if tariffs are moved to commercial levels for usage in excess of 60 kWh/month in a deliberate fashion over a period of a few years, and intermediate usage blocks are supplied with steam-generated power, ultimately the economic value of hydropower will become available to fund electrification. From an economic perspective, as soon as the tariff for incremental usage is raised to equal incremental cost, the level of subsidy to customers ceases to grow as their usage grows. As explained in the next section, this can be achieved long before major institutional reforms of the utility system are completed. The policy of increasing prices in the existing block structure to reflect the costs of current resources, including only modest increases in the prices (such as at the rate of inflation) for essential needs service can be executed immediately.

44. Within five years, increasing tariffs so that incremental usage recovers incremental costs will free up approximately 500 billion Rupiah/year for electrification. As that electrification occurs, however, the new consumers will require additional amounts of the low-cost hydropower to serve their essential needs, and the amount available to support

[9] We define as a "commercial" level of power cost the amount that a developer of a new combined-cycle generating resource could reasonably expect to receive for power on a long-term contract from a financially viable purchaser using an optimal capital structure and reasonable rate of return. For purposes of this discussion, 300 Rupiah per kWh is assumed to be a commercial level for power supply cost in the Java-Bali region.

electrification will decline. We anticipate that approximately 10 years will be required to fund the electrification of remaining villages using the economic surplus that generated by selling the hydropower surplus (i.e., the amount of hydropower not needed to serve essential needs) at commercial rates.

8. RESOURCE BASED RATE BLOCK DESIGNS

45. Currently, PLN provides service to residential consumers at block rates that increase with usage. This type of rate design is common in other parts of the world, and can be justified based on many different ratemaking theories. These include apportionment of low-cost resources to meet essential needs, recognition of the different load factors of different residential end-uses, or simply a social decision to subsidize essential needs.

46. During the transition period from a subsidized utility system to a commercially viable system, rate blocks will be linked to specific generating resources. Each residential consumer will receive an initial block based on lower-cost resources, and additional service will be linked to the cost of higher-cost resources. The goal will be to get the price for incremental usage up to a commercial level as soon as possible, with lower usage levels that can be served with lower-cost resources subjected to more moderate tariff changes.

47. The table below shows the different sources of generation currently employed by PLN, and the average operating cost (not including debt service) for each type of generation:

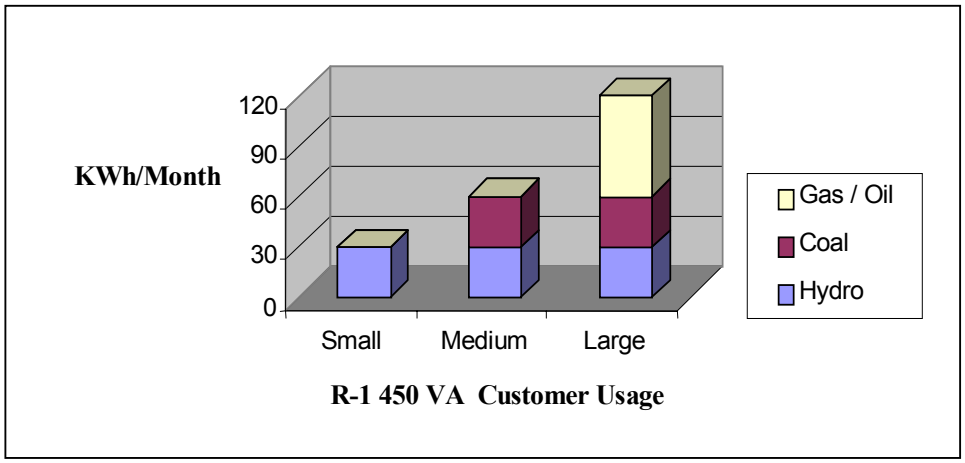
Figure 2
PLN Generating Sources in Year 2000

Type of Generation	Energy Produced (MWh)	Average Operating Cost (Rp/kWh)
Hydro	9,109	33
Steam	38,428	110
Combined Cycle	26,397	204
Diesel	5,668	231
Geothermal	2,648	262
Gas	1,251	324
Purchased	9,135	Varies
Total	92,636	

48. Because most incremental generation will come from gas, combined cycle, or purchased sources, an initial goal should be to increase the tariff for incremental usage up to the cost of such sources. The large amount of steam generation available, however, provides an opportunity to moderate tariff increases in the short-run, at least until a decision is made to divest these resources. Under the current Draft Electricity Law, that decision is at least five years away.

49. Therefore, this paper assumes that in the short-run all customers can be provided an intermediate block of power at costs based on steam generation, plus a pro-rata share of delivery costs. The graph below shows an example of how rate design could follow resources, so that all usage by R-1, 450 VA consumers could be priced at the cost of the respective resources used.

Figure 3
Rate Design by Fuel Source



50. Customers served at connected capacities in excess of 450 VA would not be eligible for the hydroelectric block in this rate design, but would still be provided a steam block of power, consistent with the existing block rate design for these customers. This reflects the policy set forth in this paper to reserve the low-cost hydroelectric power benefits to meet the essential needs of low-income consumers. It assumes that consumers choosing higher levels of connected capacity have more income, and can afford to pay the price for higher-cost resources to meet their needs.

51. There are some customers on the PLN system currently served at connected loads greater than 450 VA who might prefer to downsize if the 450 VA level of service. Customers downgrading their service would receive a low-cost hydropower allocation of 30 kWh/month.

9. INTERNATIONAL EXAMPLES OF RESOURCE-BASED RATE BLOCKS

52. The Research Report that contributed to this policy paper identified numerous examples of resource-based tariff designs. Each of these is somewhat unique, based on the circumstances of the individual utilities.

53. In Vermont, USA, a hydropower block of 240 kWh/month was provided to all residential consumers at a price about one-third the level of additional usage, until the source of the hydropower (a New York state hydroelectric facility) ceased serving Vermont.

54. In the Seattle/Portland area of the Pacific Northwest, USA, a federal law reserved hydropower benefits to residential consumers, providing a per-kWh credit to the bills of all such consumers.

55. In the state of California, USA, in the wake of the 2000 – 2001 energy crisis, a decision was made to protect small-use and low-income consumers from the rate increases needed to pay for short-term, high-cost power resources.

56. Utilities throughout India have historically provided low-cost power to meet residential essential needs, with higher prices for commercial consumers based on the cost of new generating resources.

57. Residential and farm electrification in New Zealand was serviced with low-cost hydroelectric resources, while commercial and industrial usage faced higher prices, prior to the restructuring of the New Zealand Electricity Division in the later 1980's. The sharp price increases to residential users have been a source of political controversy since the restructuring process was implemented.

10. CREATION AND ENDOWMENT OF THE SOCIAL ELECTRICITY DEVELOPMENT FUND

58. The institutional mechanism through which low-income energy assistance and electrification funding will occur pursuant to the Draft Electricity Law is known as the Social Electricity Development Fund (SEDF). According to this policy paper, the SEDF will be a Governmental entity, to which the rights to the electrical generation from Government-owned hydroelectric projects will be assigned. With this endowment, the SEDF will be assigned two responsibilities to fulfill.

59. First, the SEDF will be responsible for providing or subsidizing an initial block of low-cost power for low-income households. This can be done directly, by delivering electricity to the appropriate distribution system, or indirectly by selling the hydropower at market prices, monetizing the hydropower benefits, and using money to support these essential needs. As discussed later, the method used will depend on the types of reforms made to Indonesia's power sector over time.

60. Second, the SEDF will be responsible for supporting electrification of un-served areas, by providing loans, grants, and credits to provide for the expansion of the electrical distribution grid. The source of funding shall be the proceeds of the sale of hydropower that is not required to meet the essential needs of low-income electric consumers as described above.

10.1. Structure of the SEDF

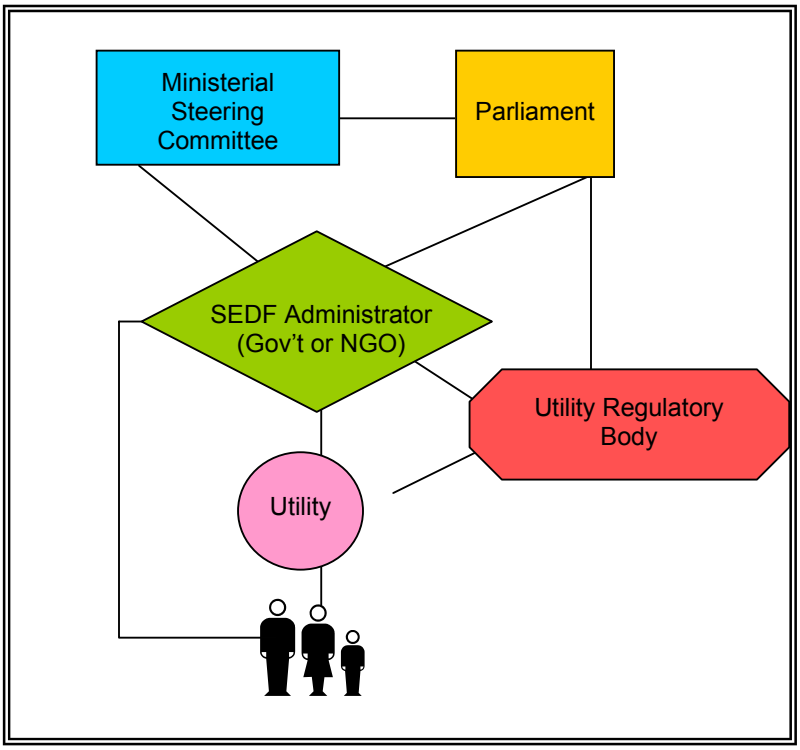
61. The SEDF shall be patterned after several successful entities providing energy sector public benefits in the USA and the UK. As discussed at length in the Research Report, these organizations have the following characteristics:

a) They are organized as governmental or non-profit, non-governmental entities, with a board of directors appointed by the government;
b) They report to the government, with guidance from agencies with expertise in the power sector, and with oversight as to their effectiveness provided by the utility regulatory body.
c) Since their responsibilities are narrowly focused, they are more likely to succeed.

62. The SEDF board will be appointed by the Government, and will be accountable directly to the regulatory body for the use of the assets dedicated to fund SEDF purposes.

63. Figure 4, below, shows the recommended governing structure for the SEDF:

Figure 4
Structure for the SEDF



10.2. Operation of the SEDF

64. After the effective date of the Draft Electricity Law, all rights and operational responsibilities related to electricity generated by hydropower facilities owned by or contracted to the Government or PLN will be transferred to the SEDF. The SEDF Executive Board shall operate these facilities in a manner consistent with the public interest, taking into account the multiple purposes of such facilities. In order to maximize economic benefits of flood control, irrigation, navigation, and other purposes beyond power supply, the economic value of the electrical output may not be maximized if competing requirements so dictate. Nonetheless, hydroelectric output is expected to have considerable value above the cost attributable to power generation.

65. As explained in later sections of this paper, the SEDF shall direct the economic value of the hydropower to finance low-income customer assistance and electrification projects. The pace of electrification may be constrained by the economic value derived from the hydropower projects, or may be enhanced if the economic value of other sources of relatively low-cost power (i.e., steam generated power) are dedicated to public purposes.

66. The SEDF may directly deliver power to utilities providing distribution service, and/or may sell power in the marketplace and provide cash assistance to support the essential needs of low-income consumers. The optimal operation will depend on both the timing and geographical location of hydropower output, and the status of utility sector reform.

67. The succeeding sections will describe the operation of the SEDF in four different future scenarios of utility sector reform.

11. OPERATION UNDER A VERTICALLY-INTEGRATED, GOVERNMENT-OWNED UTILITY

68. Currently, PLN is operating as a vertically-integrated, Government-owned utility. This is likely to change for the Java-Bali integrated system, and less likely to change in the near future for the more remote regions of the PLN system.

69. Within the vertically-integrated portion of the utility sector, the SEDF will provide either power at low cost, or cash assistance, to the utility providing service, in order to hold down the cost of providing electrical service for essential needs to low-income households (i.e., 30 kWh/month/household served at a 450 VA connection). This will be achieved by unbundling utility tariffs, and providing different power supply sources for different types of customers within an unbundled tariff.

11.1. Implement a resource-based block in rates

70. PLN will establish resource-based block rates to replace the current block rates for the residential sector. The initial block of 30 kWh for the R-1, 450 VA customers will be defined as a hydropower block. The block will either be supplied directly with low-cost hydropower under the control of the SEDF, or will be financed by the SEDF. SEDF will sell hydropower that is in excess of the amount needed to serve essential needs at market prices, and use the earnings from these sales to reduce the cost of meeting essential needs power service during periods when hydropower output is insufficient.

11.2. Gradually increase upper-block rates toward marginal cost

71. As a part of overall tariff reform, the uppermost block of power for residential consumers – i.e., consumption above 60 kWh/month – shall gradually be increased to a commercial level. This will ensure that consumers choosing higher usage levels will consider the total social cost of new electricity supplies in choosing to buy, for example, air conditioning units.

72. The price for the initial 30 kWh for 450 VA customers shall remain a low-cost, hydropower-based block, and will increase only at the rate of inflation.

73. The intermediate block of power for 450 VA customers (and an initial block of 60 kWh for all other residential consumers) will initially be served by steam-generated power under the control of PLN. In order to finance this block of power for customers in regions without steam resources, or during periods when steam generation is insufficient, the earnings from selling steam-generated power at market prices during periods of excess would be used (assuming that the price exceeds the cost of operating such facilities). The steam generation assets of PLN shall not be divested until the SEDF is fully functional and progress toward achievement of low-income energy assistance and electrification is well underway. In this manner, if a portion of the steam generation assets is required to facilitate the SEDF in achieving its purposes, those assets should remain under Government ownership.

74. Over a five-year period, however, tariff reform will move the price for all electricity usage in excess of 60 kWh/month for all residential consumers to a commercial level. Larger-use residential consumers will see significant, but orderly, price increases, while small-use customers will see only inflationary increases.

12. SEDF OPERATION UNDER A CORPORATIZED, GOVERNMENT-OWNED UTILITY

75. A first step of reform, and one which the Draft Electricity Law anticipates, is to convert PLN's Java-Bali operations into a corporatized, Government-owned utility, which is fully self-financing. This utility would remain a vertically-integrated utility operation, but would be fully responsible for meeting all of its own financial requirements.

76. The tariff reform discussed above would suit such an entity well. The block rate structures described would track the accounting costs of the corporatized entity, and the amount of power committed in the first two blocks would not exceed the hydropower and steam output available to PLN from its low-cost and medium-cost generating resources.

77. In the simplest of terms, the rate design described herein is a cost-based resource-block rate structure, similar to that identified in the Research Report for many USA utilities. Those utilities are self-funding and commercially viable, and there is no obvious reason that the Java-Bali portion of PLN could not become similarly self-supporting.

78. This form of organization could be accomplished entirely within PLN with appropriate accounting assignment of the costs and benefits of the hydropower and low-cost steam generation to the specified purposes. With the creation of the SEDF, the hydropower assets would be transferred to the SEDF. The steam assets would remain with PLN, but must be dedicated to providing mid-block power supply through appropriate accounting and regulatory oversight. This provision would remain in effect until it is determined that the hydropower assets are able to generate enough economic value to meet low-income energy assistance and electrification needs.

79. One benefit of this option is that it would result in a fairly rapid tariff reform so that incremental usage is priced at incremental cost. Growth of commercial and industrial loads on the system would be charged rates that would fund new generating resources. This would be equally true when residential users increase their usage above 60 kWh/month through the purchase of additional appliances, or when new commercial or industrial facilities are

developed. With the exception of specified public commitments to low-usage residential consumers, growth of demand on the system will pay for growth in supply, and the level of below-market power provided would be kept constrained, which mitigates the risk of an increase in the level of subsidy required.

80. Such a tariff policy would assist PLN meet the goal of financial self-sufficiency because PLN would be charging commercially viable prices for all incremental demand. While rates for the initial blocks in the tariff would be at less than the cost of new resources, these blocks of demand would be served with low-cost resources at their own respective cost. All tariff blocks would be matched with resources, and the incremental blocks would cover incremental costs. Thus, PLN would be able to finance additional generation (provided by new PLN construction or new IPP contracts) with the revenues from incremental sales.

81. In the event that PLN were never privatized, or the form of utility organization never changed, this tariff policy would enable this form of operation to continue indefinitely.

13. OPERATION UNDER A PRIVATIZED SINGLE-BUYER UTILITY STRUCTURE

82. The third possible future for power sector reform would be a monopoly transmission and distribution (T&D) utility, buying all of its incremental power supply from independent power producers. This is commonly referred to as the Single-buyer structure.

83. Within a Single-Buyer structure, the SEDF would be a seller of power to the T&D utility, with the power coming from hydroelectric sources. The utility would then deliver that power to the designated class of recipients, charging them a cost-based delivery tariff, and a cost-based hydropower supply tariff for the affected kilowatt-hours in the essential needs block. Any incremental power demand would come from higher cost sources of supply.

84. If all or a portion of the steam generation resources currently controlled by PLN were dedicated to providing a cost-based, mid-priced block of power, the same arrangement could be made for that power – i.e., transfer the steam assets, or the costs and benefits associated with such assets, to the SEDF.

85. In any event, it is anticipated that at least all incremental demand would be met with power acquired by the Single-buyer utility at market prices, and sold to consumers at commercially viable prices.

86. Because this form of industry structure requires that title to power generated must change hands several times, a slightly more complex operation is required of the SEDF. During wet months, the amount of hydropower available exceeds the essential needs level of service, while in others the amount is too small to meet essential-needs.

87. Under the Single-Buyer form of organization, during those months when the SEDF could deliver enough power to meet essential needs, it would do so subject to: (1) a cost-based price charged to the delivering utility, and (2) a provision that this charge be flowed through to eligible essential needs sales. When the amount of hydropower exceeds essential needs requirements, it would sell the excess at market prices, and accrue funds that could be used for SEDF purposes, including electrification. In months when it could NOT generate

enough hydropower to meet designated customer essential needs, the SEDF would draw down its financial reserves, buy power from the market, and sell this (at a loss) to the delivering utility at a price based on the cost of hydropower. Based on the assumptions we have used, the SEDF would have an annual residual surplus that could be used to fund electrification.

88. Because the flow of electrons will follow the laws of physics, it may be more expeditious to convert all hydropower generation into money at commercial rates, and then use the proceeds to offset customer bills. This is the format used by the Bonneville Power Administration in providing residential bill assistance to the consumers of Puget Sound Energy, as an alternative to a complex exchange of power resources to achieve federally directed residential benefits. The SEDF, once operational, will be best able to determine whether directing actual power, or monetizing the hydropower benefits and directing funding assistance, will be most efficient.

89. One advantage of monetizing the hydropower benefits is that utility-supplied power and rate designs would all be priced at commercially viable levels, and customers would then receive a fixed bill credit equal to their share of the hydropower monetary benefits. Assuming that the commercial rate for power is Rp. 300/kWh, and the hydropower cost is Rp. 75/kWh, the usage-related portion of a customer's bill might look something like what is shown in Figure 5, below:

Figure 5

Usage for month (kWh)	45
Commercial Rate per kWh	Rp. 300
Cost of Usage	Rp. 13,500
Less SEDF hydropower credit 30 kWh @ Rp. 225	(Rp. 6,750)
Amount Due:	Rp. 6,750

90. Monetizing all hydropower benefits would permit making the hydropower credit (what some might call a subsidy) more explicit on the customer's bill. While this type of arrangement would be possible within a vertically-integrated utility structure, monetizing all hydropower benefits is not necessary under such a structure. However, it becomes increasingly advantageous to monetize the benefits of hydropower if the industry is transformed to a more competitive multi-entity institutional structure.

14. OPERATION UNDER A PRIVATIZED MULTI-BUYER / MULTI-SELLER UTILITY STRUCTURE

91. The final potential institutional structure for the future of the power sector in Indonesia would be a full privatized multi-buyer, multi-seller open access market structure similar to those of the UK, New Zealand, Australia, and parts of the USA. The approach of this paper, dedicating the economic benefits of government-owned hydropower to serve the essential needs of low-income residential consumers can work very well in this type of structure.

92. First, the hydropower assets (or the costs and benefits of these assets) would be vested in the SEDF. The SEDF would then monetize these benefits, by offering the output into the market. The difference between costs and market revenues earned from the hydropower assets would provide the pool of funding for the SEDF to fulfill its low-income assistance and electrification responsibilities.

93. Based on year 2000 hydropower production of 9 billion kWh, and an assumed market differential of Rp. 250/kWh between the cost and value of the hydropower production, hydropower would produce about Rp. 2 trillion of operating profits per year. As indicated earlier, about three-quarters of this would be necessary to provide bill credits to existing 450 VA consumers, leaving approximately Rp. 500 billion per year to dedicate towards electrification efforts.

94. Once the hydropower benefits were monetized, the SEDF would offer all retail sellers in the marketplace the ability to receive credits for each low-income 450 VA customer served, up to a maximum credit of the difference between the commercial price and hydropower cost for 30 kWh per month. It may be that default suppliers will serve most if not all low-income consumers, which has been the experience in many open access environments. If this were the case, the SEDF would provide all such benefits through a single retail vendor. However, in the event that competition evolves to where low-income consumers are served by multiple retail sellers, the SEDF could make low-income bill credits available to all retail sellers. Customers could choose any retail supplier, including a higher-cost green power supplier, and still receive the monetized hydropower credit on their bill.

95. The retail seller, then, would collect the commercial rate less the bill credit from the final low-income consumer, and receive separate compensation from the SEDF for the amount of the bill credits. The consumer's bill would look just as shown in Figure 5. The SEDF would need to establish rigorous reporting requirements to ensure that bill credits were granted only with respect to eligible consumers, subject to regulatory review and enforcement.

15. VESTING OWNERSHIP AND CONTROL OF HYDROELECTRIC RESOURCES IN THE SOCIAL ELECTRICITY DEVELOPMENT FUND

96. One essential element of this policy is to vest the ownership and control, or the economic costs and benefits, of the hydropower resources in the Social Electricity Development Fund.

97. For the purposes of this policy, it does not matter whether actual ownership is vested, or alternatively, if the costs and benefits are vested. In either case, the SEDF will be responsible for paying the debt service, operation and maintenance costs, and other expenses associated with continued maintenance of the hydropower resources. In either case, the SEDF will have an incentive to maximize the economic value of the output of the hydropower system, including concentrating output during peak periods when the power has the highest economic value. In either case, the SEDF will have either a pool of low-cost resources or a pool of monetized benefits that can be used to provide low-income energy assistance and electrification support.

98. Within 12 months of passage of the Draft Electricity Law, and at least 30 days before any tariff adjustments are made that would affect 450 VA consumers, the costs and benefits of the hydropower resources shall be transferred to the SEDF. In the event that the SEDF cannot assume this responsibility immediately, it shall contract with PLN to provide oversight and support for these resources until the responsibilities can be assumed. This does not preclude the SEDF from outsourcing the operation and maintenance of the hydroelectric facilities. However, the SEDF would effectively become the "owner" of such resources.

99. PLN will agree to purchase any output from the hydropower system that is excess to the direct needs of SEDF program recipients at a commercial rate. PLN shall also agree to accept power from the SEDF for redelivery (either physical or by displacement) to eligible recipients. These provisions will ensure that the SEDF can readily convert the assets assigned to it into the economic benefits that it requires to perform its functions.

16. TRANSITION OVER TIME FROM ELECTRIFICATION SUPPORT TO LOW-INCOME SUPPORT

100. Over time, the SEDF will support the electrification of more and more villages and assist in extending electric service to more and more households. As the number of customers receiving electric service increases, the percentage of the hydropower benefits needed to provide essential needs service to this growing number of customers will gradually use all or nearly all of the hydropower benefits available to SEDF.

101. Ideally, the amount of hydropower benefits will exactly equal the essential needs of low-income consumers once electrification is "complete." In the event that the hydropower benefits are not adequate to serve the essential needs of low-income residential consumers, the SEDF will need to either secure additional low-cost power resources, or else ration the level of benefits below the 30 kWh/month assumed in this paper. This will need to be addressed as the program evolves. It cannot be predicted with certainty how many consumers will remain on 450 VA service (which will include the hydropower allocation), and how many will elect higher connected loads in order to power additional appliances (which would make such customers ineligible for the hydropower allocation).

102. The status of the SEDF shall be reviewed prior to any divestiture of steam generating properties currently owned by PLN, regardless of the status of power sector reform. If it is necessary to augment the SEDF, the option of doing so with low-cost steam generation should be explored prior to either divestiture or the pursuit of general tax support for the SEDF because it appears that the steam generating assets also have below-market cost characteristics. Thus, it would be the policy of the Government to retain ownership of below-market generating assets in order to provide financial support to low-income energy assistance and electrification.

17. OTHER ELEMENTS OF LOW-INCOME ENERGY ASSISTANCE PROGRAM

103. The Government will pursue numerous other elements to providing low-income energy assistance in addition to the provision of hydropower benefits to meet the essential needs of low-income consumers. Many of these are addressed in the Research Report.

104. First, establishing efficiency standards for newly manufactured lighting fixtures, ceiling fans, and refrigerators sold in Indonesia will ensure that low-income households are able to maximize the utilization of their hydropower allocation for which they will be eligible. By establishing such standards, the magnitude of existing inefficiencies will stop increasing, making it more feasible to develop a program to address existing uses.

105. Second, a retrofit program for these energy-using appliances will need to be developed in order to permit existing customers to upgrade their essential energy using appliances, particularly lights and ceiling fans.

106. The use of prepayment meters, now being tested by the Ministry of Research and Technology in Sulawesi, may be an option worthy of further implementation. South Africa has used prepayment meters extensively to provide low-cost basic electric service to low-income households. By eliminating the cost of meter reading and billing, it may be possible to reduce distribution utility costs associated with providing basic service to low-income households.

18. OTHER ELEMENTS OF THE ELECTRIFICATION ASSISTANCE PROGRAM

107. This policy provides a means to fund the existing and ongoing electrification work that PLN has funded out of general revenues. There are several other elements to be pursued for an electrification program.

108. First, the creation of a Rural Electrification Administration to provide the institutional support and a loan pool for electrification has worked well in the Philippines and in the USA, and can be beneficial in Indonesia. This will become increasingly appropriate if the institutional structure of PLN changes, and the responsibility for providing electric service in rural areas ceases to be a central Government responsibility.

109. Second, a program to assist in the development of renewable resources in remote areas has been somewhat diffuse in Indonesia, spread among several different implementing entities. Some distributed renewable resources have been developed by PLN, while others have been promoted by other Governmental entities. Creating a central focus to this type of development, in a manner where distributed resources can be evaluated based on the savings they provide to generation, transmission, and distribution investment can optimize the use of distributed renewable resources. The Rural Electrification Administration may be the appropriate entity to focus these efforts.

110. Creating better-defined opportunities for local participation in the expansion of electric service is important. Examples in Central America, South America, and the USA of

local communities creating either a volunteer labor pool or donating local indigenous raw materials has been demonstrated to facilitate electrification of un-served areas at low cost. The Rural Electrification Administration may also be the appropriate entity to coordinate these types of efforts. The SEDF may establish policies to give preference and priority in electrification funding to communities that provide a portion of the funds or infrastructure needed to expand electric service.

111. Finally a schedule for phasing down operating subsidies to rural services will be developed by the DGEEU, in coordination with the SEDF and PLN. The underpinning of electrification is that community economic welfare is enhanced when electric service is available. Once electric service in an area becomes more universal, the local economy is expected to grow, and with that growth should come an ability to self-fund ongoing capital improvements of the electric system. A principle of providing not more than ten years of cost support to a newly electrified area will permit scarce resources to be re-deployed to new areas and the expansion of electric service to consumers not now enjoying that service.

19. IMPLEMENTATION STEPS

112. Implementing these policies will not be possible without coordinated planning and the cooperation of many different entities.

113. The first step is passage of the Draft Electricity Law, and the creation of the SEDF. These need to occur to provide the institutional and legal framework for implementing the new programs.

114. The SEDF must be vested with either the hydropower assets, or the hydropower costs and benefits, so that it has a source of low-cost energy and funding to achieve its energy assistance and electrification responsibilities. A transfer of these resources should be timed to match a change in the PLN tariff structure, so that customers begin receiving their power (or bill credits, if the power benefits are monetized) on the same day that tariffs change. This transition should be seamless for consumers.

115. The DGEEU will take the lead responsibility for developing efficiency standards for new and replacement lighting fixtures and lamps, for ceiling fans, and for refrigerators. This is an essential step to making sure that the limited supply of low-cost hydropower can serve the essential electric power needs of low-income households.

116. Steps involving the creation of an open access retail market can wait until other elements of this policy are in place. Experiments around the world with open access are providing many useful lessons learned in the design of such structures. If and when a single-buyer or multi-buyer / multi-seller market is established, the method used by the SEDF to extend hydropower benefits to low-income consumers will necessarily change. These changes need to be coordinated. However, the provision of competitive markets to serve commercial and industrial customers is not dependent upon the SEDF or the use of Government-owned hydropower assets, and can proceed on a separate timeline.

117. If experiences in the early years of this policy demonstrate that additional resources are needed to facilitate low-income energy assistance and electrification, it may be desirable to vest the SEDF with a portion of the lower-cost steam generating assets currently held by

PLN. For this reason, any consideration of divestiture of these resources should wait until the SEDF gains operating experience with the framework identified in this policy.

118. Finally, if and when an hourly electricity market is in place and operating in a robust and competitive manner, it will become possible for the SEDF to fully monetize the benefits of the hydropower resources. Additionally, international experience with open access may evolve to the point that techniques for providing benefits of competition to small users are possible. At that time, it may be useful to consider an open access mechanism for small consumers, with full monetization of hydropower benefits as the tool to funding bill credits for low-income energy consumers.

20. SUMMARY AND CONCLUSIONS

119. This policy is designed to ensure that low-income households in Indonesia have long-term access to low-cost electricity to meet their most essential needs, and that electrification of currently un-served areas can continue. It does so by dedicating the limited amount of low-cost hydropower to meet these two social purposes. This is appropriate for many reasons. Foremost among these reasons is that hydropower is a resource that relies on publicly-owned assets and publicly-controlled waters, and dedicating this resource to the service of the general public is equitable, responsible, and enduring.

120. This policy is capable of operating regardless of the form that Indonesia's power sector takes in the future, ranging from the current Government-owned, vertically-integrated utility to a full open access multi-buyer, multi-seller market. It is a policy that is sustainable in a near-perpetual manner, relying on precipitation, gravity, and long-lived hydroelectric facilities. No other alternative has the same set of attributes.

121. By dedicating these assets to these specific purposes, the Government of Indonesia makes a long-term commitment to helping the poor achieve a step forward in life: electrification of low-income households and rural villages, and provision of low-cost electricity to meet essential needs.