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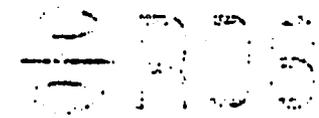
N.R.E.C.A. WORKSHOP
REQUIREMENTS TO FINANCE SMALL-SCALE
HYDROELECTRIC PROJECTS

D R A F T

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RURAL DEVELOPMENT SYSTEMS

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WORKSHOP

REQUIREMENTS TO FINANCE SMALL-SCALE

HYDROELECTRIC PROJECTS

DATE: March 10, 1981

PLACE: NATIONAL RURAL ELECTRIC COOPERATIVES ASSOCIATION
(N.R.E.C.A)
Main Floor Conference Facilities
1800 Massachusetts Avenue, N.W.
Washington, D.C.

A G E N D A

- 9:00 am INTRODUCTION
Mr. Herb Wegner, R.D.S.
- 9:15 WORKSHOP OBJECTIVES
Dr. Jack Fritz, A.I.D.
Dr. David Zoellner, N.R.E.C.A.
- 9:45 STATEMENT OF REQUIREMENTS FOR FINANCING SMALL,
DECENTRALIZED HYDROELECTRIC PROJECTS
Mr. Jorge R. Asin, R.D.S.
Mr. Bard Jackson, N.R.E.C.A.
- 10:15 SUGGESTED CRITERIA FOR FINANCING SMALL-SCALE
HYDROELECTRIC PROJECTS
IBRD PERSPECTIVE. Messrs. J. Fish and E. Moore
- 10:45 COFFEE BREAK

- 11:00 am SMALL-SCALE HYDROELECTRIC PROJECTS AS COMPONENTS
OF REGIONAL PLANNING
Dr. Arthur Heyman, O.A.S.
- 11:15 ECONOMIC ANALYSIS FOR SMALL-SCALE HYDRO
Mr. James Ladd
- 11:30 A.I.D. REGIONAL OFFICES PROGRAMS
Latin America, Mr. Carl Duisberg
Asia, Mr. Robert Ichord
Near East, Mr. George Self
Africa, Mr. Robert MacAlister
- 12:00 noon FINANCING SMALL-SCALE HYDRO BY THE PRIVATE
BANKING COMMUNITY
Mr. Douglas Blair, Chase Manhattan Bank
- 1:15-
3:00 pm ROUND TABLE DISCUSSION ON NEW CRITERIA FOR FUNDING
SMALL HYDROELECTRIC PROJECTS
- Institutional Structures
Economic Criteria
Socio-Economic Impact Criteria
Other Development Factors
End-User Organizations

Herb Wegner. Good morning, we are, I think we can get started, we are a little bit late, but a couple of our speakers will not be on the program, so I think we'll catch up to ourselves. We debated originally whether we should start at 9 o'clock or 9:30, and I think the group has made the decision for us.

To set the stage a little bit, there are two questions I'd like to toss out to you. One is where are the most effective levers in development. That is a question we are not going to discuss and consider, but I a number of electricity to a number of communities in the world is an extraordinarily important lever, it has a great number of implications to it. The second question, how do we keep procedure from becoming an end in itself or how do we signal priority in a bureaucratic world. This is a question that I think we want to deal with very much. Our objective in a general sense today is to find obstacles to the orderly and timely development of small hydro generation plants in appropriate communities in the L.D.C.s and to collect as many recommendations as we can as to how these obstacles can be overcome.

Now, I don't think we, again in the interest of time and the fact that this is less than a full day's workshop, I think we will assume as a given that the process of electrification of a community can result in increased production in their economic

standards, higher standards of hygiene, all sorts of things. You may not be aware, but in small villages, I've actually seen the following: the installation of lighting, suddenly people paint their houses and they sweep their floors and later this is followed by installation even of such things as glass windows which replace the holes in the walls. And then begin to get a lever on such things as hygiene, infant mortality rates and so on. It's very hard to trace out these soft benefits in quantitative terms, but I am totally convinced that they are there. So the virtue of what we are discussing I think we will omit. Unless there is objection, we will simply assume that that virtue is there. There is also a great potential virtue on both the production and productivity side and again let us assume that that's there. We note that the need for small hydro is frequently identified in national development plans. There is no apparent shortage of either technical talent or the generating of related equipment necessary to meet the need, but the question of project finance seems to be the key area to break something loose, and increase this kind of development throughout the world.

Everything from project analysis to design development approval and implementation, we'd like here to try to define the minimum but essential role for government, the maximum role for the private sector. It has always been an observation of

mine of some sadness that governments are heavily involved in the process of development and that the private sector through sheer inertia of procedure has been locked out of much of it unless there is a high profit potential or that we are talking in terms of great numbers of dollars.

I think that we hopefully can review the basic criteria for project finance, determine that these criteria can in any way be simplified, discuss the type and extent of risks lending institutions should be able to assume, to find the borrower - this is difficult in a small world community. Is there an organization there, is there a municipal administration that has power under law to borrow? The means to assure capital recovery can be very expensive and assess if a community will repay a loan they got a few years ago and they're enjoying the fruits and benefits of electrification, and the question of the orderly repayment of loans is an abstraction which has not been fully absorbed in the society.

It would be useful to discuss typical project profiles and to generalize the needs for such things as grant assistance in addition to loans, the need of many for guarantees, and how in general to expedite the process of financial support for small hydro development.

More specifically, is it possible to pre-design the modular approach using pre-engineered specifications to meet certain needs, to come up in other words with some modular packages which

we do not have to re-investigate and re-evaluate every time that we consider the project as a way to bring these kinds of efficiencies to this. An example of this kind of process I'll give to you. Two jobs ago, I flew my own airplane where I traveled quite a bit. I had a telephone put in it. When I bought the telephone, it came with an application to the FCC that was about twelve pages long and asked such questions as how high the antennas were to be above sea level and all kinds of things that were utterly, totally and completely irrelevant, but because this kingsilver crown package was a pre-engineered module, if you will, a standards specifications, fortunately it was only necessary to fill out about half a dozen questions on this form. Once you specified the particular piece of gear, then a chain of assumptions at the FCC fell neatly into place. Fortunately, the formidable task of dealing with the irrelevancy of 12 pages of questions was lifted from these weak shoulders.

Can we simplify criteria? Can we, I saw, I was looking the other day at a booklet published by BID on the subject of the criteria applied to electrification and I plowed through as much of it as time would permit, but you know it covered everything from the Hoover Dam down to a little ten KW unit to be applied in a small village. The process, the procedure here was dramatic overkill, so what would come out of it? Can we simplify sight surveys, is there a standard way we can develop a table that can be punched with minimum effort by persons who

have less than the highest possible qualifications and still do a job that we can respect and use usefully. What about the promotion of electrification in general? Unfortunately, in our world, things, whatever their intrinsic virtue, seem not to happen unless there is an organized promotion, a focusing of attention. World hunger recently has been the benefit of this and is bringing together a high level commission to identify a need and bring back solemn, serious and qualified people to meetings, to produce reports and analyses and so on, in other words, to focus on a great need.

Again, referring to my opening remarks, I believe this is one of the fundamental levers of development and the question I ask of you is: is there a potential for organizing the attention of the world in some fashion, by some series of techniques, that would be beneficial? What is the potential for the institutionalization of data communications and coordination? We're dealing with little bits and pieces of things in terms of data, sections of national development plans, statistics available for this country but not for this country, with some sort of organized effort to bring data together in order to create larger packages of development.

What other steps can be used in terms of achieving the objective? And then lastly, rather than produce another transcript here for the shelf, what are the logical follow-up steps from the suggestions and recommendations we get today. I'm

getting too old anymore to be turned on solely by ideas unless there is a development plan that comes out of it, unless there are specific and concrete steps as to what we do and where we go. I think, frankly, that the day probably is wasted, so I would hope that you would apply a certain pragmatism to whatever you bring to us. One last comment on the nature of this equipment. If anyone wants to speak here within the group on matters they would just as soon not have come out in the record, please just indicate and we'll press the appropriate button, and if for any reason that fails, it will be edited out in the transcript. So you are offered the gift of aynonymity or complete censorship if that's your desire. So we'll move then from my rambling remarks to what you've really been waiting for, and that will be a discussion of workshop objectives by Jack Fritz and David Zoellner.

Jack Fritz. I didn't have a whole lot of time to prepare remarks so I will talk very briefly. I think Dave can describe a little later what the N.R.E.C.A./A.I.D. program is all about, but in a nutshell you have to remember that the A.I.D. program is only a \$1.2 million program for 18 months initially, a very modest program. All we can do with that is interest people in small hydro and raise the consciousness level, among manufacturers, among various development agencies, in small hydro, and then the multi-laterals and large organizations are going to have to follow the lead. So we would like to know what you are thinking in terms of what you need for various types of project appraisals, project documentation.

I think one of the first things we have to think about is to identify the possible donors, and I, just going down the list, these are sort of self-evident. We have, of course, the multi-laterals, bi-lateral organizations, commercial banks, possibly, various private organizations such as equipment manufacturers. And then we have myriads of voluntary organizations and non-profits, so these could all be sources of funding and then we should also talk about how do we characterize a mini-hydro program? In other words, is it a rural development project? Or is it a big hydro project? One way of looking at it of course is that it is many sub-projects. What are the differences between a mini-hydro program and a typical rural electrification program? Should we do a cost/benefit on the entire program? Cost/benefit analysis? Or should we do it on each of the sub-projects?

These are all questions that begin to come out. How do we integrate them into other development projects, perhaps into agricultural projects, irrigation projects, rural industry projects, and then the question of economic and financial program justification. Should we use the traditional cost/benefit analysis or should we look for a more innovative approach? We have to have a fairly clear articulation of cost and benefit. Should the system be economically self-supporting? Or should it be subsidized? Should special interest rates or special loans be established, or should the system be definitely self-supporting?

Then, some of the things Herb mentioned on methodological approaches, we are beginning to deal with. For instance, site specific analysis, regional hydrologic analysis and power production, site selection criteria, environmental and social assessments, feasibility studies, pre-feasibility studies, standardization of equipment. All these points have cost implications.

Then, where the institutional aspects link to financing; how should a system be managed? Should it be managed through a local utility, a local municipality, or should it be managed from the capital, from the metropolis? What kind of tariff structure should be imposed, should you have subsidization by urban users, what about construction, procurements or the establishment of local equipment manufacturing. Training is another aspect.

These are all components of the financing, of ways of financing a program. Perhaps some innovative financial packages have to develop, for instance, the possibility of an equipment manufacturing organization and commercial bank. Another possibility is for A.I.D. to provide grant funds for institutional developments and the multi-lateral banks to provide a loan for the equipment and construction. Another possibility might be those countries where there are oil revenues - Peru, Ecuador, Indonesia - that some arrangement be made where for every barrel of oil exported from that country, there is some kind of equivalent or fractional equivalent in terms of kilowatt hours of required hydro capacity. And then there are various, perhaps cooperative, bi-lateral packages; for instance, German equipment with a, paid-for-by-the-Germans and perhaps U.S., institutional civil works package. But, the whole point of it is that we have to structure program financing so that we can essentially maximize development. That is all I have to say, very briefly. David.

David Zoellner. Herb has, I'm sure, already done it, but I would, on behalf of N.R.E.C.A., like to welcome you all and am glad you were able to come. Hopefully, we will have a productive discussion on financial issues, questions on criteria and procedures for financing mini and micro scale hydropower projects and programs. Some of the other studies that we have underway, I'll touch on in a minute.

I think, basically, we here in the small hydro program are in a learning mode. We are here to listen and to learn and to ask a lot of questions, and if they appear dumb, that is okay. So I appreciate your coming. I will talk just a little bit about our program, what we are doing. We talked with some of you already about what we're doing, but this may be news to others.

The program is part of a cooperative agreement with A.I.D., that was established last May to provide technical assistance to developing countries around the world. In micro-scale hydropower, as Jack mentioned, it's a little over \$1.2 million for 18 months, which runs out at the end of October this year. The scope of the work: we have a small staff in-house with expertise in engineering and information and training and other shorter-term specialized areas. We use consultants from individual companies and experts from various other companies for particular assignments in countries as well as using our own staff.

The scope of our work deals in a number of service areas. One of these is an area that we generally term administrative. What this means is that we, from time to time, send survey teams into countries to perform either countrywide or site specific prefeasibility surveys. We conduct regional workshops, we finished one in August in Quito, which was designed to essentially exchange information on mini and micro scale hydropower.

Information exchange is one of the best ways to put it. We're scheduling another one in Thailand for June this year and planning still another in West Africa probably in October. In addition to these administrative services, we're involved in identifying potential sites for development around the world ourselves, assisting countries in doing this. We're also involved in developing inventories of capability, lists of experts, we're also developing inventories of U.S. manufacturers and their suppliers, many of whom are rather small scale, not just Allis Chambers level, but some of the smaller firms that are developing in this country as a result of the PURPA and other incentives. We're also preparing design manuals. We have one under preparation now which is a civil works design and operation manual which perhaps will be supplemented with similar efforts by others who are involved in electrical and mechanical design and operational guides. This is for use not just by engineers but by other field people who may not have expertise in engineering. We've also prepared methodologies for assessments. We're also in the process

of preparing a proposal for training. Jack mentioned the importance of training in this technical assistance business. It's critical and it's an ongoing process. We will begin preparing a proposal this year for the next funding cycle that will cover a substantial training program in many of the sites in countries that we're already selected sites in.

That in a nutshell is our program. It is a mix of things - conferencing, training, developing publications, developing methodologies, providing survey services. We can essentially do a lot of things - we review designs, we work closely with manufacturers for equipment, we do everything except buy the hardware and put it in. We can't do that. I think I'd like to touch just a little bit, it's a bit repetitious, but I give it a different perspective a little bit - in the Quito workshop in August, we conveyed a lot of information but the feedback we got from the workshop was also useful. Some of the issues, and there were a lot of issues that were talked about as well as presented, we spent a lot of time presenting methodologies - how do you do economic analysis, what are environmental impacts, what is the state-of-the-art in technology and on and on. But a lot of discussion focused around, well, this is all very nice, but we need money to get equipment in the ground and get it on the line and operating. So a number of issues surfaced there.

That was part of the impetus for developing this particular special study that we have going on right now. Some of the

issues that we talked about, one of them was the apparent disparity between existing financial institutions, their criteria, and the characteristics of small-scale, decentralized energy systems. They are very isolated, they're not part of the national grid system, they're unique in many ways, technology is a little flaky in some areas, and the established criteria are based on single generating systems so there's a disparity. How can we, if we're going to bring some of these systems to fruition, deal with that? Another issues was, as has been mentioned, the project vs. the program approach. The way I like to understand it, it's kind of like selling Volkswagens, you've got to sell a lot of them to make any money. In a sense it's the program approach to developing not just one single generating site but maybe 10, 20, 100, or 150 sites, to become significant in a program. The soft vs. hard kind of financing is public vs. private. They sometimes tend to divide along those lines. The criteria are different; there is potential in this area in both cases.

Another issue was the potential for change in approaches to financial analysis, systems and accounts, economic analysis - particularly in the area of social benefits. Qualifying social benefits has always been a problem and continues to be a problem. It's not a problem in some cases, but it is in others.

Rigidity of criteria - this is sometimes an institutional problem; for example, if a bank has a set of criteria and they're

very rigid and fixed and pretty much follow step-by-step - sometimes in funding for renewable energy projects or alternative energy projects, there is a little flexibility because the criteria don't exactly address mini-hydro or renewable energy and you have a little room to play with. As soon as the bank develops a whole set of criteria for a renewable energy program or a small-scale energy project, then you're forced sometimes into a rigid set of criteria with no flexibility. I think that's a problem.

The influence of financial institutions can be substantial so their criteria are often critical. In the area of manufacturing, for example, local vs. import, there are viable cases of both that I've observed in the short time I've been knocking around the various continents. Integrated programs again is an important area in terms of offsetting costs, particularly integrating mini-hydro projects with substantial civil works, heavy program of irrigation, water supply, and so on.

The influence of the scale of the technology is important because we're talking about the large end of the scale of small hydro, say around one megawatt or maybe slightly over that. Maybe we're talking about systems that are tied into the national grid but we're talking about really tiny, 10K or 50K, or even smaller than that. We're not talking about tying something like that into the national grid - it's a very isolated generation and consumption scheme. Or does the scale of technology have

anything to do with financing or vice-versa? Is there any influence on the scale of what is developed?

The timing of this workshop (those are some of the issues that are kicking around in my head) today, I think, is probably good because we are at a stage in our program now at which we are confronted with questions about how do we get equipment, how can we get our programs financed and funded. And we have to say, well, gee, I think there's the World Bank and I think there's maybe some commercial banks, financing for manufacturing - there's a substantial interest in developing countries in developing manufacturing capabilities or in other things, but financing - what are the possibilities, what are the alternatives? The timing of this is also rather gratuitous for us because of some other special studies that came out of the Quito workshop. There are also ongoing ones, they tend to overlap a little bit. One of them is addressing some of the problems with management systems. How are some of these isolated rural energy systems managed? What are some possible management schemes? Which will work and which will not work? Maybe it's a local organization, maybe it's a local coop, or maybe it's some other institution that's already in place or maybe there's a need to develop something new. Or maybe the possibility is for a regional subdivision of the government to manage or maybe it should be a strong, national, centralized management scheme. There's an influence of financial institutions on how these programs will be managed, so there's a connection there.

There's another special study we have underway that's looking at how might we develop evaluation criteria for these small hydro systems? What do we want to look at five or ten years from now in order to evaluate how effective they've been? Effective financially, effective socially, effective from a technological standpoint, what do we look at in order to make that judgement? We don't really know, there's no good, consistent way of doing it, there's lots of ideas. There's no consistent way of doing this.

This particular set of criteria could also be used obviously as a planning tool as well. There's overlap obviously with what we're speaking of today. In that case, I think the timing is good with respect to other studies we have ongoing. I think the timing is also good in terms of recent developments, certainly administrative budget cuts will eventually work their way down to providing foreign assistance, financial assistance. Certainly private initiatives are underway to compensate for those, and I think the private sector will be challenged quite a bit in the years to come, particularly in terms of international activities. Such things as the Stevenson bill may or may not be alive today (I'd be interested in knowing that).

So the objectives, as they have already been articulated, are basically to develop a product out of this meeting and of a special study on finance. It would be useful to A.I.D. missions,

it would also be useful to developing countries' governments in terms of alternative sources of financing, in terms of where to go to get financing, what are the limitations, what are the possibilities. We'd also like to identify and clarify some of the issues that we're already articulated. I think we'll do that. And, as Herb mentioned, I think it's very important also to develop some recommendations. If there are changes that need to be felt, we'd like to hear some of those recommendations. So it's a mix of things we'd like to have come out today, but basically we have a good group and again, thank you for coming.

Herb Wegner. Next on our agenda we have a statement of requirements for financing small, decentralized hydroelectric projects. My associate, Jorge Asin, and Bard Jackson of N.R.E.C.A. will speak on this topic. Jorge.

Jorge Asin. At the request of David Zoellner sometime ago, I started looking at the requirements for financing small hydroelectric projects. In order to do that, I started by taking a good look at the situation of small hydroelectric systems. It was very pleasant for me to find out that small hydroelectric systems seem to be tremendously accepted in less developed nations. Of all the alternative sources of energy, there seems to be almost a consensus that small hydro and biomass technologies are some things that most of the people that I talked to would indicate are their main choices in terms of energy for decentralized areas, decentralized systems for rural areas basically.

In looking at the flow of a process to develop hydroelectric systems in rural areas of the L.D.C.s, I found several barriers. One of them was that there is a lack of structural flow of communications between potential end-users of hydroelectric energy and funding mechanisms. In other words, people in rural areas that do not exist within the mainstream of the economy of a nation have very little access to knowing about the technologies.

And then the lack of organizational initiative at the rural population level to promote the appropriate development tools and management of hydroelectric systems obviously will be a problem, and it's a problem, I think, that deserves quite a bit of attention. There's a lack of knowledge and to some extent, skill, on the part of development schemes to identify key local

institutions which could motivate those rural populations to participate in development programs.

And in another element that seems to be a problem is that there isn't a clear understanding about the impact resulting from the use of these technologies, small hydro, which we're talking about among others, in the development process. In other words, what can we really expect out of the use of these technologies? How can we find the adequate linkages? I'm pretty much used to thinking in terms of integrated development; therefore, whenever I see a technology I try to see what it's connected to, what would it do, not to see the technology as an end at all, but as a means, and therefore a great deal of my interest in looking at all this has been to try to connect the technology to the possibility of some kind of production at the other end of things, not just electricity itself to provide light, but how can it really be connected and how can people be motivated to use that energy for production purposes.

In most cases, I found no answer to that type of question. We get the system, we can give some electricity to a school, to a specific project, but how far can we go into planning what type of an impact it will have in what I really think development is all about, which is the increase of production and the increment in productivity levels.

In discussing the requirements to finance hydroelectric projects recently in Latin America, I found out that another tremendous barrier is the lack of basic information, historical data on the flow of water, for instance. In discussing this issue with several people in international organizations, I was told it would be very interesting if it would be possible to start not looking simply at one project, and I think this has been touched on before by David here, the idea of not trying to look at one project directly but trying to look at the resources available in a region. The resources in a global way in a program type of a way that would make the analysis or determination of sites less costly. Once prime sites have been determined to really have a good potential, then, of course, go into making much more careful in-site analysis for the possible development of a project. What I see here is that it would be like working from the base of a triangle to the apex of a triangle and having the apex being really the approval of the system in one specific site. But that specific site should then become the apex of a development project, of an integrated development project, that should tend to, as I said before, create some kind of production. Probably one of the areas that we can speculate at this stage should benefit by this type of idea would be the production and the benefits of agriculture. In looking at different countries in Latin America, it's very easy to see the

tremendous problem that exists and that would probably increase in terms of agricultural production, in terms of food production. Probably energy, if it is within the development and context of an integrated rural development project, should be geared towards the increase in production of some kind and at the same time, of course, if there's already a factory or system of production, probably there can be an increase in the level of productivity.

Another barrier that I have found for the development of small hydro is that there are two ways of looking at the beginning of the development of this kind of system. One would be depending on the support that a project or a program can have on the part of the local (the national, normally) electric company. Probably, it is very interesting to have the electric company as the system that backs up the development of small hydroelectric projects because of the fact that there's quite a bit of experience in this type of technology, not in small hydro, but they have experience in the larger hydro systems and therefore they can adapt that knowledge to smaller systems.

However, it is rather clear that the heart of the organization is not in the development of the small systems and there is a conflict - a serious conflict - so an important element has to be to think about how to get the small hydro projects and programs graduated from institutions of that type to some type of an institution that becomes much more functional, that is much

more interested in developing small hydro and making it operate. I think that the kind of people, also, dealing with this type of problem, should be people who are not used to the concept of the large hydroelectric system which is an institution by itself that thinks in terms of the small components that go toward the production of energy, but on the contrary, they should be people who think in terms of the integrated development concepts.

I found out that due to the basic changes in criteria, the attempt there is today in looking at small hydro, I should not say there's new criteria but there seems to be criteria which are evolving today, we are pretty much in the middle of the situation.

Instead of trying to finance one project, some international organizations have attempted to look at several projects at once and develop them as a program. I think that probably is the trend that will continue to develop. However, there seems not to be consensus on what that means, and I think that should be one of the central points of the meeting today. The fact that some sites might not be necessarily economically feasible when looked at individually, yet they might be feasible or close to it as components of a program for development. This is something I dealt with in Latin America recently and it was sort of a difficult situation to look at because there seemed to be an impasse. People who had developed the total concept are not finding funding

easy in that type of situation because some of the sites were not necessarily feasible from an economic perspective. Yet, looked at from the point of view of a program, they would get pretty close, of course, to being economically feasible.

Another element of criteria that has to be dealt with is, is it necessary in all cases to look at small hydro projects, or, for that matter, probably to alternative sources of energy projects, in terms of its cost benefit compared with other systems, or is it necessary to look at it in terms of the derived benefits that will come from the development of the systems. And here again, we're talking about the increase in production, the possibility of having energy as one of the incentives. If we think about the schedule of incentives to retain populations in agricultural sectors of a nation or of an area which probably definitely constitutes an element of great importance, which we said before leads to an increase in the level of production of foodstuffs.

The last point I would like to touch on is the fact that a recent case I also saw in Latin America seems to have developed in a very interesting way because the organizers of the project went about getting groups of people in a village where they were going to install a system to make the population of the entire town, practically, to participate in the decisionmaking process to accept the establishment of a system. I am not totally sure

whether they participated in the funding of it but at least they participated very actively in the organization of installation of the system. I think that that kind of institution, going to the grass roots level, might be tremendously useful and I think that the organization of these kinds of institutions can mean an element of funding that probably can be matched with international lending organizations for the rest of the funds needed to develop these kinds of projects.

Let me make one more comment. It is that it seems to be rather clear that there are going to be different roles for different types of financial institutions within the development of small hydro projects.

One thing that I find important, and it is a conflict at times, is the establishment and definition of what small hydro-electric systems are. What are the systems that we are thinking about in terms of rural development, what are the sizes of them? Probably the very small systems will not be something that will be contemplated by development schemes. If somebody has a tremendously small system, probably it will be privately owned, it will not be something that the world development community will be involved with. I would like to try to get to some kind of definition of that situation.

That's all. Thank you.

Bard Jackson. In our work with small hydroelectric systems worldwide, we see a vast number of potential sites, that is, sites that have sufficient flow and head and nearby electrical motors. Over 1100 towns and villages have been identified that could be powered by small hydro units to serve over two million world people now not getting electric power. We also work with several turbine manufacturers, some of whom have recently gone abroad, they're all out looking for customers. Nobody seems to argue that small hydro is a needed and appropriate technology. The problem is getting the financing for the towns and villages and the manufacturers.

Projects which incorporate rural electrification have traditionally needed some sort of central government subsidy. It's not because projects are uneconomical, it's because one has to consider more than just the revenue generated by the electric system and consider the benefits of rural electrification. Hence, we need to look at more criteria than just the revenue generated and the ability to pay back a loan. So there needs to be another party mixed in with the towns and the manufacturers. This third party will have its own set of criteria. It can be some assistance program like the A.I.D. whose criteria is providing assistance for the poor. Other criteria could be displacing oil-fired generation for countries going broke paying their oil bills or it could be an area where you have identified productive uses or criteria for improving quality of rural life or stemming urban migration.

The other parties we identified need to be expanded. Some suggestions for these other parties might be small industries, that is, joint projects with small industries where industry can provide some of the capital and guarantee fixed revenue. Also using volunteers, labor and material, from the local towns and communities such that the revenues generated can just pay back the loans for equipment. And also integrated rural development projects such as irrigation and water supply. At N.R.E.C.A. we are concerned with supplying the electrical needs in the rural areas of the world. We welcome your thoughts and comments on how to go about that given the structure of international finance and the attractiveness of small hydro.

Herb Wegner. Thank you, Bard. Our next agenda item calls for participation by Mr. Ponomariov and unfortunately, I do not believe he is with us. He may be in another meeting somewhere... So we'll zip on over to the items on the beginning of the back page here, "Suggested Criteria for Financing Small-Scale Hydroelectric Projects." For the IBRD perspective, we'll call on Mr. Fish and Mr. Moore.

James Fish. I'm from the World Bank. Ted Moore wasn't able to be here today, but I hope that I'll be able to answer any questions to carry our end of the proceedings. The introductory material here has pretty clearly identified most of the issues that we are dealing with and are concerned with in small scale hydro. From the Bank's point of view, we look at small scale hydro simply as another alternative of nuclear power or coal or about anything else. It is simply another way to generate electricity; therefore, the tendency to mix up the development aspects of electric power with the mechanisms is, I think, a dangerous trend, and we have to be very careful about how we look at this.

The Bank produced a policy paper on rural electrification about five years ago which had rural electrification as a good thing that there were mechanisms and methodologies for economic justification, and that the most important point was that economic justification be considered in a long-term. We have to look at a twenty-year perspective and sometimes even longer. The Bank is willing to finance rural electrification provided that the long-term perspective does show a reasonable economic return, and that as a corollary you can make a satisfactory financial program to support the project during the development period.

So the criteria for pretty explicit. First, for rural electrification, the question is: how do you supply it, whether it's going to require energy. As I said, in our view, small scale hydro is simply another alternative. I think we have to be realistic and have to recognize that we're dealing with a highly capital intensive, very expensive, upfront management absorbing technology. It's not alternative energy in that sense; it's not second stage; it's not alternative technology; it's very much a high technology mechanism; therefore, the rural development approach that is often taken may be misplaced. We might be deluding ourselves. I hate to take this approach, but I'm afraid it's a realistic one.

Therefore, the Bank, when looking at hydro or any other means of generation has two criteria: first is that the undertaking itself be demonstrated as being worthwhile. Now in the case of the existing power system, the market forecast is taken as justification that the undertaking is worthwhile. There's a market, you've got revenue flow; therefore, the only question is how do you supply it, not whether you supply it. The second question is: is the technology being proposed in this project least cost, is it the best way to do it? Now I go back to my statement that small scale hydro is highly capital intensive and not clearly better, for example, than diesel generation. In many cases, it's very difficult to make this determination.

Partly for this reason, we feel the initial thrust or major program of small scale hydro probably will rest on fuel replacement in the existing systems. So the first place we ought to be looking for a small scale hydro project is as a supplement to or an addition to existing isolated systems. For instance, in Ghana, there are about 150 isolated diesel-based generating systems and there appear to be reasonably good prospects for fuel replacement in those systems. As another advantage associated with the technology hydro, it means you can divorce yourself from the seasonal problems of rainfall and water availability that you usually have and still have a pretty good justification for the project. You don't need full capacity, all you need is energy and small scale hydro in general is a pretty good energy source. Most of the Chinese experience, I understand, is primarily as an energy producer rather than as a capacity-activated system supplier, but if anyone is more familiar with that particular situation, I'd certainly like to talk to him or hear from him.

As far as financing mechanisms go, the Bank has a number of ways we can deal with this. We have project preparation money. Over the next five years, we'll probably do maybe 125-150 power projects, and it would be possible to have a small scale hydro complement to any place. We're going to do about the same number, maybe more, of rural development projects, and a small

scale hydro complement will even fit into there. So the mechanisms exist, there's no problem, however, we really want an impact on the energy situation. I think we have to do a project as programs of small scale hydro. After all, we're looking at a dozen sites in Thailand, several in Malaysia. These are demonstration scale projects, and they're interesting but they really don't address the problem. They don't really solve the energy crisis or do anything towards rural development. We've got to figure out some way over the next ten years to have the major portion of the 7,000 sites in Indonesia, for example, and in order to do that, we have to very much move towards macro-capability studies approach that have been mentioned earlier. I think this is essential. We've got to get away from site-by-site basis for development.

From that point of view, if we're talking about single projects, focused on small scale hydro, we would very much like to see the upfront money, the feasibility studies, devoted to a resource assessment and analysis of a typical site or prospect classifications which should probably be able to be developed on a computer or standard types of projects that suit the terrain, suit the nature of the demand and rainfall, hydrologic matters and anything else.

And from that do an economic calculation which would be sufficient to justify a program. The actual site investigation

work for the bulk of the program will then be undertaken as part of the project itself rather than as part of the upfront feasibility study. It seems to me that this is the only way we're going to be able to accelerate small scale hydro development, again assuming it's feasible and all these other caveats. The other advantage to this sort of approach, especially if you're dealing with existing systems, is that you've got to mark the initial day of this program and quite easily be simply supplementing systems and move from there into an expansion of what is basically a rural electrification program.

I think that it is becoming clear that there are many pre-classifications of sites, projects, that we're dealing with. The first is what is called in the U.S. small scale hydro, and this may go up to 5 MW or I don't know what the definition is now. It was 25, I think now they're talking about 50 MW as a cutoff point for DOE programs. Clearly, given the financing required, it would be possible to develop a small scale hydro project consisting of two or three such sites. You've got a reasonable size of project, \$10 million or something like that to support. This is really not small scale hydro in the sense of having to take a program approach.

The second general classification, and where I feel most of the effort should be placed, is the 100-300-500 KW range of plant capacity. Primarily, it would be fuel replacement, primarily associated with the existing systems, possibly extended into new areas as the experience develops, but amenable to treatment

through a program approach. And this is where I think we can put most of our money and can talk about a project consisting of 100 sub-projects, requiring, say \$40 million, something like this. A reasonably-sized project as far as the Bank is concerned gives you enough clout with the government, you can worry about setting up a program, you can create an organization to provide the technical background if necessary, and if it's a big enough thing it becomes an undertaking in its own right.

The third general classification are the individual entrepreneur-type projects where units would be designed to supply an individual load, arm a mill, whatever, and that takes a completely different kind of approach, because you don't need a system organization, you don't need a power company, you don't have to collect bills, you don't have to go through all the mechanics of customer service and this sort of thing, which is a very important part, but a very difficult part of any rural electrification scheme.

Financing for that kind of project would have to be pretty much through an agricultural credit type of operation with technical assistance provided from some central organization with individual loans to individual users through agricultural credit arrangements. I think, again, it would be a quite positive approach, and could very well arise from feasibility study on a macro-regional basis, where we can identify how much of it is in relatively large projects which would justify individual

treatment, how much of your resource base is in medium-scale projects that have a good role to play but still have to be part of systems, and how much of the resource base could be installed by individual mill owners, farmers or other rather personal user. Then it would have to be treated, for instance, as an irrigation project, and there are ways to find possible ways to get loans.

Since the technology is highly cost intensive, it seems that a principal criteria would be to involve local people. You've got to have someone on the individual-type level who is not necessarily government connected to an organization who essentially would take a small sub-project under his wing and see that it gets executed. It could be anyone with an understanding of what the mechanism is and how it should be approached. Again, if you have an existing system, then it helps because then you have usually a local resident or plant operator or someone like that who can serve this function. But, grass roots participation seems to be essential to really make a dent in the energy problems of developing countries.

I learned just a couple of days ago of an isolated project in Haiti that was done by a Canadian consulting engineer. This was one in which they did the design, graphics, local specs, procured equipment, and the construction was done by a monastery that runs a school in Haiti. This was done locally with practically

all volunteer labor, as far as the civil works went; it was a high head, impulse deal, 500 KW, but even with all these inputs, the cost was still about \$1500 per KW. It isn't cheap, especially if you're talking about supplying lighting demands with 20 percent load factor. It gets to be very expensive. In this case, they had to develop a reservoir, and it is, I think, indicative of the scale of costs we're inevitably going to be faced with, and that's still one of our biggest problems. The Bank's prepared to help in this, small scale hydro, like all renewable technologies, is a sexy undertaking. I'm sure that our Board isn't going to be unduly critical of the economic analysis supplied to such projects, especially if we're talking about demonstration scale. I think we can handle it within the scope of our existing methodologies for economic analysis. But the fact remains, we need financing, we need subsidization, we've got to have a strong creative local participation.

The foreign exchange for 40 percent or so of the project is the easiest part, no problems, that's forthcoming. All you do is pick up the phone and say: hey, we've got half a dozen small scale hydro projects in Peru or somewhere else, and I'll practically guarantee you that within the next eighteen months we'll fund the project. Provided we've got the feasibility studies, provided we have enough information to show reasonable economic justification and on something that doesn't depend 100 percent on

financing or subsidization from government or outside sources. There has to be some degree of local participation either in a cooperative sense or through an existing system of if you have a market demand paid for.

I guess that's about all I have to say. The Bank wants to help in this. I brought along a few copies of a recent staff working paper on renewable energy resources which has a few paragraphs devoted to small scale hydro which more or less repeats this. You have to recognize it as a capital intensive technology. There's undoubtedly a role for it but we're not adopting this because many other people are in the scale at which these projects can be developed. That doesn't mean we're not willing to try and that we're not interested in helping.

Herb Wegner. Thank you very much, Jim, that was right on target. I think that indicates the welcome flexibility and insight. ...

Next on our agenda is the presentation of small scale hydroelectric projects as components of regional planning. Before we get into that, I'd like to do one thing that I should have done and did not do this morning. That is, realizing that not everyone here knows everyone else, if we would go around the table, very quickly, and introduce ourselves, and tell us a little bit about who you represent, and that may help out. Jim, may we start?

James Ladd. I'm known as a free-lance consultant. I've been working in Washington for the last 9 years. I've done work for the OAS, IFC, World Bank. My activities also represent the engineering firm of our family in Rio de Janeiro in Brazil.

Carl Duisberg. I am from A.I.D. in the Latin American Bureau as the Energy Officer.

Jim Ballard. I'm an attorney, specializing in energy matters for the last five years or so. I'm now at the bottom end of the learning curve in small scale hydro.

Douglas Blair. I'm from Chase Manhattan Bank. I don't represent any of their views today, but I work in our trade banking group, which tries to promote financing for trade around the world. At Bard's and Jorge's request, I came to see if I could offer some commercial, profit-oriented business ideas on how you finance these things.

James Fish. I am a power adviser in the Energy Department of the World Bank, which is sort of an oversight function trying to, I won't say coordinate, or keep track of, what is being done by our seven regional power divisions which do the actual operations.

Powel Brown. I'm with Rural Development Systems, an engineer working with energy here in Washington.

Robert Ichord. I'm with the Asia Bureau of A.I.D., Energy Advisor, also looking after forestry and environmental problems.

Paul Park. I work here at the N.R.E.C.A. in the small decentralized hydropower program.

Larry Koppelman. I'm a friend of the international program division.

Bard Jackson. I'm the principal engineer with the Small Hydro Program at the N.R.E.C.A.

Art Heyman. I work on energy issues for the program of regional development for the Organization of American States and am also your next speaker.

George Self. I'm with A.I.D. and the energy advisor for the Near East Bureau.

Jack Fritz. I'm with the Office of Energy at A.I.D. looking basically at small hydro power projects.

Bob MacAlister. I'm with the Africa Bureau of A.I.D. in a division that reviews energy projects.

Jorge Asin. I'm with Rural Development Systems, and at the request of David, I put this workshop together.

David Zoellner. I'm with N.R.E.C.A. managing the small decentralized hydropower program.

Herb Wegner. At various times I was with credit unions in Latin America, also here in the U.S., been on Peace Corps staff, been on A.I.D. staff. Currently, Jorge and I are working together at Rural Development Systems, and I'm also associated with an electronic funds transfer organization in Illinois, a computer company in Boston.

Alright, Art, may we call you up for the "Small Scale Hydroelectric Projects as Components of Regional Planning."

Art Heyman. Well, I'd like to say to begin with that since everything is going so well, I'll do my best to screw it up.

The topic I'll talk about is only remotely related to the one assigned to me. One introductory remark - I'd like to agree with Mr. Fish's observation that the least difficult issue that we have to deal with is that the issue of international financing and technological issues clearly are issues that have been alluded to by a number of the speakers are going to be a good deal more difficult to handle.

I'd like to both expand and narrow the discussion. I would like to look a little bit at some of Jorge Asin's concepts concerning integrated rural development and the relationship of some other energy technology to mini-hydro and I'd like to narrow a little bit by looking at an individual case study in Brazil, and I have the results to do so.

One other issue. I'd like us to consider for a moment what I think is a generally accepted kind of operating hypothesis - that there are two kinds of energy activity: the large scale commercial/industrial, economically intensive kind of thing which we look at if you will, "as an economic kind of activity." Then, the small scale, dispersed kind of energy or non-conventional which we tend to think of as more social welfare or concerned with getting energy into rural areas where people do not now have access to energy.

It has to pay somehow, but that's not the most important aspect of the thing. These presumably are dichotomous means of the energy situation. What I would like to propose is that they're not really dichotomous at all, that they're hopelessly intertwined, that they're completely dependent on one another. And that one must view the energy problem that we face as an integral thing, as either of two aspects of the same problem.

Let me tell you just for the moment a little bit about a study we've been making in the Araguaia-Tocantins Basin in Brazil. These are two tributaries of the Amazon.

Together, they have a basin area of about 1 million square kilometers about half of it the size of Texas or a little bit larger than Montana, Idaho, and Wyoming together. It's a big chunk of territory. I want to talk about it because it may have some unique aspects. I think it begins to focus on the magnitude of the problem we all face as was mentioned earlier, the 7,000 mini-hydro sites in Indonesia. I think we have to be thinking in those terms. The reason that I want to talk about it, is that it does give us some concept of this magnitude.

This place is not as empty as one might expect. There's a population of one million people and a population growth rate of 7 percent a year, it doubles every ten years. The population tends to be very concentrated in semi-urban settlements, surprisingly not very much dispersed rural population as you might expect in a rapidly growing area like this.

Enormous debt, astonishing resources, good soils - Class I, II and III soils, of about 300,000 square kilometers, about the size of Wyoming. Forest resources (we don't need to talk about forest resources in the Amazon), very rich mineral resources, water power resources. Thirty-five thousand megawatts in the Araguaia-Tocantins and Gurupi adjacent basins.

When I talk about these megawatts, I'm talking about not the theoretical amount of power that might be calculated by the downflow of a river. We're talking about engineering studies of economically viable dams that could capture this and will, over the next, perhaps, 50 years. Dams that will be built, and there are already pre-feasibility, feasibility studies that have been completed.

Industry - very, very rapidly growing on the basis of the Tucuruí Dam which is almost completed. There is now growing one of the very largest concentrations of aluminum manufacturing plants anywhere in the world, at the mouth of the Amazon which will be based on the power production from the 8,000 megawatt installation.

We're dealing with tremendous potential here and then the question becomes, how do we deal with this, or how does Brazil deal with this? Basically, we can look at two alternatives. It can be an enclave of the Sao Paulo-Rio- economic power base of the country. Those great cities with their economic resources can invest in the Amazon region, create an economic enclave there which never becomes a viable economic entity by itself, but which in fact feeds a very powerful economic nuclei in the south.

Or Brazil can make the very tough decisions that it wants to create a new, economically viable region in the Amazon area. That could be a marvelous political decision, terribly difficult to implement.

Well, Brazil says it opts for the latter, and that, of course, then has tremendous implications for us in the energy business. What do you do in order to create what would amount to something like a new Chicago in the interior of Brazil? What would you do to create a situation where you have a dense enough population, where you have a viable agriculture, an industrial base, all of which are interrelated with one another so that you create some new operational entity there.

The first thing you have to do clearly is you have to bring people and you have to bring small scale industry. Equally clearly, enormous steel plants and enormous aluminum plants don't create the kind of new region that we would like to see. They can easily be controlled from the outside. The profits they make can be taken out of the region. They don't build the region itself.

In addition to those kinds of large scale things, one needs dispersed things, one needs small scale things, one needs agriculture, one needs population. And this then by definition means you need some kind of rural development which the first requisite must be rural energy. And this, then, is the way we interpret

our approach. How do we create a dispersed form of rural energy that can be the basis for a new viable region in the interior of Brazil? That's not a small problem. But we at the OAS are looking at it that way and we are dealing with political forces in Brazil which are clearly on the defense with regard to that question, but basically they endorse this generalized approach.

Let's look then at the geography of this thing. We've got Tucuruí going up, there will be whole other series of dams which will be going up in some sequence, and from these dams will be running transmission lines, tremendous amounts of power but carrying electricity at such high voltage rates it will be very difficult to tap these lines very easily for local utilization. The substations themselves cost so much that it doesn't pay to put them up very frequently. So these things are running overhead and down below guys are still rubbing sticks together.

We have to do something better than that. If you think about it, the geography of it begins to look almost like a tic-tac-toe game. You've got these large power lines running all over the place and in between them cells which have no power at all.

And our question then becomes: how do you produce power from these little cells so that the cells will attract rural population, they will attract small scale industry and your power facility, your energy facility in the small cells must be

designed so that they're expandable and eventually as the population increases, they will be connected to the central grid, to these other systems throughout the area. This is generally the picture that we look at.

When you look at it that way, then how do I know about producing small energy sources for these cells? And I guess the first answer you have to come to, the first pair of answers, is you use some kind of combination of sources that will address itself to the energy demands of the cells. You don't get stuck on a particular source or on a particular technology. You think about that combination of sources, that combination of technology, which will most effectively address the combination of demands in a cell. And you immediately divorce the idea of getting stuck on a particular technological campaign.

That's one thing to think about - that combination of sources and technology. And the other thing you have to think about is what is going to be my institutional approach to this? I've tried to give you some impression of the magnitude of this problem.

We're dealing with literally hundreds of thousands of installations. How do you analyze what are the most appropriate installations to make? How do you finance the construction of these installations? Most important, how do you organize the operation and maintenance of all of these things?

This institution focus, in my estimation, is going to be probably the most difficult question to address. There's going to have to be some degree of spontaneity here. There's going to have to be some form of automatic defusion. When you build your pilot plant, your demonstration plant, you demonstrate that this thing works, what you really want to demonstrate is not only that it works technologically or even economically. What you want to provide is that it works so well that people will come looking over your fence and say, "I'm going to have one of those and build one in his backyard." Your demonstration plant has to demonstrate that there is an automatic defusibility that will work. That's a much more difficult kind of thing to prove than economic or technical feasibility.

And the third problem is selling the government on any of these propositions.

I started off by saying that if the government is dedicated to creating a new, viable, effective region in Brazil, in the Amazon region, I am really convinced that the government's convinced of that. The step between that and saying that you have to do all these things to produce local energy because that is inherent in your own policy. The step between those two ideas is a very large one, and how do you convince the authorities that one must address there about the problems we're discussing is very difficult.

Let's go back and look at the technology of resource combination. Clearly, the technologies most indicated are some kind of mini-hydro, some kind of woodburning facilities. Wood is an inexhaustible resource. Inexhaustible is an advisedly used term because it would be no difficulty at all in maintaining forest plantations here. The other technology which looks to be exceedingly effective because it's being used so widely in another state of Brazil, Santa Catarina, is biogas production.

There are lots and lots of other potential technologies that one can play with. But I think it's reasonably realistic to quickly come to the conclusion that the others are quite remote possibilities, where all three of these are very serious possibilities.

What do you do with these things? I went down there with a set of hypotheses about how this question should be approached. Hypothesis is a development expert's term for "I've got the answer, I'm looking for the question." I did have some hypotheses and the issue was the following: we should create a team who, then, will run around and analyze in each locality what are the combination energy demands that are not supplied, and then look at the array of energy technologies that might address these demands and design, first select, with the participation of the community, that combination of projects most suitable for their needs and then go through the series of steps necessary to bestow this

combination of projects at the local level. Personally, I thought that was pretty brilliant. Then I went to Brazil and found it wasn't very applicable at all. We also have hypotheses on how financing could work. There are four states involved in this large area and looked as though we could probably organize some system whereby the governors of the states could get together and establish a rotating fund to get upfront money for the fund from some of the international lending agencies and using this team approach, analyze problems and install facilities, pay for the facilities with the rotating fund and have the community pay back into the fund and keep it on a rotating basis. That wouldn't work.

Then another thought was where's the closest interest to these facilities, who are the people who are most immediately involved. Certainly they would be the ones who would focus on an institutional approach. As near as we can get down to it, the municipal, the small county level areas, looked as though they would be the ideal institutional focus for such a thing.

Theoretically that should be true. However, each of the municipals has so little technical capability. So little access to financing and the heads of the municipals have such great political ambitions that their real interests are in the large projects. They couldn't care less about the kind of scales we're talking about. This has been our experience.

What we finally came down to in the end was, they've got the answers there, why are you making such a fuss? In each state, for example, we found that there is an ongoing institution that directs itself to the mini-hydro facilities. These are operational. These are creating small dams on a scattered basis throughout the four states. Those facilities could use strengthening, some technical resources, some financial resources, but basically they're viable operations.

The second thing that we found was that in Sao Paulo there were growing a whole series of new private industries that were dedicated to one single purpose - they were making their living by converting oil-burning furnaces to woodburning furnaces, and there isn't much wood left close to Sao Paulo so these guys were importing wood but yet were a completely economically viable proposition.

So it becomes very clear that if you create proper incentives, if your legislation is suitable, it will be very simple for private industry to come in the Amazon area and build wood-burning furnaces that will supply a large part of the local energy required.

And, finally, as I mentioned earlier in Santa Catarina, we found that the state discovered that it can install facilities in a number (there are hundreds programmed for the next few years). And they found that the bio-gas facilities function so effectively that the state can finance them almost completely and repay the taxes by the equivalent in the increase in production of the quotas that are stored over a period of about three years.

This looks like a very attractive kind of proposition. My original theoretical construct of looking at things in an across-the-board way, try not to have technological campaigns for particular technology, but rather look at the combination of technologies to fulfill a combination of needs probably isn't going to work.

Probably what's going to work is that the individual technology will, in fact, be installed by a series of interrelated institutional devices, the mini-hydro within the government, within an assisting government facility. The woodburning furnaces through private industry and biogas probably as a new activity, as an adjunct of the state departments of agriculture. These three institutional devices will probably be a reasonable, effective approach to supplying rural energy needs in a way that one would hope will fill demand, creating new, viable regions in the Amazon.

Herb Wegner. Thank you very much, Art. It raises the interesting question that we've all been looking at this from the approach of the emphasis on a single technology. I think that's a good question to bring up in our discussion session later.

I omitted a member of our group who probably offers the greatest esthetic value, Vicki de la Reza, who is, I'm proud to say, a member of our organization, and will be handling the logistics here and the machinery.

Next, we have "Economic Analysis for Small Hydro" by Jim Ladd.

James Ladd. First, I want to thank Jorge, Herb, Bard and David for letting me make this presentation.

I handed out a paper which most of you probably have. Anyone who does not, I have a few extra copies.

I will limit my comments now to a few, brief remarks on the background, advantages and limitations of this financial planning model and a few comments on what's next, what alternative uses it might be used for, it might be put to, and some industry-specific suggestions.

First, as a background, I should say that this financial planning model evolved from a project that I worked on with the World Bank in Brazil on low cost housing which was praised in 1978. The project was being managed by the Brazil National Housing Bank, \$26 billion-resource generator and manager. We requested then the financial planning projections of the Bank and its clients in the major cities in which we were operating, and to this day, we haven't gotten satisfactory financial planning projections from Brazil. This led to a number of alternatives, one was that we looked at FAST, which is a financial planning program developed by the Bank's staff. Some of you are probably familiar with this. I'm sure Mr. Fish has seen it. He probably has one with a different name for the power industry.

And the thought that perhaps something else should be done with new technology in mini or micro computers.

I spent a few weeks last summer taking an intensive course on computers at Wesleyan University taught by one of the more remarkable people I've met in the computer industry, Russ Walter, who publishes The Secret Guide for Computers, has published it annually for ten years, and is a course instructor there. His program has gone from 13 students to something approaching 200 students this summer, as I understand. He's taken over about one-fourth of the entire graduate liberal studies program at Wesleyan. It's a very remarkable experience, which I would be happy to discuss with any of you afterwards.

And partial funding from the World Bank. The World Bank thought this was perhaps a worthwhile endeavor and they did provide some financial support to develop on a micro computer a financial planning model, the first samples of which I've given to you in the form of these exhibits, A, B & C.

I can probably say that it's not easy to digest these in a few minutes, it's taken quite a few hours to first translate from a complex Fortran language back into ordinary English, some of the commands that are indicated, then to format and develop this model on a micro computer.

However, it's been done and it works, and I present this to you. I would appreciate to hear later from you your comments on its utility.

The exhibits A, B and C are briefly: Exhibit A is a sample printout of the typical financial statements that any project, any unit, requiring financing might be asked, would be asked by the international lending organizations to develop. Most of them can't do it. Hopefully with this tool they might be able to do it and do it very quickly.

Income statements, balance sheets, and sources and applications based on a year or two or three of actual operating results projected into the future. Nothing very unusual about that. Conceptually there're some problems, but they've been solved many, many times.

If you look at Exhibit B, there are five pages which show the same statements printed out, however, with data that has been added to the electronic worksheet on which this has been developed. In the right hand column you'll notice a number of comments; which are the assumptions, which are the givens, what are the key formulations, what are the ratios, how are they defined? In this particular case, a half dozen additional schedules. Separate schedules which are integrated into the whole for working capital, non cash, cash reconciliation, other assets and payments, fixed assets, schedule and depreciation schedule, a working project schedule. Other schedules could be developed, and there is enough capacity for the system for elaborations of other accounts.

Then Exhibit C is very simply an alternative. Quite frankly, it is a test run done on Saturday, it's the first alternative. It may have taken approximately 40 working days to put together the results of A and B. It took about 10 seconds to develop Exhibit C.

There is a bug or two in it but I think I've discovered what they are. You learn that there are short cuts you can't take in computer logic. If you look on page C-4 you will see ... I think it's interesting to point this out. You might want to look at...let's look at page C-2. The last line of C-2 says Balance Sheet Error, this is a built-in check to see if we have balanced our accounts and you will see that there is no error in the first year, an error of \$30,000, \$60,000, \$90,000 in the second, third, and fourth year, etc. If you look at C-4, you'll see where this error is initiated.

The first schedule, non-cash working capital schedule, shows in the prior year a negative \$71,000 in non-cash working capital. That's been brought forward, a negative times a negative makes a positive prior year balance of 71 in the second column, the first column of the projection. That leads to the result of the net change.

However, you'll notice that the figure that has been brought forward in succeeding years is each year \$30,000 shy. Something's

wrong with the little formulation that was input into the computer. A very simple mistake. It's useful to have this error check for reconciliation purposes and this can be corrected very quickly. There's one more error that involves plus rather than a minus in one of the last columns, but that's also quite simple and I'm confident it will be fully integrated when those two errors are corrected.

What are the advantages and limitations of this system? Let me comment briefly on the limitations. I ran into serious formatting difficulties and memory limitations. This was developed with 64 kilobits of ram. Visikalb is the essential software tool on which this was developed. Visikalb and the operating overheads of the computer systems limit the user ram to about 35K, 35,000 characters. Not a small amount of memory, but I found in setting up the format I could quickly exhaust that if I wasn't very careful, and, in fact, did exhaust it and had to go back and reformat. The way the system's now developed, I've used about 33 K's. I've got a couple of thousand characters of additional memory for elaboration of other schedules. I'm confident by reformatting again, I could save another four or five thousand characters. I had hoped to print out or to reproduce a copy of the entire electronic worksheet. I approached the Xerox Corporation Reproduction Center on the cost of that and it proved to be what I thought prohibitive. They wanted for 25

and a half inch by 20 inch printout or printed table over \$100 in full scale and something close to \$70 in reduced scale. So I went to the straight Xerox machine and printed it out more economically.

It would be useful to see the formatting of the various columns as they have been set up on the electronic worksheet. All you see in the monitor in this system is forty columns, but you can scroll anywhere throughout the system. You can go to any coordinate very quickly, and once you develop a familiarity with the program, it's extremely easy to use.

But one limitation that I want to mention was the memory limitation. You have to format fairly closely.

There are operating hazards which anyone who's ever worked with micro-computers is familiar with. Sometimes you get disk input output error, you can't load disk properly, you must save your program all the time. These are minor little problems that can be very annoying. It's almost like a manic depressive activity. You're so excited when something works and so depressed when something fails. And you just have to save your program all the time.

Finally, I think the most difficult thing I had, and this was a temporary difficulty, was equipment access. I was working first last summer at Wesleyan. I found some equipment at GW which I could work on for a short while that is no longer available. And finally, there is one system at the Computer

Activities Department of the World Bank to which I was given reluctant access. I was told that as an outside consultant my prime time was lunch hour and after 6 pm. We finally worked that out so I could finish the program over there, but it's been very intermittent development process.

As a side note, I think it's interesting to remark that this particular equipment is in very short supply right now. The computer stores are backed up. The Apple Computer Company, as you perhaps know, raised \$30 million in the equities markets in the last three or four months in their first public offering. Here's a garage type company that has gone public, which sold at the outrageous price of 100 times earnings when it first hit the stock market. The Apple III system which has approximately twice the capacity as the Apple II system still is not working properly according to those whom I've talked to, including a number of retail vendors. So equipment access is a problem, but is a temporary problem.

Now for the advantages. I found the system extremely friendly. Anyone who has worked with Fortran or with maxi-computer equipment (the Burroughs IBM system at the World Bank), I think they'll have to agree that that system is less than friendly. The cost is extremely low. This system cost under \$5,000 fully integrated with printer disk drive, monitor, and the central processing unit. The system is highly portable. With the printers that have come

out in the last six months, particularly the Epsom, which has brought printer prices crashing down by 50 percent or more in the last year. High speed printers. Everything about this system is extremely portable. Any analyst can take this in the field in a couple of carrying cases, very small, very compact. That includes the monitors, the disk drive, the whole works.

Powerful, reliable. Apple users swear by the reliability of the equipment. The major problem has been the disk drives where the housing has become loose and there have been problems of seating so that the disks are reproduced, stored, saved with fidelity.

The system is extremely fast. Maxi-computers talk in terms of metaseconds, they develop things. Micros work in terms of microseconds. Considering other relative time measurements, a few microseconds is not too much to expect a recalculation of several thousand additions and subtractions all at once. It's remarkable, really, how fast the system really is. And adaptable. I think it's important to note that although this is a model of a financial planning projection series, the equipment that we are referring to has been used successfully by engineers in doing engineering analysis. Any formula you can write mathematically in 255 characters or less can be built into this program, and called on when needed. Economists. Economic modeling. The West Africa Division (Agriculture) at the World Bank has used the Apple in its economic planning successfully. They've built

in some forty systems of the Apple. There's only one now of the several vendors which might be utilized. They built some 40 systems into their Nigerian agricultural development project. These will be used in the field in small towns to observe and record a data base of climate conditions, of crop cycles, crop production, and recording productivity of the soil. This data base will be accumulated in a central city, in Lagos. The 40 outposts will provide to the central system, which will not be a micro computer, it will be some kind of mini-computer, which will then reproduce the data as a whole. But a very large data base.

So again, memory limitations are a problem there, but the point is for under \$5,000 you get a completely integrated system way out in the interior of a country.

Cross tables can be developed very easily on this. Staff planning, planning of time. You have 20 people in your division. Where will they be at a given time. This sort of thing can be very effectively done with this personal computer. The major skill you need to bring to one of these is typing and it's my observation that people who are comfortable at a typewriter learn much faster than people who are not. People who are not tend to be stand-offish with the system and ask their secretary to do it. That defeats the whole purpose of the micro-computer, the personal computer.

What next? I think the key thing here is to focus on an industry-by-industry basis and ask how difficult would it be to develop for any given industry a financial planning model like this and is it worthwhile? I happen to believe it is very worthwhile. I have some ideas about the time requirements needed for this development. I expect that the next logical progression will be that this plan which was developed emulating a transportation company model, will be adapted to housing finance banks, on the one hand, and construction management companies, both of which are critical to Brazil's low-cost housing industry.

There is no reason why the same plan cannot be adapted in a few days to the accounting plan of any specific industry, a utilities such as water and sewer or an electric power company.

That's my belief. I'd appreciate your comments afterwards, after the lunch break, as to how this sort of thing might be used in the future.

Herb Wegner. What about the applicability of the TR-80. I hear that compared to the Apple as another low cost system.

Mr. Ladd. I'll make one comment here. The real strength, the real genius of this system, I think, is in the Visikalb software. I've talked to the guys that put the Visikalb together. Their professor said it couldn't be done, he's no longer teaching, and these guys have become millionaires in a couple of years.

Last summer, the Apple II was the only one for which Visikalb was available. In the last six months, Visikalb is now available on the Radio Shack, it's available on the Atari, which is Warner Communications Company, and I've just seen that Hewlett-Packard has paid them a presumed half a million dollars to develop it for the HP-85 and 83. So, in six months, there are four systems of comparable ability which all have Visikalb, any one of which could be utilized for this purpose.

Herb Wegner. That's a very good introduction in the way a number of us will be doing business in the future. It blows my mind that Sony has come out with another device that fits in your briefcase and has a small screen on it. You can type up (it has a pullout numeric keyboard) a draft report in the field, and it has some of the flexibility you find in a larger word processing unit in terms of editing capability. If you can get to a telephone, you can buzz the data back to your office on a larger machine with a printout. You can stay in the field forever, there is no need anymore to ever come home. Beautiful. Another contribution made by the data processing industry. But actually I can remember there was a time when all of the figures at A.I.D. were held manually and the worst thing that could happen was during the crunch to get the Congressional presentation out, someone would come along with a low level figure change. That itself was

not so ominous but because it would change 1800 different totals and of course the gift of the data processing industry is that all these things cascade down and all these changes are made automatically.

The application of what Jim was talking about to the systemization of the approach is going to have several benefits, I think. First of all, it's going to eliminate a lot of scutwork of the handling of figures, but it's also going to force the introduction of orderly thinking in advance in the design and the formulation that supports the planning process. What it's going to require is an intensive examination of the criteria to be applied and the flexibility of the criteria. Once the job is done and the curves are developed, then I think we have a marvelous servant working for us and data can be manipulated and aggregated with such an extraordinary rapidity that a great deal of our work will be done.

Thank you, Jim. That's very stimulating. I hope during the course of the day we can get back to the application of this tool.

Next, we'd like to call on our friends from A.I.D. Let me say that I watch A.I.D. these days with a great deal of interest. The new A.I.D. Director, Peter McPherson, is an old-time friend. I met him while working with the credit union development program. He was a Peace Corps Volunteer and I was working on a Special Projects and Evaluation of the Peace Corps in those days. I met

him in Lima, Peru where Dan McClellan, who some of you will remember as an early development hero in Latin America. Peter is a very special person to me. He has hands-on experience and maybe the first A.I.D. Administrator in my memory working down with the folks who are really the end objectives of the work of a great number of institutions. He is an attorney, first and foremost an individual with enthusiasm and optimism about what can be done. My hope is that circumstance, budget, and the Administration will allow him to achieve only 1/10th of the potential of his personality and his ideas. If that occurs, we will have the best A.I.D. administration that any of us will be able to remember. I'm really looking forward to what happens.

Okay, I guess, in the order listed here, we'll call on Carl Duisberg to talk to us about Latin America.

Carl Duisberg. Yes, I guess we're really going to get down to just dealing with programs we've been talking about. A lot of the issues and questions surrounding the use of small hydro that touch rural and regional socio-economic development, but we've been asked pretty much to talk about a few of the activities which the regional bureaus represent. And I don't know to what extent we're being a little bit presumptuous in that both the World Bank and the Inter-American Bank also have active programs in this area, but I have a lot of views and particular comments on various issues and points that have been made this morning, but we've gone over them in so many different versions I think it's best just to move right along for now.

So, I'll just say that in the Bureau for Latin America and the Caribbean, small hydro is being considered in a good percentage of the countries that we have active assistance programs. To list the countries most actively from the top down: Peru, Panama, Ecuador, Dominican Republic, and then via the Caribbean development banks in which we have regional projects we've been talking about. Small hydro in Dominica and Belize is going on right now. The most significant project in terms of money and potential impact is the one that has recently been formalized and signed off with Peru. Commitment involves \$10 million, \$9 million in loans and \$1 million in grants over the next few years to fund a large program for decentralized, mini-hydro generation

systems. It's Electro-Peru, which is the large central power utility, and they have an office within that for applied technology which is an actual implementing group.

In the development projects which N.R.E.C.A. has been much closer to than several other groups, they've certainly had to deal with questions of financing institutions, how the energy can be used and paid for, and one of the products of the actual project will be the further design and definition of the methodology for site selection and evaluation. In a few words, the kinds of sites that will be selected will be those in the isolated areas remote from grid connection possibilities where the poor roads mean unreliable supplies of petroleum currently and depending on the kinds of assumptions you make in the economics, presumably that the discounted costs of the hydro facility would be less than diesel so that they really are economically cost effective. It's a little different approach than Jim Fish of the World Bank is talking about the hard-nosed economic considerations but in that we are looking in many cases at places where this won't be supplementary energy but new energy. The fact is too that our loans are more concessionary, even though \$9 million is loans, it's 25-year term, 10 years of that is grace, and it's two percent interest during the grace period and three percent thereafter.

The loan finance studies for the equipment, construction of standardized small scale hydro installations from a range of 100 KW to a Megawatt. The number will actually be determined during

the process, it depends on size and cost, it's between 28 and 35 units probably. A companion grant, which I think is maybe even more interesting in part because it deals with the issues that aren't the financial questions we're talking about as being critical for the promotion of small hydro activity will address a lot of the technical assistance and training needed to strengthen both Electro-Peru's ability to implement this kind of activity and also involves the design. First a curriculum to train people who will do a promotional program going into areas and communities that will be receiving these units and teaching them about potential productive uses for the electricity because the provision of electricity, particularly in areas where it hasn't been before, doesn't automatically lead to utilization levels that would be sufficient to begin to pay for it. I think this is very important, and I think there's a lot to be learned there. What are the productive applications vs. just the domestic uses in irrigation, food processing, milling grain, etc. How can the electricity to be produced be taken advantage of to expand the range of economic activities in these communities?

I think this is a critical thing which comes back to financing. Unless the productive uses are found for these new energy sources that will pay for it in some sort of commercial application, we're not going to be able to begin to talk about the harder kinds of loans that we may be looking for in the private sector in the future. The rest would best be left to the afternoon.

Herb Wegner. Thank you, Carl. Next, Mr. Ichord.

Robert Ichord. Thank you very much. In the Asia Bureau, we have active A.I.D.-funded programs in Thailand, Indonesia, the Philippines, Bangladesh, Sri Lanka, Nepal and possibly Pakistan, and a small program in Burma.

I think that almost all the countries there with the possible exception of Bangladesh which is looking at their potential are interested in hydro technology and have developed over the last few years at least some capacity in terms of the management implementation, in some cases, the fabrication of systems.

I think the countries are looking at both the fuel substitution aspects that Mr. Fish mentioned, particularly Thailand and the Philippines, the large importers that have a large number of small generation units that are feeding mini-grids in rural areas as well as the potential of micro-hydro and other systems to supply small amounts of energy for remote village applications.

The motivations for this interest, therefore, are many - political, economic, social in nature. So it's hard to generalize, I think, about this field and the applicability and the types of technology that are applicable to all the Asian countries.

What I'd like to do is suggest some of the issues that we're looking at in our programs. At the moment, we are focusing primarily on Thailand, planning a program there that will look at what is good so the optimal investment mix of mini-hydro and micro-hydro technologies for the government. And some of the issues that we're looking to in that essentially experimental type of project is one sort of the whole issue of the role of mini-hydro

in meeting rural energy needs. The whole issue of the demand for electricity is one form of energy that is used in rural areas to both meet basic energy needs as well as to meet productive uses in agriculture and rural industry.

Another issue that we're looking at is the issue of sort of what are some of these distributed energy options, what are the economic, social, environmental impacts and costs of those technologies? The third issue is sort of the issue of local manufacturers, for the potential of the manufacturing of these technologies that could not only provide important employment and economic benefits domestically into the local areas, but also reduce the high costs of generation in terms of electric systems.

We're also looking at the issues of management and community participation in mini-hydro projects and the whole issue of the economic cost/benefits of the mini-hydro systems.

Two, I was recently in Thailand and I visited a hydro site near Ching-lai. I might just go briefly through some of the issues in relationship to that site and what's being done there because I think it illustrates the kind of site specific problems that we face.

The site was about 100 kilometers or so from Ching-lai up in the hill country not too far from the Burmese border. The main income of the people in the area is growing poppies and the fields are hidden a couple of miles away from the village.

The village is quite isolated in a mountainous area. They're building a new road that will open up the area from Ching-lai to the westernmost province there by the Burmese border.

It took twelve hours or something like that several years ago to get to the location, and now it takes about three hours by this new road that they're building to open up markets and to diversify economic activity up in that area, working to develop alternative crops for income.

Also the area is an area of focus for the reforestation program and the rural Thai Forestry Department is up there trying to develop trees and speed the reforestation efforts there. The hillside villages scattered throughout that area depend primarily on wood and they move from place to place and cut down the hillsides. There's tremendous erosion taking place in these areas. There is a Nam Dang a village of about 700. There is a stream that runs through the village and also there is a rural Thai forestry Department regional headquarters there that currently uses diesel and gasoline to run generators, also some bottled gas.

There's no electricity there. The King of Thailand, who lives in Ching-lai part of the year, is very interested in the economic situation of the hill tribes, and he asked the Rural Thai Forestry Department to develop a hydro project in this area. The

The Rural Thai Forestry Department in turn worked with the National Energy Administration in terms of looking at the site designing a mini-hydro system that would provide electricity for the headquarters of the Forest Department as well as to provide initial electrification for this village.

The NEA has been involved in rural electrification programs as you probably know and several of the engineers there have been very much interested in the whole area of mini-hydro and in working with some of the local machine shops up in the Ching-lai area to fabricate turbines and things like that for some of these projects.

So the idea was to try to do as much of the project as possible from the local material. They did run into problems though, in terms of the generators and governors that would be required for the system, and so they had to rely on the external sources for these components as well as the components for some of the control panels and that added significantly to the cost of the overall system. They do make generators in Thailand but they wanted, because this was an initial project, sort of a showcase project, to be assured of the reliability of the system.

So there was a mix of local vs. imported, but for the most part, the turbine, the pinstock, the transmission lines, powerhouse, the control panel were all made in Thailand. As I mentioned, the Forestry Department was basically in charge of

supervision of the project with technical assistance from the National Energy Administration. The community was involved in the construction of all civil works, about 50 or so men and women.

The economics depend a lot on the reliability of the system and the load that's going to be there in the village. At the moment, the full economics aren't in in terms of cost, but figures that I was given while I was there indicate that for this 50 KW unit works out to about \$66,000, about \$1,300 per kilowatt. I think that includes all the civil works.

But the powerhouse is built so that they can increase the capacity of the system at another 50 KW's unit, possibly a third, in the future.

They anticipate that there should be 60 percent load factor over the next few years. They do grow rice in that area so there will be grinding activity for their rice, and sewing machines and things like that.

The village itself, of course, with their revenue from opium, has a pretty good income so they can afford some appliances. In anticipation of electrification, they're already buying some appliances. This is maybe unique in that sense that there is this isolated village that has a pretty good income level but it's...

Herb Wegner. Are you saying that one of the benefits of rural electrification is boosting opium sales?

Robert Ichord. I think the system, in my estimation, because it is a showcase system, was somewhat over designed, and that the potential for some other villages could probably reduce the cost on it. A key factor, of course, will be whether the turbines from locally made materials will stand up, and I think that's a consideration that particularly the PEA, which is the prime provincial administration of Thailand, the prime agency responsible for distribution of electricity to rural areas, is concerned about. Therefore, in some of our thinking in terms of Thailand, we're helping look at sort of what are the advantages and disadvantages of domestically produced vs. imported systems.

In terms of the Asia Bureau program in other countries, we're essentially in the very early stages, looking at resource assessment of activities in Nepal, Bangladesh, and possibly Indonesia.

I think a point I'd like to leave with you is that I agree with Jim in terms of looking at the energy situation, you've got to look at where you can substitute for diesel generation units in larger size units of 50 KW or so, but I think the potential for smaller units that are based on indigenously manufactured components for smaller villages that won't be electrified for many years to come. A key problem is the problem of the income level of these areas, the uses that electricity can be put toward.

But I think that a small amount of electricity, getting these villages started using electricity can have positive effects in the future. And, in saying that, we shouldn't lose sight of the fact that most of the villages in Asia in rural areas rely primarily on biomass resources. Therefore, we've got to be very aware and sensitive to the overall resource position in terms of natural resource environment that these villages find themselves in. I think that relates to the basic problem at present that most of the energy resources are used primarily for cooking. Some people argue that electric rice cookers are a desirable development in rural areas of Asia, and I think that in most part these villages will have to rely on biomass resources for cooking in the future. Given the problems of deforestation and pressure on agricultural residues, particularly in south Asia, the diversion of those residues from agricultural uses to cooking - we need to look at what priority should also be given to try to deal with that particular problem. It's not clear that mini-hydro is the best technology for dealing with that problem.

Herb Wegner. Thank you very much.

GEORGE SELF: I want to talk about some of the issues and problems that we have been confronted with in our recent development, small hydro in Morocco, and some of the issues that had to be worked out. But first to back up, I'd like to reiterate something that Mr. Heyman said earlier, that something we have to be so careful about, even with single issue technology, is that we don't grab hold of a technology and then go around looking for problems to solve with it. I think it often happens, so I think the first step that we need to do is make a decision that Village X or Place X will get some type of new source of energy or energy substitution or present fossil fuel, and at that point we need to start with a need and resource assessment. What is this energy supposed to be used for, what resources are available? And then start worrying about the most appropriate type of technology to solve that problem. I'm afraid that's not what we did in Morocco. We wanted a demonstration hydro, three demonstration hydro plants, so we proceeded to find villages that were suitable for that. So that's kind of a take off of what I've just said. Everyone went off scurrying around the Atlas Mountains looking for villages that had the right kind of resources, then started worrying about if they had the need for it.

Some of the justification that we have to use for any type of new energy resource or substitution is the rural development argument. And here it's usually in the form of what we call four linkages in economic terms, that we provide an infrastructure

that we're hoping will bring about some type of productive future, as opposed to the other way, which is backward to linkages where you expect a plan of something to happen then you think about infrastructure coming along after it. I think for most rural development you look at the forward linkage type of structures that really brings about the development by infrastructure and then development will occur as far as factories and cottage industries or whatever.

The other thing is the justification of the social aspects and improving quality of life because we've provided lighting in the homes, refrigeration, health clinics. We're finding one type of quality of life/rural electrification studies in the Philippines showed there was a drastic decrease in the birth rate attributed to having electricity. Something to do at night other than go to bed, I guess. And then also the third would be the fuel energy substitution problem, which is also one of AID's and the U.S. governments aims of providing new resources for energy besides scarce renewable energy resources such as bio-mass or whatever or fossil fuels.

Then once we have chosen that we are going to go in with small hydro system, that it's the best type of technology given needs and resources, what we have to deal with is what was addressed by the various bank officials is the economic feasibility and the economic return, the ability to pay back, generate revenues. By and large, villages cannot generate enough revenues to pay back any type of loan, even if you go for 30 years, especially if you're going to talk forward linkages. We can't guarantee that

X number of cottage industries will occur. If we're looking primarily at the beginning of substitution of one form of energy for another, it is often in the form of replacing human energy for non-human, therefore relieving some of the drudgery of work. It's a quality of life thing. It does maybe increase productivity some if you already have a large supply of whatever is being done and a market. But often the work's being done anyway. And so we have a kind of problem.

I think the route we have to go is the route we're arguing in Morocco for future development is that the costs have to be a systems cost, that we can't expect each little, individual hydro system to be self-contained. It's a form, in a way, of extending the grid. In urban areas when we extend the grid, or we put a booster plant out in the suburban area, we don't expect that suburbia to pick up the cost of that booster plant. It's spread over the whole cost of the grid. So the hydro should be the same thing. And if we do this, we have a very small incremental cost to the whole electrical system, the country or the region. And then it can be, and usually the villages do have a small amount that they can put towards paying some kind of electric fee. But we can't expect the systems to stand alone. They didn't stand alone in the whole United States. Our rural electrification program in the United States was not based on what each rural community cost, it was based on the system paying the cost. So I think that's the direction we have to start thinking of, not the individual projects.

Now within specific areas of our Morrocco project, we have completed the feasibility studies and economic engineering studies. We are planning on building three plants in three rural villages in the Atlases. The designs call for a 150 KW plant, a 60 KW plant and a 50 KW plant. The 50 KW plant also will have a civil works large enough to eventually plug in an additional 50 KW so eventually we expect to go to 100.

Again, on this forward linkage type thing, we only need 50 KW now. Maybe in five to seven years if development occurs, we might need the additional. So rather than pay the cost now, we're building a civil works so that it can meet that, but we'll put the equipment in later on. I think we need to start thinking about that often, that it's possible to try to make a hydro plant fit into that type of system.

Some of the decision processes that we had to deal with in making these decisions, one thing is a sensitivity to small scale hydro. Small is not simply large scaled down. It's a different type of thing.

So we need to establish the need. We don't need to simply squeeze out every ounce of power out of a stream. If we only need 50 KW, we don't to have a 120 KW plant. It's unnecessary cost. That's again a type of system that many hydro system engineers, large firms, are not sensitive to. They're job is going, see how the stream is, they want to get every little energy out of that system he can. It might end up costing us \$5000 per KW, but, boy, we got every ounce out. That's not sensitivity.

We also had to deal with the problem of risk versus cost. And here we have again, with the Morocco case, the problem of the civil works to guarantee that in the worst case, it's happened once in the history of 100 years, the flood level, that our system can hold up. We have to take a risk that someday we might have a washout someday on the line. But we can't afford to pay 10 times, 5 times, the cost of civil works for that type of guarantee. We have to take some kind of risk.

Third, we need to try to keep the civil works down to a minimum. Again, we don't have the luxury we do in the U.S. where the big systems in civil works is a very small component of the overall thing. You can have a fourth generation capacity. So you can keep the civil works down. Also, the problem of year round energy supply. That's a problem we also have in Morocco. Do we want to have a system three to four times the cost so we can have guaranteed energy 12 months of the year? Or do we have a system that might be a factor of four to five to have guaranteed electrical power ten months, eleven months a year? We chose the ten/eleven months a year approach. Politically, the villagers might not be happy with it, but our thing is a little bit of energy is better than none at all. Just simply the winter months. you talk about a cheap backup system possibly.

Those are some of the decisions, hard decisions, that have to be made. We're talking about trying to keep things as cheap as possible.

Now in Egypt we're just starting thinking about hydro systems and they're using them on the irrigation canals, very small hydro systems. I think these types of decision-making will be some of the things we'll look at in some detail this afternoon in our roundtable discussions.

Herb Wegner. Thank you George. We'll call next on Bob MacAllister and then if it is satisfactory with Mr. Blair and Mr. Pittman, we will have lunch, and then talk about the private banking thoughts in this area. That will help us with the schedule a little bit.

Bob MacAllister. In order to get your undivided attention, I want you to know that I'm very aware of the time and that the culinary delights of the Dupont Circle area await us refugees from Foggy Bottom; so I'll go very quickly and if you find that some of the things I say are provocative, I look forward to discussing them with you this afternoon.

As you will hear from my remarks, we are not a monolithic agency. We have different approaches and we work in different areas of the world in different stages of economic development. For instance, I think it's well-known that the African continent, by and large, does indeed represent the poorest of the poor in terms of any of the criteria that are used to gauge development and relative poverty. Unfortunately, it ranks very high in all of those categories. Not only in terms of monetary situation and material situation, but in terms of human and material infrastructure. I was struck by an article I was reading recently by Yuma Laley (?), the distinguished World Bank economist where she pointed out that in 1960 the countries of Nigeria and Ghana, which are probably the most educated countries in Africa in terms of higher education, in 1960 has 2% of their population university graduates in comparison to 8% for Bangladesh, which I think is considered one of the poorest countries in Asia, ranging up to 25% for the Philippines.

Also in terms of resources, particularly thinking of the gentleman who just preceded me to the podium, in terms of aid

and finances, if we're lucky, we might have something like \$385 million for the continent of Africa in development assistance in the coming fiscal year. And it is certainly my impression that our sister Bureau in the Near East will spend at least double that in the country of Egypt alone during the coming fiscal year.

So I just give you this a little bit in terms of where Africa comes in.

So as we look at this there are a number of questions that we keep asking. One of these are the whole question of recurrent cost. Most of the countries in which we work at the present time have serious basic budget problems. In many cases their budget is annually supported by a foreign donor just to stay alive, just to function, not getting into the question of economic development.

So whenever we talk of introducing some new program, whether it be hardware, whether it be people, we constantly have to ask ourselves how is this country going to pay? There is the whole question of opportunity cost, i.e., if we're talking about power to do a job, can some other form of power do the job more cheaply and provide services to more people? For example, if they need, a very important need, potable water, in a rural area, and you only have \$2 million to spend, can you provide more potable water for more people by having hand dug wells with a concrete top to prevent the goats from dumping into the wells, or can you have more by mini-hydro photovoltaic pumps or what have you costing it out over a period of time?

Another question we run into constantly is the ability of the host country to maintain, not just the money, but literally maintain the hardware that you're talking about. Many of you have travelled in Africa, I'm sure that you seen that there are many rusting mementos to the good intentions of outside donors in terms of bringing in some high piece of technology which started rusting as soon as the outside donor left. The question constantly comes up are there spare parts available, are there people trained to maintain hardware?

And of course, there's the whole question of social consideration. After you get the piece of hardware, are you in the situation where the people are really going to use it?

Since we're almost at the point of eating, I just want to recite to you an interesting story that came up in Upper Volta. Some years back it had to do with a solar cooker. In this case there was a European donor who thought it would be a marvelous idea, given the tremendous sun one finds in Upper Volta, to bring in solar cookers and people could save wood and everybody would live happily ever after. So they brought in their solar cooker, made of a stainless steel interior, and found it got scratched up in its travels from Europe, so they then sent back for some giant sheets of tinfoil. They relined it and went out to the village one day with the solar cooker and the sun was out and all the Europeans were standing in sunglasses, because the solar cooker was glaring, and they presented this solar cooker to the association of women of the village. And the first comment of the women was, "We want sunglasses." I think this is really

a graphic example of checking out some of these things before you move the solar cooker from Scandinavia.

In any event, it seems to us that some of soundwaves to decide on whether or not to use a particular piece of hardware are some of the following.

One, if you're talking about mini-hydro replacing some other power system which is economically sound because mini-hydro can do the job cheaper. For instance, there are places now where you will find diesel-operated grain grinding mills being operated commercially and it seems to us in that type of a situation if you could show that the mill could be operated cheaper by mini-hydro, giving escalating costs of petro using a twenty year projection or something like that, that sounds viable.

Secondly, would there be situations where mini-hydros could provide energy cheaper when mandatory public service where energy is an absolute requirement to function. For example, could you show that mini-hydro would provide power cheaper to operate a refrigerator for vaccines and provide lighting for the operating room in a rural health clinic than the current diesel oil generator or combinations of other sources of power.

Another interesting possibility that to date I haven't seen come across my desk anyway is other situations where economic analysis would indicate that over the life of the project mini-hydro is the cheapest way to provide energy that could increase the incomes of poor people in a given area.

For instance, if you have a situation where a farmer gets one crop a year now and depends on rain to come for irrigation. If you put in a pumping system and you'd have to provide some loans to the farmer and it could be worked out that the farmer could get three crops a year instead of one, and you could show that over a period of time the farmer would be able to pay back the cost of the pump, or a group of farmers, and at the same time increase his income and at the same time contribute to the general economic development of that area, then that to us would be a sound intervention, a sound investment from the viewpoint of economics.

In terms of what's happening now, we're currently trying 24 different technologies in Africa and certainly one of them coming up is mini-hydro. In general, we're very much at the research and development stage because we're constantly challenged by the technology that our target group, namely the urban and rural poor, can afford and one that is virtually accepted.

In terms of things coming up in Africa, we recently had a conversation with some people at the NRECA who were going to Ghana to talk there about the possibility of some rural electrification and we urged very careful economic analysis in that case given the triple digit inflation of Ghana and the fact that the International Monetary Fund has a mission there now trying to deal with the basic finances.

We have a renewable energy project coming up in Usoto (?) and there is provision there for projecting the use of mini-hydro in a rural clinic area which is currently dependent on diesel oil.

for generating the electricity.

There's a small project in Liberia which is just getting started up. It's the classic test of bringing electrification to a village in Liberia where they haven't had it and they will be looking at what are the implications of electricity in that situation in terms of sanitation and development.

We have a renewable energy project in Rwanda which has provisions for trying mini-hydro technology. There is a team just about to go out from the NRECA to Zaire in response to a missionary hospital there to use mini-hydro to generate electricity for their uses and to look at some possible applications in education and agriculture.

We've had a request from the government of Togo for a team from NRECA to come take a look and see what is their mini-hydro potential.

And finally, we look forward to having a conference in Africa which will be coordinated by NRECA and we hope also some African co-sponsors which will be an opportunity particularly from our point of view for a field mission, to have an opportunity to look at what are some of the possibilities of using mini-hydro.

Having said that, I wish you bon appetite.

HERB WEGNER: Thank you very much, Bob. Ok, we're at the point of lunch and, unfortunately, we've run over sufficiently that they've had to cancel the Pheasant en Plume in orange sauce and it's been replaced now by sandwiches. They will be served on the premises.

Let's establish a reconvening time. Let's try to be back

about 1:15 p.m.

(Lunch Break)

HERB WEGNER: You may want to consider moving up to this end of the table for the roundtable discussion. We're back in solemn session.

We have one more presentation, one I'm looking forward to very much, by Douglas Blair of the Chase Manhattan Bank.

DOUGLAS BLAIR: I remember the first gentleman who spoke made his notes on the Metro, I made mine at the table here.

One reason is I really want to deal with the realities of the situations that you're all talking about and I'm obviously not well informed on the technology or the economics of small hydro electric projects, but I'm beginning to get a feel for it this morning. I'm glad to tell you that I'm still not interested in the technology involved, so we won't have to discuss that.

Unfortunately, though, there's a good reason that I'm not interested in the technology. The bank does have interest in technology and financing technologies, and we have an area called Project Finance which looks at projects strictly on their own merit for financing. In other words, if just the economics of a project are so overwhelmingly favorable that they can obviate the need for any other kind of support.

It's pretty clear that the small hydro project that your're talking about in economics is extremely fragile and probably on a more negative than positive side anyway. So for that reason

the technical side doesn't interest me because it's obviously not financible.

The question, then, it seems to me that we really should be addressing here if we're going to look from the commercial viewpoint is, not how do we finance small hydro projects, but who's going to pay for it? That's the real question. Your projects are not financible so what you have to decide is who's going to pay and which people are acceptable obligors for a bank loan.

I should probably start by telling you that when a banker makes a loan, his first consideration is not his interest rate, it's not his profit, it's how is he going to get that money back. Because you don't make very much money when you make a loan, in fact a very tiny amount, usually less than 1%. And if you have \$10 million in loans outstanding and you're making 1%, one loan can cost you many, many years of interest in future \$100 million loans. So you have to be very careful of the money you do lend.

Secondly, when you're talking about very small amounts of money, you have to ask yourself what's the overhead, what's the upfront cost to the bank in making such loans. We're talking about \$50,000 loans, which I understand from the discussion buys a fairly sizable small hydro plant, and because it's such a small loan and because of the high risk involved, we could make even 5% spread on our interest rates, we're only talking about \$2500 and that won't even cover the cost of going down to look at the site.

So, we need to find acceptable obligors and ways of financing that reduce the overhead. Now overhead is reduced in two ways. One is by eliminating (?) paperwork and mechanics. Now we have ways to do that. But usually what happens is that those things are reduced by lending to a better borrower, not to a lesser borrower. The other way to do is to get your amounts up to such a level that you begin to get some return to scale. Instead of making \$50,000, we want to make \$5 million loans.

Quite frankly, our experience overseas, and we are more or less represented in about 100 countries around the world, is that loans of less than \$3 million are unprofitable loans.

So what I would like to do is suggest who some acceptable obligors might be and these are really possibilities that have occurred to me listening to the discussion.

The first one, and one that came of Jorge's presentation, is the end-users. There's obviously to me going to be some interest by private industry, or even local individuals, for example, a large agricultural interest, in small hydro projects. And perhaps they could be the direct obligor for a loan to finance such a project.

A second one might be municipalities, particularly if you're talking about hydro projects that complement a grid that serve not only the rural population, but the more dense central municipal population. Municipalities internationally are a little bit of a tricky issue and you do it on a country by country basis because you're not quite sure what the obligation of a municipality is. In many countries there's no difference between the

municipality and the national government, which is probably what we're going to aim for in the end (?).

Going up from municipalities, there would certainly be the regional authorities, whether they would be government, bank development or the major utilities. And I thought the example of electric in Peru is certainly one which ought to fit in with many, many developing countries, particularly in South America. Generally, the major utilities, which I'm thinking of course government owned, are among the best creditors in a country so if you can interest them in any individual project or, preferably, in a type of program, either regional or national, they can be very good obligors and you'll find any commercial bank happy to work with them.

Moving away from the government/public sector, I think that local banks can also be a source of interest. Certainly we have relations with more banks than corporations around the world, and at least our bank, which I grant is rather uniquely set up in the trade area, does have guidance lines of credit, in other words, lines of credit that we don't tell the banks they actually have with us in which if a customer in their country buys something from the U.S. or somewhere else, requests financing and gets that bank's agreement to guarantee the financing, we will offer them a loan on the spot based on that guarantee.

The local banks can be both a source of both the funds and, more importantly, the guarantees. And I say more importantly because you're usually talking about imported projects and a

local bank, of course, is not going to be able to generate dollar financing for dollar purchase. They're going to need help in one way or another either by the foreign bank, like ourselves, directly making the financing or by offering a foreign exchange with someone.

I think one of the most promising paths is one that I discussed last time I was here with Bard and Jorge which is the national governments. The reason is it seems that these kinds of programs really do have to fit in some kind of national energy plan anyway, and what to my mind would be the ideal situation is to have a national rural electrification or national small hydro power program that the government could be made to buy off on to support the financing that was going to be provided for this. It would certainly be the easiest and probably the cheapest because not only do I think that that has the most

but what I hear from my friends who offer aid and development funds, this would be the most interest to them also. And I think one of the real benefits that I hear coming out of these discussion is that regional and national plants don't involve you in very self-defeating cost-benefits analyses that seems to be involved in the rural isolated project which are going to be the hardest ones to finance all the time, no matter how you're doing it.

of course, the development agencies would be happy to with but they don't want to fund it, they like to guarantee or would like to work in a joint program. Usually the

development agencies don't like to work with us so much because we have very, very different kinds of requirements, both economic and business. They're very different. In my bank, in particular, I think it's very hard to work with on that basis, although we are working hard to try to reach working relationships with all the development agencies.

I'd like to mention a couple of other problems I see. Let me go on to a little bit more complicated solutions.

One, something we discussed briefly last time, which is sort of a unified exporter. The U.S. suppliers would always have access to FCIA although it would usually mean that they had to have a series of international exports that could be put under a single portfolio. But certainly you would have access through the supplier to the FCIA policy in the sense that he could insure his receivables from foreign obligors with FCIA and sell those receivables to commercial banks who would be willing to buy based on that insurance. Of course, what we're now talking about is the maturities on the debt created, even less than a commercial bank would offer which, of course, is far less than any development agency is going to offer. Commercial banks generally will not go beyond seven years. In the case of this equipment, I can't see any reason for an exception in that regard.

If you have unified plants, there might be some possibility for obtaining longer term funds through private sources in the

United States and abroad with the participation of the banks. One of the possibilities we've been looking at for access to longer term funds is to guarantee (?) syndication funds, here I'm talking small amounts, say to guarantee insurance companies who in return lend the funds to the buyer of equipment and we would accept the credit, political, economic risk involved and the insurance company would then be taking on our credit risk, not the buyer's credit risk. And we thought maybe we could induce them to make some international loans that wouldn't upset the regulatory bodies too much.

Along these lines we discussed the idea that it might be possible to set up a separate exporting agency, that you create the small hydro power export company, separately incorporated, separately funded, which could make all the purchases and then export them and qualify on its own for FCIA or EXIM. If you're talking about an entire country, presumably we could get over the \$5 million minimum that EXIM has and perhaps get the reduced rate.

Financing, such as it is, in the current world -- there's not much left at EXIM Bank -- but definitely projects like this, I think would be offered some priority.

Furthermore, I think if you're talking about sources outside the U.S. for the equipment, there's a lot of potential to work with other government agencies, and I think this is probably best explored by contacts with the chambers of commerce of those countries, countries like France, which has a very

relatively ambitious plans for small manufacturing exports, is a place to start. And, again, the developing countries. Mexico would be a wonderful place to (?) this type of equipment out; Taiwan, Singapore, Brazil, any of these developing countries, Korea, very interesting export programs, government guarantees to promote these small exports. These are places (?)

I think the problems that we could lay out with commercial bank financing are (1) concerned with a suitable obligor (2) finding a suitable maturity for the buyer since I don't think in any case we're talking over seven years, and (3) finding a large enough amount to induce a commercial bank to make the loan.

One other point that I think has got to be addressed when you look at commercial bank financing is the interest rates that you are going to be charged and the foreign currency exposures that are going to be incurred in the case of imports. As I said, we're looking at very fragile economies in these projects. It seems to me that most commercial rates in today's world -- rates which we expect to persist for quite sometime -- can really wreak havoc among any of these programs. When you have 15%, every six years of interest is equal to the cost of the project, and if you're talking about twenty year maturity, you've probably doubled the cost of the project with the interest rates. Those considerations would have made, too.

So basically those are all the ideas that I came up with
and I hope they're some help to you.

Herb Wegner. We're at the point on the agenda where we invite a general discussion. To try to get one theme going, let me make a comment on the question that has come up a couple of times and that is, are we justified in pushing this technology. I'm reminded of some of the writings of the economist Kenneth Molding who developed something called "The Law of Political Irony" where the more you try to help people, the more you hurt them. I think there is, first of all, an enormous virtue in keeping any kind of development program, keeping any kind of an approach utilizing technology, as absolutely simple as it can be. I think small hydro has some of these virtues attached to it.

Second, if you go out into the world, and I state this not to close off discussion, but rather to open it, these are my opinions and do not represent the sponsor's - if you go out into the world, if you look at all the possibilities for development, if you take a random view as to what's out there and what can be done, and you try to organize this, then you are faced with the monumental task of a delivery system which will meet these needs.

On the other hand, if you have an answer and you're looking for a problem, it may not be as bad as it sounds because either by experience or intuition or by whatever data may be available - however imperfect it is - you can deduce that there is a very high probability that the answer you're proposing has enough problem sets out there that you're going to have an impact, a significant impact, in the general area of development and the improvement of life, economically and socially.

If you push this answer, because by pushing that answer what you're doing is creating a technical delivery system, and a financial delivery system along with it, which then has the prospect of increasing efficiency and lowering the cost of delivery, at least that's my theory. It's a personal one, and I offer it to you to be shot down. With that the floor is open and please make any comments you want. Don't let me call on people, just fire back and forth, and if things begin to slow down, we'll interject other questions. Also, let me encourage the N.R.E.C.A. people to ask whatever questions they want to get out of this. My usefulness as a moderator probably expired before lunch, so please help in the direction of this in the areas that you are most interested.

GENERAL DISCUSSION:

Mr. Fish. Can I start out the discussion, because I think there's something here that we need to clarify, and I unfortunately will have to leave.

During the discussion we have often times confused economics with financing. And since N.R.E.C.A. in particular may be responsible for preparing feasibility studies and are looking at these kinds of projects, I think it's important to clarify that at least as far as we're concerned at the bank, the economic evaluation is a completely separate kind of evaluation from the

financial one. The bank, as you mentioned, has to look at the opportunity cost of available capital. For that reason, our practice, at least, is not to permit the concessional elements of concessionary finance to be clothed into the project economics. In other words, the fact that the money might be available at 2% for 50 years for a mini-hydro project is not particularly relevant to the economic justification of that project, unless you can swear on a stack of Form 1040's that it would not be available for any other development project in the country. That is, of course, very seldom applicable.

So I think we have to look at these two things completely separate. If you decide a project is economically justified, then we worry about how we're going to finance it. And look at cash flows and that sort of thing.

I might say that I don't think that we should be discouraged or perhaps as negative as I might have been in my earlier comments because the bank is looking at, for example, a project in Africa now that will have a unit cost of something like \$6000 per KW. It appears to be economically justified. Hydro projects intended primarily to serve as fuel replacement in an area where it's diesel fuel-dependent, transportation costs are high. So despite these high costs, it's something that we think we can live with. At least we're looking at it. It probably will make sense.

So there's certainly scope for projects in the \$2000, \$3000 KW range that we've been talking about. This means a lot of up-front money.

The second point that I wanted to make in general here was that it's very important from our experience in these kinds of studies to look at operations costs, because whenever you have a diffuse resource like solar or wood or biomass or small hydro, the operating costs associated with that can be quite substantial and significantly different in percentage terms from the larger scale alternatives. And so studies that, say, automatically assume 1% of investment cost as an operating cost per year, or something like that, clearly are not realistic in this kind of environment. I was curious in the Ladd presentation whether or not the item called working expenses there was indicative of a renewable resources project because it's about three times the depreciation and usually we expect this to revert. I suspect that that's not particularly applicable there.

But if we're going to talk about the next stage, which really depends on large scale production of feasibility studies to support big programs in small hydro, then I think that we have to focus on these issues, we have to try to come to some mutual sort of agreement on what constitutes an acceptable project and how we might approach it.

Mr. Ladd. Could I ask a question while Mr. Fish is still here?

That is on the general issue of cross-subsidies. It seems that a powerful country like Brazil can approach a powerful organization like the World Bank and convince them of the need

for cross-subsidization. I'm not sure who convinced whom. But the fact is that this has happened in the area of low-cost housing where social justifications and others have led to a national program where the poor pay one and two percent interest above monetary correction and the rich pay 10-12 and 14%. And those that fall in between, including municipalities, pay rates that are in between. Is this concept salable at the World Bank or other international organizations in the area of power where you have very economic large scale projects, perhaps cross-subsidizing less immediately measurable benefits in the rural area?

Mr. Fish. Well, the key is your last statement - less immediately measurable benefits. And again, that's why I stressed the contrast between the economic analysis and the financial analysis. Cross-subsidization is something that comes into the financial analysis, in general, because you're talking about how do you execute this, who pays for it, and where does the money come from? It may be quite legitimate to the economic analysis shadow price social benefits arising from the project. We do this quite often in rural electrification, for example, where you're trying to determine whether or not it makes sense to start a new activity or to undertake particular activities.

But I think that we shy away from cross-subsidization as an economic justification. In other words, we don't like to say that the systems approach that you're talking about, for example, that you treat things on a systems basis. We don't agree with

that. We feel that each extension of that system has to be shown to be able to be economically justified. Now you may treat a system on a systems basis from the financial standpoint simply as a mechanism for getting the thing done, but the mere fact that a government is willing to pay 100% of the cost of a project wouldn't make it necessarily justified for bank financing.

Mr. Wegner. Jim, what is the - the bank, I'm sure has a view, it must, however informally held - to the relative priorities of lending for power development, electrification in particular?

Mr. Fish. Compared with what?

Mr. Wegner. That's exactly right - compared with what? Compared with the universe of other possibilities in development financing. I realize that's hard, but what I'm really saying is, is there a prejudicial framework informally held by the people within the bank that says this here power is more important than education and less important than food and about as important as a sewer system or a runway extension - you know, that sort of thing.

Mr. Fish. Well, that's an allocation problem and we're beginning to run up against this. If we adopt the proposed expanded program in lending, we'll be back to dealing about 25% to 30% of the total bank lending in the energy field, including electric power, which reverts to the pre-1960 days when the bank was primarily thought of as someone that financed hydro

projects. Now we're doing about 15% a year in electric power, and I think that's going to stay about the same.

The constraint, though, is not one of allocation, but rather one of good projects. It always has been. And we want to do more in rural development and agriculture and in things like this, alternative energy, and that does have the highest priority. I think if you came up with a good, viable small scale hydro project with a rural complement, it would be right on top of the list, no question about it.

Mr. Jackson. Before Mr. Fish leaves, I'd like to address a question, one that we discussed a little bit.

In Panama they have a small hydro program going where AID is looking at funding at a few very small sites with the idea that hopefully the U.N. development program will come in and take on a little bigger project, and if that develops, the World Bank will come on bigger. But that seems to be an exception where there's sort of a joining international lending institute working together. Is there any way we can maybe increase that amount of participation in one particular project, knowing what each party is doing?

Mr. Fish. Well, I think that's one of the big issues that we have to face is sharing information and coordination of projects. I feel that we're rapidly getting to the point where two consultants show up one day to look at the same site. It may be embarrassing. The bank publishes its monthly operational summary which

shows the projects which are looking for financing. As I said earlier, it's quite easy to add complements to projects.

But I think that we need to look more, plan more deliberately to use the preparation effort, the investigation effort, the initial demonstration project effort, to build a pipeline of projects which would be suitable for the Bank, or IDB or anyone else who might be interested. And there's a serious need for an information exchange of some sort to identify who's doing what in this area, especially as we move into the larger programs.

Mr. Jackson. Do you have any recommendations for this information exchange - who all should be there, obviously you, Caribbean Development, African...

It seems like there are a lot of parties.

Mr. Fish. Anybody have any ideas who might serve as an agent for that? I mean, as I say, we do publish at least the state of project preparation on most projects, but it's hard to find out who's doing what elsewhere.

Mr. Blair. Well, we have no formal way of knowing all of them.

Mr. Duisberg. I think in an informal way it's beginning to be addressed on a regional basis and in some endeavors, even sub-regional. In the case of Latin America, there is the Caribbean coordinating group to the Bank and the World Bank are very active in it. Then there are other regional institutions that are beginning to talk about having interagency meetings on their energy

activities on a biannual basis to begin to try to coordinate them. But it's an uphill battle. I wanted to ask Jim Fish a question. You were talking about economic analysis of projects, you mentioned shadow pricing for social factors, and you also talked about the more hard-nosed approach of the Bank. But what kinds of assumption - is there a standard assumption that the Bank makes in evaluating a power project? For example, in oil price projections, then the more site specific ones would be the reliability, or the availability of fuels, the transport costs given them. Could you say something very briefly about these kinds of assumptions?

Mr. Fish. Well, what we do is to do sensitivity tests on the rate of return to accommodate them and in accordance with the forecasts of our commodities department, we use a 3% increase in real prices through 1990 as the basis for the actual binary price of chosen products. You have to add to that transportation and everything else. It's necessary to get the fuel to the site. In fact, usually that's the base. Now we may say what happens if it goes up 10% or if they find oil in this country and that sort of thing, and look at what the impact on the project return would be if the situation changes.

Mr. Duisberg. Where were you talking about 20, 25 plus useful life for hydro facilities? What do you talk about after 1990? Do you have any speculation on that?

Mr. Fish. Well, I think the general feeling is that there must be a limit at which alternatives become available, and we don't have a specific methodology for handling that. My own view is that the decade between 1990 and the end of the century is going to be one of a severe price disruption in petroleum products in developing countries because of supply constraints, even though we might be well above prices that would justify coal conversion and things like this. In terms of alternatives, the capacity to supply that simply won't be available. And so there will be an increase in prices. But it's questionable whether that's an economic increase and how you can take that into account over the far long range, if you will. So it would appear that this kind of assumption will give you a petroleum product price which would appear to be a reasonable limit compared with alternatives.

Mr. Blair. On the Electro-Peru, is that a nationwide project or is there a specific area?

Mr. Duisberg. Electro-Peru is the national utility. One of the things that makes it interesting, and I think exceptional, one of the institutional restraints of small hydro programs is that there was a ministerial resolution within the government of Peru in 1978 that decided it would be a priority to talk about small hydro development in remote areas of Peru as opposed to just an extension of the regular grid. There's that and then there's the national development plan that has designated particular regions of the country as priorities for support from the

government. So the hydro program is being geared to a few states and regions, so it is not nationwide in that sense. There are a few areas where there will be much more focus, obviously they are areas, too, that do have greater potential.

Mr. Blair. It is a nationally directed program?

Mr. Duisberg. Yes, it is nationally directed, but this phase that AID is funding will be focussed on a few of the priority areas for development in Peru as established by the Peruvians.

Mr. Ichord. While I think there are economies in terms of national programming, and I think there are a number of examples of countries that are pursuing that direction, one of the basic problems with financing these schemes is what is the financing available for the complementary inputs that are required on the end-use side because you can build a facility, but if it's operating on a 20% load factor or something like that, it's income is going to be very poor. A lot of times the integration between the national utility and the agricultural ministry or the rural development ministry in terms of making available credits for the end use devices, whether they be irrigations pumps or sewing machines or what have you, that can enhance the productivity of electricity, that is not integrated into an overall program. So it's fine to talk about a national mini-hydro program with the rural areas, but that's only one component. You've got to talk about financing the overall package. That's something, I think, the N.R.E.C.A. can tell us about, the programs around the world.

The productive uses, the ability, the income levels of people and their ability to afford those appliances are a major bottleneck to improving load levels.

Mr. Ladd. I've been struck by the disparity in rates of return that are considered economical by various agencies from time to time or the same agencies in different sectors of economic activity.

For example, I was looking at some World Bank water and sewer projects in Sri Lanka, Egypt, and India. I saw rates of return that were accepted as economic, ranging as low as 3%, 4% and 7%. And I wondered if there are any guidelines in AID, in OAS, the banks, for economic rate of return cutoff lines, cutoff percentages, in quantifying these cost benefit analyses.

Mr. Wegner. As a general answer, it depends on who you are and why you're lending. AID has frequently considered itself as a lender of last resort and frequently lends for either humanitarian or political reasons or a combination thereof. Frequently its lending operations, at least when I was working more closely with it, couldn't really be examined in any kind of a commercial context, and that's why I was really interested in Doug's comments. I think in the long view, AID's role is that of a Paladin lender. You come in and hopefully catch a situation that's deteriorating, you can throw some money at it and get some things going, and if the planning is good and the assumptions are correct, then it'll do a job. It may bear absolutely nothing to doing good business. But ultimately I have faith that the world is going to

run on a businesslike basis. My hope is that we can arrive at some insights that would support the notion that private lending and business development has a parallel interest with the social and humanitarian goals of establishing the availability of power in rural areas and in small communities throughout the L.D.C.s.

Mr. MacAlister. In terms of stimulating people concerning the possibilities of mini-hydro, and as I indicated, mini-hydro is one of 24 technologies that we're testing, but if at some point in time, we could see some examples of projects that were working, that somehow we're financing. You talk about lending. A lot of the money that we get involved with in the Africa region of AID is not loan money, it's grant money, and our people are so poor, in a lot of cases, we're making grants, not loans. In a lot of cases, we deal in such a poor situation, we're waiving even the 25% input by the host government. We're putting up 100% of a project, or close to it.

I make this with reference particularly to our project conference in Africa where we'll get in the people from the missions and some of their host government counterparts. If we could have some empirical case histories that people could deal with which would demonstrate the economic, viable use of mini-hydro which takes into consideration the question of maintenance, spare parts, etc. that I raised. I think that could really help to focus attention on what the possibilities may or may not be.

Mr. Ladd. One question I would have as an extension of your question would be what is the U.S. experience in justifying out-post, rural marginal mini-hydro? And other cases which can be documented which are super-indicative and perhaps relative to the same kinds of issues we're talking about overseas. How do you justify putting a hydroelectric plant out in the boondocks?

Mr. MacAlister. Or how do you justify it when you don't have enough medicines for your basic health services?

Mr. Ladd. Well, that just complicates the question, I think.

Mr. MacAlister. Those are the real questions we have to deal with.

Mr. Ladd. But other U.S. cases where we have a high level of documentation and experience amongst your...

Mr. Fritz. The U.S. cases are actually very basic. It's the old Corps of Engineers cost/benefit approach based upon revenues.

Mr. Self. But I think you miss the whole point if you say how about cases where we can justify small hydro. More basic than that is that it's not all small hydro, but it's rural electrification, or it's increasing the amount of energy per capita of a population or whatever. Forget the type of technology that's used and AID has been doing rural electrification for a long time by and large from grid extension or through diesel and you can look at some of those evaluations. And there they've used things such as the development of the area as far as cottage industries, looked

at health changes, life expectancy, all these kinds of things, looked at literacy as far as having lights on in the evenings for adult education, potable water sources. So there's a whole variety of things you say are the beneficiaries, how they've changed per capita income, health, whatever, quality of life in general. And I think that's the way we've done it in the past. It's not a certain technology, it's given energy, how do you justify it.

Mr. Ladd. Granted the need for comparative and more sophisticated analyses, but is the answer that you have it in-house, you have your own cases. If not in Africa, you have cases in the Near East and around the world.

Mr. Self. Our PPC last year, Policy Planning Coordinating Group, did a major rural electrification evaluation.

Mr. Ladd. Is that available to the public?

Mr. Self. Yes, it was done by the studies group. It does give some of the methodology and shows some of the proofs. One of the things it did knock out right away was one of the justifications often used which was would it solve the rural to urban migration problem. It found as a matter of fact it was increased because people get a little taste of modernization and good things and they get the hell out of the boondocks quicker.

Mr. MacAlister. There are all kinds of things justified to slow down keeping them down on the farm.

Mr. Self. That one fell through. They found life expectancy and those kinds of things definitely increased, better nutrition,

etc. I think a lot of it leads into our energy things so we have to think of as Bob Ichord mentioned, I think you have to look at the total development picture. Just throwing in energy, I think you have to think of, if we want this thing to pay back, in addition to going in with the hydro or whatever kind of energy power, we also provide a hardware for some kind of cottage industry to use that power or develop training programs or infrastructures - marketing potential, this kind of stuff, that we're going to do. There's one in Morrocco. They've set up marketing for handicrafts, using electric-powered looms. Those are the kinds of things you have to build into. You have a complete development package in which energy is one of the resources to make a thing happen.

Mr. Duisberg. Even a more simple response to your question of U.S. experience which I think Jack or Bard referred to. Isn't it true that in much of the rural electrification programs in the West that they were not proven to be economically cost effective at the time of the actual investment and even some of the larger projects - the Grand Coolee and some of the big dams in the Far West - that it's only with time, after 10, after 20 years, that we really see the real impacts, that over the short range we didn't know the extent to which they would have really dynamic impact on total development on those areas, and it's very difficult - it's only after the fact that we know this and we really can't make these assumptions.

Mr. . I think that's absolutely right. I might say as far as the U.S. is concerned, they never did do any of this cost benefit analysis work. They just went ahead with the rural electrification program on faith and carried it out. Twenty or thirty years later they went back and said it was a good thing.

Mr. Self. Wasn't this on faith, though, that people had a right to electricity?

Mr. . Yet, it was a rural development program put forth by the Roosevelt Administration. It was politically motivated to start with, and the idea being that this was what the New Deal was about. They were going to do it and went ahead without any hard data or any research or anything. We look backwards now and say yes, it seemed to have worked.

Mr. Asin. Was there any kind of support system to that? You had the electricity in order to keep on having the area develop. Was there any other type of incentives for people to move in one direction or another?

Mr. . Well, the program itself, of course, was subsidized in a sense by the U.S. Government through the Rural Electrification Administration and cheap money.

Mr. Duisberg. Talking about credit programs actually bringing into...

Mr. . Yet, well, that's right; the cooperatives themselves had what is not a productive uses program in the sense you are talking about. It was sort of a member education power

use program. It didn't focus really on anything in particular except building a loan to make the assistance viable and they didn't care whether it was irrigation or hairdryers, which we would care in the development business. That was something the cooperatives just did, it wasn't a government program, it wasn't anything, but just made good business sense. It became sort of a policy in the cooperatives to teach farmers what electricity could do, how to use it, make sure they didn't kill themselves, all kinds of household uses, farm uses, what not. But, I think, looking back, it was essentially the same kind of thing that we recognize really needs to be done now in the developing world with a different focus - not focusing on hairdryers and lots of light bulbs but on things that raise the level of economic activity in the region in which this energy source is put to use. I think we can learn a lot from what happened in the U.S., looking back, but it's not directly transferable, there is no energy sophisticated program of evaluation in the U.S. system.

Mr. MacAllister. Obviously, we're getting into a gray area here, and I think we all realize it's impossible in most cases to make full scale direct analogy, particularly taking the U.S. in the 1930's and comparing it to the general economic situation in Niger, but on the other hand, one does have to make some projections. When we do make these given all the bad mistakes that have been made in the past, most of the time, including, given all the rusting hardware I mentioned, in Africa - I

don't know if there's any in Asia or Latin America. I think we've got to have something more than just saying, "let's live dangerously." Asking ourselves, "what can we learn from the past, what, after reasonable analysis, is the best way to go from here.

Mr. Asin. The situation described by you in terms of the U.S. is very interesting. Could we find a similar situation among the less developed countries in which we would see more or less that kind of a pattern?

Mr. . It's hard to say. I think that one of, ... of course, we do have some problems with the PPC evaluation in some of the rural electrification projects, but look at the Philippine effort. I don't think that there was a lot of hard data collection prior to the Philippine program. I think when AID got involved in that it was more or less, "it's a good thing, let's do it."

So it's difficult to really analyze what happened in the Philippines. The Philippine Government in this case thinks that what they've done is a great thing, and they're not too concerned about the figures or statistics or anything. All they know is that it's a program that's going like mad and everybody seems to want it. It sells on faith type of thing. It doesn't mean it shouldn't be analyzed, it doesn't mean a lot couldn't be learned.

Mr. Ladd. It's being backed by the international agencies and even the low return segments of it? I really mean the international development organizations. Are they picking up the low benefit segment of that program as well as the high cost, the

high benefit segment?

Mr. . The program is run by the National Electrification Administration of the Philippines. I think it's the body created to do rural electrification. It was started with AID funds and AID supported it through the years for quite some time until it really got going. The international banking agencies, i.e., the World Bank, the Asian Development Bank, looked at the thing and said, "it looks pretty good because the systems were becoming economically viable." And it looked like a good banking opportunity for the development banks. They are beginning to put a lot of money into it, picking up on the AID program and carrying it forward, which in a sense is the model, I think, that we kind of like to see.

Mr. Asin. And what we would have here is one central system, one central grid. We would not have isolated systems.

Mr. . Oh, yes. A lot of isolated systems because of the Philippine Islands. Also a central grid. In other words, it's both - isolated as well as central grid. Isolated is diesel.

Mr. Duisberg. How decentralized is the actual management operation - are they very autonomous or do they still have a lot of technical assistance from the central electric authority?

Mr. . They're cooperatives. Theoretically, essentially, independent bodies. The fact is that puts a strong financial tie between the National Electrification Administration and the cooperatives, and therefore a strong oversight. Therefore, they aren't as decentralized as they say they are or like to think they are, but they're more decentralized than most systems. Sort

of halfway. But, hazarding again a transfer, we're not talking about a transfer again obviously in block, but in sense. In our own country, the system worked pretty much the same. It does still work with cooperatives in the same way.

Those cooperatives that borrow from the Rural Electrification Administration are looked at very closely by the R.E.A. still today. So it's not an unusual kind of relationship - they're looking out after their own interest.

It's a disruptive kind of thing, in a sense. Now, in the Philippines, this is a matter of interest. They started a productive uses program, but it failed, in essence, if you look at it, because it wasn't conceived well, it wasn't thought through, there was no financial support. It was just sort of a half-effort on somebody's part to do something because they thought something like that ought to be done. And it didn't work. That is, they started a lot of industries that failed, there was no market study, etc. That was in the early days before people recognized there was more to it than power use in a developing country.

Mr. Self. Yes, I think you have to develop a whole market and everything. One of the cases we looked at - we picked a site and looked for productive uses. We had to travel five hours by donkey to get to the place. If they do produce something, how does it reach the market?

Mr. _____. We acknowledge productive uses, but I must say when you get down to the nitty-gritty and ask what do you mean and how are you going to carry it out, it's a difficult thing to do.

Mr. Asin. Jim, is that what you were talking about when you talked about cross-subsidies - the fact that here you have a centralized organization and yet there are decentralized areas?

Mr. Ladd. I think we're getting there again, Jorge, that's what I was getting at too. It's too bad Jim Fish isn't still here. I think, despite what he said, if a national program is enacted, and it's gained a lot of enthusiasm throughout its society, I cite the Brazilian low-cost housing program as one, I would come back to the Philippines program again.

I think, in effect, what's going on is cross-subsidization, de facto, and contrary to what Jim was saying, at least in my experience at the bank (granted, as a financial consultant outside the bank) working very closely with the Brazil low-cost housing program, those who were making the justifications and the arguments were the economists at the bank and not the financial analysts at the bank. The argument had been made and accepted by the bank and it was no longer an issue, and I think if you get the expertise, the momentum, of a program, such as the Peruvian program, you build in the kind of talent that is required to make these arguments effectively. If you have a large program, the banks are just going to come along and buy them and the issue will disappear about financing. Subsidizing is a dirty word, cross-subsidy is a nice word. That's been my observation.

Mr. Asin. One of the topics of the agenda we had for the afternoon was, of course, institutions, how to really go about developing decentralized systems. And we're coming back precisely

to the institution. Ideally, I think that the central electric organization is the one that can promote all this. But, what happens when you really go outside to relatively small decentralized systems? Can the central organization still provide all the support?

The marginal cost of that will be higher than the average cost of the original plant and that is a cross-subsidy, of course.

Is that something that is acceptable, for instance, in Peru? I think that Electro-Peru would be a typical case. Electro-Peru is managing this operation.

But eventually you go into these marginal costs which are higher than the average costs of the ...

Mr. Duisberg. I think that's why they looked for the concessional kind of loan that AID could provide because the near commercial rates from the World Bank and IDB (near 9%) wouldn't begin to pay for that kind of investment, whereas the program that AID's offering is much softer and I think it's also, coming back to the economic, productive uses of that electricity, the extensive training and curriculum development for extension workers in agriculture or small cottage industries, going out and establishing uses that begin to make it possible for the users of electric systems to become more self-sustaining or more likely to be able to pay the higher marginal cost of the installations.

Mr. Self. I think also, if you look at the whole institutional situation, compared to similar type programs AID is doing,

throughout North Africa, potable water systems, the institution we've built up or are essentially building up there, is basically for maintenance for whatever type of energy systems you need there.

And there it includes training of a local individual who would actually draw some salary for some low-level maintenance. But then a crew of government workers whose jobs every so often are to stop by and look and also be on call for any kind of major things. And what we're concerned with is not that the rate charged for the water necessarily pay for the entire system, although that would be nice. But what we're really concerned with is that the rate must at least cover the cost of that employee in the village, the maintenance guy, and also the total system pickup the cost of this two, three, four-man crew whose job is to stay on the road. Also to pickup the occurring costs, as far as parts over the long run. That's the kind of thing we also need to look at for any type of decentralized power system. You've got to have some local maintenance and you've got to have some supply for spare parts and also a centralized maintenance. Those costs have got to be picked up, at least picked up by the system itself, or you end up adding another recurrent cost onto your central government or local government somewhere, which always, if things start fading down, the system ends up falling apart.

This is the least required for any kind of a system over a whole rural electrification system like in Peru. What we would eventually like to happen in Morrocco, the bank has some upfront money to identify some 100 potential hydro sites which the Morroccan

government has cut down now to around 30, which are really good looking. In fact, our demonstrations were based on trying to pick out three that were fairly similar to the other 30 so we could have some packages where these 10 look like these 10 and so on.

Mr. Duisberg. There seems to need to be, talking about dealing with large central power authorities, a commitment or a political will on the national level to decentralize what is otherwise an extremely centralized power authority. Their willingness to allow the autonomy in the operation of these more remote and decentralized power stations. The question is once you start to decentralize, to what extent is there still this sort of assistance and support. How much are they involved in the tariff rate structures and the day-to-day operation, especially if you're concerned with financing from a private source or any source that requires a certain kind of return. To what extent can you relinquish that control, day-to-day operational control, of these systems. You really don't have any way of gauging the required return, whatever it will be, will come out of it.

Mr. Asin. If there's acceptance on the part of the central authority to have these systems under their umbrella, but managed or operated in a decentralized way, then what is the percentage, really, of those decentralized systems vis-a-vis central systems. Because if those marginal costs jump up the average cost tremendously, obviously there's an impossible type of situation. I don't know what is going to be the effect of the Peruvian situation on what the costs will be for the central system, the percentage.

Mr. Duisberg. In the case of Peru, they had a rural electrification program in any case, and in many cases were sponsoring diesel units. But the idea is that anyplace they install a small hydro facility (some 1100 sites identified where there was not only the potential to produce the electricity, but also the market demand or community demand or whatever that would use it), that in each of these cases, the discounted costs over whatever period, making whatever assumptions you're going to make about fuel price and reliability of supply and so forth, would be competitive with the installation of diesel over that same period of time. And not being concessional about that, it was small hydro versus an equivalent size diesel unit and only those sites would it be constructed where it would be better than diesel. The diesel already is taking some sort of cross-subsidy from the larger electrification program. Again, this would be more advantageous than taking that route.

Mr. Ballard. I wonder if I might ask a rather heretical question. Your focus in the last half hour has been on the relationship between central country authorities opposed to decentralization. I think what I was hearing earlier is that there is another way to look at this. Even though one is talking about decentralized facilities, there might be a need for an international view of commonalities between those decentralized facilities. Is there a mechanism? Is there anything that would make the studies happening in Peru and the studies that are happening in Morocco focus, perhaps at this stage as opposed to a later stage,

on what is in common between those two areas. This is what I thought I was hearing about these macro-feasibility studies. If this were a group that was sitting here laying a plan for such a macro-feasibility study, what would go into that, how would we do it?

Mr. Asin. Jim, I think in talking about the macro approach to that really did not refer to it necessarily on the very international level, but looking at a region and seeing what the potential sites are. I think that Peru is a very typical example of that, because it's been a matter of looking at just about all the potential sites in Peru, in a general way, I assume, and then focusing on the ones that have the most number of favorable factors for the development of all this. And I imagine it's an attempt to manage them also in a central way in terms of long-term support.

Mr. Duisberg. That's certainly true. There's a large number of prospective sites and those will be chosen from a whole methodology that will be set up - everything from the economics to the social impact to even maybe certain political considerations of development of a certain region.

Mr. Ballard. Is there room for doing it on a broader scale given that the World Bank is talking about making, if you'll excuse the expression, a real dent on the energy challenge through small scale hydro, given that some of the large banking institutions are thinking about ways to make loans of some size. You had an international group of companies or consortia in a position to standardize some of the technologies and some of the approaches and

found five or six or ten needs rather than 100 different kinds of projects. Is there anything that would lend itself to developing a broader approach rather than a narrower one?

Mr. _____. You're talking about the technology or the institutional aspects of small hydro projects?

Mr. Ballard. I'm not sure, I think both.

Mr. . We are, because of the PPC studies, and others, beginning to try and make an effort to determine what preconditions are necessary for a successful rural electrification program. It seems to me that small hydro is rural electrification. The product of small hydro is electricity. If you're talking about less than a megawatt of power, it doesn't make much difference. Most of the isolated installations in Bangladesh and the Philippines - they're talking about 500 KW to start with, even smaller, 100 - 200. Because the load factor is so small to begin with, you can't have large installations.

So we're really talking about the same thing, whether or not it happens to be a small 100 KW diesel or a hydro plant. You have to look at the whole picture and see what are the preconditions, if there are any, or standardize preconditions (internationally, I'm not sure) that one should examine before getting into a project. Throughout the Philippines, there are a lot of things that exist in the Philippines that don't exist someplace else. Are those things critical or aren't they critical. Eventually, we hope to come out of these with some indication that it might "make sense" to go into rural electrification or small hydro rural

electrification. And that's where on the institutional side of things, we're dealing with the same sort of things also. You put in a 500 KW diesel unit, 500 KW or 300 KW small hydro, you've got the same output, you've got the same task of making the whole system work from a management and institutional point of view. Those are the basic issues. Making it work is the point. Making is economically viable from a management point of view, viable. We've stressed a tremendous - in everything we've done, at least since I've gotten into the organization. I'm not talking just about me, but my experience - but management inputs into these decentralized institutions has been very, very heavy. So that it will be managed and can work. Personally, I don't care whether they're cooperatives or whatever, they're localized and they have a job to do. The management inputs are extremely important. Otherwise it won't work.

Mr. Ladd. In this area, it seems to me there are at least two questions on the table that are being addressed here. Isn't it really the role of people like your program to cross-fertilize, to get this information out, these kinds of cases, these kinds of descriptions. AID, isn't it your role to get these things out so that the people who should know everywhere have a chance to know, what the cases are, what the models are, what the information is?

Mr. Self. I believe that's one of the major components of this contract.

Mr. Wegner. Do we act on data when data is developed or do we act in the belief that a certain thing is useful and then work to develop the data to support that? I went through the early

discipline in AID trying to work from behind the data and found that it's a disappointing way to live one's life. I believe in the lost art of advocacy, particularly in foreign assistance. Remember that the heydays of the Alliance for Progress and that sort of thing, which, by the way, was built on a terribly false premise about the nature of the potential for the industrialization and commercialization of Latin America. But that was less important than the fact that, like the space program, there were so many spinoffs, that it left a changed situation and it raised people momentarily. Unfortunately, only momentarily, to the point where they were willing to rely on the mechanism that is built into them as human beings and that is the judgemental factor, the intuition, the ability to say, "Yes, that's good, by god, we're going to do that, now let's go out and figure out whether we can actually make it happen."

It saddens me and I think it probably started in Congress - these little knife thrusts that came toward the foreign aid program one year after another.

That created a defensive mechanism that said: "Our defense is data, we're going to build great structures, great mountains of data, and we're going to hid behind it. We will be invulnerable because we will have so much data that nobody will ever be able to understand it or question it." As we know, that really doesn't work. It just weights everybody down. I think if things are going to happen - this is from personal conviction and this will be my last speech, I promise - it is the idea of power, of energy, and

particularly of electrification (and I happen to favor small hydro because of its simplicity and I've seen it managed by relatively unsophisticated people in a number of small communities where they were essentially illiterate populations and yet were trained to run these things. I've seen what I believe is a cause-and-effect relationship between the availability of electric power in a community and what happens in that community. The studies are very difficult to create after the fact. A number of years ago, SRI came in and did a study about directed agricultural production credit programs and credit unions in Ecuador. It was a very, very thick study, very expensive. But the difficulty was, while there was almost a 100% correlation between the existence of these projects and a dramatic improvement in the mental attitude, the expectations and the aspirations as recorded of these people, there was no way to tell if people had had these virtues and sought out the project or vice-versa. So unless you start with an evaluation mechanism early on in a project, you have to make judgements about which came first and we will have mastered our planning, we will have mastered our technology. Furthermore, we will re-enter, I believe, as useful citizens in the world, and we can stand up within AID, within the banks, and those of us within the public sector, and say with conviction, "Yet, this is what we think we ought to do. Now let's go to the machines and see if the machines verify our basic intuition." And in most cases they will. I think that's the order in which things have to happen.

It's first with the conviction. Your story about the early days of electric coops, I think it's beautiful, because that was man working as man was designed to work. Sure, mistakes were made, of course, but don't ever kid yourself, that mistakes aren't made by careful planning. The first DC 4's that came up, this marvelous four-engine airliner, neglected to analyze turbulence caused by propellers in the air stream that wrapped around the fuselage. To make a long story short, in certain configurations, when the plane was in a steep climb, and the gasoline was coming out of the overflow vents as was designed to do, the airstream picked it up and whipped it around the fuselage and took it into the air heater intake at the root of the tail and blew off the tail. So, this was an extraordinarily well-planned airplane and had all the engineering a human brought to the subject in the course of the time. So, good planning will not defend us. The only thing we have in the last analysis is sound judgement and intuition based on experience. I think we must use that.

Mr. Ladd. Whether we agree with you or not, Herb, I think in the era of McNamara we saw a swing in the pendulum in the opposite direction. We must analyze, we must quantify, everything. Now, McNamara's gone, but he's left a lot of baggage behind, and I sense that organizations which are somewhat less powerful than the World Bank have picked up the terminology, the methodology, if you will, and are almost holier-than-thou in their application of it. I was looking through the IDB manual Jorge left with me last week, and it's tough to slug through all that stuff. What strikes me

also is that there are departments in places like the World Bank that lend minimum service to that kind of mandate of highly sophisticated analytical techniques. So I don't know where we come out on this issue.

Mr. Wegner. I think what we need is somehow inspiration under planners and then turn around and do their planning, but in that order.

Mr. Ladd. It seems to me there's a political element here that we haven't touched on at this point. Politics of the New Deal is the politics of Peru - why is Peru important to AID or vice-versa. In 1979, 1980, 1981. If you get some enthusiasm in a country in a program I really sense that it will carry by its own momentum through the international lending organizations. Perhaps not through the private banks but then the private banks are probably viewed as a lender of last resort in the sense that they don't, they're least desirable because their terms are tighter, their terms are more expensive, certainly than AID and the development banks.

Mr. Wegner. What is the potential for the...I'm very interested in Jim Fish's comments on the clearinghouse function. We're nearing the end of the trail here and I'm just curious as to... if a group like this breaks up without forming a committee, it's considered we haven't done our job. But, seriously, another level occurred to me and that is in the aggregation of a common data pool on energy needs, perhaps beyond hydro, certainly including that. Is there any potential for that sort of thing? Should

there be a group that meets every six months to exchange information and becomes mutually reinforcing and points to the existence of data and studies that can provide the underpinnings for great intuition?

Mr. . I think there's something of that type urgently needed, actually. I think Jim Fish mentioned that three or four guys might show up at the same site. I think that's going to happen more and more. One organization doesn't really know what another organization is doing and there's the tendency to want to hide what they're up to, so they can get the first crack at something. I think it's important to overcome this somehow. I think it would require quite an effort - more than a once-every-six-months type of thing. Maybe that's what we're supposed to be doing.

Mr. Self. Until the international agencies are willing to cooperate in this. The bank plays it very close to the vest. Usually, you get things from them through friendships with certain individuals who will pass things under the table. In fact, I got a phone call from a bank official that said you're going to be invited to a meeting. The sole purpose of the meeting is to find out if I had leaked this out to you. Be sure to deny it. That's the kind of thing that happens. I have a friend that works at EEC and he tells me things that if they found out he told me, they'd have his job. It's competition. A lot of it is commercial, especially talking about the EEC. They're giving toys to be played with, hoping they will buy more, from Country X. They don't

want to share their information, they want to jump in there first.

The only way you can do it is by individual, personal relationships. If people trust you enough to tell you because they know you won't talk, to keep it quiet.

Mr. Heyman. Well, now that we've been as negative as possible on this issue, there might be some brighter way of looking at it. There's a possibility that while you can't organize such cooperative stuff on a project basis, on an international agency basis, there might be some possibility it would work more effectively on a technology basis. I noticed EECA, for example, has compiled a lovely bibliography of agencies working on biomass energy research projects. They are keeping this up-to-date, I think, on a computerized system.

There might be some application for somebody who wanted to take on the job of doing something similar in mini-hydro.

Mr. Ballard. That's what Dave and his group are doing then, I thought. In the formation of indices and manuals and collection of information that is generally available, at least it lends itself to expansion to do something like that.

Mr. Jackson. Yet, we're hoping to, as David mentioned, put together a design manual to address the civil works features of small hydro and we hope to integrate that with other agencies. Some people working in Colombia, some working in England, are developing other studies which we hope will eventually evolve into an overall manual.

Mr. Zoellner. I think it would be an onerous task just to attempt to compile the information from various newsletters that are generated. We get a lot of them and I don't have time to read them all. Unless someone has a fulltime job of just extracting renewable energy or mini-hydro or solar technology or whatever just from the information that's being put out by the U.N., by AID, by the World Bank and one and one - that's an onerous job. I think if you did that alone as well as touch base with...

Mr. Asin. There's a company, International Business Services, Inc. which has had very large contracts with DOE and they publish a daily monitor that is a collection of clippings from all publications you can think of doing precisely what David was talking about. There's one for wind, one for solar thermal technologies, one for geothermal, there's nothing being done for small hydro. I don't know whether the contract will continue. I suspect it may have been discontinued very recently. It has been in operation for about three years.

Mr. MacAlister. For my final word, I'd like to say something very briefly about this question of analysis, and I'd like to start back at the fillage level or at least at the urban poor, whom-ever it is we say we're out to work with. I think, first of all, we need to talk to the people who we say we want to work with and find out what they need. So often there's been many situations of people in the international development business who come in from the outside with a fixed idea of just what these people need

and then sell it to them. I think this is the wrong way to start. We need to start with the source, find out what it is they need, ask ourselves some basic questions as to whether it is viable. You can use analysis to the point where you never do anything, never take any chances and you never have any initiative. On the other hand, certainly I think all of us would agree that international development is not a science. At best, it's an art. It is most appropriate in order to proceed with that to learn what we can from the future by some of the sound principles of analysis which could give us reasonable expectations to take a chance.

Mr. Asin. I'd like to go back to something that we discussed. In terms of the requirements for financing projects, what we essentially have to define are the basic institutions that will support the entire process. There are two types of institutions - those decentralized institutions that would manage the marginal systems and those that would be decentralized systems that might be created by very different types of institutions in nature. I guess we have thought about various forms of cooperatives in which the requests for funds will be done by that type of organization. Is there any case in which we can say that has already taken place? That some rural organization has called itself together and gone before a funding institution, and has requested funding for a 49 KW system?

Mr. . There are a lot of cases scattered around the world where there are 1900 rural electric cooperatives & I would say that 600 of those have never been funded by anyone. They did their own thing, pulled it together, and started operating.

Mr. Asin. And who would fund that type of thing - a local bank?

Mr. . Just a group of people. I'm only talking about 100 or 150 member coops, but there are a lot who have nothing to do with the central power authority.

Mr. Duisberg. But some kind of subscription is sold to people who would eventually use that electricity.

Mr. . Yet, in fact, there's one cooperative in central Java that runs on small hydro systems, generates 200 KW, organized themselves, put in their own installations. The whole thing is self-contained. The central power authority in Jakarta is all mad.

Mr. Asin. What motivated them to do that? Was there an outside development agent that imparted the idea?

Mr. . There was a simple motivation. They wanted electricity and they weren't getting it from the central authority. They put it all together and made it work.

END OF DISCUSSION.