IMPROVED WATER-PUMPING/WATER-LIFTING IN AFRICA

PLANNING MEETING

August 29, 1985
1815 N. Lynn Street, Suite 200
Arlington, Virginia

Bureau for Africa
Agency for International Development

IMPROVED WATER-PUMPING/WATER-LIFTING IN AFRICA

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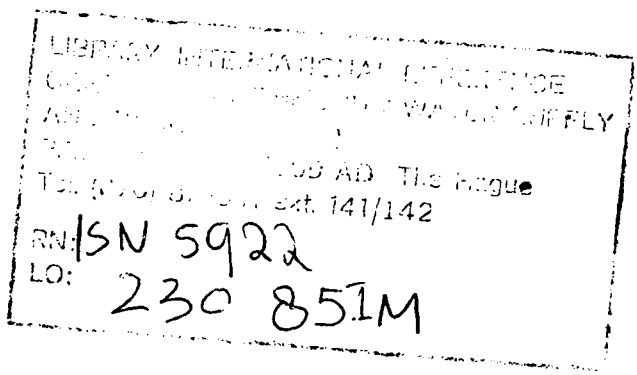
MEETING OVERVIEW



STATEMENT OF THE PROBLEM

Agricultural Development Officers (ADOs), engineers and technical specialists working on irrigation and water development in Africa have limited information available to them on energy-related issues and on the appropriateness, reliability and energy effectiveness of water-pumping/ water-lifting systems. These include the effects of energy availability and cost of pumping on agricultural productivity, comparative technical and economic performance of water-pumping/ water-lifting (WP/WL) systems, and the data needed to evaluate and select among the most energy-effective, reliable and economical options for specific irrigation and WP/WL environments.

One of the priorities of the Africa Bureau Energy Strategy is to identify energy constraints, recurrent costs and opportunities for using energy more effectively to increase agricultural productivity in USAID projects, including "energy-efficient irrigation and water-development alternatives".

To improve the economic viability of agricultural activities a second specific objective has emerged:

- to determine irrigation energy needs and how water pumping costs and power system availabilities affect irrigation potential.

BACKGROUND

There are several agricultural projects now underway in Africa which include an irrigation or water development component. What appears to be needed is a country oriented approach which will allow ADOs, engineering officers, and specialists working with pumping systems in the field to examine the various water-pumping/water-lifting options and constraints from an economic, social and technical point of view. Over the next year AID's Bureau for Africa Office of Technical Resources, Special Development Programs Division (AFR/TR/SDP), the Nairobi based Regional Economic Development Support Office for East and Southern Africa (REDSO/ESA), and the Science & Technology Bureau, Office of Energy (S&T/EY) will be developing materials for this purpose.

Under this activity, particular attention will be paid to needs, systems and reliability for locally managed, non-governmental (NGO) or private irrigation and water development as well as scheme rehabilitation.

In support of these objectives, the Bureau has initiated several activities. The first of these, an initial literature search and review entitled Water Pumping for Irrigation in Africa: An Analysis of Project Problems and Energy Options, was completed in September 1984 for AFR/TR/SDP.

This activity was followed by a REDSO/ESA cable to determine the interest of selected Africa field Missions in holding a regional workshop on how WP/WL systems can meet irrigation and water development needs. Field response from several missions has been positive, and planning is underway for a workshop in Africa now scheduled for 1987.

The following additional tasks have been completed:

- an assessment carried out for the Senegal Mission under the Bureau for Africa Office of Regional Affairs (AFR/RA) Energy Initiatives for Africa Project for the purpose of examining diesel versus electrical power options for specific projects in the Senegal River Basin;

- a preliminary analysis entitled Barriers to Expanding Irrigated Agriculture in Subsahara Africa Imposed by Pumping Costs prepared by Arthur D. Little for S&T/EY;

- a preliminary literature search, consolidation and review of available materials also carried out through the use of technical resources available through the Energy Initiatives for Africa Project;

- the initial identification of a pool of technical specialists with expertise in water-pumping/water-lifting systems (See Attachment 2);

- initial gathering of site specific information on WP/WL systems in Africa through REDSO/ESA; and

- initial identification of field Mission needs, and scope of WP/WL activities in their respective countries, also through REDSO/ESA.

Working with REDSO/ESA, AFR/TR/SDP and ST/EY subsequently identified several tasks to be completed in addition to those listed above. AFR/TR/SDP will serve as project coordinator, with technical coordination shared among AFR/TR/SDP, REDSO/ESA and S&T/EY. The FY 85 funding provided from the Bureau for Africa is $65,000, and S&T/EY has committed $50,000 in FY 85 to co-finance this activity. An additional $100,000 in Bureau for Africa funds is authorized for FY 86, if the preliminary work proves satisfactory. International Science and Technology, Inc. is serving as the contractor, with subcontracts to IDEA, Inc. and Intermediate Technology Power. Mr. Stan Berman of IDEA is serving as the overall coordinator for the activity.

Also in support of this activity, REDSO/ESA has committed $15,000 toward the preparation of rapid WP/WL country reviews in East & Southern Africa. The Water Management Synthesis II (WMS II) Project of the Bureau for Science & Technology, Office of Agriculture (S&T/AGR), is providing technical assistance,

travel and per diem for selected WMSII irrigation and WP/WL specialists, including individuals associated with the Utah State International Irrigation Center. The Office of Health in the Bureau for Science & Technology is also contributing technical assistance services through the Water and Sanitation for Health Project.

The Bureau for Africa Office of Regional Affairs (AFR/RA) is assisting in examining the relationship of energy consumption and availability to irrigation potential in Africa through the Energy Initiatives for Africa (EIA) Project.

This activity is being coordinated with the Bureau for Africa Irrigation Task Force as well as a group of specialists from the Canadian IDRC, the World Bank and other donors including French, Dutch and British specialists, and the Cooperation for Development in Africa Energy Committee.

SUMMARY OF THE MEETING

The proposed action plan for the additional tasks identified by AFR/TR/SDP, S&T/EY and REDSO/ESA was recently the subject of discussion at an Improved Water-Pumping/Water-Lifting Planning Meeting held in Washington on August 29, 1985. The Agenda for the Meeting is provided as Attachment 1.

The group included irrigation economists and project managers, WP/WL engineers, and representatives from the World Bank, energy consulting firms, AID, Water Management Synthesis II (Utah State), Colorado State, and the American Society of Agricultural Engineers and the American Society of Civil Engineers. Attendees are shown on the Contacts List provided as Attachment 2.

The purpose of the meeting was to obtain comments and suggestions on a USAID Draft Action Plan for addressing water pumping/water lifting problems and projects in Africa.

Review of Problems and Constraints

In advance of the meeting the participants were asked to read a background document entitled African Irrigation Overview prepared by Moris J., Thom D., et. al. (Jan 85) a document available through AFR/TR which summarizes many of the constraints to irrigation in Africa.

At the meeting, Derrick Thom presented an overview of water-pumping/water-lifting constraints. He and Jon Moris, both of Utah State have identified what they believe are seven major water-pumping/water-lifting issues in Africa. A summary of Thom's comments on these issues is provided as Attachment 3.

Establishment of Priorities

Participants were asked to assign priorities to a list of items identified in the draft action plan and/or to redefine priority tasks.

As part of this process the following major concerns were expressed:

- The work products/documents contemplated by the Action Plan should be of a practical character so that they can and will be used by individuals working in the field (agricultural development officers, engineers, NGO's, and water-pumping/water-lifting specialists).

- The Action Plan must address economic, social and institutional problems, as well as the technical in order to be effective. A few participants expressed their feelings that the Plan seemed more technically driven.

- Resources should be focused by undertaking a limited number of actions so that a few items can be done well. Some activities may have to be postponed. One item mentioned in this regard was a proposed analysis of comparative WP/WL cost information from existing literature which would be potentially too expensive for existing Action Plan funding.

- Two areas which are noteworthy in their constraint on WP/WL activity in Africa are agricultural policies, generally (including their impacts on markets), and the indigenous capability for operation, maintenance and repair of WP/WL equipment. Actions must be taken in these areas to move forward. There was a belief expressed that there was not much which could be done with agricultural policies in this forum, but efforts should be made to find answers to developing the capabilities for operation, maintenance and repair of equipment and the selection of systems.

- The general consensus was that the Bureau for Africa WP/WL activity should focus more on small and medium sized systems for irrigation and water development in support of locally managed irrigation schemes (e.g. local cooperative organization, private farmers, and non-government organizations) and rehabilitation of existing schemes.

The group's ranking of proposed activities in relative order of priority was roughly as follows:

1. Produce a short guide to water-pumping/water-lifting project management issues, potential constraints and problems to avoid, suggestions for more successful management and resources available to assist with problem solving.

2. Document successes and lessons from past experience.

3. Prepare guidelines for comparative evaluation of technical and economic performance of water-pumping/water-lifting systems.

4. Conduct rapid country reviews.

5. Develop an annotated bibliography on water-pumping/water-lifting systems.

6. Prepare a rationale for monitoring pump performance and O & M costs and for gathering comparative cost information on water-pumping/water-lifting systems in selected water-development and irrigation projects in Africa.

7. Prepare a rationale for fostering water-pumping/water-lifting comparative tests at an African agricultural equipment testing center.

8. Develop Terms of Reference for detailed water-pumping/water-lifting assessments.

9. Prepare papers on options for overcoming water-pumping/water-lifting constraints in Africa.

10. Produce guides to the selection of water-pumping/water-lifting technologies for specific applications and needs.

11. Perform an analysis of water-pumping/water-lifting operation and maintenance cost information from available literature and provide a synthesis of findings.

More detailed descriptions of purpose, responsible lead persons and implementation schedules for each of these priorities are provided as Attachment 4.

Identification of Successes, Lessons and Additional Resources

Participants were asked to identify, in writing, successes and lessons as well as additional institutions and individuals with experience or expertise related to the above task areas. Attachment 5 summarizes the responses provided at the meeting.

Summary of Remarks from Selected Participants

Attachment 6 provides a paraphrased summary of some of the remarks made at the meeting, which may be of interest to those of you who were unable to attend the planning meeting.

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AGENDA

WATER PUMPING/WATER LIFTING (WP/WL) PLANNING MEETING
August 29, 1985
1815 N. Lynn Street, Suite 200
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8:30 - 8:50	Introduction - Statement of Purpose & Background Fisher, Pryor, Schweitzer, Finnell (USAID)
8:50 - 9:30	Introduction of Participants Berman (IDEA, Inc.)
9:30 - 10:15	Irrigation Potential in Africa - Prospects & Constraints Thom (Utah State), Le Moigne (World Bank), Pruntel (World Bank) <u>Rapporteur</u>: Skogerboe (Utah State)
10:15 - 10:45	Discussion: What are the priority problems related to improved WP/WL in Africa? <u>Rapporteur</u>: Skogerboe (Utah State)
10:45 - 10:50	Break
10:50 - 11:00	Summary of Draft Action Plan Berman (IDEA, Inc.)
11:00 - 11:20	Discussion: Does the draft action plan respond to the highest priority problems? What's missing? How can it be improved? Additional analysis, planning, socioeconomic or technological issues not included on the agenda which should be addressed under Topic 3 in the afternoon.
11:20 - 12:00	Draft Action Plan Topic 1 - The Development of Guidelines for Comparative Analysis of WP/WL Systems (Methodology and Software) Quenemoen (Egypt Water Use & Management Project), McGowan (Associates in Rural Development), McNelis (IT Power) Westfield (Energy/Development International) <u>Rapporteur</u>: Carroll (University of California)

12:00 - 12:10	Proposed Approach to the Development of Guidelines for Comparative Analysis of WP/WL systems Berman (IDEA, Inc.)
12:10 - 12:30	Discussion: Is the proposed approach logical? Alternative suggestions? Is the timing and budget realistic? Who should be involved? Rapporteur: Carroll (University of California)
12:30 - 1:30	Lunch
1:30 - 1:40	Discussion of Topic 1 (Continued)
1:40 - 1:50	WP/WL Annotated Bibliography: Highlights Gallup (Energy/Development International)
1:50 - 2:05	Discussion: Suggested next steps. Additional sources?
2:05 - 2:15	Irrigation/Energy Project Inventory Finnell (USAID)
2:15 - 2:35	Draft Action Plan Topic 2 - WP/WL Systems Case Studies and Assessments - The Example of Senegal Westfield (Energy/Development International) Carroll (Energy & Resources Group, University of California) Rapporteur: Strudgeon
2:35 - 2:45	Proposed Approach to Case Studies & Assessments - Model Terms of Reference Pryor (USAID)
2:45 - 3:25	Discussion: Is the proposed approach logical? What kinds of assessments or case studies need to be done? Where? In what priority? What should be included in the Terms of Reference? Suggested Africa based engineering/consulting firms, institutions or individuals to work with? Other institutions to work with in Asia, Near East, Europe, U.S.? Success stories? Rapporteur: Strudgeon

3:25 - 3:30	Break
3:30 - 3:40	Draft Action Plan Topic 3 - Other Issues & Priority Needs, Analytical Work and State of the Art Papers Berman (IDEA, Inc.) Rapporteur: Quenemoen
3:40 - 3:50	Rural Electrification & Pumping Doug Barnes (World Bank Consultant)
3:50 - 4:00	Operation & Maintenance of WP/WL Systems Skogerboe (Utah State)
4:00 - 4:20	Comparative WP/WL Data Collection and Analysis as a Component of Selected Donor Funded Water Development & Irrigation Projects Testing, Certification and Standardization of WP/WL Systems Fisher (USAID)
4:20 - 5:15	Discussion: Prioritization of materials needed for individuals selecting and managing water-pumping/water lifting systems in Africa (e.g. non-governmental organizations, AID agricultural development officers and engineers, African WP/WL specialists). Rapporteur: Quenemoen
5:15 - 5:30	Future Agenda, Areas of Interest, Responsibilities Berman (IDEA, Inc.)

Attachment 2

WATER-PUMPING/WATER-LIFTING
Contacts List

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Attachment 3

Seven Issues Affecting Water-Pumping/Water-Lifting in Africa

Major issues affecting improved water-pumping water lifting have been outlined by Jon Moris and Derrick Thom, both of Utah State University. Below is a paraphrased summary of Thom's remarks on the seven issues as presented at the AID August 29, 1985 Water-Pumping/Water-Lifting Planning Meeting.

1. The danger of orphan equipment

AID has been a contributor to this problem in the past. For example, U.S. pumps have been selected for use in former French colonial territories. Where these have been introduced for the first time mechanics have a certain unfamiliarity with the pumps. The mechanics are themselves often poorly trained and the lack of standardization compounds the problem of both training and maintenance. If the original manufacturer or distributor is unable provide backup or goes out of business, as was the case for the Mali Action Ble (Dire) Project, where Indian pumps were imported, the ultimate result is orphaned equipment.

2. Pump breakdown

When pumps breakdown, irrigation ceases. In gravity flow systems the situation is more reliable. Usually breakdowns occurs at the height of a critical peak stress period when the water is most urgently needed.

Consequently, you find sustained operation and overuse of pumps, and the poor maintenance frequently results in breakdown. Compounding this problem is the absence of commercial outlets for rapid replacement, so when a pump goes out, the farmer is literally left high and dry.

3. Poor maintenance

This results in a high rate of pump failure. In Africa maintenance is often viewed as a luxury. When funds are scarce, when budgets have to be reduced, it seems the maintenance budget is often the first to be cut and so frequently a pump that should last fifteen years is written off in three years. Also when projects get behind quite often the training component ends up being sacrificed or eliminated.

4. Fuel storage and supply problems

The fuel supply problem can be likened to an aquifer, where everyone is pumping at a peak period. This results in rapid drawdown and shortages of fuel. Supplies are not met and pumps are unable to function at a time when then they are most needed. This can also apply to electrically driven pumps,

particularly when the electrical power is supplied by hydroelectic facilities whose power output falls in proportion to the drop in river flow during dry seasons.

The network for rapid fuel replenishment does not exist in most African countries. There may be some storage, but once the peak period comes, sudden drawdown occurs and rapid replacement of fuel does mot take place. Designers of projects have often not included a component for fuel storage. Usually fuel is delivered in 44 gallon drums. One of the problems with this is the potential for contamination. Dirt often gets in the fuel, obviously playing havoc with the efficiency and life of pumps. Also, given the price and local value of petroleum fuels, when fuel is lying around in 44 gallon drums, it is regarded by many of the local people, literally as a kind of a liquid asset. As a result there may be theft, or it may be drained off and sold on the local market. If this is suspected, it may be topped off with water. To resolve this problem, one must pay attention to both adequate fuel storage and protection. However, this can be a costly addition to overall pumping system costs.

5. Farmers' inability to pay pump operating and replacement costs

At the time that money is needed most, the farmer is flat broke, unable to pay for repairs, and often unable even to pay for fuel. Again the absence of credit is a problem. Even where credit is available, if the pump fails the farmer may refuse or be unable to repay the loan.

6. Fluctuating water levels

Along the rivers of Africa there can be a tremendous seasonal fluctuation in water levels. At the time that water is needed most, the water is quite often at its lowest, exceeding the lift capacity of pumps. Even worse, I recently observed a situation in Mauritania where the river was actually below where the pumps could get at the water. The intake was above the level of the water, resulting in loss of an entire cropping season.

7. General poor quality of backup services

Mechanics, parts and supplies are often scarce or unavailable.

Conclusion: All of these factors are interactive and compound the problems of pump irrigation in Africa. We begin to realize that avoidance of unnecessary pumping probably should be one of the first rules of a neophyte engineer. The French in fact have tended to shy away from small pump irrigation, and as a result have invested much more in capital intensive works. However, once the economic environment begins to improve, many

of the problems begin to disappear. We just have to look at Zimbabwe, for example, where the large scale estates have an infrastructure that can replace a pump in twelve hours. This capability is for the most part absent in the rest of sub-Saharan Africa.

Attachment 4

Priority Tasks

Improved Water-Pumping/Water-Lifting in Africa

1. Produce a Short Guide to Water-Pumping/Water-Lifting Project Management Issues, Potential Constraints and Problems to Avoid, Suggestions for More Successful Management and Resources Available to Assist with Problem Solving

Purpose: To provide agricultural development officers (ADO's) and engineers managing irrigation and water development projects with a quick and easy reference to problems, potential solutions and available resources.

Lead Responsibility: Berman

1.1 Produce outline and format and circulate for review by selected agricultural development officers and engineers by December 1.

1.2 Produce draft by May 1, 1986 and circulate for review by selected agricultural development officers and engineers.

1.3 Produce in final by December 1986 for an Water-Pumping/Water-Lifting Workshop in Africa in 1987.

2. Document Success Stories and Lessons from Past Experience ($25,000)

Purpose: To document in as non-subjective a manner as possible a selected number of successes in Africa and factors behind the successes. Successes should include non-AID activities, the private sector, non-government organizations (NGO's), etc. Also to document lessons from past experience which may be transferable to other projects in Africa.

Lead Responsibility: deLucia, Barnett, WMSII

2.1 Develop a full list of possible success stories and projects worthy of examination, partly based on the 20 or so suggestions made at the meeting.

2.2 Survey the literature, to see what documentation on successes or lessons already exists for Africa, Asia, etc.

2.3 Develop terms of reference for the preparation of 3-4 success stories (e.g. what kind of information do we need to make these case studies more than subjective reviews?) Circulate draft terms of reference by November 1, 1985.

2.4 Produce the case studies in draft using in-Africa specialist where feasible.

2.5 Circulate materials to a few selected irrigation/water development specialists working in the field to determine their utility.

2.6 Produce in final by December 1986 for an Water-Pumping/Water-Lifting Workshop in Africa in 1987.

3. Prepare Guidelines for Comparative Evaluation of Technical and Economic Performance of Water-Pumping/Water-Lifting Systems ($22,000)

Purpose: Given the perception that very limited comparative economic and performance data exist on WP/WL systems operating under field conditions in Africa, these guidelines would help WP/WL engineers and economists by providing a standard method for gathering and comparing data and experiences among researchers and development agencies, thereby improving knowledge of which systems are most economical and practical under various field conditions.

Lead Responsibility: McGowan, Kenna, Shaikh

3.1 Review existing methodologies developed by Intermediate Technology Power, Associates in Rural Development, The Egypt Water Use & Management Project, the World Bank handpump program and others.

3.2 Synthesize and produce rough draft for comment by December 15.

3.3 Send out for peer review by specialists, including individuals with backgrounds in comparative testing of irrigation/water development systems (engineering and economics) from U.K., France, Holland, U.S., Canada, FAO, IBRD, and professional engineering societies.

3.4 Use rough draft as the discussion draft document at a technical meeting to be held in London January 27-28, 1986. Also include as topics at the technical meeting presentations on software for evaluation, and field monitoring equipment. Participants to include reviewers identified above.

3.5 Present discussion document to IDRC LDC assessment teams during the week of January 27 to obtain assessment team comments and criticisms.

3.6 Initiate professional engineering society committee review.

3.7 Incorporate all comments in draft document to be presented at 1987 Water-Pumping/Water-Lifting Workshop in Africa.

4. Conduct Rapid Country Reviews ($5000 per review)

Purpose: To determine the degree to which WP/WL problems and issues are a constraint to irrigation and water development in specific countries and types of interventions underway, proposed or needed.

Lead Responsibility: Pryor

4.1 Survey a few selected countries in Africa under the following Terms of Reference:

- prepare a brief profile of the extent and type of irrigation and other pumping undertaken in the country, including pump quantities and type by manufacturer and estimates of projected markets.

- conduct an in-country search for the following information:

  - o assessments of the reliability and status of information on the potential for future pumped irrigation and water development, and estimates based on best available data;

  - o estimates of present and projected energy requirements for water-pumping/ water-lifting;

  - o assessments of in-country manufacturing and servicing capability and training requirements with the private sector and host-government training institutions.

- identify any ongoing, planned or completed field tests of power systems and summarize status, emphasizing available life-cycle cost information.

- meet with other donor groups and ministry staff to discuss status of projects.

- meet with USAID missions to discuss mission portfolio, CDSS, and other documents.

- identify and meet with local companies or institutions involved in the manufacture, sale, service, and testing or relevant power systems.

- prepare initial survey.

5. Develop an Annotated Bibliography on Water-Pumping/ Water-Lifting Systems

Purpose: To obtain through peer review a bibliographic list of key WP/WL documents for use by (1) WP/WL field specialists and (2) agricultural development officers and engineers and to select key documents for reprint or purchase and distribution to field missions, NGO's, host-country institutions, etc.

Lead Responsibility: Berman

5.1 Expand annotated bibliography using services of J. Gallup of Energy/Development International.

5.2 Submit draft bibliography for peer review by November 1, 1985 and ask for reviewers to indicate what they believe are the twenty most useful documents for distribution to field specialists as well as the ten most useful documents for project managers.

5.3 Compile replies by December 1. Put annotated bibliography in final form with ranking of most useful documents and distribute.

5.4 Print or purchase sets of key documents for distribution.

6. Prepare a Rationale for Monitoring Pump Performance and O & M Costs and for Gathering Comparative Cost Information on Water-Pumping/Water-Lifting Systems in Selected Water-Development and Irrigation Projects in Africa

Purpose: Again, given the scarcity of comparative data and evaluation on WP/WL systems in Africa, to make the case for building monitoring and cross-comparision of pumping in a few selected irrigation and water development projects in Africa and to outline the resources and budget required to do so.

Lead Responsibility: Fisher

(Internal AID paper)

7. Prepare a Rationale for Fostering Water-Pumping/ Water-Lifting Comparative Tests at a African Agricultural Equipment Testing Center

Purpose: The primary purpose is the same as for no. 6 except that strengthening such an institution might eventually result in a center which could carry out independent certification of WP/WL systems and function as a repository for WP/WL data and information, thereby providing an in-Africa institutional memory on WP/WL systems.

Lead Responsibility: Fisher

(Internal AID paper)

8. Develop Terms of Reference for Detailed Water-Pumping/ Water-Lifting Assessments

Purpose: To provide terms of reference for assessments of national, regional or project specific water pumping/water lifting problems and issues. These types of assessments would be expected to provide a detailed picture of trends, operation and maintenance problems, pricing and market constraints, training needs, import or manufacturing problems, current and future energy requirements, etc. and options for addressing identified problems. The TOR's could be used by host-countries and donors to initiate assessment activity. Assessments are envisioned to consist of teams with experience in irrigation and/or water development, agronomy, and sociology. Cost per assessment would be in the $50-75,000 range.

Lead Responsibility: Fisher

8.1 Prepare draft TOR by November 1.

8.2 Submit draft TOR for peer review and discuss at Agricultural Development Officers Workshop November 17 - 22 in Togo.

8.3 Produce revised draft by January 1.

8.4 Identify candidate countries for detailed assessment, based on rapid country reviews above.

8.5 Have final TOR prepared for distribution to agricultural development officers and engineers together with rationale for assessments in suggested candidate countries and a description of available technical assistance resources.

9. Prepare Papers on Options for Overcoming Water-Pumping/Water-Lifting Constraints in Africa

Purpose: To outline possible options for dealing with constraints identified under priority 1.

Lead Responsibility: Water Management Synthesis II and Others (To be determined).

9.1 Provide overview of environmental and Socio-economic constraints to irrigation & water-development and water-pumping systems in Africa (e.g. soils, variability in river flow and rainfall intensity, lack of information on ground water quality and potential, insufficient training in land leveling, canal maintenance, irrigation management, land tenure disputes, lack of markets and price incentives, etc.) Note: This task has been completed as a S&T/AGR Water Management Synthesis II Project document entitled African Irrigation Overview by Moris, et. al.

9.2 Options for Analysis of the Impact of Pricing and Tariffs on WP/WL System Economics.

9.3 Options for Improving Operation & Maintenance of Pumping Systems.

9.4 Options for Improving Local Servicing and Training.

9.5 Options for Fostering Local Manufacture, Distribution and Spare Parts Availability.

9.6 Options for Solving Fuel Availability, Storage and Contamination Problems.

9.7 Options for Promoting Equipment Certification and Standardization.

9.8 Options for Assessing Potential Role of Rural Electrification in Meeting National Water-Pumping Requirements.

9.9 Options for Complementary Irrigation.

10. Produce Guides to the Selection of Water-Pumping/ Water-Lifting Technologies for Specific Applications and Needs ($30,000)

Purpose: To provide WP/WL specialists working under field conditions with guidebooks to the selection and application of specific systems (e.g. electric diesel, wind, photovoltaics, and animal, human and biogas driven systems).

Lead Responsibility: IT Power (Funding not identified)

10.1 Improve FAO/Intermediate Technology Power guide by producing short workbooks on each technology (e.g. diesels, electric, photovoltaics, wind, animal, human, biogas, etc.)

10.2 Publish before December 1986.

11. Perform an Analysis of Water-Pumping/Water-Lifting Operation and Maintenance Cost Information from Available Literature and Provide a Synthesis of Findings ($50,000 ±)

Purpose: To provide agricultural development officers and engineers and WP/WL specialists with a document that summarizes the current state of knowledge on life-cycle costs for WP/WL systems operating under field conditions in LDC's and specifically in Africa.

Lead Responsibility: Funding not identified.

11.1 Gather available documentation which provides actual field data on water-lifting/water-pumping costs over time.

11.2 Evaluate accuracy and assumptions made and attempt to integrate data from different researchers into tables which allow cross comparison of the data.

11.3 Produce tables which summarize the data from the literature and summarize how the tables were derived.

11.4 Publish before December 1986.

Attachment 5

Contacts for Success Stories and Lessons

Country	Project	Sponsor	Contact
Botswana	Village Water Supply Programme	SIDA	McGowan
Burkina Faso	CIEH and CILSS		Pruntel
Egypt		USAID	
India	Agricultural Research/Bombay		
Kenya		Peace Corps	
Kenya	Mwea		
Mali	Aqua Viva		
Mali	photovoltaics	USAID	Solar
Energy Lab., Bamako		diesels	
			Terry Hart I T Power
Mali	Helvetas		
Mali	UNDP handpumps	World Bank	Tschannerl
Niger	Niamey handpumps	World Bank	Tschannerl
Niger		World Bank	Pruntel
Nigeria	Northeast/Raza	World Bank	Le Moigne
Pakistan		Agr. Develop. Bank of Pakistan	
Philippines		International Rice Research Institute	Ed Chrise
Senegal	Caritas		
Senegal	De Lansa	World Bank	Pruntel
Somalia			Arte
Malin (WDA)			
			Louis
Berger			

Country	Project	Sponsor	Contact
Sudan	Renewable Energy Project		Don Peterson Matt Gamser
Zimbabwe	Agritex		Peter Morgan, Blair Research

Other Suggested Contacts

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Telex (842) - 270844

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Mr. Jean-Louis Imhoff
World Business Inc.
1819 H Street, N.W., Suite 600
Washington D.C. 20006
Tel: (202) 293-0612

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Division of Natural Resources & Energy
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United Nations
New York, NY 100017
Tel: (212) 754-5554

BCI Geonetics
Laconia, NH
Mr. Bisson

Transcentury
Washington, DC.

Roscoe Moss Co.
Los Angeles.

FAO/Land & Water Division
T.H. Mather & Bob Thomas

IDRC/Barnett

International Agricultural Center
Wageningen
The Netherlands

International Institute for Land Reclamation
and Improvement (ILRI)
Wageningen
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Irrigation Association
Gene Koch
Silver Springs,
Maryland, Washington D.C.

Pierra/ILO

World Bank
OAD Documentation
Contact: Pruntel

Pump manufacturers

Water Systems Council
Chicago, Illinois

Hydraulic Institute
Cleveland Institute

Foreign Pump Manufacturers'
Association
(contact through McCray
National Water Well Assn.)

Water-Pumping/Water-Lifting Assessments

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Attachment 6

SUMMARY OF REMARKS FROM SELECTED PARTICIPANTS
Water-Pumping/Water-Lifting Planning Meeting
August 29, 1985

Guy Le Moigne, Senior Irrigation Advisor, The World Bank:

The African Irrigation Overview paper stresses institutional problems. I couldn't agree more. The Bank financing for irrigation in sub-Saharan Africa is only 4% of total irrigation lending in spite of the fact that sub-Saharan Africa is a priority. The Bank has even set up a special fund, so its not so much a matter of funding. Availability of soft loans is not the major constraint today, the major constraint is the general environment, the price paid to farmers. I can give one example in Ivory Coast. There when the government decided to introduce irrigated rice, the price the government actually set for rice was too high, but it was so good that the country was an exporter of rice in a year. After that not only did the government decrease the price of rice, the decrease was so severe that Ivory Coast is now importing 3/4ths of its rice. So that that one factor I think can play one of the biggest roles. In spite of all the inexperience of farmers, if they really can make money, the rest in my view has perhaps lesser weight.

I would also mention the Bank's involvement in large schemes. For example, on the Senegal River, the OMVS has obtained financing for two very large dams, the Manantale and Diama dams. The Bank was involved in the discussion at the time, but disagreed with the conclusion to build two dams at the same time, one of them a very large dam. What we thought at that time, was that instead of investing one billion dollars, one dam should be built and probably a smaller dam at roughly speaking, for sake of comparison, half the price. Then the other half of the funds could have been spent on irrigation development which would have made somewhat more sense. At the moment the two dams are going to be completed, enabling the irrigation of at least 200-250 thousand hectares in the Senegal River Valley. How many years will that take? I don't know, but will take a very long time, certainly more than 50 years in my view, and the amount of money that will be required is not available today.

The lack of coordination among donors, is strongly stressed in the African Irrigation Overview paper, I would mention it as one of our major issues.

In addition to Thom's example in Mauritania, we have another horror story which is in Kenya where we participated in the financing of the Bura project. This is an irrigation scheme in Kenya in an area that was not populated so it is also a settlement project. I won't mention the cost per hectare, but

what I will mention is that there is a pumping station that was supposed to be temporary. Whenever I go there, I feel more depressed than anything else, because there are four pumps, and when one of them works we are very happy. It's always management by crisis, there is total lack of basic management. One never knows how long a pump has operated, what service was done on it. Now countries are very reluctant sometimes, at least in that particular case, to employ foreign expertise and yet when the basic tools of management are missing this may be necessary for pumped irrigation. So I would agree with Mr. Thom's statement that if you can, avoid pumping on rivers. It is not always possible for economic reasons to do so. The Bura project was supposed to be gravity barrage and a then a canal, funds were not there so a decision was made to build a temporary pumping station. But in Bura, Kenya, isolated as it is, with total lack of management, the pumping station doesn't work and the results: There are 2,500 hectares irrigated and the yields are desperately low, because the water is not there. That's not the only reason, there are many other problems, but if that one is not solved there is no way to solve the others.

Another issue worth mentioning is related to our work with our colleagues in water supply. There has been in recent years great experience developed particularly in the Sahelian countries in using handpumps for rural water supply, at wells that are at quite some depth. Tenths of thousands of wells have been drilled and equipped with handpumps, in Niger, Burkina Faso, Senegal, Mali, etc. In spite of all the problems with handpumps and their maintenance, they have served a fantastic purpose. The objective from these handpumps as I understand it is to extract about one cubic meter per hour, roughly the amount needed to provide the water to a village for water supply. Now the well is very costly to drill at $10-20 thousand per well, particularly in comparison to $400-1000 per pump, and it appears from experience that in very rough terms, about 10-15% of time, that the well could have provided 10-15, even perhaps sometimes 20 cubic meters per hour, enough for very small scale irrigation.

An important question is, how much groundwater do we have? And on this we lack data. I know in the Bank, except in the field of my water supply colleagues, we have no groundwater specialists, and the dialogue with groundwater specialists is very difficult because they speak a different language. When we think of a river, the Senegal River, we can estimate the developed potential of the river. The figures are rough, but you can estimate the number of kilowatts, you can even say you have enough water to irrigate 200 thousand hectares, you come up with a figure. Try to come up with a figure for what is the groundwater potential for irrigation in a country. I don't know. And when you ask a hydrogeologist what is the groundwater potential, you have to provide guidelines, say take

a minimum of five cubic meters per hour for your well, given a maximum depth. But even if you can, I personally do not know what is the groundwater potential for micro-irrigation in most of sub-Saharan AFrica or even North Africa for that matter. Now in sub-Saharan Africa, this may represent a very interesting potential. So it seems to me to be important to improve the dialogue, and have an assessment of the groundwater resources in a number of countries in sub-Saharan Africa, because if present indications are that in a number of countries 10 percent of these wells could give you 10 cubic meters per hour, then micro-irrigation from those wells could make a very significant improvement to food security in some of those countries. So that is one area for action, where I think there is some potential.

But now if 10 cubic meters per hour can be delivered, what is to be done with it? It's not all that simple. All the other problems of irrigation remain. One the ideas now being considered, which is also mentioned in African Irrigation Overview paper is complementary irrigation. If you have say 10 cubic meters per hour you could irrigate quite a few hectares by guaranteeing during the rainy season that you could start irrigation and have water when it's needed, and this theoretically could allow you to introduce varieties, high yielding varieties, because you would have the water at the time that it is needed. And all the other complements. In rainfed crops, when you have only rainfed, the irrregularity and the uncertainty of the rainfall makes it very risky for a farmer to introduce the high yielding variety and the fertilizers that are required.

Now a lot of social issues have to be studied. What would be the livestock pattern, the role of women, all this in my view needs researching in pilot development.

I only want to query Ms. Finnell what she said energy in agriculture plays a small role in agriculture, well I'm not all that convinced. In Pakistan and India...it is not so obvious ...

Let's assume that there is some merit in using groundwater for micro-irrigation development, that we are able somehow to locate wells where we can extract 10 cubic meters per hour. The big unknown, and this is very much related to your seminar, is where does the energy come from. It is a lot of energy which may not be available. Animal traction perhaps, diesel. Very often there is no electricity around in those parts of sub-Saharan Africa. In the Bank, the impression I have derived from my colleagues, Mr. Dosik was I think supposed to be here today, but in the research we have conducted, photovoltaic power is by Bank economics not yet there for us to justify. Wind power, well I think we're looking at it, but we don't have

the answers. So all the other sources of energy, how to extract water for micro-irrigation, and have something that is reliable and which can be maintained, financed and replicated is another area of your interest today where we don't have the answer, except that the ones we tried for World Bank use are not yet deemed economic enough to be replicable.

Ulrich Kuffner, Senior Water Resources Engineer, North East African Projects Department, The World Bank:

I'm disappointed that there are no African engineers at the seminar, and there are a few in Washington. I'm always amazed at how the Sudanese are able to maintain pumping stations with equipment that dates back to the twenties and thirties. Old British pumps installed more than fifty years ago still running. Equipment that perhaps might be in the Smithsonian, if it were not in use today. Small pumps that if not available in the market, there is surely a brother in Saudi Arabia who will bring one back and keep the little system running. I think you have to give credit to the ingenuity of these farmers to circumvent the problems which exist and have been mentioned here.

There is a tremendous potential in these countries. It has been mentioned that we don't know about the aquifers, its true, but there are aquifers which could irrigate surely several thousand hectares and in parts especially of East Africa where local institutions exist without our help where people have developed small wells using the wrong equipment because the right equipment is not available, maintaining it where they are with the little resources they have.

What do we do, and how to address all the problems you mention? Institutions like the World Bank naturally have had as their main objective the provision of the necessary funding. That is being done, it is complemented by providing technical assistance. Technical assistance may be part of the problem: we have equipment from various sources and we don't get spare parts.

Another difficulty I see sometimes is that the harder the situation, the harder it is to find highly qualified and dedicated professionals to live there for a long time. You can find highly qualified professionals to visit for a few weeks or a month. In the better environments you can find more highly qualified people than in the poorest countries. I think you can almost establish a direct relationship between poverty, poor living conditions and the quality of professionals in the country and those which you can bring in. I don't see a solution for it, I'm just pointing out a problem which exists for the poorest people. If you go to drought prone areas in

East Africa or the Sahel, the same situation exists. We have tried to devise certain assistance for the drought prone areas in the Sudan, Somalia, Ethiopia. How could one overcome the problems presented by drought? We may help through provision of pumping equipment in areas we know with water sources, and the provision of pumping equipment is relatively high on the list of those drought assistance projects, but it's a long-term proposition.

Jan Pruntel, Rural Engineer, West African Projects Department, The World Bank:

I would like to read a few figures that might be of interest, primarily for the Sahelian region, Burkina Faso, Gambia, Niger, Mali, Mauritania, Senegal. The total land area of these countries is 400 million hectares. The soil suitable for agriculture is about 10 percent of that or 40 million hectares, and actual total rainfed area is about 10 million hectares. Now soils suitable for irrigation are estimated to be about 10 million hectares, and water availability from rivers is estimated to be 1.5 million hectares. So water may be very much a constraint. The total irrigated area today is only about 300,000 hectares. Of this about 100,000 full water control and 200,000 partial control. So in comparison to total rainfed area of 10 million hectares, you've only a added a couple hundred thousand hectares irrigated land. So in our division the main focus of our effort is on improving rainfed agriculture. This includes flood recession and the development of water harvesting techniques. This has been quite successful in Burkina Faso.

If we then talk about irrigation, and the problems and constraints, the major ones include:

- water quality (Senegal, Gambia, Mauritania certainly, as long as we don't have the dams on the Senegal River);

-salt problems in the dry season;

- water quantity, both seasonal & annual variation (makes it very difficult to plan agricultural campaigns);

- groundwater quantity (we don't know really what the recharge rates are) pumping yields of wells, and pumping heads.

Of the 1.5 million hectares potentially suitable for irrigation, it may well be that not more than 50 percent could economically be developed.

We've also talked about the size of scheme. It is true that the World Bank has concentrated on the large schemes. This does

not mean that we are not very much interested in the subject of very small schemes, and we have some practical experience there. In Senegal, for instance, we have different examples side by side: large or greater than 300 hectares (considered very small by India standards), medium or 50-300 hectares, and small or less than 50 hectares. In preparation of designs for these schemes, I see a decrease in difficulty from large to small. The same is true for operation and maintenance, as well as farmer participation.

Our experience has been that investment costs also tend to be much lower on the small schemes, as are recurrent costs. Let me give you the figures of a few of the projects we have financed and what the costs have been. In Burkina Faso where we have a project, small schemes of about 10-100 hectares cost about $7000 per hectare. In Niger, we have both river pumping and well pumping. Costs for river pumping are $15,000 per hectare, for well pumping $10,000 per hectare. In Mali, river $15,000 per hectare and Mopti on the order of $1000 per hectare. In Senegal, and in Mauritania also, a new project has developed with small scale irrigation and pumping of 20 hectares each at a cost of $4000 per hectare. And in Senegal we have two types, pumping schemes at $10,000 and small perimeters schemes of 20 - 30 hectares at an estimated cost of $2000 per hectare.

By supporting very small perimeters with rudimentary canal systems, a minimum of land leveling, and irregular plot shapes costs may be brought down to a fraction of what they have been in the past.

Kuffner:

May I add some figures from East Africa. One in the Sudan, a project completed last year - 300,000 acres - total cost $3,500 per hectare including all settlement, agricultural machinery, cotton ginneries, etc. I don't think that would be comparable. We have to see what is included - that is the problem. Are housing, settlement, access roads, installations included or not? Sometimes these figures can be misleading, in some it's not, in others it is. A recently completed scheme in Ethiopia of 10,000 hectares cost roughly $7000 per hectare, also including housing, agricultural machinery, etc.

Russell deLucia, deLucia Associates, Inc.:

Why has it taken us so long to absorb some of this into the project design process. I have notes from meetings in 1972, where the same problems were discussed. Should we be looking at a broader set of infrastructure problems? In India, anywhere in the subcontinent south of Nepal, an Indian machinist would make pump replacement parts and make money in the process.

The broader problem of the support infrastructure in light and medium industry doesn't just plague agricultural projects. If you look at the renewable projects, it's the same thing in terms of the technical skills to maintain development. Why is it that in the other places of the world, people keep these going, the technology transfer that guarantees maintenance, privately. We have to look at some of these broader infrastructural issues. One of the things we could get AID to do would be not to just focus on the picture of what's the right technology and whether or not in such and such a basin we know about the geohydrology, but also to examine whether some kind of broader set of infrastructure support or development projects are needed.

Pruntel:

In West Africa we have a very scattered affair, a few hectares here, a few plots there. There is no private enterprise or company interested in maintaining pumps under those conditions.

deLucia:

If there is a certain amount of return, and the price of water is right, there ought to be some kind of support service for maintaining that equipment. Maybe not. Maybe what we ought to be doing is training institutions or training people to provide those kinds of maintenance services. Maybe the market's not big enough. Is it, is it because the market's too scattered? Or is it that we haven't helped to develop that infrastructure. Even the markets in African cities apparently aren't large enough, and you think they would be. You walk in African cities you can't find a machine shop.

Strikes me, we ought to do some research in this area, to make sure we understand it better.

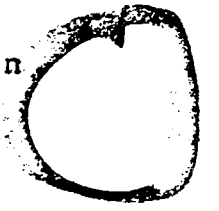
Kuffner:

The market in the Sudan is definitely much larger. You have about 4,000,000 acres of pumped irrigation. There is also some tradition of pump maintenance. Over the last 20 years there have been restrictions in the Sudan on the importation of replacements or spares, we have even tried to open lines of credit to small repair shops to import repair equipment, because that was in our view in certain places a bottleneck. Now more recently during the past couple of years the government has relaxed foreign exchange controls, and it is easier (not only illegally, but now legally) to bring in spares and small pumps from Saudi Arabia. So suddenly you see springing up more and more small repair shops, even in areas far from Khartoum, along the Nile where there is private irrigation development. The response of the people is there,

and we know from Bangledesh and Pakistan, people respond. Naturally one thing is the size of the market, there are millions of acres and probably thousands of small pumps, apart from the large pumping stations. If you have to drive a hundred miles to offer your services, you wouldn't do it. I wouldn't do it.

deLucia:

Maybe donors should overinvest in mechanical training in spares, etc. where the infrastructure does not exist.



Kuffner:

I don't think an overinvestment would be accepted by a majority of the donors.

deLucia:

Yes, but if they look at the real reliability and the failure rate maybe they would change the standards in terms of how much investment there ought to be for spare parts and maintenance.

George Strudgeon, pump consultant:

One of the points that I heard made is that standardization on equipment is desirable and certainly from a manufacturing point of view equipment manufacturers will go along with technology transfer, setting up repair operations, even going so far as to manufacture specific parts in some part of the world, so if you can get yourself into a standardization program you could begin to develop a program that would indicate that these are the class of pumps or style of pumps that you are going to be using. Then you can develop some type of importation or non-importation guidelines, or support manufacturing within a specific area, within a guideline that will allow you to get away from the import restrictions, etc.

Just as a side issue, the pictures showed what I thought were interesting things. The shallowness of the river (ankle deep), the color of the river, the catchment basins and the ingenuity of the women taking the soil and importing it next to the river were all interesting, and certainly the pictures showed the rivers are carrying a tremendous amount of silt and if you get into any kind of catchment basin, retainage area you're going to get a very fast siltation, and unusability as a storage area. To me this says that if people are bringing the soil from the river, to make themselves their own plots of ground alongside the river, then the catchment basin silt becomes the

source of the soil to be dredged out with a specific type of pump (or by hand) and can be used to develop your plots of land alongside of the river using the silting that's being carried automatically by the rivers.

Richard McGowan, Senior Engineer, Associates in Rural Development, Inc.:

It seems to me alot of the problems being mentioned might have to do the approach that AID at least seems to take towards some of their projects. For example, the Department of Water Affairs in Botswana receives substantial contributions from Swedish SIDA and those contributions have involved managerial and training support, as well as actual equipment support, and it's been a very successful project.

Matter of fact, when you do the economic comparisons among all these different alternatives the diesels show up really well, and one of the main reasons for that, is they have a very successful infrastructure for the maintenance and operation and installation of those diesel pumps. The differences between the two approaches, the AID project approach and the SIDA project's approach involve a couple of things. One, the SIDA approach is very long term. They're in there for 10 or 15 years and they put people in an existing project, rather than start a new project. They also provide the managerial and technical training expertise and they inject that knowledge and that skill into local individuals, the people who are already working with a particular technology.

One of the other big reasons is the standardization of equipment. They use just a couple of different pumps and a couple of different types of Lister diesels and everybody knows how to fix them. They have plenty of spare parts, and that seems to really contribute strongly to the success of the project, whereas the AID projects at least that I'm familiar with are very short-term, three or maybe five years if they get extensions. SIDA is in there for 10 or 15 years, they have time to absorb the idiosyncracies of that particular setup, and try to find ways to get around it, as opposed just setting up a totally separate agency, to deal with problems other people are already dealing with, and not availing themselves of the expertise that is already there.

James Westfield, Energy Initiatives for Africa, Energy/Development International:

One of the things that we found in looking at economic and financial analysis that are used to either justify or analyze project outcomes, is that there is a substantial amount of effort placed on least cost solutions, and that when you go to

pumping that the selection of the least cost solution may not be the reason that something succeeds or fails (take for example the point about infrastructure costs). So if you look at Senegal as an example, if you expand the boundaries to some national longer-term objective and if you include the benefit stream, to get some different measure of success than only least cost, you find out that you may arrive at reasonably expensive solutions, but ones that will in fact succeed, because the other solutions were short-term, or too least cost for that particular problem. Sometimes I think it is the attempt to find the least cost solution that drives the failure of some of these projects. So if you expand the boundaries of your analysis to larger than just that irrigation perimeter or even farmer, and if you include benefit streams you may to demonstrate that certain things were done because they were least cost, but that they shouldn't have been done if you include both benefit streams and the larger perspective (and in Senegal that's not too hard to do in hindsight, after the fact).

Another comment. It may be worthwhile financing very expensive demonstrations of initial applications to get something started, and I guess that can be to get either irrigation started in particular areas where isn't now going, or to begin to build the infrastructure necessary for other projects. And again, our emphasis has been on this economic and financial analysis and we're finding that by doing sensitivity analysis and looking at certain pieces of data, you even find that least-cost solutions are not in fact least cost solutions, because the assumptions that are made or the data are used vary so much that you have no reliability in them, or that errors have crept into the analysis.

Le Moigne:

I'd like to make one comment on the economics and financial aspects which I think partially answer your question. The environment in sub-Saharan Africa doesn't help at all. The European Economic Community and the United States dump at very low price or sell at very low price, the basic food commodities. The governments'want to have low prices for their cities, and the result is the price paid to farmers is not conducive for him to pay for the repairs, and so it is only self-subsistence, and unless this environment is corrected ... on the other hand it may not be all that easy from an economic point of view, the price of sugar has reached the lowest ever, the world price of cotton is going down, the price of rice is going down, and these are things that are being grown in Africa, so they also have to adapt to changes in crops, at least in the larger sense.

Now to go back to some more specific points, in Northeast Nigeria, there are Honda pumps, 4000 of them, they're selling them like donuts and you have good facilities, but Nigeria has had that opportunity for some years. What we're trying to push for in some of the larger schemes in Morocco, Mali and Senegal (in Morocco we have partially succeeded) is maintenance by the private sector. The Senegal irrigation authority, in charge of rather large schemes 10,000 hectares upwards, with a number of pumping stations, have contracts with private firms for the maintenance of the pumping stations. When you have a market, and where the government is involved, that helps alot. What we tried to achieve is not just pumping, but even in Mali we found a contractor who was offering to the Office De Niger a contract to maintain the gates. Privatization is not always easy in those countries, because the private sector may not be willing to come, but when it's willing, it can be part of the answer. But the overall economic environment is one of the problems.

deLucia:

You've made some very valid points about food grains policy, but I think that in Africa, unless things have changed dramatically, on cash crops there used to be a real issue about what was market price and what was was world price and whether or not the government was trying to capture all the rents. If the government wants to let the farmer get a fair return they'll respond, so it's an issue of both the broad question and whether or not the government's trying to do the rakeoff. I agree that alot of our governments'policies with respect to food grains are perhaps not the most rational from the point of view of economics.

Jack Vanderynn, Director, Directorate for Energy & Natural Resources, Agency for International Development:

Let me just say that I'm delighted by the large attendance here, and the tremendous amount of expertise that's being brought to bear on what we think is a very critical issue. We hope that we can continue to draw this light from you over the coming months and the coming years. Some of the presentations made this morning are very sobering and its very clear that this is a very difficult area, but at the same time its a challenging and important area, so I hope as we go down the road, that AID can learn from your experiences as well as from our own experience and do better. Thank you.

Other Key Remarks:

Tony Pryor, Energy Advisor, AID REDSO/ESA, Nairobi:

Many of the AID sponsored activities in water-pumping do not show up in AID documentation because they are part of an NGO project, not an energy or irrigation/water supply project.

Pruntel:

Also true in Bank projects.

Frank Carroll, University of California:

The scope of work for the Senegal pumping assessment started out very broad, but was subsequently narrowed by the Mission once the team was in country. They were interested in pumping as it pertained specifically to their own projects, not the country as a whole. When assessments are carried out in a period of two to three weeks in country, educated guesses about the performance and economics of systems are going to have to be made. Small variations in estimated performance can dramatically affect the overall estimate of system economics and thus the system selection process. This makes careful sensitivity analysis important, and points up the need to have individuals in country who have continuing experience with pumping systems and are familiar with their basic performance and economics.

McGowan:

In comparative testing programs certain types of issues (more often than not, non-technical issues) become of paramount concern. These include: 1) inputs/outputs of pumps in terms of both energy and costs; 2) quantities and heads against which you'll be pumping - accurate hydrologic information will often not be available; 3) reliability of the pump (unfortunately that's one of the most difficult issues, because you can only ascertain the costs of maintenance after a long period of time and it is difficult to identify the buried costs for infrastructure support); and 4) renewable energy site information (reliable historical wind data may particularly hard to come by).

Kevin McCray, Director of International Programs, National Water Well Association:

The pump is only as good as its well, and the cost of the well is much more than the pump, so don't overlook the importance of proper well drilling and construction.

Douglas Barnes, World Bank Consultant, Agriculture and Rural Development Department:

From personal experience in India, private farmers were able to maintain their pumps, mechanics were relatively easy to find as were spare parts.

In India, the observed constraints to pumped irrigation included: 1) credit, 2) market access; and 3) labor availability, since irrigation is very labor intensive.

The selection and development of pumping systems may be significantly influenced by energy pricing. In India, the government has heavily subsidized electricity to farmers, resulting in rapid expansion of electrified pumping. In Indonesia, diesel has been subsidized and the result has been very limited use of electric pumps.

In India, diesel pumping may also eventually expand in areas not served by the grid as farmers see the benefits of pumping. Also diesels may be kept as a backstop to electric pumps, since a week is enough time to bring the diesel in if the electric pump is inoperable.

Gaylord Skogerboe, Director, International Irrigation Center, Utah State University:

From experience in Asia, maintenance is a major problem, and the most important element is to develop some type of private sector capability for maintaining pumping systems. We consider that a major hurdle. We are finally making some progress in a few countries in placing greater emphasis on operation and maintenance and less emphasis on construction. But we've still got a long way to go with most countries in Asia. Deterioration of irrigation systems is a terrific problem throughout Asia. We continually go through a cycle of construction, deterioration, rehabilitation, deterioration, etc. It strikes me that the problems in Africa have to be even more severe than in Asia.

If I were to say what should be the highest priority activity in Africa, it would be first to find out what needs to done. I get the feeling that we're probably lacking the necessary information to really know what kinds of programs to implement in Africa. We need to better define the problems and develop appropriate solutions to those problems.

Training in operation and maintenance requires a two pronged approach, one through the private sector and the other through the public sector.
I would make the recommendation in the private category, that an organization like the National Water Well Association and

the trade industry be asked to look at how that might be done in Africa. For the public sector we should look to training first through international centers and then through national programs and focus particularly on developing extension specialists who would have some of this capability.

Thom:

It seems to me some of the issues that you've identified here, you're kind of reworking the wheel, so to speak. I think alot of this has been done, especially when we deal with things like constraints to irrigation, and if you want someone just to pull things together, all well and good, but I think there has been enough done on things like this. I think also in terms of the success stories that there's a lot of literature available and I'm not sure whether one ought to give this too much attention (now I might be contradicting myself because I've also indicated that if you're going to do that I'd like to be involved). I think maybe the true success stories in Africa can be counted on one hand, that they are rather few anf far between, so I think that might be an exercise in futility. But if you want to go in and look at different countries, do a country survey, then again I think that has been done. So I question the validity of being involved in that, which would also from my perspective eliminate the snapshot approach.

Pruntel:

I wasn't going to say anything, but this remark tempts me to say something as well. It makes me say that I have completely the opposite opinion. I think we know very little, certainly that I am aware of, but there are so many things, so many ideas have been tried, by so many NGO's, by so many private people whose work do not know nearly enough about, that if we could evaluate all the experiences and put it on paper, I think it could make all the other ideas that you have there superficial.

Westfield:

This may be somewhat of an apples and oranges problem. Many of the successes and failures don't have that much to do with the water-pumping/water-lifting technology. They have to do with the institutional arrangements, the crops, marketing, which gets us way beyond pumping technology issues. If you look at the broader spectrum of issues behind successes or failures, such examinations become more useful, but I'm not sure that's what you're asking for, I think you want to try to examine pumps and water-lifting rather than the overall project perspective.

deLucia:

Whatever you're going to do, don't try to do very many things. Just try to do a couple of them really well. Understand that you have very limited resources and a very complicated problem. Also, I think I agree with both Thom and Pruntel. We don't know alot, and it's not well-documented and where we have had the writeups, very often the prospective doesn't allow us to draw some of the inferences we need to have for project design. As a consequence, I think the documentation of successes is very important, but I think it's important only if we do that with some kind of a uniform outline where you try and look at all of the issues and attempt some kind of inference as to why it succeeded or failed, and that means not just the narrow technological focus, but very much the broader focus.

Barnes:

Yes. I would really agree with that and I think that to develop an overall framework for this whole set of issues is probably more important than alot of individual parts put together. And I think in order to do that you need to have some people - engineers, economists, agricultural economists talking with each other and developing the larger perspective. I know that that's difficult to do in reality, but it seems to me that it's needed. I think I would really agree that you need to understand the problems and issues within a larger comparative framework.