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Rural Infrastructure Projects: Roads

Judith Tendler

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For the Studies Division, Office of Evaluation, Bureau for Program and Policy Coordination, U.S. Agency for International Development

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RURAL ELECTRIFICATION

Introduction

Most of the attempt to justify rural-electrification projects in New-Directions terms has focused on the impact of electrification on the rural poor. The design and operation technologies of rural-electrification systems, however, have not been subject to the close scrutiny for New-Directions implications that the technology of road construction has. Despite the lack of discussion of alternative approaches to design and operation of electrification systems, it would seem that some of these choices would have considerable impact on how growth in the countryside takes place. Partly because of the lack of discussion and research on alternative design and operation questions, rural electrification was not given as much time in this study as rural roads. The following discussion, then, should be seen as indicative of the kinds of issues that merit further exploration.

AID's impact studies of rural electrification (RE) have focused mainly on household use, as opposed to industrial,

commercial and public uses of rural electricity.[1] The attempt to answer criticisms of rural-electrification projects have also placed most of their emphasis on the benefits accruing to household users of electricity.[2] This focus of attention on benefits to household customers has contributed partially to the neglect of New-Directions opportunities lying in non-household consumption and in the design and operation of the system itself. Before these

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[1]It should be noted that the focus of the New-Directions-related discussions and evaluations of RE projects has been on household consumption even when the projects themselves had a production-consumption focus.

[2]E.g., U.S. Agency for International Development/Philippines, "Nationwide Survey on Socio-Economic Impact of Rural Electrification," 10 February 1978; preliminary results of this study can be found in U.S. Agency for International Development, "Philippines: Rural Electrification V," Project Paper AID-DLC/P2275, 21 November 1977, pp. 51-56; Development Alternatives Inc., "An Evaluation of the Program Performance of the International Program Division of the National Rural Electric Cooperative Association" 28 January 1977; and Development Associates, Inc., "A System for Evaluating the Economic and Social Impact of Rural Electrification in Bolivia," (Final Report), Contract No. AID/otr-C-1382.

other sides of rural electrification are discussed, it is useful to understand why AID has tended to focus on the benefits to household consumption of rural electricity.

Household vs. Other Consumption

Most of AID's rural electrification projects have been promoted, designed and implemented by the National Rural Electric Cooperative Association (NRECA). In 1976 and 1977, for example, NRECA worked on various stages of promotion and design of AID rural-electrification projects for the Philippines, Bangladesh, Pakistan, Syria, Guatemala, Honduras and Bolivia. Outside the engineering design work, AID uses only NRECA as its contractor for the design and implementation of rural-electrification projects. (NRECA does not have the capacity to do engineering design, according to AID; this work is contracted out to private engineering firms.)

The NRECA model, forged out of its experience with rural cooperatives in the United States during the 1930s, evolved mainly out of concern over rural household consumption. The appeal of the cooperative model for rural electrification in the U.S. was an appeal to the potential household consumer who was not large enough to interest the private utilities. The cost of rural household connections was particularly high in the U.S. countryside, where rural settlement patterns were dispersed. This was in contrast to the denser and more nucleated rural settlement of Europe and many Third-World countries. The U.S. cooperative model, then, was infused with a populist appeal to the "little guy" who was being exploited

by the big utilities. The little guy was the neglected rural household consumer, not the industries or commercial establishments that one might find in the area of influence of an RE cooperative.

The Philippine success story

Before giving some examples of the household emphasis in AID and NRECA decisionmaking on rural-electrification projects, it is important to note one final reason for this emphasis. AID's most successful rural-electrification program has been in the Philippines, where it invested US$80 million in RE projects over the 1972-1978 period. For AID and NRECA, this successful program became a launching pad for other RE programs in Asia--mainly, in Pakistan, Indonesia and Bangladesh. Rural-electrification projects now account for 40% of AID's food-nutrition lending in Asia.

The Philippine case was somewhat unusual in that rural electrification received a major political and financial commitment of the government because it was seen as crucial to one of its basic political objectives--to win support away from the Communists in the countryside. This political objective meant a strong emphasis on household consumption,[3] also reflected in the AID-financed

[3]The objective of winning over the peasants would not necessarily mean a priority for household consumption; electrified and small-scale irrigation for agriculture would also further such an objective. Though such a use of electricity was not an initial focus of the Philippine program, it was added later as part of a program to create and assist water-user associations. (Continued on following page.)

(Footnote 3 continued) Electrification was not the only rural program in the Philippines with the objective of winning support from the Communists. The "compact farm" program was also meant "to help blunt the threat of insurgency and to bring dissident farmers back to the government fold." Jose V. Barrameda, Jr., "Compact Farming in Camarines Sur," p. 1, Appendix to Frank Lynch, "Rice Farm Harvests and Practices in Camarines Sur...," Social Survey Research Unit, Research Report Series, No. 2, January 1974.

impact studies carried out by the Philippine Rural Electrification Administration with the technical assistance of the U.S. Census Bureau.[4] Interestingly enough, the results of the Census Bureau/REA impact study suggest that the political objective was achieved: the benefit cited most frequently by the new rural household consumers was "an increase in peace and security in the countryside."[5]

The Philippine case, then, was a happy marriage of the AID/NRECA emphasis on household consumption and the high political priority given by the Philippine government to winning over the rural population by supplying it with household electricity. Since the Philippine case is one of AID's most successful stories of rural electrification—in terms of getting the system in place and having it managed well—it is not surprising that the household emphasis of that success story and its evaluations tends to get carried over to other cases.

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[4]See footnote 1 above.

[5]P.52 of the Philippine RE loan paper cited above. It is difficult to say to what extent this result was influenced by the form of the survey instrument, whereby respondents were given pre-determined answers to select from—one of which was "an increase in peace and security." Respondents may have felt it was safe to give the peace-and-security answer. This type of response has also been reported in RE impact studies for other countries.

One would like to know what the increased peace-and-security resulted from. Individual household lighting? Village and town lighting? One would think that the village lighting would be the most likely answer. This in itself would be an interesting finding, because it would mean that the major benefit to household consumers of rural electrification resulted from a public-service use of electricity, rather than from individual household connections.

Flat vs. metered charges

The concerns of U.S. rural-electric cooperative development, and its focus on the household consumer, are prevalent today in the myriad decisions that NRECA and AID make when designing RE projects in other countries. NRECA tends to be against the use of flat charges for household consumption, for example, instead of charges based on metered use. Flat charges have been used by the Indonesian power authority and some other countries on the grounds that this saves the additional cost and complexity of meters and their monitoring. NRECA is against these flat rates, in contrast, on the grounds that they are inequitable. The user of little electricity, who is likely to be among the poorest of household consumers, pays the same as the larger user and thus subsidizes the latter's consumption.[6]

The use of flat charges in the Third-World context of frequent blackouts and rationing may actually result in less inequity than one might think. The shortages, that is, put a ceiling on how much anyone can consume, and thus act as a leveler of the distribution of electricity consumption among households. Indeed, the Indonesian power authority combines the flat charges with a device that automatically limits electricity use after a certain point.

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6 A partial discussion of this difference of opinion is found in USAID, "Rural Electrification Preliminary Engineering and Feasibility Study Report," by the National Rural Electric Cooperative Association, Task Order No. 5, Contract No. AID/pha - 1090, Central Java, Indonesia, August 1977, pp. 62-63.

This limiter, adopted by the Indonesians to ration scarce electricity, ends up performing the same leveling function as frequent blackouts—and in an even more equitable way. (AID and NRECA have also expressed disapproval of the limiting devices because they are felt to be part of a "shortage mentality."[7] The conditions of shortage will no longer exist once the Indonesian project is finished, it is felt, and the limiters will restrict the utilization of the new installed plant to full capacity.)

Another reason that flat charges may make more sense in AID-recipient countries has to do with institutional problems of state-controlled electricity distribution. Distribution of electricity is noted for its difficulties in developing countries, partly because of the myriad individual accounts a state utility has to deal with and the vulnerability of such a bill-collecting process to graft and corruption. This contrasts markedly with the organization of electric-power generation, where contact with buyers involves only a few large wholesale purchasers. Anything that minimizes the number of contacts that a state distribution company has with its consuming public, then, will give the company

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[7] Disagreement with the limiters can be found in the citation of the preceding footnote, pp. 49, 63.

a better chance to do well.

Finally, metering is objected to by recipient countries on the grounds of its costliness and cumbersomeness. With flat charging, then, the utility may be more willing and able to hook up a larger portion of the poor population than it would be if it had to do so with metering. The equity benefits of metering, in sum, may be less than their costs. Though flat charges are disliked by AID and NRECA on equity grounds, the alleged superiority of metering on these same grounds may turn out to be academic in developing-country environments.

There are ways other than metering to approach the equity question that concerns NRECA. In area where homogeneously poor populations are found, for example, lower flat rates could be charged to these consumers than to those living in areas populated by better-off groups. Or different flat rates could be determined, at the time of the electricity connection, based on a measure of the quality of the house or of the number of appliances possessed by the household. Or, as AID tried to do in the Indonesian case, RE development can be limited to homogeneously poor areas.[8] Though these approaches are a cruder way than metering of getting at equity, they also do not involve the institutional and financial costs that metering does.

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[8] USAID, "Indonesia—Rural Electrification I," Project Paper AID-DLC/P-2244, 2 September 1977.

Protecting household rates

Another rural-electrification issue that merits some exploration is electricity rates. Consistent with pro-household concerns, AID and NRECA have sometimes objected to the charging of lower rates to users of electricity for productive purposes—or for larger-volume purchases by such users—as is often the policy of state power authorities in recipient countries. Pakistan and India are examples, where users of tubewell pumps for irrigation have been allowed to pay considerably less than household users do. The argument against such rate policies is, in part, that household users should not have to subsidize non-household users.

Third-World countries frequently prefer to subsidize productive uses of electric power at the cost of household uses. This preference may relate to the considerations discussed above concerning flat charges vs. metering. Supplying fewer larger users as opposed to many smaller ones, that is, may be a more easily achievable task for a state power authority—for the same reasons that electricity generation is "easier" than distribution.

New-Directions policies are concerned with maximizing the impact of rural infrastructure projects on the rural poor. This means that the costs to household consumers of "paying for" the lower rates to productive uses of electricity should be compared to the benefits to the rural poor of additional employment resulting

from the productive uses of electricity—and from the fact that state power authorities are often more interested in and do better at supplying productive users. Tubewells in particular are known for the increased opportunity they provide to employ additional labor, because they increase the potential to farm the land intensively. On New-Directions grounds, then, priority might be given in some cases to certain non-household uses of electricity, perhaps even explicitly at the expense of household users. As in the example of metering vs. flat charges, the loss in equity to household users may be less to the rural poor than the gain in increased employment opportunities resulting from productive electricity use.

All this is not to say that non-household uses of electricity will always have higher benefits than household uses—or that productive uses of electricity will even have the employment benefits predicted. Some recent literature, for example, suggests that (1) the employment-generating effects of rural light industry are not really what they were thought to be,[9] and (2) that productive uses of rural electricity yield such high returns that

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[9] This reasoning, as well as the other side of the argument, is presented in Dwight Perkins, Rural Small-scale Industry in the People's Republic of China (Berkeley: University of California Press, 1977). For a summary of the case in favor of rural light industry, on pro-employment grounds, see International Bank for Reconstruction and Development (IBRD), "Rural Enterprise and Nonfarm Employment," A World Bank Paper, January 1978.

users do not need subsidies to adopt it.[10] Despite these doubts, however, recipient countries still show preferences for a promotional approach to non-household rates. This approach needs to be evaluated in terms of its New-Directions potential.

The position I am taking with respect to electricity rates, and the use of them for subsidy and taxing purposes, is not a popular one in the literature on rural electrification.[11] Tampering with rates in this way is considered financially untidy for the electric utility, whose prime concern should be to make itself a self-sufficient enterprise. The institutional viability of these enterprises, it is felt, should not be burdened with redistributive or promotional policies; more efficient subsidies and taxes should be found to implement these policies. The productive users of electricity, moreover, are said to be able to pay market rates for it because the returns to such electricity use are so high—as witnessed by the fact that firms often buy their own high-cost generators when there is no alternative source of electricity. Subsidies to productive users, then, are said to have little net impact on the growth of production, for they simply reimburse

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[10] For a summary of the argument against "promotional" rates for productive uses of electric power, see IBRD, "Rural Electrification," A World Bank Paper, October 1975.

[11] See, for example, the IBRD paper on rural electrification cited above.

these users for costs that they were willing to undertake anyway. Finally, the effects of promotional rates are said to be regressive. The subsidy is often financed out of the household rates, that is, which means that the "little guy" ends up subsidizing the big one.[12]

The arguments against using electricity rates for subsidies and taxes makes good sense. The main reason I question them is that the use of electricity rates to pursue development strategies is common practice in Third-World countries—as it has been in the history of U.S. electric-power development. While AID and IBRD often object to the subsidies, the recipient countries continue to apply them. Since AID often ends up going along with the subsidies in the end, there is some reason for trying to figure out how one might live with them better—instead of steering clear of them completely for economic reasons.

The donor world is much less accustomed than Third-World countries to living with the concept of state-companies as mechanisms through which to channel national development policies.

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[12] The proponents of this anti-subsidy/tax position do not reject the concept of subsidizing power rates for rural electricity across-the-board, at least in the early years of the system's growth. Because the unit cost of supplying rural electricity is so much higher than for urban electricity, it is felt, the rate should not reflect the full cost of providing service in the early years. If it did, it is argued, little electricity consumption would occur.

Donors are more interested in the potential for financial self-sufficiency of revenue-earning public enterprises. They are concerned with the independence and protection from the rest of the public sector that revenue will provide. Third-World governments often see just the opposite side of the picture: the revenue-earning aspect of the service presents one of the scarce opportunities to execute smoothly the subsidy or tax features of certain development strategies. An important part of this opposite picture is that well-working institutional mechanisms for dealing out subsidies and collecting taxes are hard to come by in developing countries. Such mechanisms are difficult and expensive to create and are usually vulnerable to graft. When a ready-made mechanism for both subsidies and taxes comes along, like electricity charges, it is hard to resist. In comparison to the more difficult and direct approaches to the subsidization and taxation of various sectors, then, the ready-made mechanism of electric-power rates must seem quite effective to policymakers in Third-World countries—and worth the cost imposed on the financial independence of the power entity.[13]

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[13] This same logic also lies behind the insistence of Third-World countries on using concessional interest rates on agricultural credit—despite the barrage of donor criticism and common-sense economic reasoning against this position. Like electricity rates, interest rates are a handy instrument to latch onto: they are administered by an already-existing institution, with considerable institutional representation in the geographic area where the to-be-subsidized sector is located. As with electricity rates, interest-rate subsidies represent a quick and ready vehicle for getting something difficult done.

Despite the current wisdom to the contrary, AID should take a closer look at the possibilities for using the electricity-rate structure to pursue some New-Directions objectives. Recipient countries will probably use the rates for similar purposes anyway. And there may be good institutional reasons, as noted above, to prefer the state power companies as instruments for executing such policies. These reasons may be just as powerful, in a different realm, as the economic arguments against doing so.

Household consumers and the rural poor

Impact studies of rural electrification consistently find that the household users of rural electricity are the better off among the rural population.[14] This is not surprising, since household electricity usage requires expenditures for hookups, wiring,

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[14] E.g., University of Florida, Center for Latin American Studies, "Rural Electrification: An Evaluation of Effects on Economic and Social Changes in Costa Rica and Colombia," 31 August 1973; IBRD, "Costs and Benefits of Rural Electrification—A Case Study in El Salvador," P.U. Report No. RES 5, 1975; USAID/Philippines, "Socio-Economic Impact..."

monthly consumption, and for the purchase of appliances.[15] Where rural electricity actually succeeds in reaching truly poor households, moreover, usage is virtually limited to lighting. In these cases, electricity does not succeed in substituting for wood and other fuels in cooking, the principal use of energy by poor rural households.[16]

It is difficult to provide a strong New-Directions justification for rural electrification if one rests the argument mainly on household consumption: either the poorest of the poor are excluded, or their gain is limited to the substitution of electricity for other fuels in lighting. It may be that the substitution of electricity for other sources of lighting in poor households represents an important gain for the rural poor. But AID needs to show that this gain is greater than those to be had from the development of non-household uses of electricity, or

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[15] Some AID missions have recognized the regressive effects of electricity's user costs on benefit distribution. They have attempted to eliminate, lower, and/or finance the capital costs of connecting to the system. The concern for lowering connection costs also arose out of the finding that many rural inhabitants would not connect up to the proposed systems at prevailing charges—which would make it impossible to financially justify the RE project.

[16] E.g., the Philippine impact survey cited in the above note, pp.4-5; the Nicaragua case study in Development Alternatives, Inc., "An Evaluation of the Program Performance of the International Program Division of the National Rural Electric Cooperative Association" 28 January 1977.

through investment in other rural services like water supply.

All this is not to say that the benefits of household consumption are not worthwhile ones. It is just that household consumption may not be the trump card that rural electrification has to offer with respect to the rural poor. In one sense, then, AID's and NRECA's concern for equitable treatment of the household consumer may sometimes lead to a more "regressive" approach with respect to the rural poor: greater employment opportunities for the poorest are neglected in order to protect the household consumers of electricity, who are not the poorest. Lower electricity rates for non-household consumption, then, might in some cases be more equitable because they transfer the benefits of a project from the better-off beneficiaries of rural electricity (the household consumers) to the poorest-off beneficiaries (those who gain employment because of the use of electricity).

Electric utilities and appliance-using consumption

It is the nature of electricity-producing companies that they engage in the promotion of electricity use. Increased usage gives them greater revenues and evens out the peaks and troughs of demand, thus increasing their load factor.[17] Promotion of electricity

[17] The load factor, expressed in percentage terms, is the ratio of average capacity usage to peak capacity. The higher the load factor, the less unutilized capacity there will be.

use by utilities occurs even in systems where there are periods of rationing or outages resulting from faulty equipment and maintenance, inadequate installed capacity and, in hydro-based systems, lack of rain. The consumer, rather than the utility, incurs the costs of the idle or damaged appliances during the rationing periods, or the costs of privately regulating uneven voltage. Increased consumer use of the utility's electricity supply, then, increases its revenues during non-rationing periods and imposes extra costs mainly on the consumer during shortages.

Rural electrification is considerably more costly than urban electrification because of lower population densities in the areas served. Put together with the necessity of installing a minimum costly physical plant from the start, this means that rural electric utilities can have considerable excess capacity, and thus operate at high unit costs, for many years. If run well, then, a rural utility will have to promote electricity consumption even more agressively than the urban utility.

For all the above reasons, it is in the utility's interest to create and serve an appliance-using clientele.[18] One such promotion technique is the offering of installment credit—through electric cooperatives, for example—for the purchase of electrical appliances.[19] For purely business reasons, then, it may be against

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[18] A passage from a NRECA report on the Indonesian rural-electrification project gives a sense of these promotion concerns: "This electric cooperative will be providing electric utility service to a very large group of persons who have never before used such service... A great amount of education and power use promotional work must be planned and carried out by the sponsoring agency of the government and by the cooperative itself. Very few of the prospective customers have ever had the opportunity to enjoy use of electric service. Viability of the project depends on a high rate of connections and an increasing use of power over the years... Full utilization of the system should be encouraged. Member services specialists can show consumers how to benefit from additional uses of electric energy. Night lighting and other off-peak consumption of power will give the system a better load factor" (p. 91).

Also, "In countries and in times not hampered by energy shortages, there should also be an incentive component to the rate schedule to encourage consumers to make more abundant use of electricity. They must believe that their investment in a greater use of electricity is worthwhile when equated to the social and economic benefits derived from that use" (p. 70). USAID, "Rural Electrification Preliminary Engineering and Feasibility Study Report," by NRECA, South Sulawesi, Indonesia (August 1977). Also, "In every home, there are many potential uses for electricity. Consumers must be shown that the electric service is better and cheaper than alternatives" (p. 77). USAID, "Preliminary Engineering..." by NRECA, Central Java (August 1977).

[19] The Indonesian mission has suggested that the state power authority use credit in the housewiring fund, after it is rolled over, to finance consumer purchases of water-heating coils, hot plates and rice cookers. USAID, "Indonesia—Rural Electrification I," No. 497-0267, Volume II (August 1977), Annex G-1, p.3.

the interests of rural electric cooperatives and other local utilities to make decisions about rates, investments, and other matters that would benefit the poorest sectors of the population—especially if any of these actions are financed out of rates charged to the appliance-using clientele. There is somewhat of a conflict, in sum, between the objectives of maximizing the impact of rural electrification on the rural poor and of creating and running a well-functioning rural utility.

AID's rural-electrification coops provide an opportunity to look into the question of what type of utility can be more attentive to the rural poor—public grids, private grids, or autonomous local utilities (public, private or coop). The above-cited impact study of the Philippine rural electrification found a somewhat lower income level among users in villages and towns supplied by coops rather than private or state utilities. But the difference in income levels was not great enough, nor the analysis of causality comprehensive enough, to determine whether this finding has any significance with respect to the coop model. An AID-contracted study of RE cooperatives in Latin America found that they charged more for power than the state-operated grid systems.[19a] The study did not look into whether this difference was due to real differences in cost, or to different pricing and profit policies. Since AID relies so heavily on the coop model for its rural-electrification programs,

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[19a] Development Alternatives, Inc., "An Evaluation of the Program Performance of the International Program Division of the National Rural Electric Cooperative Association," 28 January 1977.

it is important that this type of finding be investigated further. It may be that a strong business orientation of a utility, along with its emphasis on appliance-using clientele, is the only way to get adequate electric utilities established. If that is the case, then rural electrification may not be conducive to having its impact directed to the rural poor.

Conclusion

The discussion above suggests that the greatest New-Directions impact of rural-electrification projects may lie elsewhere than with the benefits to rural households. Concern with providing equity to household users—or distributing equity properly among household users—may result in a fairly limited impact on the rural poor. The focus of equity concerns on the household consumer is somewhat misplaced outside the context of U.S. rural history, where rural unemployment was not a major problem the way it is in the Third World today. In the Third World, moreover, the plight of the "little guy" at the mercy of the "exploitative" private utility is not a gripping issue. Instead, a good part of the gains from electrification for the poorest may occur through electricity-using production activities that increase employment. In addition, the impact on the poor of public uses of electricity—like village hospitals and village lighting—may be much greater than the availability of electricity for individual household use.

That rural electricity can have a positive effect on the rural poor through the employment effects of non-household uses is not a new idea. But AID's tendency to focus on household consumption in its evaluations of rural electrification has resulted in a neglect of this potential. More specifically, AID should (1) look into the way this particular impact has occurred in rural-electrification projects and devise criteria for maximizing it; (2) correspondingly, devote less evaluation funds to household electricity impact studies; these studies read as somewhat forced attempts to "squeeze" New-Directions justifications out of rural-electrification projects, trying to smooth over the fact that household electricity will be used mainly by the better-off; and (3) try to break loose from the unquestioning acceptance of the conventional wisdom on how to design and run rural-electrification systems.

Forward Linkages

If an electric power system is put in place and managed reasonably well, one can be fairly certain that households will be connected up to it and receive its benefits. There is much less certainty, however, about whether employment-generating uses of electricity will occur, as well as public-sector uses benefiting the poor. Though the non-household use of electricity may have a greater potential than household use for having an impact on the rural poor, then, the certainty that such a favorable outcome will occur is not as great.

AID should attempt to increase the probability that the potential benefits of non-household use will actually take place—instead of settling mainly for the more certain household benefits, which do not always fit New-Directions objectives that well. Some possible ways of exploring this potential are (1) to look at cases where rural elecrification has had powerful employment effects, and try to uncover the sequence that led from the power facilities to the employment impact; (2) to analyze the ways in which various "technical" decisions—about rates, layout of the facilities, selection of communities to be served and geographical sequence of electrification—can influence the location of rural industries and the type that locate; and (3) to try to forge the link between electrification and employment-creating uses in the AID project

itself—for example, by including credit and technical assistance for location of small labor-using industries.

Rural-electrification projects tend to be looked at as technically pat. Design and operational questions are seen as being subject to standard solutions.[20] It is important to recognize, however, that there are technical and organizational alternatives, and that they can have different development impacts. In many instances, the technical choices necessary to bring about the desired linkages may be considered contrary to good standard practice—as labor-intensive road construction techniques were considered for many years. It is not that contractor organizations cannot be convinced or directed to make decisions that maximize such linkages; they are simply not used to looking for the opportunities for such decisions in the myriad choices they make when designing

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20 A NRECA discussion of engineering and construction for the proposed North Central Klaten RE project in Indonesia is an example: "Large outlays of money for system design can be avoided by using already available standard design/criteria, construction specifications and drawings, and approved materials. All of these have been thoroughly field-tested in close to a thousand rural electric cooperatives, and are available from the Rural Electrification Administration in the U.S.A" (p. 39). USAID, "Preliminary Engineering..." NRECA, Central Java.

their projects. Ultimately, then, AID should learn more about how to identify these technical alternatives and their differing development impacts. What it learns should inform the instructions it gives to its rural-electrification contractors.

Another approach to forging the link between rural electrification and electricity uses that impact favorably on the rural poor is for AID to be selective about where it does such projects. AID might finance RE projects only with governments that are already showing a strong political and financial commitment to making the link between rural electrification and employment generation. Usually, however, a certain type of AID project seems to "spread" from one country to the next—often because it worked well in one country, like rural electrification in the Philippines, or because it fits AID's programming constraints, like sector lending in the late 1960s. This way of deciding what to do in any particular country has its merits. Learning by doing takes place, and each successive experience with a particular type of project is a little more informed. (This benefit is often sacrificed, however, because of the pressure to do certain types of projects simultaneously.) But the "spread" model does not allow for much selection of projects on the grounds of what works best in the country at hand. The soundest New-Directions justification for a rural infrastructure project, then, may be related to parallel commitments and programs

that a particular recipient-government is undertaking—programs that will maximize the impact of the infrastructure facility on the rural poor.

Services to the rural poor

One item consistently mentioned in AID's impact studies of rural electrification was the way in which electricity facilitated the supplying of public services that were not previously available—a community clinic that could not operate without electricity-using sterilization procedures, a school that could not operate at night without electric light, etc. To the extent that such services are free, they can reach the rural poor more than individual household electricity. AID should attempt to identify those electricity-dependent services that have the greatest impact on the rural poor and, as in the case of employment-creating uses, try to force the linkage in the project between the supply of electricity and the supply of the service. A local-clinic component for example, could be included in a rural electrification project.

As in the case of employment-generating uses of electricity, there may be some argument to having the more "regressive" household sector subsidize these public uses of electricity. If the poorest of the rural poor are not usually able to acquire individual household connections, then lowering the costs of the hookup may

not constitute that significant a benefit to those poor. Indeed, financing the hookup costs may simply result in subsidizing the capital costs for better-off households—costs that they might have been willing and able to pay on their own.

In New-Directions terms, then, the more significant benefits of rural electrification may lie not so much in lowering the capital costs of household connections as in maximizing the creation of electricity-using services that benefit the non-adopting poor. To this end, one might want to promote the community uses of electricity and rely partly on the "better-off" household connections to help pay for them through "tougher" rates. (Note the contradiction between this suggestion and the normal tendency of electric utilities, noted above, to promote the greater use of household electricity.) In order to clarify some of these issues, it would be useful to have some evaluation work on various AID attempts thus far to lower the cost of the hookups. It is important to find out if non-adopters are staying behind because they cannot afford the capital costs of electricity—or the operating costs. If the latter is the case, then financing the hookup charges will have less potential than other approaches for extending the benefits of electrification to the rural poor.

Backward Linkages

Parallel to concerning itself with the linkage between rural electricity and employing-creating uses of it, AID should try to maximize the linkage between electrification projects and local suppliers. Much of the equipment for RE projects can often be manufactured locally at competitive prices--particularly poles, lines, conductor, small transformers, switchgear and substations. In general, public-sector infrastructure projects usually account for large shares of the gross capital formation that takes place in developing countries and therefore represent significant opportunities to feed demand into local industry. Because of this potential of its infrastructure projects, AID should require that such projects attempt to feed their demand into local industry. Similarly, AID should ask what decisions are being made about project design and specifications that will facilitate local supply of the project.

The importance of requiring that infrastructure projects show what they are doing to feed demand into local industry cannot be overemphasized. This is because the stakes are high, and because the biases of the system all run in the other direction, including AID procedures themselves. It is important to know not only what attempts are being made to maximize local procurement,

particularly of labor-intensive goods. But it is also important to find out how the technical specifications for the project can be changed so as to qualify existing local production. The questions should be asked in a way that elicits an actual attempt to do things differently, rather than just a "cosmetic" response. To obtain adequate answers to such questions, it may be necessary to hire an independent consultant with no vested interests in having the project go forward as such projects have in the past. In fact, it would be useful to contract an entity that has a vested interest in making the project go the other way—a local manufacturing association, the representative of a ministry of industry and commerce, a labor union. A separate office in AID responsible for technical assistance to local industry would be another appropriate entity with the "right" vested interest, as discussed further below.

Arrangements with local suppliers

The Philippine rural-electrification project provides one example of how AID can link its projects to local-industry supply. AID had insisted that the Philippine project use locally-supplied rather than imported wood poles for stringing the electricity wires. The Philippine electrification authority wanted to import the poles since local sources of supply were not adequate. AID prevailed in this case, and AID-contracted technicians helped set up local timber operations. Today the electricity poles in the Philippines are fully locally supplied.

The case of the wooden poles was a particularly apt occasion for insisting on import substitution, since the RE network being constructed would provide a constant and predictable demand for replacement poles in the future. In the Indonesian case, AID was less successful in forcing this type of linkage. NRECA had surveyed the availability and suitability of Indonesian woods, and strongly recommended the establishment of, and procurement from, a local wood-pole industry.[21] The Indonesians wanted to continue to import steel poles at three to four times the projected cost of producing wood poles locally—rather than commit themselves to the promotion of a local-supply operation. AID therefore excluded the poles in its share of financing for the project, and the Indonesians paid for the imported steel poles themselves. Similarly, NRECA has tried to facilitate the purchase of locally-produced conductor in some of its projects in Asia, as well as other hardware. It would be useful to find out more about such attempts, and the conditions under which they can be successful.

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[21] An extensive discussion of Indonesia's wood-supply potential for the RE project can be found in USAID, "Preliminary Engineering..." NRECA, Central Java, pp. 45-48.

A significant obstacle to feeding the demand for AID-financed infrastructure projects into local industry is the tariff exemptions granted such projects in many developing countries. Recipient-government tariff policy and AID compliance with it inadvertently undermines the local-industrialization objectives that the tariffs are meant to serve. AID should try to devise a strategy for its infrastructure projects that deals with this particular problem. An agreement might be sought whereby for certain cases the more costly local product would be purchased, and/or the tariff would not be waived. The tariff exemption, moreover, could be applied to the imported raw materials required by the local supplier, and not just to the project.[22]

The local items selected for special treatment could be those that were most labor-intensive in their production and for which a stream of future demand would be assured through maintenance and replacement needs or because of a long-term program of future construction. The wood poles are a case of this type of predictable and continuous future demand. As part of such an arrangement, AID's

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[22] This suggestion was made to NRECA by the manager of an Indonesian wire-and-cable-fabricating plant. He felt he could offer internationally competitive prices on ACSR and all-aluminum cable if he could import the rod and cord-wire duty free. To the same end, he suggested that the Indonesian government use part of the foreign-currency proceeds of the AID loan to purchase the required raw materials, which could then be furnished in bond to his plant. USAID, "Preliminary Engineering...," NRECA, Central Java, p. 49.

rural-electrification projects could also include technical assistance and/or credit funds for enabling local industry to supply certain items for such projects—items that are labor-intensive in production and for which there will be an ongoing demand.

Certain bargains might be struck by AID and the central government with the electric-power entity. The government, for example, might subsidize the extra cost of the selected local products to the power entity. At the same time, it could inform the local producers that it was subsidizing their high-priced and/or lower-quality production now in exchange for diminuition of the tariff in the future. Whatever such arrangements might be, it is important that they be sought with the central government and not with the power entity. The latter, understandably, will not be interested in paying more to achieve the employment-creating and development impacts of local procurement. Indeed, the power entity will normally resist local procurement on the grounds that it is being forced to pay a higher price in exchange for a benefit to the economy that it does not reap directly.[23]

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[23] In the longer-run, of course, the benefit of this action can accrue to the power entity in the form of a reliable and reasonably-priced local source of supply for future maintenance and construction needs.

Specifications

The specifications of infrastructure projects provide considerable opportunities either to avoid or encourage local suppliers. Most specifications for internationally-financed projects will tend to exclude local suppliers, without necessarily meaning to. This happens because specifications get written in ways that are customary and familiar to the international design and engineering firms that work on such projects. These ways of doing things grew out of the resource availabilities and the relative factor endowments of the Western industrialized countries. Specifications for roads, for example, usually require materials for the road base that are best handled with equipment- rather than labor-based techniques; base materials more suited to labor-intensive techniques rarely appear. Thus possibilities that labor-based techniques will be used are considerably narrow under current spec-writing customs—no matter how earnestly the donor and recipient are interested in promoting them.

To the extent that the problem of labor-intensive techniques and local suppliers is embedded in specifications, AID will have to make a deliberate foray into spec-writing practices to see how they can be neutralized at the least. The engineering department of AID is currently engaged in such an endeavor with respect to roads, trying to remove some of the pro-equipment biases

of standard roadbuilding specifications.[24] AID could do the same thing with rural-electrification projects, along with the additional task of removing anti-local-supply biases.

It may be more difficult to systematically remove anti-local-industry biases from specifications, as opposed to anti-employment biases, because the availability of local materials and the adequacy of local industry will vary from one country to the next. Thus AID may have to scout the local situation for each individual project, previous to drawing up the specifications. Though this task might seem cumbersome, the development and New-Directions impacts it could facilitate may well be greater than that of the electrification project itself—and at an incremental cost that would be small in relation to the project.

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[24] USAID, Africa Bureau, "Infrastructure Projects," by Palmer Stearns, 9 November 1977; USAID, "Utilization of Local Labor on Highway Construction Projects" (Draft), by Palmer Stearns, n.d.

An office of backward linkage

Because of the high return to be gained from a backward-linkage approach to its construction projects, AID should set up a separate office to deal only with this matter. Such a unit would be a more operational and potent way of introducing a "technology-transfer" program for industries in recipient-countries—in comparison to running such a program independently of AID's construction projects. The latter has been recently proposed for middle-income countries. The office could have a roving staff, mainly engineers, who would deal only with this particular question for each infrastructure project financed by AID.

Making the local-supply question the function of an office devoted exclusively to it—rather than of each country mission in the preparation of its project paper—increases the likelihood that the task will receive good treatment. If the task is assigned to the mission's project preparation team, it will be looked at as an additional burden, understandably, to be dispensed with as quickly as possible. Leaving the specifications the way they are and letting procurement fall where it may will be a much less time-consuming task. It will take considerably more time to find out that local industry may actually be able to supply some items, to have the specifications re-written to allow for this, and to work out an arrangement with local suppliers.

Because of the costs to the mission of taking such a matter seriously, in short, it cannot be expected to act as an advocate of local-industry supply. An office whose only responsibility was the promotion of local industry would be fulfilling its role—rather than cutting into its scarce time—by coming up with possibilities for local supply and with ways of changing specifications so that this could happen.

The advocacy role of the party in charge of facilitating local-industry supply will be crucial to the success of such an undertaking. One will come up against the reluctance of those who will worry about the additional work this approach might give them, and of those who are used to having structures designed in certain ways. The success of such an attempt, then, will be more dependent on the separation and role of the office than its size. One person might achieve more than the total result of every mission giving consideration to the issue in every construction project—and coming up with a boilerplate "status-of-local-supply" statement.

In order to gain some ideas about how such an effort could work, AID should look at the scattered experiences of success in this area—as in the case of the Philippine telephone poles noted above. AID would have more leverage with central governments in creating a mechanism for feeding project demand into local industry if the mechanism were routinely used for all AID-financed

construction projects, not just for a particular project or for a particular sector like electric power. In so doing, AID would increase the value of the procurement at stake to a level where it would be strongly in the self-interest of the central government and the private sector to participate. If such a mechanism were to work one time around, moreover, it might be considered by other donors.

The Case for Electrification and Central-station Systems

AID's justifications of rural-electrification projects normally assume that (1) rural electricity is more environmentally and economically sound than existing energy sources,[25] and (2) central-station electricity is more economically and environmentally

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[25] E.g., the Indonesia RE economic analysis states that "given the improved quality, reliability, and convenience of electric power vis-a-vis alternative enrgy sources..." (Annex K, p. 1, italics mine). USAID, "Indonesia—Rural Electrification I," No. 497-0267, Volume II, August 1977. Also, "bulk generated-electricity is a more efficient source of energy for household uses (lighting and cooking) or productive uses (lighting and motive power) than the alternative energy sources currently available" (p. 1). Also from the same annex, "the use of wood for cooking has resulted in a severe reduction in forest cover...which is causing serious soil erosion problems. The reduction of soil erosion may be another type of resource savings which results from rural electrification" (p. 10). The Philippine RE economic analysis refers to the kerosene cost savings and hence foreign exchange savings to result from rural electrification (pp. 59-60). USAID, "Philippines:Rural Electrification V."

efficient than independent diesel generators (autogeneration).[26] The environmental justification made for rural-electrification projects is that the two alternative sources of household energy—wood and kerosene—are environmentally undesirable. The use of wood for fuel causes deforestation and erosion, it is said, and kerosene pollutes the air. The economic argument against kerosene is that it is a petroleum derivative, the use of which should be minimized on price and balance-of-payments grounds.

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[26] The DAI evaluation of NRECA's RE programs reports that NRECA believes there can be "no serious development without central station electricity." Development Alternatives, Inc., "An Evaluation of the Program Performance of the International Program Division of the National Rural Electric Cooperative Association," 28 January 1977. The DIS summary of the Indonesia RE paper states that the government of Indonesia "has provided expensive and unreliable small diesel generators in isolated towns."

The social analysis of the Jordan RE paper has quite representative passages on autogeneration. "Several villages are presently served...by privately-owned diesel generators...of old vintage and ill maintained and thus unreliable...To some extent all the foregoing benefits of central-station electricity are available through privately-owned generators, however, the quantity and quality of the electricity provided is uncertain. Public service will...raise the standard of living by encouraging the seeking of employment and increased income with which to purchase household appliances and luxury items such as television sets" (pp. 26-27). USAID, "Jordan: Rural and Urban Electrification," Project Paper AID-DLC/P-2238, 25 August 1977.

These above-stated assumptions may be accurate in some cases and not in others. In any particular case, however, they need to be proven true, because a complete analysis of the matter could easily arrive at the opposite conclusion in many instances. With respect to wood, for example, AID's impact studies of rural electrification have themselves shown that a majority of household users do not substitute electricity for wood in cooking and ironing.[27] Indeed, it was found in the Philippines that even in households using electricity for refrigerators, fans and television sets, wood frequently continued to be used for ironing and cooking.[28] These findings suggest not only that many of the rural poor will not substitute wood for electricity but that electricity is not competitive with wood. Contrary to what is assumed in loan papers, then, the adoption of electricity does not seem to have a significant impact on the household use of wood for energy. Even in cases where there is substitution of electricity for wood in cooking, it is likely that the better-off consumers are the ones who are making the substitution. This leaves a significant amount of woodcutting still being done by the poorer electricity users, not to mention the non-adopters.

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[27] E.g., USAID/Philippines, "Socio-Economic Impact..."

[28] Ibid., p. 3.

To the extent that woodcutting is a byproduct of slash-and-burn cropping systems, its use or non-use as household energy will be determined more by that fact than by whether or not electricity is available. In that wood is frequently an input in the joint production of cooked foods and agriculture, moreover, it may be difficult to offer electricity at a price low enough to induce the substitution of electricity for wood as energy for cooking. For many of the rural poor, moreover, the acquisition of firewood requires no cash outlays, and only the expenditure of household labor. Electricity, in contrast, requires a capital outlay for a hot plate and iron, and regular cash outlays for continued usage. In reality, then, not much is being achieved by rural electrification in the fight against deforestation, and the "conservation benefit" is hardly worth mentioning. AID can work on deforestation problems more directly than through rural electrification—with greater impact, and in ways that take into account the wood-gathering economies of the rural poor.

With respect to the benefits of substituting electricity for kerosene in household lighting, one cannot argue that electricity is preferable on environmental grounds unless one completes the comparison. That is, the pollution caused by oil-based and coal-based thermal plants that generate electricity for lighting must be shown to be less than that caused by kerosene-based lighting of households—

not to mention any additional pollution caused by industrial or commercial operations that establish themselves as a result of the new availability of electricity.

With respect to the petroleum- and foreign-exchange-saving "benefit" of switching from kerosene to electricity, the same argument applies: one must show that the new electricity-generating thermal plants, and the industrial growth they facilitate would cause less petroleum consumption than existing kerosene lamps.[29]

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[29] The economic analysis of the Indonesia RE paper is the best attempt to make such an all-inclusive analysis of the fuel-savings question. (USAID, "Indonesia—Rural Electrification I," (August 1977), p.14; and USAID, "Indonesia—Rural Electrification I," Annex K, pp. 7-10.) It compares the economic cost of generating a kwh-equivalent of energy derived from kerosene and that from electricity. It also compares the fuel-oil needs for total Indonesian electricity consumption to those required for current kerosene consumption in all uses. The latter comparison pertains to the issue discussed in the text, but is not specific enough to determine whether the results are relevant—and does not seem to include increased oil consumption resulting from expanded uses complementary to the new supply of electricity. The Indonesian RE project, for example, includes the introduction of new fuel-oil-using diesel plants.

As mentioned above, moreover, electric utilities promote the increased use of electricity as part of good management practice. A proper comparison between the petroleum costs of kerosene vs. electricity, then, would have to include the increased energy usage resulting from electricity, and the resulting increased fuel demands.

To a certain extent, environmental arguments for rural electrification are "boilerplate" and thus should not be taken seriously. They reflect the current preoccupation with environmental issues and the demands made upon AID to be responsive to them. But the arguments should be more carefully treated, because they can justify actions that are in direct conflict with New-Directions objectives--and because there is ample room in AID's projects for serious dealing with these issues. A concern for lessening the use of petroleum derivatives in the generation of energy, for example, could take the form of financing micro hydro installations. A concern for deforestation might take the form of providing household sources of energy that could compete with wood and thus would be adopted. Or, such concern could lead to a program to change the land-tenure pattern, common in Third-World countries, which leaves the rich valley bottomlands to large farmers and forces peasants to farm the mountainsides.

Autogeneration vs. central-station systems

Most justifications of rural-electrification projects state that these new systems will replace the "higher cost" and "inefficient" alternatives of independent local diesel generation (autogeneration).[30] Central-station electricity is assumed to be superior. This assertion, which may be true in some cases and not in others, is stated rather than proven in AID project papers.

Maintenance is a major problem in electricity systems in Third-World countries—especially in the case of rural systems, where so much elaboration of the transmission system is necessary. The maintenance problem is not peculiar to electric power; it exists just as seriously in other infrastructure projects, like roads and water supply. Most analyses of the costs of central-station electricity vs. autogeneration, however, do not take into account the lack of maintenance and the costs of the resulting downtime in the system. Like the cost-benefit analyses of roads, these comparisons assume that maintenance will be forthcoming. AID's long experience with these types of projects has shown that maintenance is not forthcoming, more often than not, and that losses from its absence are considerable. The Pakistan electric power network, for example,

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[30] See footnote 26 above.

is said to sustain losses of 35% of the electricity generated—resulting principally from inadequate maintenance and, to a lesser extent, theft. An argument for rural electrification, then, must show that even with the normally high amounts of electricity loss, centrally-generated and distributed electricity is more economic than a series of unconnected local systems. Typically, however, the cost comparison assumes that the proposed project itself will cure the maintenance problem.

Outages and voltage variations are characteristic of electricity supply in developing countries, both in central and autogenerating systems. Central-system supply tends to magnify the losses from downtime by transmitting them to all connected localities, while the failings of autogenerators affect only the immediate locality. In making the comparison between central-station and autogenerated electricity, then, one needs to compare the losses from downtime as between the two systems. Since central-station electricity is subject to problems in the extensive transmission network of an RE system, as well as in the generation system, a set of independent municipalities supplied by independent generators might well experience less aggregated blackout time in any one year than a central system supplying the same localities.

An example of the kind of cost considerations being raised here is provided by the DAI evaluation of a NRECA

rural-electrification program in Nicaragua.[31] The study reported that the agro-industrial firms using the new central-station electricity also owned their own diesel generators. The diesels, the firms said, were more reliable than the central-system supply. This was not simply a case of making good use of generators already owned before the advent of central-system electricity; some owners reported buying the generators after central-system electricity became available because the latter could not be counted upon. (Even for those who own generators before central electricity is available, the retention of such generators is costly because deterioration occurs when the equipment is not in frequent use.)

The result of introducing central-system electricity in the Nicaraguan case, then, was not necessarily to substitute lower-cost for higher-cost electricity. To a certain extent, the new system supplemented rather than substituted for the existing higher-cost supplies. The cost to the agro-industrial consumer of this combination of private autogeneration and central-system supply may have been cheaper than using autogeneration only. Rural-electrification systems do not normally charge the full cost of supplying power, at least in the early years, because these unit costs are so much higher than those of urban electricity supply. Thus the

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[31] DAI, "An Evaluation of the Program Performance of the International Program Division of the NRECA," 28 January 1977.

autogenerating consumer might save something by substituting some of the central-system supply for the previously autogenerated supply. The cost of this particular electrification project to the economy rather than the autogenerator, however,was clearly not less than the existing system of "inefficient" autogenerators. The new system, that is, included the operating and deterioration costs of keeping the autogenerators in service, in addition to those of putting in and running the central-system supply. The Nicaragua study shows, in sum, that the costs of central-station supply under the conditions normally prevailing in developing countries can not always be assumed to be less than those of autogeneration.

There is an institutional reason that central-station supply involves so many losses for rural-electrification systems in developing countries. State power entities have shown themselves to be better at generation than at distribution of electric power, for the reasons noted above. Rural-electrification systems represent the greatest possible elaboration of the transmission system, and thus involve an activity where state-sponsored management of electric-power supply tends to be weaker. To move from a set of independent autogenerated localities to a central system, then, involves a more demanding task of management—as does the move from generation to distribution. State power companies, usually already in charge of power development in recipient countries, are less up

to this type of task than to others. Thus a group of independent autogenerating companies may produce better aggregate performance, simply because the integration of electricity supply to these separate localities is not necessary.

For all these reasons, the timing of the move from autogeneration to central-system supply should be conservatively determined. If AID makes the move before the management capacity is in place, then the economic edge that central-system supply has over autogeneration may not really exist—at least for many years. There may well be many cases where a more efficient way of providing rural electricity is to finance the growth of separate autogenerated systems, thereby avoiding an existing and weak state power authority. Or, the best sequence for developing management capability for rural electrification may be through previous mastery of the easier task of generation. Or, as in the case of the Philippines, the best path may be the creation of a separate RE system with coops from scratch. AID should look at the rural-electrification success stories of the Philippines—as well as of Taiwan and Japan—with these management questions in mind. An attempt should be made to understand what the path of institutional growth and maturation was in these cases—and whether outside assistance was able to overcome the kinds of management weaknesses found in the other Asian RE programs today.

The unique success story of rural electrification in the Philippines provides at least one answer to the above questions. The existing state power company in the Philippines has been prohibited by law from doing anything but generation. Thus when AID and NRECA moved in, they had clear ground on which to create a new rural-electrification administration, independent of the state power authority. In most other countries where AID has rural-electrification programs or aspirations, this is not the case. It has to work with an existing state power authority, most of which are admitted to be weak. AID's ability to create something from scratch in these other situations is limited--not only because of the uniqueness of the Philippine commitment to electrification and receptiveness to AID and NRECA--but because of already existing prerogatives and preferences on the part of the state power authorities. In Indonesia, for example, there was considerable conflict between the state power authority (PLN) and AID/NRECA over questions of turf. The PLN did not want independent coops to be created and used as a vehicle of rural electrification. A compromise was finally arrived at whereby a non-coop approach was used for the densely populated island of Java, the area most desirable to the PLN. AID was allowed to try the coop approach in the less populated outer islands, where the PLN had less interest.[32]

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[32] The project is described in USAID, "Indonesia--Rural Electrification I," No. 497-0267 (August 1977).

New Directions and central-station projects

AID's focus on central-system projects as opposed to autogenerators is partly a reflection of the philosophy of its rural-electrification contractor, NRECA. It also reflects New-Directions attitudes about infrastructure projects. Though unsympathetic to rural-electrification projects in general, New-Directions sentiment in Congress has been more sympathetic to such projects if they did not include generation. In its original form, for example, AID's Indonesian RE project included some diesel generators. Congress objected to the loan, and particularly the generators. AID let the generators go, knowing by that time that they would be picked up by the Canadians, who were also looking for something to finance in Indonesia.

Transmission and distribution in the countryside, then, tend to be looked at as more "New-Directionsy" than generation. This distinction does not seem an unreasonable way of selecting projects that get one closer to the rural poor. But the central-system grids of AID's RE programs are transmission-intensive compared to a set of independent autogenerators, which are generation-intensive. Thus it actually is not true that transmission can get one closer to the rural poor than generation, if one is talking about autogeneration as opposed to the generating plants that supply central systems.

Interestingly, the New-Directions distinction between generation and transmission gives even greater credence to the assumption that central-system grids are always better than autogenerators. It makes it easy to overlook one of the advantages of autogeneration. By requiring very little transmission and coordination of the various systems, as noted above, generation minimizes the demand for organizational and management skills that are scarce in recipient countries. Thus autogeneration may sometimes do better at getting electricity to the rural poor precisely because it is generation and is not transmission.

Piecemeal and lumpy investments

There is another reason that a set of independent generators supplying a region might be more economic than a central system. The system approach constitutes a lumpy, indivisible investment, compared to the town-by-town acquisition of independent generators. Because of the scarcity of capital in developing-country economies, a single investment at one moment of time is considerably more costly than stringing out these same expenditures through time. Towns, of course, can connect up one by one to a central rural system once it is in place. But the system is still a lumpier investment than growth by autogeneration, since the former requires a major investment in a transmission network and a minimum number of towns to start out with.

This lumpy-vs.-piecemeal distinction was actually first applied to the analysis of development projects also in the area of electric power, more than ten years ago.[33] IBRD research demonstrated that the economic comparison of hydro vs. thermal power projects, when based on the interet rates charges by donor institutions, gave an artificial edge to hydro projects. The hydro project has a greater initial capital cost than the equivalent thermal, while thermal has higher operating costs than hydro. If one uses the concessional interest rate on donor lending to discount the stream of costs and benefits of the two alternatives, the future operating costs of thermal are not discounted as heavily as they would be if the higher, real cost of capital were used. Using the real cost of capital, in contrast, gives greater relative weight to present costs (the lumpy investment in hydro) as opposed to future costs (the higher operating costs of thermal).

As in the case of thermal vs. hydro, independent autogenerator growth has an advantage over central-system projects in that it strings out the total costs of supplying electricity through time, instead of concentrating them in the present.

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[33] IBRD, The Economic Choice between Hydroelectric and Thermal Power Developments, by Herman G. van der Tak, World Bank Staff Occasional Papers No. 1, 1966.

Actually, autogeneration is to central supply as thermal is to hydro in two ways: not only can the investment be strung out over time, town by town, but the operating costs for autogeneration are higher than those of a central RE supply.[34] Like thermal vs. hydro, then, autogeneration has lower present (capital) costs and higher future (operating) costs in comparison to central supply.

The piecemeal growth pattern of electricity supply through autogeneration has another advantage in a capital-scarce developing country. Autogeneration allows the demand potential of an area to become known before one has to make the major and irreversible investment involved in central-system supply. The planning of RE networks must be based to a great extent on projections of future demand and is subject to considerable uncertainty. It is not uncommon, for example, for an RE network to be in existence for 20 or 30 years before its capacity is fully utilized. The growth of electricity supply through separate autogeneration systems avoids these long periods of startup and excess capacity, so costly in capital-scarce countries. It also serves as an indication of existing demand and potential for future growth in a particular locality.

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[34] The World Bank shows typical operating costs of autogeneration at 12 times greater than those of grid-supplied projects. Total autogeneration costs are said to range from 9 to 20 cents per kwh or more (at 1972 oil prices), in comparison to total costs for public supplies of 4 to 18 cents (except in the case of widely scattered villages, where these costs will be two to three times greater.) IBRD, "Rural Electrification."

This makes the task of central RE projects easier, when they ultimately do come about, and lowers the likelihood of expensive mistakes resulting from inaccurate estimation of demand growth. Autogenerators are also suited to this demand-mapping and transitional role because their service lives are much shorter than those of the equipment in central RE systems—ten years vs. 30-40 years.

Autogeneration is typically criticized in AID loan papers for making power available only during certain periods—typically only at night. The proposed central-system supply, it is said, will have the advantage of providing electricity on a 24-hour, "full-service" basis.[35] This partial functioning of autogenerators can also be seen as one of their "piecemeal," and therefore desirable, features. The 24-hour-service standard for AID projects, that is, is quite a rigorous one for many rural areas, and may be more than adequate.[36] After all, if use of electricity by the rural

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[35] Both the Jordan and Indonesia RE papers refer to the fact that villages supplied with autogenerators have electricity only at night, citing this as a reason for the superiority of the proposed central-system supply.

[36] Some of the differences of opinion between NRECA and the Indonesian state power authority revolved around this type of issue. The Indonesians were accustomed to planning and designing on the assumption of partial supply and interruptions, as in the case of the limiters discussed above. NRECA, in contrast, wanted planning to be based on "full-service" thinking.

poor is pretty much limited to lighting, as shown by the impact studies, then not that much is being lost by supplying electricity on during the night hours.

The high investment in generation and transmission required for central-station RE systems makes it financially unwise to think of less than 24-hour service.[37] At the same time, the resulting high unit cost of rural electricity makes it impossible to set rates at levels high enough to cover these average costs—at least until the system is fully loaded up. The high operating costs of autogenerators, in contrast, mean there is some financial sense in supplying electricity only at moments of greatest demand. Also in contrast to central-system supply, there is nothing to be gained by setting rates at less than costs. The economics of central-system rural electrification, in other words, carry an inherent bias toward the promotion of more electricity consumption, while those of autogeneration do not. The most compelling reason to promote greater electricity use under

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[37] The World Bank estimates the average costs of rural-electrification projects as three to four times greater than those of urban projects. Not infrequently, moreover, the excess capacity in the rural systems will be enough to meet up to 20 years of growth in demand. As a result, it is typically recommended that rates be set at lower than unit costs—at least for the first five to 15 years of RE projects. IBRD, "Rural Electrification," pp. 54,59.

central-system supply can become the advantage of more rapidly amortizing high-cost installed capacity—rather than the economic benefits of such expanded use to consumers or the impact on regional development. The "higher-priced" autogenerated electricity, then, may also reflect the real cost of rural electricity to the economy instead of just "inefficiency." The sparer consumption opportunities available under autogeneration, in sum, may sometimes fit better the needs of rural areas. It can not be assumed that full-service supply is always more desirable than partial supply, in sum, given the considerably greater investment costs of the former and the fact that autogeneration may satisfy most of the needs of the rural poor for electricity in many rural areas.

The piecemeal development of rural electricity supply can economize on central-government finances. Communities with already-existing electricity supply are likely to mobilize efforts and finance when an opportunity presents itself to improve the quality of that supply and lower its price—i.e., when the possibility arises of hooking up to a central RE system. The community with autogenerated supply has the incentive of lowering the costs of something it already buys. The community with no electricity at all has less incentive to contribute to the installation of a service for which it will have to make new cash

outlays and whose advantages are not familiar. Not surprisingly, studies of village preferences have shown electricity to be of low priority to villages without it—in comparison to investments in health and water supply.[38]

Development of rural electricity supply through autogeneration, in sum, is likely to help mobilize support and capital for the next and much more costly stage of the process—central-system supply. This potential for mobilization of local interest in and financing for infrastructure projects is a strong argument in general for decentralization of decisionmaking and financing, as noted above in the discussion of rural roads. Thus the piecemeal nature of autogeneration growth not only saves on scarce public capital and allows eventual RE systems to make more economic decisions about location and capacity. It also provides a significant opportunity for the mobilization of local capital for further stages of electrification—in a way that large lumpy investments, financed by the central government and from outside, do not.

The lumpiness of central RE systems is precisely what makes them desirable to AID as projects. Though lumpiness may be a costly way to use scarce resources in the recipient-country economy, it is at the same time a more efficient use of AID staff

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[38] Ibid.

time than the piecemeal approach.[39] This efficiency relates not simply to dollars commited per unit of AID staff time, but also to the institutional feasibility of such projects for AID. With central-system rural electrification, AID has to deal with only one or two government authorities—and has a contracting organization at hand, NRECA, that is ready and able to do such projects anywhere in the world. The financing of independent generators, in contrast, could involve myriad local authorities and private entities—as well as going against the preferences and working habits of AID's rural-electrification contractor.

Conclusion

There may be ways of combining the efficiency for AID of the central-station approach and the efficiency for developing-country economies of the piecemeal approach. One possibility could be a central-government fund for local autogeneration projects or for hookups to central-station RE grids. The fund could be partly financed by AID and operated on a matching basis with the localities. This would

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[39] Similarly, IBRD staff has noted that despite its correction of the pro-hydro bias in hydro-thermal cost comparisons, as described above, large hydro projects kept being approved at the same rate.

create a mechanism for tapping the potential that exists for local financing of and organization for such projects. Such a fund might eventually be expanded to include other projects for which localities are likely to put forth some effort—like roads, schools, clinics. The resulting decentralized decisionmaking of such an approach could have a significant impact on the rural poor—above and beyond the potential impacts of central-station RE projects. The New-Directions appeal of this approach would be the mechanism by which local projects were decided upon and funded, and not just the fact that one was financing an electrification, roads, or schools project.

One of the more successful aspects of AID's experience with rural electric cooperatives might also be applied to autogeneration. The DAI evaluation of NRECA's RE programs suggests that the coop approach can be good at setting up local organizations to generate and distribute their own electricity or to obtain a hookup to a central grid. In Latin America, however, RE coops did not seem to be able to supply power at prices that were competitive with those charged by the central state power authorities.[40] The latter were either already in existence at the time of AID's RE project, or came into existance during the course of the project. Though the evaluation reported these price discrepancies as contributing to the

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[40] DAI, "An Evaluation of the Program Performance of the International Program Division of the NRECA." The study did not indicate whether the coops' costs were higher, as well as their prices.

"takeover" and "demise" of the coops by the state systems, this sequence of events could also be looked at in a positive way: the coop may have been a crucial first step toward getting the attention of the state system to serve these particular localities. If a more efficient entity came along and replaced the coop, this does not deny its important role in attracting a more efficient supplier to the town.

The role of the local coop in the sequence described above is complementary to that of autogeneration: it creates an organized group at the local level that will be able to pressure more effectively than previously for a hookup to the central system. The autogenerating coop's experience with its own electricity, or as part of a smaller system, will provide some track record of electricity demand for the larger power authority. The coop "phase", moreover, can take care of the task that is hardest for state power companies to do—organization for and carrying out of local distribution. The coop approach, then, could be applied to the creation of autogenerator systems, as the first step in a sequence of electrification growth. Later steps, if successfully taken, could well involve the withering away of the coop—as happened in the Latin American cases noted by DAI.

It should be clear by now that autogeneration and central-station systems are not being discussed here as mutually

exclusive alternatives. Each approach corresponds to a stage of electric power development. There is some argument for not skipping the autogeneration stage, however, as AID may be doing in some of its rural-electrification projects. There is good reason for AID to finance autogeneration, moreover, and not only just central-station systems. Finally, the justification for moving to central-station systems should be more rigorously made for AID's projects. This is because the move is costly and because the comparative costs of replacing existing autogenerators with RE systems have been underestimated.

Summary and Recommendations

With the new concern for the rural poor, AID's infrastructure projects have had a more difficult time gaining approval. New-Directions critics say that infrastructure projects do not have a direct impact on the rural poor, in comparison to projects in the areas of rural health, nutrition and agriculture. In contrast to these latter projects, it is said, infrastructure can not be focused exclusively on the poor. Rural electrification has been particularly affected by this new thinking, though a good number of such projects have still succeeded in overcoming the opposition.

In trying to defend rural-electrification (RE) projects against New-Directions disapproval, AID seems to have focused on aspects of such projects that do not represent their greatest potential. Namely, it has emphasized the benefits resulting from household consumption of rural elctricity more than those from productive and municipal uses. The household focus dominates AID's impact studies of rural-electrification programs—partly because of the household emphasis of its most successful RE program in the Philippines, and partly because of the household orientation of its sole RE contractor, NRECA (The National Rural Electrification Cooperative Association).

It is difficult to show that the introduction of rural electrification to households can have as significant an impact on the rural poor as other types of rural development projects. Either the poor do not have the resources or the houses to hook up to the system—or they use electricity only for lighting, continuing with wood for cooking and ironing. On the one hand, one can not claim a significant New-Directions impact on the rural poor on the grounds of lighting only. On the other hand, one can not classify as the rural poor those who do make more extensive use of household electricity through the purchase of appliances. Finally, the rural poor themselves do not place high value on the acquisition of household electricity. When villages without electricity are polled about their preferences, electrification is low down on the list, with highest priority given to services like health and water supply.

A stronger New-Directions case for rural electrification can be made on the grounds of the potential impact on the rural poor of certain productive and municipal uses of electricity, and of procurement from local industry of materials used to build and maintain such infrastructure projects. Productive uses—in the form of rural light industry or irrigation—generate employment for the rural poor, whose major source of income is

from off-farm earnings. Municipal uses of electricity can facilitate the supply of services such as health clinics, night education classes, or street lighting. These services are accessible to and valued by the rural poor more than household connections.

As currently designed, rural-electrification projects do not necessarily result on their own in these desirable impacts. AID should therefore direct more attention to evaluating the non-household potential of its rural-electrification projects—not to provide them with a better justification, but so as to learn how to design them in a way that assures that this potential is realized. Some possible approaches would be the following: (1) credit and/or technical assistance for rural light industry could be included in RE projects—or other features that would increase the probability that electrification would result in the establishment or expansion of employment-creating uses; (2) similarly, AID could try to increase the probability that municipal services directly benefiting the rural poor, and dependent on electricity, would be introduced with an electrification project: a health-clinic component might be put together with an RE project, or special consideration could be given for hookups and rates to municipalities that organize such efforts on their own; (3) attempts

should be made to facilitate local procurement of equipment and materials for rural-electrification projects and, indeed, for all AID-financed infrastructure projects; infrastructure projects create a large, predictable and ongoing demand for certain locally suppliable materials, and many such local supply operations are labor-intensive.

Promoting the local supply of AID's rural-electrification projects will require an overhaul of specifications for RE projects—as is now being done with road-construction specifications as part of the attempt to introduce labor-intensive methods of construction. The effort will also require that AID enlist the assistance of those who have a vested interest that such local supply take place—local associations of manufacturers, ministries of industry and commerce, local labor unions, etc. For the AID mission, in contrast, local-supply arrangements are undesirable in that they mean an increased expenditure of scarce project-preparation time. In order to keep this burden off the mission, and to create a vested interest for local supply within AID itself, AID should create an office of "backward linkage" to supervise the search for local-supply possibilities. By neglecting the backward-linkage aspect of its RE and other infrastructure projects, AID may be giving up the greatest opportunity that such projects offer for New-Directions impacts.

All the above suggestions will require a questioning of the standard way in which AID's rural-electrification projects are designed and implemented. Modifications of design and specifications will be required that maximize the employment-creating uses of rural electricity and the employment-creating local procurement for RE projects. Up to now, RE project design has not been subject to this kind of scrutiny, in contrast to the case of road-construction technology. The desired modifications of RE project design, of course, will be different from those in roads, for electrification concern will be focused more on employment-creating uses of the infrastructure facility than on employment-creating techniques of construction. But the two are similar in that they both merit the promotion by AID of employment-creating supply of construction and maintenance materials.

AID may in some cases be introducing large rural-electrification projects into areas where electrification, or central systems, are not yet economically justified. Up to now, AID's justifications of rural electrification simply assume that electricity is more efficient than existing forms of energy use (wood, kerosene, batteries, etc.)—and that central-station systems are more economic than existing diesel generators (autogeneration). AID usually says, for example, that one of the important economic benefits of the

introduction of rural electricity is the replacement of kerosene use in household lighting: electricity is cheaper than kerosene, causes less pollution, and reduces the demand for petroleum derivatives. This is a quite partial reckoning of costs and benefits. The saved cost of kerosene in household lighting needs to be compared to the increased use of petroleum derivatives that results from the new power-generating plants and from consumption uses that are complementary with the increased use of electricity.

Similarly incomplete benefits are cited with respect to the substitution of electricity for wood as a source of energy in the household. This substitution is said to help prevent deforestation. AID studies actually show, however, that even those poor who hook up to the system continue to use wood for cooking and ironing. This suggests that electricity is not competitive with wood—at least for the poorest—and does not therefore lead to the alleged conservation benefit.

Central-station systems should also not be assumed to be always more efficient than autogeneration. The introduction of rural electricity through independent diesel generators—or the continuation of an existing autogenerated supply—would in various cases be more efficient than the introduction of central-system supply. In contrast to autogenerator units, central-station

systems require difficult management skills that are scarce in developing countries, especially for the state power authorities now usually in charge of electrification. The integration of power supply in central-station systems—said to be one source of their efficiency—can upon closer examination be seen to have a significant disadvantage: central systems spread the results of breakdowns to more consumers and over more systems than in the case of a set of independent autogenerators covering the same number of municipalities. Because these breakdowns, and the faulty maintenance practices that contribute to them, are common in developing countries, the breakdown-magnifying impact of central systems introduces a significant economic cost not present in the more primitive, unconnected generators.

Growth through autogenerators allows a more divisible investment in electric power—often more suitable to the capital scarcities of developing countries and the uncertainties about how and where demand will grow. Growth of rural electricity through autogeneration can also elicit local organization and financial participation in a way that central-system growth does not. Unfortunately, the biggest argument against autogeneration is that it is easier for AID to finance a big capital project than lots of little ones. The evaluation suggests some ways in which this problem might be overcome, and how AID might finance autogeneration in cases where it is more desirable than central-system supply.

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