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OFFICE MEMORANDUM

TO: Members of the Operations Policy Sub-Committee (OPSC) DATE: May 27, 1982

FROM: Sidney E. Chernick, Assistant Director, CPD

SUBJECT: Bank Group Financing of
Tea, Coffee and Cocoa

The Operations Policy Sub-Committee will meet on Wednesday, June 9 at 9:00 a.m. in Room E-1208 to consider the attached memorandum on "Bank Group Financing of Tea, Coffee and Cocoa."

Attachment

cc: Ms. Pratt
Messrs. Humphrey
van der Tak
Mrs. Hughes
Messrs. Yudelman
Waide
Grilli
Scandizzo

OFFICE MEMORANDUM

TO: Mr. Ernest Stern
Through: Warren C. Baum
FROM: E. Bevan Waide, Director, CPD

DATE: May 17, 1982

SUBJECT: Bank Group Financing of Tea, Coffee and Cocoa

1. On July 15, 1981, the OVPs agreed that, in view of international agreements and of the very low price elasticities of supply and demand for these crops, "there should be no financing of projects that would lead to production in excess of established export limits, and more generally, that would lead to increases in world supply" of coffee and cocoa, but that "exceptions could be considered on a case-by-case basis for the very poorest countries and those with no other alternatives" (minutes of OVP meeting, para. 3).

2. Bank support for investment projects with products in price-inelastic world demand is already restricted. 1/ Extra output of tea, coffee or cocoa may well harm developing countries as a whole because:

- price-elasticities of demand are very low (-0.25 to -0.5);
- world import demand is projected to grow in the 1980s at 2.7% yearly (tea), 1.3% (coffee) and 2.0% (cocoa), all well below projected export capacity expansion;
- all exporters are developing countries, and most imports and consumption are by developed countries; and
- usually, to diversify land out of these tree-crops is slow and costly.

3. Tea lending guidelines 2/ already reflect these facts. Appropriate guidelines are needed for coffee and cocoa as well, supportive of the International Agreements between producer and consumer countries. To avoid discrimination and to simplify Bank project work, similar guidelines for the three crops are desirable.

4. Accordingly, since the OVPs' meeting in July 1981, EPD has done substantial work in preparing a proposed Bank lending policy for these crops. A draft was discussed by the PRC staff on December 11, 1981, and a revised paper was distributed in February, 1982, which elicited a wide range of comments. There has also been much attention paid to the issue

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1/ Development Policy for Countries Highly Dependent on Exports of Primary Products, R73-3 of January 4, 1973.

2/ Bank Group Financing of Tea, Board Paper, August 17, 1973; reaffirmed in Bank Financing of Tea: A Reappraisal, February, 1979.

by AGR and regional agricultural offices. After extensive consultation and exchange of views, there now is agreement between AGR and EPD that the ideal approach would be to apply a global cost-benefit analysis at an early stage of project identification.

5. A global benefit-cost framework would recognize the likelihood of an adverse impact of output increases on world export revenues, while taking into account the different conditions in producing countries, including the different income levels, and the Bank's objective of improving income distribution and providing special help to the poorest countries. A study, now under way, is to provide a set of country-specific benefit/cost factors to be applied on a project-by-project basis. These would be updated periodically as conditions within countries change. The country-specific factors would also be used as a base to value alternative pricing policies for the same commodities in the member countries.

6. A proposed methodology is being prepared by AGR in close consultation with EPD. The aim is to modify existing EROR (benefit/cost) analysis to allow for impact of beverage crop projects on the real income of producers and consumers in other developing countries. To implement it, agreement will be needed on (a) methodology, (b) data (more work may be needed on country-specific demand and supply elasticities), and (c) a Bank screening-panel procedure (applied as early as possible in the project cycle). Once the methodology has been worked out, its basis and implications will need careful review in the Operations Complex and by the OPSC.

7. An interim approach, to meet the objectives of para. 1 above in an ad hoc manner pending establishment of a global benefit/cost procedure, is attached as Annex A. The interim approach would be replaced by the global benefit/cost procedure as soon as the latter has been adequately prepared, and agreed upon by the OPSC.

8. Only two tea, coffee, or cocoa projects are likely to come to the Board before the second quarter FY1983, by which time it is hoped the para. 5 procedure would be operational; they are the Sri Lanka Rehabilitation and Diversification Project and the Rwanda BGM II. Both projects appear to meet the interim criteria.

9. In addition to projects coming to the Board, there are usually, in various stages of the project cycle, some 25 to 45 projects involving production of tea, coffee or cocoa. AGR would inform the relevant project officers of the proposed screening procedure (para. 5). Project officers would be expected to ensure, in a rough-and-ready way, that projects involving significant production of these commodities are so designed that the procedure would be unlikely to reject them.

10. Mrs. Hughes and Mr. Yudelman concur in the approach described in this memo and in Annex A. If you agree, I suggest this memo be discussed by the OPSC to be sure the approach is fully understood by the OVPs.

Attachment

cc: Messrs. van der Tak, Yudelman
Mrs. Hughes

ANNEX A: INTERIM LENDING GUIDELINES

1. This note sets out the interim procedure to be followed for all projects, including comprehensive rural development projects, which include significant production of tea, coffee or cocoa. Before negotiations a panel comprising representatives from AGR, EPDCE and the relevant Projects department will confirm that the project adheres to these lending guidelines. The interim guidelines, described below, come into force immediately, and will be replaced by final guidelines once OPSC has reviewed and accepted the proposed global cost-benefit procedure.

Tea

2. In this interim period, the existing Bank guidelines for tea shall be administered by the above panel. 1/

Coffee

3. The Bank Group should normally not lend for coffee projects, except:

i) for crop diversification out of coffee and for rehabilitation of plantings affected by sudden and recent damage by disease or weather, for quality improvements or for new plantings which replace output from other areas; and

ii) such projects should be undertaken only if they do not lead to increases in total production in the borrowing country in excess of projected increases in (a) domestic consumption plus (b) International Coffee Organization (ICO) quota exports plus (c) exports to non-ICO countries.

4. Almost all coffee-producing countries are members of the International Coffee Agreement and are therefore subject to export quotas. For small coffee-producing countries (i.e. producing less than 400,000 bags of 60 kg. annually), the rate of expansion of their export quota is specified in the Agreement. For other countries, export quotas are set annually by the International Coffee Organization, but their long-term expansion is determined by the growth in world import demand.

5. Application of the above guidelines would mean that domestic consumption and export growth must be forecast for each potential borrowing country, with exports including those to non-ICO countries as well as to ICO importing members. It also means forecasting the future growth of production in each potential borrowing country, to determine if future production is likely to be in harmony with expected total demand. Such forecasts are already provided by EPDCE.

1/ Bank Group Financing of Tea, Board Paper, August 17, 1973; reaffirmed in Bank Financing of Tea: A Reappraisal, February, 1979.

6. According to the most recent Bank analysis of the coffee market (reported in the Technical Annex to the draft Policy Paper) 1/, world production of coffee cannot grow on average faster than about 1.3% per annum for the next 10 years if the intervention "floor" price is to be maintained at its present level in real terms. For the time being, this should be the norm against which the expected production of each potential borrower is assessed, with appropriate allowances made for ICO export quota allocations, for export growth to non-ICO countries and for potential growth in domestic consumption.

Cocoa

7. There are no export quotas within the International Cocoa Agreement (ICA). The ICA seeks to stabilize prices by buffer stock purchases and sales. Unlike the Coffee Agreement, the ICA does not cover all significant producing and exporting countries.

8. The following guidelines are proposed:

i) As a general rule, the Bank will not undertake financing of projects involving production of cocoa;

ii) Projects for diversification out of cocoa production will be encouraged where economically feasible, particularly in countries with large shares of the market;

iii) Financing will be provided for rehabilitation involving no increases in output (this implies a reduction in acreage and encouragement of diversification). This may include the rehabilitation of plantings ravaged by weather or disease, or the substitution for them of new plantings in other areas. In such new plantings, emphasis should normally be on quality improvement and productivity increases.

9. Exceptions to this policy should not be considered except for projects in "low-income" 2/ countries. Such projects should not be approved unless their economic rate of return meets normal Bank criteria even after discounting the projected world price by 50 percent. 3/

1/ T. Akiyama and R. Duncan, Analysis of the World Coffee Market, EPDCE, November 1981, annexed to World Bank Group Financing of Tea, Coffee, and Cocoa, EPDCE, February 1982.

2/ Defined as those countries that would be eligible for IDA financing.

3/ This discount factor is a preliminary estimate of the average "marginal revenue" effect of increases in output on the world price.

M. Humphrey

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

M.B.
could you check to see if the minutes of this meeting have come out yet
with
6/8

TO: Members of the Operations Policy Sub-Committee (OPSC) DATE: May 26, 1982

FROM: Sidney E. Chernick, Assistant Director, CPD

SUBJECT: Sector Support Strategy Paper: Electric Power

The Operations Policy Sub-Committee will meet on Wednesday, June 2, 1982 at 9:30 a.m. in Room E-1208 to consider the attached Sector Support Strategy Paper: Electric Power, prepared by the Energy Department.

Attachment

cc: Ms. J. Pratt
Messrs. W. Humphrey
Y. Rovani (w/o attachment)
J. Fish (w/o attachment)

REVIEW DRAFT

SECTOR SUPPORT STRATEGY PAPER

ELECTRIC POWER

Energy Department
Power Advisory Unit

March 1982

ABBREVIATIONS AND ACRONYMS

CIGRE	- International Conference on Large High Voltage Electric Systems
ECLA	- Economic Commission for Latin America
EEI	- Edison Electric Institute
EPRI	- Electric Power Research Institute
IAEA	- International Atomic Energy Agency
ICOLD	- International Commission on Large Dams of the World
IEA	- International Energy Agency
IEC	- International Electrotechnical Committee
IEE	- Institution of Electrical Engineers
IEEE	- Institute of Electrical and Electronics Engineers
OLADE	- Organization of Latin American Energy
UNIDO	- United Nations Industrial Development Organization
UNIPEDE	- European Union of Producers and Distributors of Electric Energy
WEC	- World Energy Conference

Foreword

The CPS Functional Management Task Force Report of November 1976 directed each CPS sector department to prepare, coordinate with the Regions, and present for senior management review a Sector Support Strategy Paper which would assess the Bank's activities in the sector over the preceding three years, the changes desired, the strategies and plans for bringing them about, and the resulting priorities and relationships among the various CPS "Other Output" activities. This paper, covering the electric power sector, is in response to that directive. It is not intended as a review of Bank policy in the power sector even though the last such review was the 1971 Power Sector Working Paper. It will, however, allude to the need for such a review particularly in light of the changes that have taken place in the past decade. Furthermore, the paper is not intended to be critical of performance in the sector. Bank work in the power sector generally is highly professional and very efficient. The recommendations should serve to make good work even better.

The paper is not a budget document although budget-related conclusions are inescapable because among other characteristics power is the second largest sector in lending terms in the Bank but it ranks eighth in Bank staff and other resources devoted to it. The August 1980 policy paper, "Energy in the Developing Countries" proposed an increased lending program in energy, including electric power, but since long-range financing for this program has not been secured the implications that it will have for staffing and programming in electric power have not been taken into account.

In accordance with the task force directive, this review is intended for internal use. It assumes that the reader is familiar with the Bank's organization and the nature of the policies and issues in the sector. The paper is organized in three sections: (i) power sector issues in the LDCs and Bank lending in electric power and how it is programmed; (ii) lending objectives, issues and strategy for the Bank in the sector; and (iii) the resources available in the Bank to devote to these issues. It is hoped that this format will permit readers to focus quickly on their particular areas of interest. The discussions are descriptive as well as prescriptive, and a Summary of Recommendations is included. An Executive Summary is provided for managers and others who wish only an overview.

Energy Department

March 1982

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SECTOR SUPPORT STRATEGY PAPER

ELECTRIC POWER

EXECUTIVE SUMMARY

I. The Sector in Perspective

Electric Power and Development--New Challenges

1. Electric power is critically important to the economies of all modern societies. Industry in particular depends on a reliable supply of electric power, accounting for the major share of electricity consumption in LDCs--up to 75% in middle-income countries. The move of developing countries up the income scale demands ever-increasing amounts of electric power, and in an effort to meet these needs LDC generating capacity increased sixfold in 1960-80. Despite higher energy prices and a world economic recession, growth at relatively high rates is continuing although at a somewhat slower pace. LDC investment in electric power facilities will almost treble from some $60 billion in 1976-80 to $170 billion in 1981-85 in constant prices, and generating capacity will more than double in the decade to 1990. Indeed, this persistent growth is a distinguishing characteristic of the electric power sector. Yet, even with growth of this magnitude, unmet LDC power needs will still be tremendous. Only one-third of the people will have access to electric service (as few as 4% in some countries), and average electricity consumption per capita will remain one-twentieth of that in the industrialized countries.

2. The structural changes that accompany economic development inevitably imply a high elasticity of demand for commercial energy in developing countries. The inherent flexibility and convenience of electric power and its ability to harness indigenous energy sources such as hydro, geothermal and solid fuels further imply that electric power programs will occupy an increasingly important place in developing countries' investment plans. Along with this enhanced role, however, comes a growing complexity in the analysis of issues affecting the sector, particularly in the pre-investment phase when difficult choices having large financial implications are faced. Furthermore, following the price increases of the 70's, governments are hard-pressed to accommodate these investment demands and sometimes have pursued policies which deliberately or consequently result in power shortages, rationing and similar shortfalls. The economic cost of such policies is very high. Therefore, when faced with resource constraints it is of first importance to ensure that electricity prices are "right" and reflect the full economic cost of capital, and that opportunities for high-return marginal investments to improve system efficiency are not overlooked.

3. These issues call for a wide gamut of changes in the Bank's approach to power operations. Improved system planning through more use of engineering loans and technical assistance operations; earlier identification and resolution of pricing and economic issues in the context of a multi-sector dialogue leading to better programming of lending operations, and new approaches to financial viability to enhance co-financing prospects for programs as well as projects, are examples of these operational changes. To support this effort, power advisory services must stress development of more responsive analytical techniques to account for risk and uncertainty in system planning, and must seek new objectives for financial performance to deal with inter-sectoral dependencies and the fiscal and macro-economic impact of electric power investments.

Power Issues in LDCs

4. Higher oil prices and more expensive alternative energy sources have combined to reverse the long-term downward trend of real costs for electric power, and have rendered most power systems economically sub-optimal. This has introduced several new options into the power planning process; for example, loss reduction,load management and the re-optimization of systems can be incorporated in high-return projects, and the simple oil-fired generating plant is no longer a common least-cost solution. The outcome is that the search for alternatives must extend to hydro (both large and small), coal-based plant, geothermal, regional interconnection and similar technologies--all of which are inherently complex and risky. Efficient project implementation has become mandatory due to the high investment costs per unit of capacity and the high cost of borrowing.

5. Changes such as these have made it essential that electric power planning be integrated with a country's energy strategy because the power sector is one of the key sectors for achieving the necessary structural adjustments in energy economies. This is true for a number of reasons:

(a) The power sector accounts for a very substantial proportion of a country's aggregate energy investment program, hence investments in this sector have a major impact on the growth prospects of the economy.

(b) Mobilizing the necessary financial resources will be difficult and a wider variety of means will have to be used, including co-financing and efficiency pricing.

(c) Economic and consistent pricing strategies in power are necessary to ensure proper resouce allocation throughout the energy sector.

(d) Oil price increases have made electric power the most cost-effective "fuel" for many uses. Therefore, the potential for substitution of oil by electricity, if fully realized, could lead to substantial shifts in historical power growth patterns.

6. There are growing signs that power institutions in the LDCs need help in dealing with these issues. Despite a quantum increase in their capabilities and sophistication over the past two decades, these institutions are having trouble dealing with growth, the size of the financial resources that are required, and the increased complexity of project planning and implementation. These problems are acute not only in the smaller and poorer countries, but particularly in the middle-income countries with high growth rates and expanding portfolios of financing options.

The Changing Bank Role

7. The Bank[1/] has played a major role in electricity development in LDCs. It has been directly associated with about one-fifth of the power investment in the LDCs in the 1960-80 period and with one-half of the investment in hydro development. Power is the second largest sector (after agriculture) in lending terms in the Bank. In the past 30 years the Bank has lent $14 billion for this purpose, or 18% of all lending, to over 100 borrowers in 83 countries. In this process the Bank has dealt with some 700 entities, making it by far the largest international financing institution in the sector.

8. Over the past twenty-five years, however, the Bank's share of financing of the power investment in the LDCs has declined. This is illustrated by the fact that since 1956 Bank lending for electric power has remained remarkably constant, averaging about $1.5 billion per year in real terms (1981$) while LDC investment in the sector increased sixfold. The discrepancy is such that even the expanded lending program proposed in the Bank's 1980 policy paper "Energy in the Developing Countries", would be sufficient to meet less than 5% of the power investment in FY81-85, compared with actual lending which met about 10% of the investment in FY76-80, and up to 30% in the 1960s and early 1970s. The currently planned program--$8.1 billion in FY82-86--would meet only about 3.5% of LDC investment in the sector. Coupled with this there has been a decline in the average size of loan in real terms because of a substantial increase in the number of projects financed; 10-15 projects per year prior to 1976 as opposed to about 20 per year from that time onwards, including the planned FY82-86 program.

9. The country "mix" of borrowers has also changed significantly, shifting from a rather stable portfolio of old customers (Colombia, Thailand, India, Turkey) to one which is heavily sprinkled with countries at both ends of the income spectrum. Increasingly, the Bank is being called upon to deal with the new and unique problems that are being posed by the low income countries (Burma, Burundi, Upper Volta, the Yemens) while it assists the mature customers that are reappearing at the Bank's window (Portugal, Brazil, Nigeria, maybe Mexico, Argentina).

1/ All references to the Bank in this paper are understood to include IDA.

II. Issues in Bank Operations

Co-Financing

10. In parallel with the Bank, other sources of multilateral and official aid are projected to remain at about the same level as 1976-80. Similarly, the outlook is that the percentage of self-financing is likely to decline, or at best remain constant, because of the reluctance of governments to pass cost increases on to consumers. Increased use of export credits and larger borrowings from commercial sources are being counted on to fill the gap, but this would imply amounts of perhaps ten times such financing as in 1976-80. Aside from the magnitude of the shortfall, concerns over creditworthiness and exposure are likely to limit access to these sources. Thus, mobilizing project financing may be the largest single challenge faced by the Bank and its borrowers in the sector in the next decade.

11. More should be done to formally incorporate co-financing into the lending process, particularly since the Bank is not solely in the business of financing projects on an individual basis but rather is interested in building institutions that are "bankable" in the long term. In fact, this traditional function of the Bank's activities in power must be expanded to look beyond the narrow confines of the project financing plan to pave the way for program financing by reemphasizing creation of strong institutions which can attract financing independently of the Bank's involvement. In the shorter term and to meet immediate project needs, better mechanisms for identifying and coordinating project co-financing are needed to avoid costly delays in completing the financing plan. One current project has 23 prospective co-financiers, and plans involving six to eight are not unusual. Bank staff, both Projects and Programs, will have to pay more attention to this issue at the project preparation stage and more positive attitudes and policies will have to be developed. Processing procedures may have to be altered--for example, project descriptions in project briefs may need to be enlarged so that potential co-financiers can easily identify the components which are attractive to them. Procurement, in particular, will be affected by the increased emphasis on joint financing, and with the appropriate policy and procedural changes, it too can be made an avenue for attracting and allocating co-financing. Of course, all of this will add to the already complex burden on power staff.

Institution Building

12. Institution building is a major contribution of the Bank in the power sector, as it has helped support the rapid and deliberate expansion that characterizes power. Institution building covers many aspects: planning projects that fit a coordinated development program; instituting well-focused financial policies; encouraging continuity and independence in management as well as advising on other organizational aspects, technology transfer, training and procurement. More recently, two additional activities were incorporated--efficiency pricing and extending service to rural areas and urban fringes. The principal objective of institution building is to create both the environment and the capability necessary for power entities to manage

their own affairs. Although difficult to prove, perhaps the most important lesson that the Bank has learned in its long history of power lending is that the costs of inefficiency in the sector are high and the best means of ensuring efficiency is through responsible and reasonably autonomous institutions.

13. Over the past few years, however, the institution building function has become much more difficult to perform. The compounding effect of growth, increasing technical complexity, uncertainty of future costs and energy supplies, and strong social and political pressures, in part arising from continuing inflation, have combined to strain power entities' management resources and have invited more rigid government controls. The outcome has been an erosion of pricing policies in the face of inflation and a reluctance to fully pass real cost increases on to the consumer. An extract from a recent appraisal report is typical:

> "Tariff-setting stopped working well in the early 1970s. While (the tariff) law was not repealed, scant attention was paid to it. The Electricity Law provided only vague guidelines on what the utilities' return was intended to provide... High (staff) turnover, much higher inflation than had been the case in the 1960s, and political pressure to keep the rates of the recently-nationalized utilities low all combined to produce unsatisfactory operating results."

In addition, because of government intervention, continuity in management is still lacking in many countries, while salary problems, inefficient operations, and excessive distribution losses abound. Even the Bank's own actions sometimes abet these pressures through too-ready acceptance of short range palliatives to the detriment of long range goals. The result has been that real prices for electric power have declined in many developing countries over the past decade. Thus, not only are incorrect economic price signals being given to consumers and the resource mobilization benefits of Bank lending rapidly being eroded, but the growing resource demands of the sector quickly worsen poor performance. Experience has shown that the recovery process inevitably is long and difficult.

14. These issues demand that the Bank place new emphasis on rigorous and complete analysis of sector policy, finances and operations, and that it insist on the needed changes which are revealed by this analysis by reasserting conditionality in all its forms. This necessarily implies more involvement in the pre-investment and policy formulation stages of the project cycle. More aggressive and deliberate use of engineering loans and credits, technical assistance operations and other forms of pre-investment financing is required to bring utility policy, organization, and systems to the point where they can make efficient use of the larger increments of financing associated with Bank project lending.

Programming Power Lending

15. Persistent growth of electric power demand in developing countries creates a large reservoir of project opportunities. The Bank monitors these programs and therefore is able to bring power projects forward relatively quickly. The result is that it is convenient to use these projects as balancing mechanisms in country lending programs. Since Bank managers have been able to cope with the consequent uncertainties in the work program, this sort of scheduling has gone largely unquestioned, thereby continuing the historical "reactive" character of the Bank's involvement in the sector. This is not to suggest that programs should remain fixed over long periods of time, as this too could be damaging to the Bank's sector specific contribution. It does imply a need for change in the Bank's traditional approach to sector work since historical levels of sector effort are not adequate to deal with the increasing complexity of power development programs and the need for upstream effort to develop power sector lending strategies in active countries. This implies not only an enhanced, continuing role in program development, but also a major one-time effort to restore power sector work to a satisfactory level. A multi-country pre-investment program covering perhaps three years is needed, focussing on identification of resource alternatives (small hydro and other renewables, coal and lignite) and multi-sector investment strategy to assess investment requirements and set priorities for Bank power-sector financing using as main criteria the potential for sector specific contributions, commitment to policy and institutional reforms, and the leverage needed to bring these about. Considering the likely constraints on the Bank's administrative budget, it is necessary to explore the possibility of attracting additional resources for this work, perhaps as part of the energy assessments program now being carried out by EGY.[1/] Even without this incremental effort, these energy sector assessments have proven to be useful in providing a basis for better planning of the Bank's participation in the power sector.

16. The interest in sound sectoral planning that has been generated by the energy sector assessment reports, even prior to their general release, along with the increased emphasis on power and energy in the Bank, is to a certain extent already being reflected in more complete treatment of the sector, and proposed energy and power lending, in Country Program Papers. In conjunction with the preparation of this paper, the proposed 5-year lending program was reviewed to identify areas where more positive action could be taken. The result was the introduction of some modest changes to accelerate hydro development and distribution system improvements, but this is only an initial step. More will have to be done to use the Bank's lending program in the sector, including loans for technical assistance and engineering, to bring about the needed structural shifts in electric power and to use this program as an active tool of development.

1/ Energy Department.

System Planning

17. Power project justification rests primarily on studies designed to show that the project is a part of a least-cost development program for the system. These studies are usually prepared by consultants, often under terms of reference that have not been reviewed by the Bank. Frequently, the studies suffer because all the practicable alternatives have not been identified and considered, and more recently because demand management, improvement in the efficiency of existing facilities, and the impact of price increases on demand forecasts have not been considered as integral parts of the planning process. Changes in system planning methodology to take into account risk analysis, especially with respect to uncertainties in cost estimates and construction time, are needed now, and the Bank is in a unique position to help bring these about. This will require a deliberate effort to become more involved in the feasibility stage of project preparation.

Efficiency Pricing

18. The Bank's philosophy on electricity pricing can be summarized as follows: prices should be set to cover long run marginal costs (LRMC) and all of the demand that materializes at these prices should be met, thus ensuring efficient allocation of resources. This implies a rejection of subsidies but at the same time discards over-pricing as a rationing mechanism. The Bank also recognizes that some adjustment to strict marginal cost price structures may be appropriate. For example, social conditions may compel a government to introduce life-line rates. Although the use of LRMC for tariff setting is not widespread, Bank efforts have helped to promote this approach in recent years. The main problem to be overcome is the reluctance of governments to accept the higher price levels sometimes implied by the adoption of LRMC-based prices. This has led the Bank to accept, in the past, a modified system where the overall average price level is determined by the financial requirements (even though this may not be consistent with LRMC), while the structure of tariffs reflects LRMC. Financial viability has long been considered the principal objective in Bank power work and the financial presentation in project appraisals is confined almost exclusively to this analysis. Because of the significance of sector efficiency stressed in this paper, this approach must change--the order of priorities should be inverted with the emphasis first on efficiency pricing, and secondly on financial viability. The operational implications of this change should not be underestimated. Aside from presentational issues like treatment in appraisal reports and necessary revisions of OMSs and staff guidelines, the staffing structure of the regional power divisions may need to be shifted to reflect the corresponding increase in economic work, and financial analysts may need training (or re-training) to deal with the new order of priorities.

Economic Analysis of Power Projects

19. Revenues from incremental power sales are used to calculate economic rates of return for power projects. This calculation results in a relatively low rate of return, frequently less than 10% or so because tariffs are below

LRMC. While the resulting value is lower bound on the true economic return, a low value does not signal that the investment is unjustified but rather is because revenues are a poor surrogate for economic benefits. Studies of the value of a kWh foregone indicate high figures compared with the average LDC tariff of about 4¢/kWh, resulting in a high consumer surplus. In an attempt to capture some of this consumer surplus in the calculation, various combinations of future tariffs and expenditures on alternatives (kerosene, or autogeneration) are used as measures of willingness-to-pay. Even though this results in a closer approach to the "real" economic rate of return, the calculation is not particularly relevant to the investment decision and because of the various methods used, comparisons of returns among power projects, or with projects in other sectors, are not meaningful. Some degree of standardization is needed to improve the usefulness of this calculation. To be consistent with the emphasis on efficiency pricing, the rate of return calculation should be the return on the entire investment program (including the project), using expected tariffs (in real terms) as benefits, and economic costs for all inputs. This presumes that the project has been demonstrated to be a part of the least-cost investment program required to meet demand at economically efficient price levels, and requires an explicit judgement that the price levels do not exceed a reasonable willingness-to-pay. A supplemental calculation may be made using demonstrated willingness-to-pay for alternatives which will be supplanted by the proposed program. The basis of the calculations should be set out in the appraisal and president's reports to prevent misunderstandings concerning the implications of the rates of return.

Legal Undertakings

20. Bank loans in the sector typically are highly conditioned. Financial covenants establishing revenue targets and setting limits on borrowing are included in virtually every loan. Requirements for management and organization studies are common, and undertakings concerning pricing in energy (e.g., petroleum products) as well as power are now frequent. Conversely, aside from standard requirements covering consultants and "due diligence," specific covenants related to project implementation and operations are rare. This set of covenants appear to meet the needs of the sector and few changes are recommended. Substantial improvements are needed, however, in the procedures for formulating them. In particular, project briefs and issues papers should devote more attention to the scope and intent of anticipated legal undertakings to ensure that these are not overlooked or misinterpreted in the later stages of loan processing, and negotiating strategies should focus on the purpose of the covenants rather than on their form.

21. Compliance with covenants requiring specific action, particularly revenue covenants, has not been good, and disputes with borrowers over financial covenants are frequent. Probably no single issue has created so much dissension in the recent past, especially in circumstances where the Bank's requirements lead to increased prices. Partly as a result, there has been increasing resistance from borrowers to accept the usual rate-of-return test embodied in the Bank's standard revenue covenant because it is perceived as reflecting a profit motive inconsistent with the public-service concept associated with electric power. This has led to frequent confrontations with

borrowers over earnings requirements and other issues such as asset revaluation, and has prompted more use of cash-generation covenants, a form which is much less satisfactory. Performance indicators and targets could be used more frequently in power loans to stress the importance of operational efficiency and to downplay financial results as the sole criterion. This will require a broader approach to financial analysis which evaluates management and institutional performance as well as the narrower issues of earnings, cash flow and accounts. Financial covenants will continue to be important because they embody practical and testable performance measures--for example, standard legal undertakings covering LRMC pricing have yet to be devised--but reasserting the principles of efficiency pricing and resource mobilization by stressing the intent of the revenue covenant rather than its form in discussions with borrowers is a matter of urgency. In addition, to reduce the Bank's role as policeman, every appraisal should attempt to seek agreement with borrowers on appropriate financial objectives and to build these objectives into sector legislation or equivalent alternatives (such as the French Program Contract system) to ensure automaticity. There is a corollary requirement for more explicit analysis of the impact of sector finances on government investment and taxation policies as part of the Bank's project appraisal work. This has not received the attention it deserves because, in part, Bank power divisions are not adequately staffed to undertake this fiscal analysis.

Rural Electrification

22. Most Bank power projects deal directly with the principal sector agencies and issues, and the appraisals include discussions of access to service and evaluation of country policies concerning connection charges, grid extensions, and rural electrification (R.E.) programs. In particular, institutional and organizational obstacles to service expansion are identified and dealt with as part of project activities. If R.E. accounts for a large part of the sector program (India, Bangladesh) and the Bank can play an effective role in planning, or by coordinating cofinancing, then R.E. projects are very worthwhile but often R.E. projects per se are not especially good vehicles for Bank lending. They are attractive to other donors, they are staff intensive, and they are not particularly useful for attaining the Bank's sectoral institution-building objectives. R.E. projects are sometimes perceived as being vehicles of change, but hard evidence to support this perception is lacking. Since the Bank has been involved directly in R.E. for some years, a study of the effectiveness of such lending should be undertaken, perhaps by OED, to guide future participation in this part of the sector.

Nuclear Power

23. In 1975 the Bank produced a policy paper on nuclear power which accepted nuclear as another option to be considered in developing least-cost programs, and advocated a more positive role by the Bank in developing training, safety and regulatory programs. Since then the Bank has played a passive role, partly because LDCs have deferred their nuclear programs but also because of growing concerns about safety, reliability, and public objec-

tion to nuclear power. Meanwhile, systems have grown so that about 15 LDCs can be considered "nuclear eligible" taking into account that the smallest economically justifiable unit is about 600 MW. Should smaller units become economic in the near term, substantially more countries could consider nuclear. It is likely that LDC power development programs containing economically justified nuclear projects will become more numerous. To prepare for this, Bank sector and project work will have to evaluate more directly nuclear training and safety programs in nuclear eligible countries. Despite a close association with IAEA, the Bank is not well equipped to deal with these key issues.

Hydro and Renewables

24. Energy price changes have driven countries to renew efforts on hydro development and such efforts are proceeding at a satisfactory rate in most countries, at least on large projects. However, because of the large investments required and long construction times, it is becoming evident that many countries can more profitably pursue programs incorporating smaller projects that can be constructed quickly, although not necessarily at lower cost. Conventional hydro-project identification procedures often summarily exclude sites below some arbitrary capacity, usually 50 to 100 MW. The Bank is conducting a country-by-country study of the status of hydro identification and feasibility work, but regional power divisions will need to play a more active role here by including small hydro studies in project identification and preparation activities. "Mini" hydro (say, projects less than 5 MW) presents another problem. The issue is organizational rather than technical--construction programs of as many as several hundred subprojects will be needed in some countries if mini hydro is to play a meaningful energy role, but successful strategies for dealing with site identification, construction and operation in programs this large have not yet been developed despite substantial work on this problem by the Bank and other development agencies. Moreover, the initial results of trial programs have not been encouraging. The oft-expressed hope that mini hydro would be a panacea for rural energy problems has not been borne out by experience; in fact, it appears that the most effective role for mini hydro is as an energy supplier to relatively large grids. Similar setbacks have hampered development of wind energy, dendro thermal (forest and agricultural waste), solar, and other "new" technologies. Lack of site data is a constraint. A few Bank projects have included study components to collect such data but this is not yet a common project component, even though it should be.

III. Bank Resources in the Sector

Staffing

25. Although power is one of the largest sectors in lending terms in the Bank, it is one of the smallest in terms of staff and resources. At end-FY81 only 64 regional operations positions (about 2% of Bank professional staff) were assigned to power activities, and less than 4 staffyears/year were devoted to advisory services, policy and research in the central staff complex over the FY78-80 review period. The traditional practice in the sector of

using small teams--typically an engineer and a financial analyst--for all project work places a high premium on broad experience. When combined with language constraints these requirements make the typical power division staff (5 engineers, 3 financial analysts, 1 economist) a "sub-critical" mass. The small number of economists is noteworthy. Despite the growing emphasis on efficiency pricing and other economic issues, the regional divisions do not yet have sufficient resources to permit economists to play a meaningful role in every operation.

26. Staffing increases of about 20% would be required to support the growth in the operations program in power in FYs 82-84, but the analysis of this paper indicates that doubling the complement of power staff over the next three years would probably be cost effective. Obviously, this is unlikely to happen, and not solely because of limitations on the Bank's administrative budget. There is a limit to the rate at which divisions can absorb new staff, and there is a scarcity of qualified candidates. Changes are likely to be evolutionary through training, some increases in work coefficients as resources permit, and efforts to overcome the "sub-critical mass" problem.

27. Recruiting power staff is difficult principally because the broad experience requirements are met only by senior level mid-career individuals--often managers who are not especially attracted to the Bank. Formal training programs in project and sector evaluation to "broaden" otherwise-qualified recruits, and the time to implement this training, will be necessary if future staffing needs are to be met. In the near term, matrix management and adding a few specialized staff might permit more efficient utilization of staff, but real improvement will be possible only if additional resources are provided so missions can consist of several members with relatively narrow technical skills, as in most other sectors.

Staff Development

28. Aside from periodic state-of-the-art seminars and the annual audit review discussions, there are few formal opportunities for power staff to meet. The Power Advisory Unit (PAU/EGY) has arranged additional seminars and taken other steps to remedy this, but much more needs to be done. A similar problem afflicts training programs for sector staff. Adequate opportunities exist for external training, conferences and seminars and other professional development activities but there is virtually no participation by Bank power staff in these since operational duties take priority. This is paralleled by a relative lack of power staff participation in international conferences. Simple issues like ensuring that staff have access to the latest technical journals, and a policy for Bank sponsorship of professional society memberships, also deserve more attention. The Power Advisory Unit is attempting to develop sector-specific programs to address these issues, but the problem of professional development needs to be dealt with in the context of a planned Bank-wide action program. The 1981 review of the Bank's training activities identified many of these issues and the research done for this sector paper reinforces the general conclusions and recommendations of that review.

Power Advisory Unit

29. PAU/EGY consists of two engineers supplemented by assistance from the financial and economic advisers in the Energy Department. Participation in the project process absorbs about half of the unit's resources and is necessarily quite selective. As in other CPS advisory functions, the unit provides functional support for the sector but is not responsible for quality control of specific operations. However, because of the relatively few staff in each division, some regions do not have technical review capability so EGY/PAU generally provides some input into every project operation, often informally. Staff training in the form of advice on policy issues, reviews of draft reports and occasional seminars is a principal, yet informal, function of the unit. Consultants, suppliers and general seekers of information on the Bank's power program usually contact this unit first. These meetings, which account for 15% of the unit's work, increased noticeably following the publication of the 1980 energy policy paper. In the past few years Energy Department resources have been shifted into energy policy work such that total advisory effort on power has declined from about 7 staffyears/year in the mid-70s to 4 staffyears/year in FY78-80, including research. As a result, preparation of power policy and guideline material, dissemination of research results, and training and "cross-fertilization" activities in electric power have declined.

Intellectual Infrastructure

30. The Bank is one of the foremost authorties on efficiency pricing in electric power. Numerous publications and guidelines on this topic have been produced and several seminars have been conducted in borrowers' countries. In fact most of the small research budget (only 2-1/2% of total Bank research in FY78-80) has been directed to this issue. In recent years, however, training for Bank staff on efficiency pricing has received insufficient attention and the economic evaluation guidelines are out of date. Despite the volume of research material and staff guidelines on electric power available in the Bank, it is not comprehensive. There is little on the financial aspects of power operations and virtually nothing, for example, on techniques of economic system planning or the role of electricity in the development process. Nuclear safety and small hydro are illustrative of topical issues that deserve more attention. Even so, cataloging, organizing, revising and disseminating the large volume of statistical and guideline material on the sector that is available, is long overdue. The importance of the sector justifies a larger share of the Bank's research and policy formulation effort if conservation, public enterprise management efficiency, evaluation of rural electrification, and similar issues are to be addressed adequately. Unlike other sectors, the problem here is not necessarily a shortage of research funds, but rather a shortage of staff time to manage the research.

SECTION I

THE SECTOR IN PERSPECTIVE

BANK LENDING IN ELECTRIC POWER

A. Power Growth in LDCs

1.01 Electric power is an indispensable element in the energy economies of all modern societies. Industry, in particular, depends on a reliable supply of electric power and accounts for the major share of electricity consumption --up to 75% in middle-income developing countries (para. 1.07). The move of developing countries up the income scale demands ever-increasing amounts of electric power, and to this end LDC generating capacity increased sixfold in 1960-80. Growth in countries entering the industrialization phase was even more remarkable. For example, generating capacity in Brazil grew at an average annual rate of 11% and in Thailand at 15%. This is significantly above the 6-7% rate typical of industrialized countries over the same period. More importantly growth in both of these countries, as in other countries like them, was accompanied by quantum improvements in their institutions, technical capability and in their human resources. The Bank played a major role in this growth by participating in projects which accounted for about one-fifth of LDC power investment in that period, including half of the hydro investment.

1.02 Despite higher energy prices and a world economic slowdown, growth at high rates is projected to continue, although at a slower pace, and generating capacity will double in the decade to 1990. Yet even after this growth is achieved the potential for future increases will still be tremendous. Only one-fourth of the people in the LDCs will have access to electric service (less than 4% in some countries), industry will still account for less than 20% of GNP, and average electricity consumption per capita will remain only one-twentieth of that in the industrialized countries. The outlook is that LDCs will not be able to narrow this gap in the next ten years. Deliberate planning to use electricity as a development tool will be necessary if these ratios are to improve.

B. The Role of Electric Power in Development

1.03 Surprisingly little work has been done on the role of electric power in the development process. Although the link between growth in commercial energy consumption (electric power in particular) and rising GNP is well established, quantification of that link does not always yield results that are especially useful in development planning. This is partly explained by the fact that the demand for electricity is derived from investment in other sectors and therefore the planning question is "when, how, and how much"

rather than "why". Even the Bank's 1971 sector working paper [1/] started with the assumption that electricity is known to be an essential input to a modern society, and from that assumption outlined the objectives for institution building and resource mobilization on which the Bank's involvement in the sector are predicated. More recently, however, the validity of this assumption has come under scrutiny. In the aftermath of the energy crisis there has been a growing concern in the Bank and elsewhere that LDCs simply cannot afford to meet all demands. This is not consistent with the development role electric power is expected to meet, and is contrary to the economic philosophy that if prices are right the demand is justified and should be met. Accordingly, in dealing with resource constraints it is of first importance to ensure that the prices are indeed "right", that the cost of capital is not understated, and that opportunities for high returns on marginal investments to improve system efficiency are not overlooked. Because the sector is capital intensive, the resource-mobilization impact of electric power pricing policies deserves special focus when dealing with shortages of investment capital. These characteristics lie behind many of the Bank's policies in the sector.

1.04 With the exception of a few major enclave projects, the mere availability of electricity does not, in and of itself, promote development. Experiments to prove its promotional effect (e.g. Comilla in Bangladesh) have generally been failures. On the other hand, there are many examples where economic growth has been constrained because of the lack of an adequate, reliable electricity supply (Thailand, Colombia). Clearly, there is a market-related, inter-sectoral dependency that must be taken into account when planning power system development strategy. Unfortunately, this is not always done, either in the Bank or in government planning agencies where power is usually treated as an independent sector.

1.05 Persistent growth is a distinguishing characteristic of electric power systems. This growth is linked to the underlying rate of economic development and is significantly higher in developing countries than in developed countries--for example, on average 8 % in LDCs in 1973-78 compared with 3.5% in developed countries. Economic slowdown, civil strife and natural disasters can result in lower or even negative growth but the consequences are seldom long lasting and growth quickly resumes at historical trends, or higher (Turkey, India, Nicaragua, Ethiopia, Sri Lanka). This growth arises from existing consumers as well as new connections--a fact sometimes not recognized by government planners. Prices and other load management techniques can have some impact but in practice it is not technically possible to limit consumers to a given amount of electricity. When faced with capacity shortfalls, system operators can reduce voltage and/or frequency temporarily and reduce peak demand by 8-10%; another 10% or so reduction can be realized by sequential disconnection of circuits or other forms of load shedding. If the system cannot be managed with these measures then the quality of service deteriorates rapidly, with severe adverse consequences on equipment, and the system

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1/ "Electric Power, Sector Working Paper", December 1971.

collapses. This implies that "not meeting the demand" is not a planning option. Furthermore, even though appropriate pricing structures may be used to manage demand and thus reduce the cost of supply, price elasticity in developing countries is very low and generally higher prices for power have little sustained impact on growth of demand. Therefore, one can expect that investment for electric power will continue to absorb a large if not growing proportion of a country's resources.

Electricity as Part of the Energy Sector

1.06 The Bank has only recently begun to treat electric power as part of the larger energy sector. Dealing with electric power in this manner (as opposed to treatment as part of the revenue-earning "public utilities" sector) has raised some questions which are not often dealt with explicitly in country economic and sector work, but should be. In particular, electricity's share of capital investment is considered highly disproportionate when one looks only at the small percentage of the primary energy that it produces. Similarly, electricity is perceived as being inefficient because of the losses inherent in thermodynamic conversion processes. A part of the difficulty arises from the way in which energy statistics are presented (see Annex I). Customarily, alternative energy sources are compared using their heating values and on this basis electricity accounts for only 3% of commercial energy consumption in developing countries. However, this presentation does not take account of the fact that electrical equipment is more efficient than the alternatives. For example, electric motors have an efficiency of 85% compared with 15-20% for diesel engines. Thus, in end-use terms, electricity accounts for 25% of the commercial energy consumption in developing countries. This is a more accurate reflection of the role played by electricity and helps explain electricity's high share of total investment in the energy sector.

Industry and Employment

1.07 Industry consumes about 40% of the electric power in low-income developing countries and up to 75% in middle-income countries. Although the statistical correlation is poor, there is clear evidence that industrialization is an important key to development, and that electric power is essential to industrialization. The investment implications of this can be surprising. The cost of providing electric power to one job in industry ranges from about $3,000 in labor-intensive industries such as textiles and food processing, to as much as $200,000 in heavy industry (petrochemicals, steel and cement), or one-third or more of the investment in the industry itself. Costs of this magnitude could have a serious impact on development planning in countries like the Philippines which plans to double industrial

employment from 10% of the workforce in 1977 to 20% in 1985. 1/ This relation deserves more explicit attention in the Bank's economic work, particularly when forecasting public sector investment requirements. A specific study to explore these relationships is proposed as part of the power research program (Annex I).

1.08 The increase in the capital-intensive nature of most industrial activities when the investment requirements of electric power are taken into account does not necessarily have negative import. Even at today's energy prices, the energy equivalent of a man-day of labor costs only a few cents. Besides, the introduction of energy in the form of electric power complements human effort thereby raising productivity and GNP. In this sense, and so long as the incremental amounts of electricity are being used efficiently throughout the economy, power's contribution to the development process may be equally as important as that being made by increased productivity in agriculture and other sectors.

C. Investment Requirements and Financing Sources

1.09 A forecast of investment requirements in the sector was prepared for the 1980 energy policy paper. 2/ It indicates the need for some $400 billion (1980 price levels) in financing commitments for electric power 3/ between 1981 and 1990 (see Annex I). Mobilizing resources of this magnitude is proving to be difficult for LDC economies already burdened with higher oil bills and inflation. Electric power absorbs 10-20% of gross domestic investment, almost all from public sector financing. Historically, power has accounted for 15-20% of public sector investment, but as project costs go up and systems grow at compound rates this figure is increasing and can approach 50% or more in countries undertaking major industrial programs based on hydropower and other capital-intensive energy resources.

1.10 Assuming that financing from multilateral and bilateral sources remains at 1976-80 levels in real terms, a possible financing plan for the investment requirements in 1981-85 would be:

1/ de Vries, "Transition Toward More Rapid and Labor-Intensive Industrial Development: The Case of the Philippines", Staff Working Paper 424, October 1980.

2/ Energy in the Developing Countries, World Bank, August 1980.

3/ The distinction between commitments and disbursements in the power development program is particularly important because of the long construction times required for power projects and the consequently long disbursement periods. Because of growth rates, commitments requirements will exceed disbursements by one-third or more in any given year. This paper uses commitment estimates rather than disbursements because they better reflect financing needs.

	$bn	%
Multilateral	16	9
Bilateral/Official	24	14
Suppliers/Buyers Credits	30	18
Private Commercial	40	24
Own Sources	60	35
	170	100

In this plan, suppliers/buyers credit and private commercial financing are assumed to be the balancing items with amounts several times larger than financing previously received from these sources (estimated to be $6 billion for the period 1976-80). Although prospects are good for substantial increases in financing from these sources,[1/] concerns regarding creditworthiness and exposure already appear to be limiting access to these lenders and shortfalls are likely. Self-financing of the magnitude shown also is doubtful because of the reluctance of governments to pass cost increases on to consumers or to otherwise mobilize internal resources. Any deficiencies in self-financing would be expected to be made up through even larger private borrowings, which at harsher terms would exacerbate the already serious cash flow problems foreseen for LDCs in the latter years of the decade.

D. Bank Lending for Electric Power

1.11 Electric power is probably the most "traditional" of the sectors in which the Bank lends.[2/] Over the past 30 years, lending for electric power totalled $14 billion for some 380 projects in 83 countries and accounted for about 18% of all lending. Except for a decline in FY72-75, when Bank resources were shifted into agriculture, average lending for electric power has been remarkably constant at about $1.5 billion per year ($ 1981) over the past 25 years, and is projected to remain so.[3/] In the FY78-80 review period, 63 electric power projects totalling $4.9 billion were approved accounting for 16% of Bank lending. Table 1.1 gives a breakdown of this lending by function. These totals do not include lending for electric power components of projects not managed by the regional power divisions; in 1978-80, 24 other projects contained $72 million in lending for such components comprising power

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1/ See e.g. "Developments in and Prospects for the External Debt of the Developing Countries: 1970-80 and Beyond," World Bank Staff Working Paper No. 488, August 1981.

2/ All references to the Bank in this paper are understood to include IDA.

3/ A book on the Bank's experience in lending for electric power is currently being prepared by Mr. J. H. Collier. Publication is tentatively scheduled for mid-1982. Much of the statistical material in this section is from data collected by Mr. Collier.

generation in multi-purpose irrigation projects, rural electrification in rural development, and transmission/distribution in tourism.

Table 1.1. ELECTRIC POWER LENDING, FY78-80

	FY78		FY79		FY80		Total		
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	%
Hydro Generation	6	348	4	183	10	783	20	1,314	27
Thermal Generation, Coal	3	305	3	495	4	837	10	1,637	34
Thermal Generation, Oil/Gas	2	97	4	243	1	52	7	392	8
Thermal Generation, Geothermal	0	-	1	9	1	40	2	49	1
Transmission and Distribution	4	256	8	191	12	588	24	1,035	21
Rural Electrification	5	140	3	234	2	92	10	466	9
Total Lending, Current $m		1,146		1,355		2,392		4,893	100
Total Lending in 1980 $m		1,339		1,458		2,392		5,189	-
No. of projects a/	19		19		25		63		

a/ Totals exceed number of projects because some projects included multiple components.

1.12 Even though the reference period is short, Table 1.1 illustrates the trend of Bank lending for electric power with continued emphasis on hydro, a move away from oil and gas fired thermal toward coal, some involvement in new sources (geothermal), a random but significant role in transmission and distribution, and a small component for rural electrification. The division of lending roughly parallels the investment requirements of the developing countries except that distribution, which historically has absorbed about 40% of total investment, plays a smaller role in the Bank's lending program because it is more amenable to self-financing.

1.13 The number of projects dealt with (a measure of staff requirements) stayed relatively constant at 10-15 until 1976 when it increased to 20, and it is expected to remain at about that level unless deliberate action is taken to increase this figure in connection with a Bank energy affiliate or some other proposal to increase the emphasis on power activities. This also implies a significant decrease in average loan size in real terms during a period when individual project size increased substantially. It was this large increase in project activity that was responsible for many of the strains, including recruitment difficulties, experienced by the sector in the past five years.

1.14 The country "mix" of borrowers has also changed significantly, shifting from a rather stable portfolio of old customers (Colombia, Thailand, India, Turkey) to one which is heavily sprinkled with countries at both ends of the income spectrum. Increasingly, the Bank is being called upon to deal with the new and unique problems that are being posed by the low income countries (Burma, Burundi, Upper Volta, the Yemens) while it assists the mature customers that are reappearing at the Bank's window (Portugal, Brazil, Nigeria, maybe Mexico, Argentina).

Future Lending for Electric Power

1.15 The expanded lending program in the 1980 energy policy paper indicated a desirable lending plan of $11 billion (commitments, in current $) for power in the period 1981-85 ($13 billion in 1982-86). Although substantially more than the current plan ($8.1 billion for 1982-86), this expanded program would only continue the 1975-79 lending rate in real terms. As a consequence, Bank financing of sector investment needs would decline from about 10% in 1976-80 to 5% or less in 1981-85 under the expanded program, and to 3.5% in terms of the current lending program. An indicative 5-year lending program consisting of 135 projects was developed in conjunction with the preparation of the 1980 energy policy paper, which could be used to address sector issues. This program is not optimal in the sense that as many as 20 additional projects could be included if there is a deliberate decision to provide additional resources. Instead, it represents an initial planning step.

1.16 In view of the potential constraint on other investment resources, even the expanded program may not be adequate to meet the borrowers' minimum expectations. Even if it were possible, it would be difficult to meet these demands without increasing the number of power projects, or increasing Bank financial participation in individual projects or country programs, beyond limits which might be considered prudent. Annex II gives detailed information about the Bank's recent and proposed participation in the power sector investment programs in LDCs, while Annex III shows the areas of emphasis in Bank power lending, country by country, and the proposed target countries including new borrowers. The staffing implications of this program are dealt with in Section III.

Planning and Programming Power Lending

1.17 Traditionally, electric power lending has played a gap-filling role in the Bank's lending programs. Persistent growth of power demand in all developing countries creates a large reservoir of project opportunities. Since these power development programs are monitored by the Bank, it has been relatively easy to identify and appraise power projects on fairly short notice and at low staff costs. Thus, power has become a convenient vehicle for accommodating fluctuations in country lending programs. The result is that the Bank's 5-year programs are not especially useful guides as to what will actually happen. An historical analysis of the programming experience in the sector is given in Annex I. This approach, however, hinders optimization of the Bank's sector-specific contribution. It also inhibits planning continuity and the development of strategies for sector improvement. Also, the planning environment is changing. The sector is dynamic and new project opportunities arise as costs change and new alternatives are identified. Analysis of investment programs is much more complex. More recently there has been the added problem of countries whose reluctance to accept Bank policy recommendations has caused them to forego or defer Bank financing. In these circumstances, much greater emphasis on sector work and "upstream" efforts is necessary. Even so, it is unrealistic to expect that firm project-specific lending programs for five years, or even two or three years, can be developed.

1.18 With the emergence of the Bank's lending program in oil and gas during the review period, the structure of energy sector work changed substantially. Prior to 1978, only a few regions attempted to place power in the context of a larger energy sector, but even in these cases treatment of oil/gas, coal and other energy-related issues was often confined to resource assessment and, occasionally, to the pricing of petroleum products. Recently, however, economic reports and CPP's have begin to focus on the economic efficiency, resource mobilization, and investment issues associated with energy in addition to the balance-of-payments impact of oil imports which has been mentioned in earlier economic reports. The move into structural adjustment lending provided an operational focus for this work. As a result energy related undertakings are becoming common features of structural adjustment loans.

1.19 EGY 1/ is undertaking a 60-country program of energy sector assessments, partially sponsored by a UNDP grant. This program will require more sector work participation from the regional power divisions than was done in FY78-80. Existing coefficients for sector work and project preparation, already the lowest of any major sector, are clearly insufficient to deal with the increasing complexity of the sector. More deliberate efforts to identify priority countries (using "issue matrices" as in Annex III, or similar techniques), and to build lending programs for these countries through the country energy assessments and CPPs, is required. Technical assistance and engineering loans, rarely used previously in the sector, deserve more prominence in lending programs to complement project lending and to address the many new issues in the sector, especially those dealing with operations and efficiency. At the same time, a major one-time effort is needed to restore power sector work to a satisfactory level. This could be accomplished through a multi-country pre-investment program covering perhaps three years. The program should focus on identification of resource alternatives (small hydro and other renewables, coal and lignite) and multi-sector investment strategy, and its purpose would be to assess investment requirements and set priorities for Bank power-sector financing. The main criteria for country eligibility would be the potential for sector specific contributions, commitment to policy and institutional reforms, and the leverage needed to bring these about. Considering the likely constraints on the Bank's administrative budget, it will be necessary to explore the possibility of attracting additional resources for this work, perhaps as a related UNDP effort.

1.20 Past sector work in power, and to a lesser extent in energy, has been largely supply-oriented with emphasis on resource assessment, pricing, and sector organization. With the increasing importance of conservation and efficiency pricing, an added focus on energy demand is essential. Data on petroleum product consumption and related issues, such as refinery product balance, are quoted with increasing frequency in sector reports. However, aside from sectoral consumption data derived directly from billing records (agriculture, industry, residential, etec.), power sector reports commonly

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1/ Energy Department.

contain virtually no analysis of electricity demand. Collection and analysis of demand data is likely to be manpower intensive. Even so, it is essential to a proper treatment of demand-oriented issues such as efficiency pricing and conservation. An analysis of industrial consumption, and to a lesser extent that of agriculture, is particularly important to deriving a consistent development strategy. For this reason, much closer integration and exchange of sector information between EGY, IPD, IDF and the regional divisions will be necessary. The programs divisions or country economists might usefully serve as the catalyst in this exchange. In this context the need for separate "power" reports is declining.

Role of CPPs

1.21 Out of 60 CPPs prepared in FY78-80 and reviewed for this paper only 25 proposed what could be considered a program with sufficient continuity to achieve the institution-building objectives that form the basis of the Bank's involvement in the sector. It is perhaps noteworthy that those CPPs which did enunciate a strategy mentioned institution-building most often, with resource mobilization a close second. The links with the fiscal program, GNP growth, and industry which are essential to the development of a sector lending strategy, were rarely acknowledged.

1.22 When an incentive for strategy development does exist, it can be effective. The emphasis on poverty alleviation, both urban and rural, in the FY74-78 period resulted in the introduction and on-schedule approval of 97% of the power projects with distribution components. This was markedly better than the results for power projects as a group. The renewed interest in energy is already provoking a similar response for projects involving conservation (rehabilitation) and renewable resources (hydro). It is also being reflected through support in CPPs for energy lending programs, including electric power, and increased emphasis on the evolution of energy development strategies. Explicit support of these efforts and, in particular, more focus on new-style projects (rehabilitation, small hydro) and optimization of sector development strategy will be necessary to realize maximum benefit from the Bank's lending for electric power.

SECTION II

OBJECTIVES, ISSUES AND STRATEGY IN POWER LENDING

A. Institution Building and Resource Transfer

2.01 OMS 3.72 identifies the principal objective of Bank involvement in energy, water and telecommunications projects as helping to provide the basic infrastrcture required by other directly productive sectors. In so doing, the Bank expects:

(i) to achieve institutional improvements through planning, training, and technical assistance especially in accounting and management;

(ii) to mobilize local resources through proper pricing;

(iii) to improve planning according to various least-cost methodologies, and,

(iv) to assist in organizing co-financing.

Capital transfer, identified as a major function of power sector lending in the 1971 sector paper, is not now acknowledged as a specific objective. Although it is obviously desirable to associate all Bank lending with a priority project or institutional improvements, given the sector needs, the staff contraints and the balance of payments and capital requirements of many Bank borrowers, it may be appropriate to reemphasize capital transfer (in association with co-financing) as a legitimate lending objective for the sector.

2.02 Institution building is a major contribution of the Bank in the power sector, as it has helped support the rapid and deliberate expansion that characterizes power. Institution building covers many aspects: planning projects that fit a coordinated development program; instituting well-focused financial policies; encouraging continuity and independence in management as well as advising on other organizational aspects, technology transfer, training and procurement. More recently, two additional activities were incorporated--efficiency pricing and extending service to rural areas and urban fringes. The principal objective of institution building is to create both the environment and the ability necessary for power entities to manage their own affairs. Although the premise is difficult to prove, perhaps the most important lesson that the Bank has learned in its long history of power lending is that the costs of inefficiency in the sector are high and the best means of ensuring efficiency is through responsible and reasonably autonomous institutions.

2.03 Bank policy in this sector, unchanged for many years, stresses the discipline of financial viability and maximum autonomy in order to build institutions that are "bankable" in their own name in the long term, and able

to raise capital without recourse to the Bank. It also recognizes that financial viability is of little value unless accompanied by measures such as adequate salaries, incentives for efficient operation, and planning based on sound economic principles. In fact, a real challenge facing Bank staff is how to develop strategies that are responsive to these objectives. Even though the power system technology employed varies little from country to country regional disparities are perhaps most pronounced in this field with some regions (LAC, EMENA) dealing with very sophisticated borrowers and others (WAF) virtually starting from scratch. Indeed, it is this superposition of a sophisticated technology in relatively unsophisticated environments that serves as a primary justification for the emphasis placed on institutional development in the Bank's power sector work.

2.04 In this sector, antonomy consists essentially of delgating sufficient authority to management so that it may be held responsible for delivering an efficient electric-power service at an acceptable price. Autonomy is receiving less emphasis now than in the past, partly because governments increasingly view the power sector as simply another public service with the same budgetary and staffing constraints that apply to other government functions. This way of thinking has made this part of the Bank's task increasingly difficult. Even so, a reaffirmation of the principle of autonomy and increased efforts to deal with issues such as public-sector salaries on a country basis are needed to restore efficiency and to assist borrowers in coping with the large resource needs of the sector.

2.05 Given the increased need for improvements in efficiency in most borrowers' power sectors and the Bank's diminishing ability to meet the sectors' large and growing resource needs, re-examination of the Bank's role in lending in this sector, particularly its quasi-regulatory role in establishing tariffs, is necessary. Substantial attention should now be given, particularly during project preparation, to the promotion of appropriate policies through legislation and regulatory procedures rather than reliance on strict financial covenants, and to the adoption of country strategies to remedy deficiencies in autonomy and management generally of sector agencies. The intent should be to achieve ex ante agreement among the government, the utility and the Bank on efficiency improvements, resource mobilization and pricing, rather than continuing to place the Bank in an ex post regulatory role. In this regard, innovative approaches such as the French "Program Contract"[1/] system deserve more emphasis, and EGY/PAU will endeavor to alert staff to such opportunities in Bank projects. Such systems obviously require a strong government administrative structure to function

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1/ A system whereby the public agency periodically agrees with the government on specific objectives to be attained and the resources to be used. The set of objectives then becomes a contractual obligation and the agency is free to function autonomously within the framework of the program in order to realize those objectives. See Accelerated Development in Sub-Saharan Africa, World Bank, 1981, p. 39, for a discussion of this mechanism in Senegal.

properly--not always present in developing countries--hence the need to be selective in identifying measures to be used to supplement the traditional financial performance objectives.

2.06 Measuring the efficiency of public sector enterprises is an issue which has received increasing attention in the Bank recently. Because of the focus on non-revenue earning entities, it has not received much attention from power staff. However, as governments become increasingly committed to central planning (Burma, Syria, Algeria, China as well as Romania, Yugoslavia), lessons from this work can be useful in power, and developing techniques to measure efficiency in such instances is an immediate task facing the advisory staff in CPS. In addition, a comparative data base is needed to permit meaningful use of the various monitoring and performance indicators that have been in use sporadically in the sector since about 1976. Although loans have conditions requiring collection of data on staffing, system losses, plant availability and similar non-financial indicators, we have no way of telling whether the performance is good or bad, other than observing the trends of the indicators. EGY/PAU is sponsoring a research study in FY82/83 which is intended to develop criteria and establish comparative guidelines for common indicators using data from a broad sample of power institutions in both developed and developing countries.

B. Financial Objectives

2.07 Historically, the emphasis on the financial aspects of institution building has molded the Bank's activities in the sector. In this respect the Bank plays a unique role by serving as a de-facto financial regulatory agency for many of its borrowers in the power sector. Given the sector financing needs (para. 1.09) and the imperfect nature of taxation and other internal resource mobilization mechanisms in most developing countries, this role is essential. Yet, it is often misunderstood since the accounting tests of revenue adequacy are perceived as being mainly applicable to investor-owned utility companies and therefore of questionable relevance to government-owned entities. The traditional model of an autonomous entity which has sufficient financial strength to raise funds in its own name in world financial markets is not generally applicable in today's political world, but the principle of sound financial performance is, since (i) project financing plans increasingly rely on government participation either through borrowing or from general revenue, and (ii) pricing policies impinge on many sectors. It is therefore essential that the impact of power projects on, for example, government budget and fiscal policy, pricing and taxation be evaluated as a routine part of project appraisal and sector work. This is seldom done since the regional power divisions have neither the appropriate staff nor the resources to do such analysis. Programs staff can assist; in fact, greater participation by country economists to relate sector financing to country macro-economic policy is necessary to provide a better foundation for a dialogue on financial objectives. Whenever possible, borrower/government participation in this analytical work should be encouraged in order to use it as a foundation for the proposed dialogue on the sector's autonomy and financial objectives. If this approach is not adopted, the Bank can expect growing criticism and increased reluctance to abide by financial criteria that are perceived by many borrowers as being not relevant in their particular environments.

2.08 Coupled with the reduction in autonomy, there has been a growing reluctance by governments to implement price increases for power to reflect rising costs. An extract from a recent appraisal report is typical:

> "Tariff-setting stopped working well in the early 1970s. While (the tariff) law was not repealed, scant attention was paid to it. The Electricity Law provided only vague guidelines on what the utilities' return was intended to provide... High (staff) turnover, much higher inflation than had been the case in the 1960s, and political pressure to keep the rates of the recently-nationalized utilities low all combined to produce unsatisfactory operating results."

The result has been that real prices for electric power have declined in many developing countries over the past decade. Thus, not only are incorrect economic price signals being given to consumers, but the resource mobilization benefits of Bank lending are rapidly being eroded.

2.09 Probably no single issue has created so much dissension in the recent past and the problems seem to be increasing rapidly. Unfortunately, because of the usual format of the revenue covenants in Bank loan agreements, the underlying economic and resource mobilization objective is often overlooked and acerbic disputes with borrowers over complex issues such as asset revaluation obscure the basic issue. This problem is often further exacerbated by the relative sophistication of the sector which permits defining specific quantified undertakings which can then be tested with precision and are so reflected in the legal covenants. These disputes become even more onerous in circumstances where adherence to the loan agreements leads to further price increases in economies already struggling with inflation. Because the cost of electric power is only a small percentage of the final product cost (still 3% or less for most industries), governments' fears about the ripple effects of electricity price increases are generally exaggerated. Furthermore, the alternatives to price increases usually are inflationary. Stressing these facts is essential in Bank-borrower dialogues on this issue.

2.10 A corollary objective of institution building is to improve the standards of accounting and audit. Although there are substantial variations among regions, in general the accounting profession is not well developed in borrowing countries. Yet, the financial test requirements associated with Bank loans demand a relatively high level of accounting sophistication. Partly because of the lack of a profit motive or any reward to managers for the efficient use of resources, accounts are treated as historical records rather than as management tools. Thus, the forward-looking concepts of accrual accounting (including asset revaluation), now practiced generally in Europe and North America, are not seen as particularly relevant in budget-conscious government records systems. In particular, current-cost accounting through indexing, although widely accepted in Latin America, and now common in Europe, is still rejected by most borrowers. None of these issues are peculiar to the power sector, and they should be addressed, at least generally, as part of a wider Bank effort to encourage professionalism in

accounting. In the past, progress in this area has been sporadic but is currently benefitting from a renewed effort. However, as in the technical and engineering fields, enhanced efforts to keep Bank staff informed of developments in international accounting standards and more attention to disseminating lessons learned from case studies would be worthwhile. As part of this latter effort, the EGY financial adviser is attempting to keep track of interesting lessons learned in Bank work and to ensure that power sector financial analysts are made aware of these. One planned study concerns accounting practices in centrally-planned economies and translation of accounting practices in such countries into formats that can be analyzed using conventional Bank financial theory. The results would be incorporated in a sector-specific staff guideline.

C. Efficiency Pricing

2.11 Economies of scale and low-cost primary energy sources led to decreasing electric power costs in most countries until the early '70s. Since then, a combination of real increases in the cost of construction, equipment, and fuels, and the high cost of developing new hydro sites, have reversed the long-term downward trend of real electricity costs so that price structures based on historical costs are adequate neither to meet the financial needs of power sector entities nor to give proper economic price signals to consumers. Recognizing this transition, EGY initiated substantial work in the research and development of tariff-making principles using long-run marginal costs (LRMC)[1/] and has gradually sought to introduce these principles into Bank projects, and more generally to borrowers' staff through regional seminars on LRMC-based tariffs. The economic justification for LRMC-based prices is straightforward: if prices reflect true costs, the consumption that materializes at these prices automatically is economically justified and the resulting demand should be met.[2/] This implies a rejection of subsidies but at the same time discards over-pricing as a rationing mechanism. Despite the obvious relevance of LRMC to economic decision making and resource allocation, the full adoption of LRMC prices has been slow due to practical problems of implementation as well as a reluctance to move away from prices based on actual costs. Honest concerns about applying LRMC to extensions of non-optimal systems, and the sectoral distortions that can result when LRMC is not applied throughout an economy, have also hindered the adoption of marginal

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1/ As used in the power sector, LRMC refers to the long run marginal cost of supply from the power system, not the cost of supply from an incremental generating plant or project. Like historical costs, LRMC have a structure and vary by season and time of day. Thus, under a LRMC system, the average unit (kWh) cost of supplying different types of loads (e.g. irrigation pumping, a steel mill, residential consumers) can vary widely one from the other.

2/ See e.g. "Electric Power Pricing Policy," World Bank Staff Working Paper No. 340, July 1979.

cost pricing principles. The major obstacle, however, is that governments tend to resist the price increases that usually accompany such policies.

2.12 These difficulties have led to a pragmatic combination of tariff levels based on revenue requirements and tariff structures reflecting LRMC. This may be a satisfactory short-run approach but it is not responsive to the long-run changes taking place in the sector. Accordingly, the marginal-cost analysis should now receive primary attention in appraisal report discussions of tariffs and tariff adequacy. A supplementary financial analysis is, of course, needed to ensure that appropriate measures are introduced into the loan operation to guarantee financial viability, but this should be a secondary criterion in setting targets for future tariffs and in the related negotiations with borrowers. The operational implications of this shift in priorities should not be underestimated. The presentation of tariff issues in appraisal reports will need to be related to efficiency pricing objectives rather than just finances. OMSs will be reviewed to determine necessary revisions. More fundamental changes may include shifts in divisional staffing patterns to reflect the corresponding increase in economic work, and supplemental training courses for financial analysts will have to be introduced to bridge the gap between economics and finance. Interim transitional arrangements may be necessary. Since the LRMC concept is difficult to express in legally-testable covenants, the Bank will likely have to rely on the traditional financial covenants to convey understandings on LRMC pricing, at least until new measures can be devised. In many cases, provided assets are properly revalued and no major structural changes in the sector are taking place or are foreseen, the conventional rate of return tariff can be a reasonable short-term substitute for LRMC prices. Adjustments to strict LRMC prices are not precluded. For example, social conditions may compel a government to introduce life-line rates. In general, however, such measures should be avoided because power tariffs are poor vehicles for income distribution. If subsidies are necessary, it is preferable that they be visible and direct. One problem often noted is the distribution of the cash surpluses ("economic rent") that may arise if full LRMC pricing is adopted. Although in practice these surpluses seldom materialize because of the large financing needs of the sector, Bank policy statements should acknowledge that taxation measures or other methods may be required to capture these surpluses.

2.13 The regional banks and other development institutions, previously content to let IBRD carry most of the burden of developing suitable financial objectives for project entities in developing countries, have recently become more concerned with pricing and in some cases have advocated policies that are contrary to those proposed by the Bank. The Bank should take the lead in reconciling conflicting pricing policies and should promote the adoption of a uniform tariff-making philosophy in the developing countries.

D. Conditions Attached to Bank Power Loans--Format of Legal Covenants

2.14 Typical conditions attached to loans for electric power are described in OMS 3.72. The legal covenants through which these conditions are imposed fall into three categories: standard covenants, project-specific covenants and financial covenants. Standard covenants include those on performance and

records (due-diligence, sound practice, plans and specifications, access to property, records of expenditure), insurance, procurement, land acquisition, etc. Although the substance of these covenants may vary slightly from loan to loan, the undertakings are sufficiently standardized that they are not normally mentioned specifically in appraisal or president's reports. The content of the standard covenants continues to evolve but, aside from a few curious anomalies (e.g. the project insurance covenant covers goods, but not works), they provide the Bank with a reasonably comprehensive set of undertakings that covers most exigencies.

2.15 Project-specific covenants also tend to be quite standard (completion reports, dam-safety, consultants, environment) but their importance or uniqueness usually warrants mention in the appraisal report. Other ad-hoc project covenants covering studies, training programs, management and accounting systems are common, whereas undertakings related to the specific manner or schedule for carrying out the project are surprisingly rare. In addition, there are indications that the procedures for formulating these covenants could be improved. In particular, project briefs and issues papers should devote more attention to the scope and intent of anticipated legal undertakings to ensure that these are not overlooked or misinterpreted in the later stages of loan processing, and negotiating strategies should focus on the purpose of the covenants rather than on their form. Typically, (as in other sectors) Bank lawyers become involved late in the appraisal process, often leaving insufficient time for a meaningful review of the draft covenants in the region, and by the sector advisers. A more serious issue is that the borrower often is not well briefed in advance, at appraisal or before negotiations, on the scope of the covenants, the form in which these will be embodied, and the rationale behind the process. Ideally, many of the conditions to be required should be agreed upon and the implementation mechanism should be in motion prior to lending (the SAL approach). Significant movement in this direction is taking place (Annex I).

Financial Covenants

2.16 Virtually all loans for electric power include covenants pertaining to financial performance, and the FY78-80 period was no exception. The character of these covenants has changed somewhat over the years, evolving from a simple statement of cost recovery (..."tariffs set to yield revenues sufficient to meet all expenses and provide a reasonable contribution to investment") to very detailed performance targets for tariff increases, rates of return or cash generation. In some cases (Brazil, Romania), the covenant simply repeats the financial objectives set forth in local legislation, but in others it is the only formal statement of revenue requirements which regulates tariff levels for the concerned entities. A covenant specifying a rate of return on net revalued fixed assets is the most common--60% of FY78-80 projects had covenants of this type--and is the preferred form. Contribution-to-investment or cash generation covenants (a specified percentage of capital expenditures to be met from internally generated funds) are also common (20% of FY78-80 projects).

2.17 Each form of revenue covenant has advantages and disadvantages, but the rate of return covenant currently remains technically the best available instrument, providing: (i) it is constructed on a sound basis, e.g., that the opportunity cost of capital is appropriate to the country concerned, and no allowance is built in for inflation when assets are to be regularly revalued, and (ii) the government, where it is not the borrower, is kept fully involved in the formulation of the tariffs necessary to sustain the covenants objectives. Cash generation covenants are regaining favor because they address more directly the cash generation objective rather than a "profit" objective which is less palatable to socially-oriented borrowers and because they are (wrongly) perceived as avoiding the messy issues associated with asset revaluation; however, cash generation covenants have many deficiencies. For example, (i) they are vulnerable to small changes in operating costs, especially in mixed hydro/thermal systems; (ii) they result in large variations in revenue requirements in systems having large yearly changes in investment (the usual case) which requires some form of averaging or shortfall recovery arrangement that is inherently difficult to monitor; (iii) they may induce borrowers to defer needed investments (obviously the wrong signal); and (iv) they conceal subsidies in the form of concessional financing. To some extent, the principal problem with the rate of return covenant is its name, and a simple semantic change may provide a solution.

2.18 Other forms of revenue covenants used in Bank loans include no-profit no-loss, return on historically-valued assets, return on equity, debt service coverage, operating ratio and others. All of these forms have disadvantages compared with the return-on-revalued-assets covenant. The issue partly is one of degree because experience has shown that well-constructed revenue covenants of any form will result in nearly identical earnings requirements and the Bank should point this out to borrowers whenever dealing with this sensitive issue. Disagreements with governments over non-compliance indicate, in most cases, a failure to evolve an agreed pricing strategy before processing the loan, and not the selection of the wrong form of revenue covenant. The real answer lies in re-asserting the principles of efficiency pricing and resource mobilization and in stressing the intent of the revenue covenant rather than its form. Standard forms of financial covenants are available and are widely used. Occasionally ad-hoc adjustments are made to suit particular circumstances. This is appropriate provided that the changes are well thought through and do not jeopardize the intent of the covenant. A CPN on financial covenants is being prepared to provide additional guidance in this field and supplementary training seminars for financial analysts are under consideration to improve skills in this area.

2.19 In addition to revenue covenants the financial conditions usually include a debt limitation covenant. The preferred form is a debt service test requiring the borrower to seek the Bank's agreement prior to incurring debt if by incurring such debt his forecasted debt service coverage in any future year would fall below some specified value (usually 1.5). This type is preferred because it directly controls major threats to the borrower's solvency and therefore avoids jeopardizing investment plans. Also, it can be met by a variety of measures, such as rate adjustments, equity contributions to

undercapitalized entities as well as consolidation of short-term debt. It is essential, however, that this test be enforced by agreement to implement measures of the type outlined above rather than simply by waiving the test as part of the monitoring function. Other provisions are often used to supplement or substitute for this covenant. These typically permit the borrower to incur debt up to a pre-set limit, or to undertake a specific development program without further consultation. However, the recent volatility of world capital markets has complicated the problem of monitoring such covenants because borrowers may resort to financing forms (e.g. rolled-over short term debt) not contemplated under the original financing plan. Forecasting future earnings is also risky, and devising new forms of undertakings to deal with these situations poses a contemporary challenge to financial analysts.

2.20 Compliance with covenants is monitored as a regular part of supervision work and defaults, which are increasingly common, are duly noted. Waivers are frequent, but formal modifications are not made as often as might be desired despite the fact that changed conditions may fully justify modifying agreements which were based on estimates made several years previously. Partly as a result, compliance with covenants, particularly revenue covenants, has not been good. A 1977 study indicated non-compliance in half of the cases studied and a similar survey at end-FY81 indicated that two-thirds of earnings covenants were not being met. Bank action in such cases understandably varies among countries and regions and it is clear that an increasingly realistic view of these defaults is being taken, but this is not sufficient. More rigorous financial analysis emphasizing resource mobilization, financial viability and economic pricing is necessary in order to formulate responsive action plans in such cases. To the extent possible, financial analyses undertaken during appraisal should anticipate the need for future modifications in the requirements by incorporating studies of sensitivity and risk. These studies should identify alternative requirements and courses of action to be followed in the event the assumptions used in the base analysis do not materialize.

Next Steps

2.21 It would be useful to take the current review of audit requirements as an opportunity to review the status of the Bank's financial covenants in the sector. Provided additional support is made available to the EGY Financial Adviser in FY83 as is now planned, formation of a joint CPS/Regional task force to do this would be justified. The issues to be addressed would include:

- reconciling revenue requirements with the efficiency pricing objectives now advocated by the Bank, and related training needs;

- the adoption of agreed plans/programs of action (now used by some regions) as a substitute for historical tests which result in ex-post defaults;

- renaming the rate-of-return covenant;

- devising a better alternative to cash contribution covenants;

- pricing of electric power in enclave operations absorbing all or a major portion of the output of a single project (e.g. aluminum smelters);

- trying to develop strategies for country or regional improvements in accounting and audit;

- adopting common policies with other development banks;

- identification of needed sector-specific guideline and research work, and

- professional development activities for financial analysts, including participation in international accounting courses and seminars.

E. Co-Financing and Sector Lending

2.22 Prior to 1975 only about 10% of Bank-financed power projects employed co-financing. Today, however, due to the recent growth of regional banks and other multilateral official sources, along with increasing project size and constrained Bank resources, co-financing is a common feature of Bank-financed projects. For example, in FY78-80 two-thirds of the power projects approved by the Board relied on external sources [1/] to complete the financing plan. Moreover, co-financing with export credit agencies (suppliers'/buyers' credits) and commercial sources has grown rapidly. This trend must expand because, even if the increases in Bank lending for power proposed in the 1980 policy paper do materialize, the Bank's share in power development financing will still be substantially less in 1981-85 than it was in the past. The outlook for 1986-90 is not more favorable. The fact that more projects are being proposed implies that the average loan size will decline in real terms thereby reinforcing the need to emphasize the Bank's role in catalyzing co-financing. Finally, since power projects are particularly attractive to co-financiers it is likely that most, if not all, of the Bank's power projects in 1982-86 will utilize this form of financing.

2.23 To date, most co-financing arrangements have been organized on an ad hoc basis, often resulting in extensive project delays while financing was being sought or while decisions on contract allocations were being made. The Bank has shown flexibility in allocating its financing to studies, civil works, and similar components less amenable to financing from private sources, but further efforts are necessary. A recent effort to explore the feasibility of establishing a Bank-administered fund of pre-committed export financing has

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1/ Participation by the entity and/or government is, of course, a universal feature of Bank project financing. This discussion refers to other sources, principally foreign exchange.

not been fruitful, and proposals to organize co-financing in conjunction with bidding on Bank contracts have been viewed with disfavor. However, several positive steps can be taken by Bank staff and borrowers at the project identification/preparation stage. Unfortunately, borrowers often delay arranging for co-financing in hopes that the Bank might at the last minute increase the amount of the loan to cover any shortfall. Therefore, early and open discussions of the likely ceilings on loan amounts are important. More effort to encourage borrowers to obtain precommitments for export credits (buyers' credits) and to explore the commercial markets is necessary in the early stages of project preparation. [1] Bank Projects staff can play a particularly important role in this area as well by evaluating the options for contract packaging and the resulting co-financing possibilities at the project preparation stage in order to establish reasonable limits of Bank financing, and these should be mentioned in the project brief. Requests for information on co-financing opportunities are increasing rapidly and some mechanism, other than the Monthly Operational Summary, is likely to be needed in the near future to respond to these inquiries. A reformulation of the project brief to permit extraction of relevant information on project technical details, expected contracting arrangements and packaging, and financing needs, may be required. Although the primary responsibility for arranging co-financing must remain with the borrower, there is ample scope for Bank staff, including Projects staff, to play more active roles in the identification and allocation of co-financing; however, such work would be staff intensive.

2.24 Creditworthiness will continue to be a major obstacle to expanding co-financing in low-income countries but, short of changing Bank policy on loan guarantees, umbrella arrangements are not likely to provide significantly more security to co-financiers although cross-effectiveness and cross default clauses might be used more aggressively for this purpose. Thus, securing financing for projects in low-income countries or those with deteriorating credit standings is likely to be a major obstacle to project execution in these countries. The Bank's role in these cases is uncertain but it clearly will be of major importance.

2.25 At present, co-financing arrangements with suppliers and commercial banks are "arms length" deals as far as the Bank is concerned. If co-financing is to be accelerated, more use of joint financing may be necessary. Innovative contract packaging and procurement procedures offer possibilities for achieving this and staff should be encouraged to come forward with proposals for such arrangements at an early stage. This may require that the Bank adjust its procurement policies to permit organizing co-financing during the bidding process so that Bank funds can be used to meet downpayments or to provide a specific (small) percentage of contract financing. EGY/PAU has been working closely with the office of Senior Adviser for Co-Financing to explore such alternatives, but now it may be desirable to

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1 The reader is urged to review Staff Working Paper 409, "The Changing Nature of Export Credit Finance", July 1980, for a discussion of the current status of the export-credit market.

establish a more formal system or procedure for early identification of project components that are suitable for co-financing.

2.26 In the earlier years the Bank was instrumental in assisting borrowers in arranging the issuance of shares and bonds in both local and world markets. The need for these services diminished as governments acquired ownership of sector assets and tended to arrange external financing through export credits or direct balance-of-payment borrowings from commercial banks. Although today the Bank would be hard-pressed to muster staff with in-depth expertise in this area, at least in the power sector, a return to project-related commercial bank borrowing may be beneficial both from a security aspect and as a means of obtaining longer payment terms. It should be noted that the use of medium-term commercial credit to finance assets (hydro projects) with long economic lives is the cause of many of the cash-flow problems faced by growing utilities today. Roll-overs, balloon payments and similar arrangements to deal with this problem can be more easily justified if the financing is related to a specific project, and the Bank should be in a position to advise borrowers on these matters. Adoption of efficiency pricing as proposed in this paper will improve financial performance in most cases, and may make access to private capital markets a realistic option. Although the relatively small size of local financial markets relative to sector needs is a constraint, both local and offshore sources might be tapped through innovative instruments such as bonds indexed to energy prices, and prospects should improve for sales of local share issues and similar equity paper. Bank staff should be sensitive to potential possibilities for including such arrangements in the creative financing plans that will be needed to mobilize resources of the magnitude indicated earlier in this paper.

2.27 The need for flexibility in allocating Bank finance to supplement other sources is leading to more complex multi-component "projects", and in a few cases to a sector approach. While sector lending, as defined in Annex A, OM 1.19, would appear to have many advantages for power, the large scale of sub-projects and the relatively advanced state of preparation required before the appraisal stage is reached in general preclude delegating the appraisal task to others except perhaps for distribution sub-projects. Therefore, moving toward multi-component or sector projects is likely to increase staff input requirements although innovative approaches, such as involving the borrower in appraisal report preparation (Brazil), and making more use of post-award procurement review may ease this burden somewhat. Periodic and detailed reviews of borrowers' investment programs coupled with more intensive procurement reviews, but less concern with specific project engineering (the Mexico approach), would, however, require much more supervision effort than is now usual for Bank power projects.

F. Choice of Borrower and On-Lending

2.28 Because of the emphasis on institution building, in accordance with OMS 1.25 the Bank prefers to lend directly to the entity which will carry out the project. When this is not possible (e.g. IDA credits), a direct contractual relation is established through a Project Agreement or similar

vehicle. In the FY78-80 review period about half of the power loans were made directly to the beneficiary agency compared with FY75-77 when 65% of the loans were made to such agencies. Although this shift toward lending directly to a government is not statistically significant, it is consistent, unfortunately, with the trend away from autonomy (para. 2.03). Governments have occasionally objected to the proposal to lend directly to beneficiary agencies and in most cases the Bank has acquiesced. Provided the direct contractual relationship is maintained, there is little short-term disadvantage in this. It does, however, raise basic questions about the long-term objective of Bank involvement in the sector and, therefore, goes beyond the simple question of legal precedence in which light these issues are usually cast.

2.29 When the beneficiary agency is not the borrower it is necessary to agree on some kind of onlending arrangement. Public utilities are not considered "commercially-oriented project entities" in the context of OMS 3.81; therefore, unlike DFCs or similar entities, onlending to power entities at Bank rates usually is accepted without a risk or guarantee fee since the ultimate beneficiaries are the power consumers and in most cases the revenue objective is set independently of borrowing costs (see OMS 3.72). If there are private shareholders who may benefit from the concessional element in Bank terms, or in accordance with Government policy in the sector, a lending fee or other premium may be charged. Alternatively, in cases where a government-owned utility is facing severe cash flow problems, onlending at low interest, or in rare cases transferring the funds as equity, may be justified as long as it does not result in hidden subsidies or prices less than LRMC. Responsibility for the exchange risk (it should rest with the beneficiary) is also relevant. This is not an issue that creates significant problems but there is some confusion and inconsistency in the way the Bank treats it, so this clarification of policy is desirable.

G. Program Planning and Project Justification

2.30 The 1971 Sector Working Paper identified power system planning as one of five "areas of challenge" for the Bank (the others being: pricing, village electrification, nuclear development and environment). Consequently, substantial effort went into developing improved models and methodologies for power system planning in the early 1970's. 1/ This work led to the now standard requirement that the prima facie evidence of the justification of a proposed power project is to show that it is a part of a least-cost development program for the system. Most project justification work must, of necessity, rely on feasibility studies prepared by the borrower or his consultant. Thus, Bank involvement at an early stage in reviewing the terms of reference and monitoring the progress of the feasibility study work is

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1/ e.g. see Dennis Anderson, Models for Determining Least-Cost Investments in Electricity Supply, World Bank Report Series, No. 2, 1972, and van der Tak, "The Economic Choice between Hydroelectric and Thermal Power Development", IBRD Occasional Paper No. 1, 1966.

necessary if the study is to meet this primary requirement. Unfortunately, such involvement is not the usual case and in fact is becoming rare. The majority of studies suffer because (i) all practicable alternatives have not been identified, (ii) the alternatives have not been prepared to the same standard as the proposed project with respect to cost estimates and risk assessment, (iii) the project and the alternatives have not been optimized using proper economic criteria, and (iv) loss reduction, load management and other demand management and system improvement techniques have not been considered an integral part of system planning. Project execution constraints, cost uncertainty, and time-of-completion risk analysis also deserve a more prominent place in feasibility studies and project appraisals. Aside from a deliberate effort to become more involved in the feasibility stage of project preparation, more specific guidelines for power project feasibility studies for use by Bank staff and borrowers may be helpful in alleviating some of the shortcomings noted above. It should be noted that EGY frequently receives requests from consultants and others for information and details on how the Bank "looks at" power projects. Resources permitting, preparation of such guidelines will be undertaken in FY82/83 by EGY/PAU.

2.31 The project justification task does not suffer from a lack of methodology. Work in the Bank and by others has produced numerous models, both simulation and linear, capable of handling the most complex system. Arrangements have been recently made for in-house capability to use the WASP III Model, developed by IAEA (International Atomic Energy Agency) from a model originally used by TVA. The intent is to provide a facility which may be used by Bank staff to verify a development program proposed by a country (or consultant), or to test the impact of efficiency and social prices on a program which has been developed using nominal costs. Although the utility of such exercises is acknowledged, it generally is not feasible for Bank staff to do these analyses since often neither the engineering data nor the time required are available. Moreover, it is becoming evident that the current uncertainties of project cost, risk, and timing cast doubt on the validity of least-cost programs derived from these models. The solution is not to dispense with models completely, but rather to add the capability to deal with risk and uncertainty, including such diverse aspects as transmission constraints, reliability, and probability estimates for costs and construction time. On the other hand, these complications make it essentially unfeasible for Bank staff to undertake the actual planning exercises even in a monitoring capacity. EGY/PAU intends to undertake a small research exercise to catalog the models that are available, and their applicability to the Bank's work, identify their advantages and weaknesses, and determine areas where additional work may be profitable.

Economic Analysis of Power Projects

2.32 Revenues from incremental power sales are used as a measure of benefits to calculate an internal economic rate of return (IERR) for each power project. This calculation is relevant to the investment decision only to the extent that the resultant rate of return is a useful lower bound, based on revenues that represent a minimum measure of economic benefits. A low rate of return (i.e., less than the opportunity cost of capital) generally

indicates that the average selling price is less than the LRMC of supply or economic efficiency price. Thus when calculated in this way, the IERR should be used as a check on the average tariff level rather than as an investment decision criterion. In fact, a power project is economically justified provided it forms a part of the least-cost investment program required to meet demand at economically efficient price levels. A low IERR, implying prices significantly below LRMC, does raise the issue as to whether an increase in the tariff might not choke off sufficient demand to justify a delay in the project or other changes in the investment program, and this question must be answered in the project justification analysis.

2.33 While the correct interpretation of the IERR based on incremental revenues avoids serious conceptual problems, in practice it is liable to misinterpretation. Thus, calculated rates of return are often relatively low (less than 10%) and also sometimes compare unfavorably with IERRs of projects in other sectors. The essence of the problem is that the full economic benefits should be measured by the willingness-to-pay (WTP) of electricity consumers. Revenues form the only directly observable part of this total benefit--a procedure in which consumer surplus is neglected. Studies to quantify this WTP by determining the value of a kWh foregone typically yield high figures, compared with the average LDC tariff of about 4¢/kWh, thus consumer surplus is quite high. In practice, it is virtually impossible to estimate the WTP (except in certain special cases) and therefore the revenue-based IERR is likely to be significantly lower than the true IERR.

2.34 In an attempt to capture some of the consumer surplus in the calculation, various combinations of future tariffs, and expenditures on alternatives (kerosene, batteries, diesel irrigation pumps, autogeneration, etc.), are frequently included in the benefits. This results in a higher rate of return, closer to the "real" economic rate of return, but still of little relevance to the investment decision. Furthermore, since projects almost never cover complete systems, revenues and costs must be allocated among the various system components to obtain a return on the specific project investment. There are several methods for doing this, each more or less acceptable, but having differing results. Because of the varying methods used and the differing assumptions, comparison of calculated returns among power projects, or with projects in other sectors, is not meaningful.

2.35 Some degree of standardization is needed to improve the usefulness of this calculation. To be consistent with the emphasis on efficiency pricing, the rate of return calculation should be the return on the entire investment program (including the project), using expected incremental revenues (in real terms) as benefits, and economic costs for all inputs. This presumes that the investment program has been demonstrated to be the least-cost investment program required to meet demand at economically efficient price levels, and requires an explicit judgement that the price levels do not exceed a reasonable willingness-to-pay. If desired, a supplemental calculation may be made using demonstrated willingness-to-pay for alternatives which will be supplanted by the proposed program. Care should be taken to explain the basis of the calculations in the appraisal and president's reports to prevent misunderstandings concerning the implications of the rates of return.

International Interconnection

2.36 As systems grow, international interconnection is becoming an increasingly viable alternative which deserves more study, particularly with regard to system planning. This would be particularly useful if done for several markets in western and eastern Africa, Central America, western Asia, the sub-continent and central South America. Interconnections are not rare in developing countries, and they tend to exclude situations which create dependence by one party on the other. Thus, "net-zero interchange" connections, border-town sales, marginal imports and similar arrangements are common, having survived wars and other political disturbances. On the other hand, integrated regional planning for power development is rare.

2.37 The Bank has no policy statement on this issue and EGY/PAU will explore the need for one. In on-going situations, a pragmatic approach has been taken which acknowledges that countries can legitimately consider security as an objective in planning power development but at the same time should not ignore the possibilities for imports in association with appropriate back-up facilities. As a corollary, the Bank has discouraged power developments intended primarily to supply an export market (Swaziland) unless it is likely that the exports can be sold at prices which will fully recover long-term costs and ensure that the supplier retains a fair share of the consumer benefits. This is akin to the policy recommended for enclave projects (e.g. aluminum smelters). These principles are straightforward but on occasion inconsistencies do arise. Besides, the Bank's role in promoting regional interconnection is perceived differently among the regions. For example, Western Africa is sponsoring a regional interconnection study among the central coastal countries and is taking an integral approach in project preparation; other regions are less aggressive.

Conservation and Efficiency

2.38 The shift in the structure of energy costs over the last few years has rather suddenly rendered most systems economically sub-optimal. Studies being carried out by the Bank and elsewhere indicate that the highest rates of return on funds available for system investment are likely to be realized from expenditures on rehabilitation, load management, plant efficiency improvements, and better operating procedures. Unfortunately, these investments fall outside the usual purview of system planners, and feasibility studies investigating alternatives for system expansion seldom focus on the prospects for meeting new demands through more efficient use of existing facilities (India). Moreover, because such investments usually come under the operating budgets of the power entities, they do not gain a place in the portfolios of the planning ministries or other government core agencies. Consequently, they are not in the project list usually discussed with the Bank at the programming stage. Since Programs staff are most often involved in these discussions, they should take special care to ensure that such project opportunities are not overlooked.

2.39 Preparation of conservation projects is also difficult because it involves assessments of changes to existing facilities, which lacks the

neatness and glamour of new development. Furthermore, conservation "projects" usually comprise a blend of investment (rehabilitation, upgrading, retrofitting) and procedural changes and are thus management intensive, a commodity often in scarce supply in developing countries. For example, recent advances in long-term and short-term hydrometeorological forecasting appear to offer good prospects for enhancing system dispatching and operating efficiencies in the mixed hydro/thermal systems typical of most developing countries. However, the utilization of these advances first requires an awareness that these new techniques exist and secondly the capacity to implement them.

2.40 Power systems are often perceived as the best place to look for opportunities to reduce oil consumption. In fact, the opportunities are not as good as might be expected. In many countries the bulk of the oil consumed in the power sector is by peaking stations and to support hydro capacity in dry years. Replacement of such capacity is generally not economic even at today's oil prices, and conversion to other fuels, such as coal, is not technically feasible unless the plants were originally designed to use coal--a rare situation in LDCs. Opportunities for oil substitution do exist in three areas and these deserve more attention in sector work and project preparation:

(a) Improving oil-fired generating plant efficiency through improved operating procedures and some retrofitting of new controls, fan drives, etc. can yield large annual savings.

(b) Most system planning is based on adding new capacity to meet load growth. However, deliberate acceleration of new coal and hydro plants to replace base-load oil plants is usually economical. It is essential that system planning models based on simulation studies include such accelerated plans among the alternatives tested.

(c) If hydro capacity is available (and in some cases, coal), the major opportunity for oil substitution is through "electrification" of the energy sector by replacing oil-based equipment in industry and elsewhere with electric utilization devices (e.g. boilers). Bank staff should deliberately seek out opportunities for such substitution either directly or in conjunction with studies in other sectors. Aggressive programs in this area can have a significant impact on power growth forecasts.

2.41 To date, most of the emphasis in this area in Bank projects has been on loss reduction (reducing the proportion of energy generated that is "lost or unaccounted for") but little distinction has been made between the reduction of technical losses, which improves system efficiency and reduces capacity requirements, and the reduction of financial losses through better metering, accurate billing and the elimination of theft. Although both present serious problems, only technical losses are considered true economic losses since it is assumed that energy which is stolen or incorrectly metered is used productively, even though the utility may suffer a revenue loss thereby. Consequently, the reduction of technical losses should receive first priority in any system improvement program. Other losses (theft, poor metering practices) are financially important to an entity and obviously should not be ignored, but procedures for dealing with these through

improvements in metering and billing practices, criminal legislation, disconnection policies and other measures are relatively well developed and are often addressed through specific conditions attached to Bank loans.

2.42 The savings to an economy from technical loss reduction can be quite significant. Although usual "rules of thumb" consider losses below 15% as being reasonable or even quite good, latest planning criteria in Europe, for example, call for losses of 3% or less in distribution systems. Investments to reduce technical losses to 6% or less is probably economic now in most systems. An estimated two-thirds of the developing countries have losses that are higher than optimal but very little is being done to deal with this problem. For example, assuming that technical losses are 10% higher than optimal in Pakistan, the annual cost of these losses is about $50 million. Current research sponsored by EGY/PAU is aimed at improving the methodology for determining technical losses and at establishing priorities among investment opportunities in various parts of the system (reconductoring, power factor correction, substation equipment, MV feeders etc). It is important to note that, because capital costs for constructing new generating plants have increased almost as rapidly as oil prices, the monetary savings due to a reduction in demand (kW) are as large as the savings due to reduction in energy losses (kWh). Thus, loss reduction should be investigated even in countries that have systems based on low-cost energy sources (hydro, geothermal, mine-mouth coal).

2.43 In the FY78-80 reference period 28 projects (45%) included components which will result in improvements in system efficiency but in only five of these was efficiency improvement identified as a specific objective of the project. This indicates that this criterion has not yet taken its place alongside capacity additions and system expansion in the project identification and selection process. Obviously, Bank power staff must be continually on the alert for new opportunities to achieve efficiency improvements but more formal procedures for identification and assessment of conservation opportunities through efficiency studies as part of project preparation, and for the inclusion of operations audits in Bank projects are needed. For its part, EGY/PAU will place more emphasis on identification and dissemination of state-of-the-art information on demand management, retrofitting and similar techniques. The proposed research program (Annex I) is designed to support this effort.

Project Implementation

2.44 Because of the capital-intensive nature of power projects and the high economic cost associated with shortfalls in electric power capacity, the costs to an economy of project delays can be substantial, often exceeding the concessional element of Bank financing or other official aid. In today's inflationary environment delays also usually result in cost overruns which make mincemeat out of project financing plans. Bank guidelines (e.g. OMS 3.55) encourage project officers to build implementation monitoring devices into projects and require the use of planning and monitoring tools such as computer-based systems like CPM or PERT. The Bank's training program includes courses on construction project management and incentive contracting measures

designed to improve project implementation efficiency. But, in fact, little emphasis has been placed on project execution measures in the power sector. This is largely because specific requirements are considered unnecessary since projects are carried out under the supervision of competent consultants or borrowers. As a consequence, none of the power projects approved in FY78-80 included specific legal clauses with respect to project implementation (other than the standard "due diligence" and monitoring clause), and cases were rare where the Bank intervened to seek changes in contract format or to take other measures to improve implementation efficiency. Unfortunately, experience does not support the optimistic assessment of consultant and borrower performance. Half of the project completion reports reviewed in 1978-80 indicated unjustified time overruns on project completion and current experience is not encouraging. Implementation delays are becoming common, especially delays associated with shortages of local currency. For example, the 1980 Fall Project Implementation Review indicated that 40% of power projects were experiencing implementation delays.

2.45 Better supervision is not necessarily the key to this issue. The remedies proposed presume that supervision is adequate, and it probably is unrealistic to expect Bank staff to do more than is already being done at that late stage in the project cycle. However, better attention to the proposed implementation arangements at the appraisal stage would pay dividends. In this respect, it would be useful to add to appraisal reports a statement concerning the proposed contracting arrangements and indicating what incentive and/or penalty provisions are proposed. Managers should encourage staff to take advantage of training opportunities in contracting and project management. The "Construction Manager" approach is seldom used in Bank-financed projects, partly because of borrower resistance to the delegation of procurement responsibility that is inherent in this approach. Even so, more use of this technique, "fast tracking" and similar contracting procedures which emphasize timeliness and shared risks and incentives between owner and contractor would seem desirable. EGY/PAU will endeavor to stress these points during preparation and appraisal reviews.

H. Rural Electrification

2.46 Formal Bank lending for rural electrification (R.E.) started only in FY76 following publication of the rural electrification policy paper.[1/] Earlier projects frequently included rural electrification components to support productivity increases in rural environments but there was no specific policy for evaluating and approving such components. Today, most power sector studies include discussions of access to service and an evaluation of country policies concerning connection charges, grid extensions, and rural electrification programs. In addition, institutional and organizational obstacles hindering expansion of service are hopefully identified and dealt with as part of project activities. However, rural electrification projects

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1/ Rural Electrification. A World Bank Paper, October, 1975.

per se are not seen as especially good vehicles for Bank lending. This is not because of any serious doubt about the justification for such operations, despite research findings indicating that electricity is low on the list of priorities of the rural poor [1/], but rather because they are not seen as particularly useful in the usual institution-building function of Bank power projects. Moreover, R.E. operations concern projects which are capable of attracting financing from a wide variety of sources, often on concessional terms. Consequently, the Bank's participation does not necessarily result in additional resource transfers. Recent experience has shown that the Bank can play a needed role in R.E. projects by (i) coordinating other aid sources, (ii) using more rigorous economic analysis for project justification and as an aid to prioritizing sub-projects (a task usually subject to strong political intervention) and (iii) optimizing design standards. As resources dwindle this task of sorting out the politically-inspired from the truly worthy is becoming increasingly important. It is also necessary to ensure that good programs are not shelved simply because their justification can't be proven. Unfortunately, there is a cost attached to these improvements since properly-prepared rural electrification projects can absorb two to three times as much staff time as projects in more conventional parts of the sector. However, if the central agencies are reasonably strong and efficient, if rural electrification accounts for a large part of the sector program (India, Bangladesh), or if the Bank can play an effective role in establishing planning criteria for rural projects or by coordinating co-financing, then participation in rural programs is well justified.

2.47 More explicit guidelines for evaluating the social benefits of rural electrification projects are needed to establish a better analytical base for designing these projects. Irrigation pumping, food processing, artisan-scale manufacturing and similar productive activities account for the major share of the benefits of R.E. but measurement of these, like similar benefits elsewhere in the system, is difficult. In this regard, the work done on village incomes and social pricing in recent R.E. projects (Morocco, Egypt), as well as the quantified analysis of post-completion evaluations recently conducted by other financing agencies and the countries themselves (Philippines, India) could be used as starting points. R.E. projects are perceived as being vehicles of change because they appear to bring direct benefits to a disadvantaged part of the population, but hard evidence to support this is lacking. Since the Bank now has been involved directly in R.E. for some years, a Bank-style review of such lending may yield information which would be useful in planning further Bank activities in this part of the sector. Such a study should be undertaken, perhaps by OED, but aside from completing the research work on the technical aspects of R.E. standards, nothing more formal is proposed in the EGY/PAU program.

2.48 In the early years R.E. projects typically do not generate enough revenue to cover costs because of the time required for demand to increase to

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1/ Judith Tendler, "Rural Electrification, Linkages and Justifications," USAID, 1972.

economic levels, therefore most Bank-financed rural electrification projects will continue to demand lenient treatment with respect to financial earnings covenants. This is acceptable provided R.E. tariffs, as in other parts of the sector, are set to cover LRMC. Subsidies in R.E. projects are common but should not exceed the difference between LRMC and the (higher) revenues necessary to achieve financial viability. Although social reasons are often cited for subsidizing R.E. programs, in fact the principal beneficiaries are usually large landholders and similar producers and subsidies may actually represent transfers from poorer consumers. For this reason, emphasis on LRMC-based prices is particularly important in R.E. projects, and "socially-mandated" prices should not be accepted without scrutiny. Because of the marginal economic nature of most R.E., projects, it is especially important to investigate the planning basis for the program. In this respect, Bank-supported R.E. projects should comply with five supplementary criteria: (i) the project should be part of an integrated rural development program, (ii) sub-project priorities within the program should have an economic basis, (iii) a proven market with a developed cash economy should exist, (iv) project designs should follow least-cost practices appropriate to the market, and (v) the entity responsible for operating the project should have a proven capability to maintain and expand the system, or a mechanism for developing such a capability should be included in the project.

I. Nuclear Power

2.49 The Bank's lending policy for nuclear power was set out in the 1975 policy paper, Nuclear Power: Its Significance for the Developing World. This report concluded that no new policy issues were raised as nuclear power was simply another option to be considered when searching for the least-cost solution. It cautioned, however, that a lot of up-front effort on training and safety considerations was necessary and the Bank could play a role by administering nuclear technical assistance programs and financing specialty consultant services. There was also some expectation that Bank participation in the direct financing of nuclear projects would provide some assurance that the projects would be carefully studied and constructed.

2.50 In fact, aside from a very early Italian project, the Bank has provided no direct financing for nuclear power and very little Bank funding has been applied to nuclear training and studies. The coordinating and guiding role envisaged in the 1975 paper has not materialized and the Bank no longer has explicit in-house expertise in nuclear power technology, especially in areas such as training, safety and waste disposal.

2.51 In part, the absence of Bank financing for nuclear power is the result of delays in the nuclear programs in developing countries but also because of growing concerns about safety and reliability, and public objection to nuclear power. However, the systems have not stopped growing and it is reasonable to expect that more LDC power development programs will contain economically justified nuclear projects. Although it is still expected that bilateral sources will provide the needed financing for the nuclear steam supply components of nuclear projects in conjunction with technology transfer and fuel processing agreements, the escalating cost of nuclear plants makes it

likely that other financing sources, including the Bank, will be approached to finance the "balance-of-plant". (Romania requested Bank finance for a nuclear project in 1979 but subsequently withdrew; Egypt is revising its nuclear program and may request Bank participation). Nevertheless, export credits should be available to cover most of this expensive hardware and it would be preferable for the Bank to confine its financing to training and studies, or other parts of the program less likely to attract financing.

2.52 There have been no significant commercial developments since 1975 which would warrant a shift in Bank policy but in anticipation of possible requests for Bank endorsement of power programs containing nuclear plants, sector evaluations in nuclear-eligible countries [1/] should include explicit assessments of nuclear training and safety programs. Consultants can be used for this purpose if necessary. Furthermore, EGY/PAU is rebuilding the Bank's links with IAEA, which were recently weakened by transfers and staff changes in both institutions. Following this and provided resources are available, a review of the 1975 policy paper will be undertaken to clarify the Bank's position and to recommend project pre-conditions in areas of training, nuclear waste disposal, safety, siting, non-proliferation, and other issues that have achieved prominence since 1975 and which were not covered specifically in the policy paper.

2.53 The list of nuclear eligible countries assumes that the minimum economic size for nuclear units will remain at about 600 MW. Recent interest has been expressed in smaller units specifically for use in developing countries; France in particular is marketing a 120-MW unit based on submarine technology and the U.K. has developed a 300-MW unit specifically aimed at smaller markets. It is unlikely that units smaller than about 600 MW can be manufactured at costs which would make them competitive with alternative plants (coal, for example). However, aggressive sales tactics and subsidized price structures may make the introduction of small units attractive to some countries (Tunisia, Algeria). Should this materialize, the nuclear program in developing countries will take on a completely new and demanding character. There is little the Bank can do at this stage to prepare for such an eventuality, but EGY/PAU will continue to monitor this aspect of nuclear development to provide as much "early warning" to regional staff as is feasible. A corollary issue concerns nuclear-eligible countries' proposals to start constructing nuclear plants for training purposes, even though such facilities have not been shown to be part of a least-cost program. The Bank should resist such proposals since, in general, the training function can be accomplished more quickly and efficiently, and at lower cost, through a combination of research-scale facilities (medical and agricultural isotopes) and overseas training in large-scale power operations.

1/ Argentina, Brazil, Egypt, India, Mexico, Pakistan, Philippines, Portugal, Republic of Korea, Romania, Thailand, Turkey, Yugoslavia.

J. Hydro and Other Renewable Sources

2.54 A recent review of hydropower programs in developing countries indicates that, with few exceptions, work on feasibility studies and imple mentation of large-scale hydropower projects is proceeding satisfactorily and at a rate which takes account of resource costs and the potential for shifting away from oil, but additional effort is needed to identify small-scale resources and to upgrade hydrological resource data. Bank staff and country planners alike are still seeking out prospects for international intercon nections and large multi-national projects, although few such viable projects have been identified, contrary to the hopes of energy planners. However, there is scope for innovation and change at the other end of the scale. Traditional feasibility study approaches are site-specific and often dismiss small sites as being uneconomic or outside their scope even though such pro-jects, say of 5 MW or above, may be large enough to be considered "projects" in their own right. Moreover, given today's high escalation rates and the long construction periods for large projects, a program of several small projects may be preferable even though the unit costs are higher. Bank engineers are expected to review each major hydro feasibility study critically to ensure that prospects for smaller project alternatives have not been over looked, including benefits for purposes other than power. The UNDP, in coope ration with the Bank, is funding a large program of pre-investment studies for new and renewable resources, including hydro, as an outgrowth of the 1981 Nairobi renewable energy conference. The Bank may be asked to play a large role of identifying and managing studies to be conducted under this program.

2.55 The prospects for smaller projects ("mini" hydro, say 50 kW to 2 MW) are not quite as good because their benefits are usually insufficient to justify site-specific feasibility studies. In any event the human resources are simply not available in most countries to undertake the large number of such studies which are required if smaller hydro projects are to make a meaningful contribution to a country's energy supply. The Bank and other development agencies are financing demonstration-scale "mini" hydro projects in several countries but a satisfactory formula for dealing with large numbers of these projects on a program scale has not yet evolved. Even though the total sum of such projects is not likely to make a signifcant contribution to the world energy supply, this activity is worthwhile. EGY/PAU has initiated discussions with other agencies in this field and intends to commission a study of "macro" methodologies which could lead to feasibility studies for projects consisting of large numbers of sub-projects. This may be done in conjunction with a project in Malaysia scheduled for FY82. Although small-scale hydro has been perceived by proponents as having primary potential for bringing electricity to rural areas not presently supplied, it is likely that its principal role (at least initially) will be to supplant or supplement diesel-based generation in existing isolated systems. For this reason "mini" hydro should not be planned solely in the context of rural development.

2.56 At the lowest end of the the scale, there seems to be little scope for including "micro" hydro (0.5 - 50 kW) in the Bank's power program. Instead, projects in this category should receive attention through the renewable energies program, rural development and similar efforts aimed at individual consumers.

Safety of Dams

2.57 The failure of some European dams in the 1960's and the implementation difficulties experienced at the Tarbela project in Pakistan in the mid-70's focused attention on the Bank's role in assuring the safety of projects which it financed and which contained large dams. OMS 3.80, issued in June 1977, imposed three requirements: (i) review of the project concept and design by an independent panel of experts, (ii) a covenanted undertaking to monitor, inspect and maintain the dam, and (iii) a review of past projects financed by the Bank to determine whether proper monitoring procedures were being followed, and whether covenants should be included in repeater loans to require monitoring of past projects. Since issuance of the OMS, monitoring covenants have been included routinely in loans for projects containing large dams. The standard monitoring covenant requires only that a satisfactory monitoring program be submitted to the Bank one year prior to completion of the project. Thus, given the usual construction time, such programs are only just beginning to be received in the Bank. Also, although an initial survey of past projects with large dams was undertaken in 1977/78, follow up as required by the OMS has not been consistent from region to region.

2.58 A major problem is that the Bank lacks the in-house capacity in the power sector, and to a lesser extent in AGR and TWT, to effectively monitor these undertakings. A CPN on dam safety is under preparation by AGR with input from EGY and TWT. This will provide guidelines on evaluating monitoring programs and will include suggested terms of reference for review panels. Even so, the monitoring of dam safety is a complex and highly technical subject which, given the implied responsibility assumed by the Bank in reviewing such programs, deserves more careful attention. Establishing a central point within CPS to oversee this program and to provide specialized advice on the technical aspects of dam safety would appear to be desirable to achieve the objectives of the dam safety program, and establishment of a standing expert panel on dam safety would be worthwhile. Until that time, regional divisions should continue to engage specialized consultants to assist in the review of the safety aspects of dam projects within their purview and to evaluate the proposed monitoring systems.

Other New and Renewable Sources

2.59 The recent Bank study on renewable energy potential 1/ indicated that there would be no radical change in Bank power operations with respect to renewable resources other than small hydro since available alternatives are not yet commonly cost effective for additions to power grids, even small ones. Successful applications are more likely to be task-specific like solar water heating and crop drying, neither of which represent significant power loads in LDCs. Even so, power projects can be useful vehicles for credit schemes to support these alternatives, including conservation. The prospects

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1/ "Renewable Energy Resources in the Developing Countries," November 1980.

for central-scale alternatives using renewable resources, while not bright, are far from hopeless and deserve deliberate attention by Bank staff in formulating power development programs. If ready stocks of combustible material are available, thermal plants (steam or pyrolytic conversion) using agricultural and wood wastes can be economic system additions, and in this regard sugar-growing countries should make every effort to ensure that bagasse is being used completely and efficiently. Ocean thermal conversion (OTEC) is being promoted aggressively in some countries but is not yet a proven technology, except in very small scale. Economic prospects for OTEC are brightest where open-cycle equipment can be used to produce fresh water along with electric power, and small prototype units are being installed where conditions are good as in some Caribbean sites (high ocean temperature differentials, power and water systems based on diesel generation and desalinization). Costs of wind-powered induction generators are approaching economic levels when the available energy can be absorbed in oil-based systems, but the requisite site surveys often have not been made. These surveys require relatively long record periods, akin to hydro development, therefore Bank projects commonly could include many more study components to collect data on renewable resources. There seems to be ample awareness of this issue in most countries, often abetted by the Bank's energy sector assessment mission recommendations, and some data collection systems are being put in place but Bank power staff need to be alert to opportunities to include wind prospects and other renewable alternatives in the longer term plans.

2.60 The cost of supporting equipment (e.g. batteries, transformers, and AC/DC converters) at present appears to pose an obstacle to commercialization of large-scale solar power systems. This includes photovoltaic and thermal systems. However, household scale systems to substitute for kerosene lighting and to provide modest power for radio and TV may be acceptable alternatives where demand centers are scattered or non-household demand is insufficient to justify grid extension or decentralized systems. Similarly, other technologies are approaching the marketable stage and may find a place in future programs: for example, fuel cells, which run well on 50% hydrous alcohol and therefore can be coupled synergistically with simple fermentation/ distillation processes, and low-Btu gas which can be produced from waste digesters and wood or coal gasifiers. EGY/PAU will make every effort to stay abreast with the state-of-the-art in these fields as well as with larger-scale technology such as co-generation, geothermal, combined cycle and other developments in conventional plant (actually quite promising). In addition, it will continue to monitor these developments and bring them to the attention of interested staff through seminars and other appropriate vehicles.

K. The Environment

2.61 Present policy monitoring procedures and staff awareness ensure that the Bank is unlikely to participate unwittingly in projects which would cause significant social or ecological harm. In fact, in many cases it seems that the Bank's emphasis on these issues exceeds that of its borrowers, which is all to the good. The operational issues raised in this connection are more subtle, e.g. failure of project evaluation and planning to take account of the costs and time constraints imposed by environmental effects, delays in project

implementation caused by difficulties in dealing with population resettlement in hydro reservoir areas, and borrowers' inattention to putting monitoring systems and environmental protection facilities into place. These problems seem to be particularly difficult in the power sector because the implementing agencies typically are technically oriented and not especially sensitive to these issues, or they have a long history of dealing with such matters as population resettlement and are not attuned to the increased awareness of environmental issues in the developing countries as well as in other parts of the world. These concerns have added to the operational difficulties arising from energy price increases and the growth demands that already face the sector. In addition, the project alternatives now being considered--more complex hydro projects and greater use of coal in particular--have potentially larger environmental consequences.

2.62 There are several implications for Bank operations in the sector. Resettlement issues are dominant in many hydro projects and require careful planning and costing as an integral part of project feasibility and engineering studies. Bank staff need not be reminded of this since it is of uppermost concern in the preparation of any project involving resettlement, and accordingly loan conditions requiring submission of detailed resettlement plans are common features of such projects. The major problems arise, however, at the implementation stage. Often, the Bank needs to play a stronger coordinating role to ensure that the implementing agency receives adequate support from other parts of the government, especially legal, agriculture, and the social ministries. The Office of the Environmental Adviser (PAS) should be contacted at the earliest possible stage to provide assistance in these matters. Experience gained on other projects can be useful. For example, premature acquisition of land and land rights has led to difficulties in some projects because tenants reacquire rights and sometimes refuse to leave if several years intervene between land acquisition and start of construction. Thus, this issue has to be dealt with as an integral part of the construction program and of general project planning. On the other hand, the environmental impact of coal-fired power stations may require the creation of pollution control agencies and related legislation at a very early stage in the project, and substantial pre-project air and water quality monitoring to support these agencies. The Bank's role in the sector here is not to impose standards taken arbitrarily from elsewhere but rather to assist governments in identifying and costing policies appropriate to their particular circumstances. In general, it can be said that Bank staff need to give substantially more attention to potential environmental issues in projects where the threat to the environment is not immediately evident. Coal and lignite projects are obvious candidates but the environmental issues associated with other forms of generation, particularly geothermal, may be equally serious.

SECTION III

THE BANK'S RESOURCES IN THE POWER SECTOR

A. Regional Power Staff (Human Resources)

Staff Characteristics

3.01 As of September 30, 1980, there were 52 K-M level staff assigned to power in the seven regional divisions responsible for power activities (three of the divisions also included staff responsible for water supply). This very small cadre of skilled professionals (2% of total Bank J-Q staff or 5.7% of Projects' operational staff) was responsible for 16% of total Bank lending (nearly $5 billion) in FY78-80. As a result of filling vacancies and eight new authorized positions, the power staff complement as of August 31, 1981, was 64, but this increase was not sufficient to reflect the growth in the operations program (Annex I). Whereas power is second with regard to lending and fourth in number of projects, it ranks eighth in operational staff (see Table 6, Annex I). As a consequence, manpower coefficients for lending and supervision, and CPS advisory input are the lowest of any sector.

3.02 The mix of technical specialists has not changed appreciably over the years. An engineer supported by a financial analyst (although now occasionally the other way around) forms the basic project team, with advisory input by an economist. A typical division is staffed by five engineers, three financial analysts and one economist. The small number of economists is noteworthy because the role of the economist has been increasing and much of the economic work in the sector is, in fact, done by non-economists. Due to the necessity of dealing with pricing issues, economic rate of return calculations involving efficiency and social pricing, and similar concepts, the economist is now more frequently an essential component of the project team. As a result, the operations divisions are understaffed in the economic field. Managers are attempting to adjust their staffing complements to recognize this but are bound by a budget system based on historical coefficients in which the technical and financial inputs are already considered to be irreducible.

3.03 The average division forms an almost sub-critical mass when language constraints are taken into consideration. The staffing pattern, a legacy of the 1972 re-organization, offers little opportunity for specialization or flexibility, and obviously the EGY power advisory unit can offer little direct technical support. Adoption of matrix management [1/] would permit more flexible utilization of staff with varying technical qualifications but even if this were done, resource constraints would inhibit mounting multi-man

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1/ A form or organization used widely in technical and research firms wherein each individual is responsible to two supervisors: one for administration and one for technical quality.

missions since the skill requirements are predetermined by the traditional operations pattern used for power projects in the Bank.

Future Staffing

3.04 Given the scope of the sectoral changes outlined in this paper, historical staffing coefficients are not reliable guides to future staffing needs. Nonetheless, even using historical coefficients, the growth in the operations program in FYs 82-84 (Annex I) indicates that staffing increases of 22% in the power divisions would be required. The seven regional power divisions have a sustained processing capacity of about 22 projects per year but in order to address the issues outlined in Section II a lending program approaching 30 projects per year would be appropriate. The driving force here includes, i.a. the expansion of lending into some 14 new countries, mostly in Africa, in 1981-85. An attempt has been made to quantify the staffing implications of this paper and this indicates that doubling the complement of power staff over the next three years would probably be cost effective. Obviously, this is unlikely to happen, and not solely because of limitations on the Bank's administrative budget. Even if there were no other constraints, there is a limit to the rate at which divisions can absorb new staff which is related to the amount of training required. Also, there is a scarcity of qualified candidates--recruiting power engineers to cope with the 30% turnover in this specialty in the last two years has proven to be difficult; neither is there a pool of qualified economists and financial analysts, and in some cases vacancies have gone unfilled for more than a year.

3.05 Support and cooperation from all levels of management, as well as PMD, will be required if the Bank is to cope successfully with the staffing issues in the sector. More flexibility is needed in allocating posts. Recruitment efforts should be continuous regardless of the actual vacancy situation, and we need some budget mechanism for bringing good candidates on board even if a specific vacancy does not exist (as of end-81 the Bank had ceased active recruiting of power economists, in spite of sectoral needs, because there was no identified vacancy). Since the Bank cannot afford to downgrade project quality it must, therefore, recognize the implications of this staffing dilemma. The solution will be evolutionary, not revolutionary. Managers need to allow incremental additional resources to provide for increased on-the-job training. Although a sound knowledge of the electric utility business will continue to be an irreplacable element in project teams, some specialization in technical fields can be accommodated if unit managers are assured of the resources necessary to plan an adequate training program and to move toward mutli-discipline staffing of missions dealing with complex projects.

Experience

3.06 Given the Bank's emphasis on institution building, in-depth experience in public utility engineering, management or finance has long been a principal criterion for employment in a power division. Although direct experience in a utility is considered desirable, staff have come from related

organizations including consultant agencies, other development banks and securities firms. All of the power engineers in the Bank have a direct utilities background and four of them are procurement specialists with training in that field. Over half of the engineers had more than 15 years experience in utility engineering and management before joining the Bank. However, in the past few years due to recruitment difficulties and a deliberate effort to provide Programs and economic staff with increased opportunities for interchange among the sectors, this criterion has been relaxed for financial analysts. Now as a result less than half of the financial analysts have had pre-Bank public utility or related experience in utility financing. Similar trends are appearing in power engineer recruitment since individuals with the required broad utility background are becoming scarce. Managers are accepting candidates with more narrow technical backgrounds (although familiarity with the utility business is still a must) and are teaming them with senior financial analysts who have operations experience in the sector. This has increased the training burden on CPS advisory staff but the overall outcome has been successful and will continue to be so provided appraisal teams can include at least one member who is thoroughly grounded in public utility management and operations.

Recruitment

3.07 The issue of power engineer recruitment is perennial and has been growing worse since the early 1970's. Energy economists, and to a lesser extent financial analysts, also present recruitment problems which are worsening. The combination of circumstances responsible for this are: (i) the disappearance from the "market" of the mobile broad-based engineer/manager, (ii) the indigenization of management posts in utilities in developing countries with incumbents who have no desire to work abroad, (iii) increasing specialization in western utilities so that the only attractive candidates are those in or near top management, and (iv) a decline in the Bank's competitive position. At the same time, since most power missions are already staffed at an irreducible minimum (two individuals for appraisal, often only one for supervision), the demand for even broader skills has increased with the Bank's move into energy, renewables and conservation, and with the increasing sophistication of the Bank's borrowers in the sector. For example, the terms of reference for a recent supervision mission to a small country required that the engineer review the draft feasibility report on one hydro project and initiate studies on two others, determine progress on a distribution loss-reduction program, review the technical designs for a rural electrification project, discuss consultants' recommendations on organization and management, determine whether a project on oil-to-coal conversion was worthwhile, and supervise the on-going thermal generation and transmission project. Such broad requirements are not unusual but one wonders whether even a paragon could do an adequate job on all these tasks.

Training

3.08 Even organizations with more liberal resources than the Bank are faced with similar recruitment problems. To some extent this reflects a shift

in the education patterns in the U.S. and elsewhere. Power engineering is no longer taught as a technical specialty in most engineering schools. As a result, utilities, consulting firms and others who need such skills have developed in-house training programs to meet their requirements for technical specialists. The Bank has neither the capability nor the resources to undertake broad technical training beyond the state-of-the-art seminars that are presently arranged, but in addition to language training and the usual in-house operations courses, it would be possible to arrange ad hoc training in system modelling and program development, distribution engineering , or other specialities. More planned use of the EDI power projects training course, which usually can accommodate two or three Bank staff, would be beneficial and thought should be given to expanding it into an in-house training program. The USDA graduate school power course is an option to be considered. An extended period of working with more experienced staff must also be allowed for as the present "one shot" training and familiarization mission for new staff is far from adequate.

3.09 To bridge these training gaps attempts have been made to arrange secondments from major overseas utilities, but generally without success except for a good working relationship with Electricite de France and the Irish Electricity Supply Board. Although initial contacts were disappointing, prospects for such arrangements with U.S. utilities need to be explored more thoroughly as a mechanism for providing broader experience to otherwise qualified candidates. TVA has recently expressed interest in working with the Bank in energy development. As a corollary, prospects for seconding Bank staff to utilities, investment banks, and similar institutions for sabbaticals or similar training and refresher programs need to be explored, particularly for financial analysts. Although virtually no power staff have participated in the sabbatical program, managers should consider this possibility, or an equivalent substitute, as an integral part of the professional development program. Many of these issues were identified in the 1981 Bankwide training review, and EGY/PAU is working with the training division of PMD to develop a program responsive to the needs.

Reassignment

3.10 Attempts at arranging formal succession and rotation schedules among power staff have not been successful, especially for power engineers. This matter is constantly under review by PMD with assistance from EGY/PAU, but experience has shown that vacancies and promotional opportunities are so unpredictable and the staff pool so small that even prearranged rotational shifts seldom work out in practice. The lack of a formal system, however, has not inhibited rotation. Only 19% of present power staff have been in post over 5 years and prospective rotational assignments are being arranged for these individuals. Over half of power staff have been in post less than 3 years.

B. The Work Program

3.11 Table 3.1 shows an activity breakdown of the power work program managed by the regional divisions in FY78-80. The relatively large effort assigned to lending activities (44%) and supervision (22%) is typical of the sector, as is the very small share of effort expended on economic/sector work (3.9%) and completion/evaluation (1.2%). This division of effort is also very uniform from region to region. Given the large lending program managed in FY80 (25 projects, compared with 19 each in FY78 and 79), the increase in pre-appraisal effort in that year is notable and has resulted in an enhanced pipeline (see Annex I). The reduction in completion/evaluation (PCR) work in FY80 was large in percentage terms (50%). This is in consonance with the perception that resources have been shifted into lending, but given the small absolute value of the amount it is not possible to draw firm conclusions.

Table 3.1: SUMMARY OF POWER STAFF TIME
Staff Years
(Including Consultants)

	FY78	FY79	FY80	TOTAL	%
Preappraisal	7.68	8.89	12.07	28.64	15.0
Appraisal/NGB	18.23	21.00	16.95	56.18	29.4
Supervision	13.21	14.54	14.96	42.71	22.4
Completion/Eval.	0.78	1.07	0.34	2.19	1.2
Econ/Sector	2.41	2.81	2.24	7.46	3.9
TAS & Other	1.74	1.02	1.00	3.76	2.0
Management	4.57	4.93	5.54	15.04	7.9
Training	1.06	1.42	1.09	3.57	1.9
General	2.99	2.98	3.46	9.43	4.9
Leave	6.43	7.92	7.45	21.8	11.4
TOTAL	59.10	66.58	65.10	190.78	100.0

"Other" Resources

3.12 Only 5% of the total effort (compared with 18% for agriculture) was provided by consultants and most of this was for supervision and sector work. Overall, it is difficult for managers to integrate consultants into the work program because of (i) the small team concept prevalent in the sector and (ii) the need for staff continuity on appraisals, and to a lesser extent supervision; there are few ad-hoc tasks that can be assigned to consultants aside from occasional sector missions or specific-purpose supervision and completion report work. Also, the Bank's computerized file of individual power consultants is not easy to use because it is organized by discipline rather than by function. Partly in an effort to overcome these constraints,

ex-Bank staff are used as consultants whenever possible. A random sample indicates that nearly two-thirds of the power consulting time in FY78-80 was provided by former Bank staff). There is a good possibility that this reservoir of talent may not be adequate in the future, therefore EGY/PAU will explore the possibility of providing voluntary training to interested consultants in the Bank style of project preparation and appraisal to expand the pool of qualified consultants.

3.13 Power is also somewhat different from most other sectors in that a specific U.N. agency for power does not exist. Thus, there is no possibility of drawing power staff into cooperative programs. Given the uneven results of these programs this is perhaps a blessing but nonetheless it should be recognized that a comparable pool of resources does not exist in the power sector. There are some prospects for improvements in staff utilization through cooperation with other international financing agencies. In FY81, the preparation and appraisal work on two Bank projects was done largely by co-financiers (IDB and ADB), with resulting savings in staff input of about 40% compared to an all-Bank effort. Although such arrangements would not always yield savings, there appears to be scope for further cooperation of this sort. The Bank must always make sufficient input into cooperative projects to verify the soundness of the project but it would appear feasible to expect that 15% or more of the FY82-85 program could consist of operations where the co-financier, usually a regional bank, provides some input into the preparation and appraisal effort. Staff economies are possible only if the cooperating agency undertakes full responsibility for a portion of the appraisal since past cases of "joint" appraisal where each co-financier fielded full appraisal teams did not result in reductions of staff input. Obviously, such delegation of responsibility requires mutual confidence in the capability and policies of the cooperating agencies and therefore should be undertaken judiciously.

Lending Operations

3.14 Analysis of project-related TRS data for the 62 power projects approved in FY78-80 indicates that managers have necessarily displayed great flexibility in allocating resources, as indicated by the wide ranges of effort absorbed by individual projects:

For projects approved in FY78-80:

	Range	Mean	Std. Dev.
	Staff Weeks		
Preparation	4-104	22	20
Appraisal/NGB	14-162	61	30

Such wide variations make it difficult to draw general conclusions from the statistical data except, that there is no such thing as a typical project and managers must approach the budget process with extreme caution. Attempts to derive meaningful correlations against project type or size (Table 2, Annex I)

did not yield useful results. Resolution of sector issues (Turkey), first-time borrowers (Madagascar), difficult co-financing arrangements (Honduras), or tests of new appraisal techniques (Morocco) were better indicators of projects likely to require high staff inputs. Conversely, repeater borrowers (India-thermal) usually had below-average input requirements, but not always (India-rural). Managers are usually able to anticipate these variations in advance and it would be desirable to make more use of this talent at budget time. Practices in the sector regarding project identification and preparation, appraisal, and supervision are described in Annex I.

C. The Power Advisory Unit

3.15 The FY78-80 review period was one of significant change for CPS activities in electric power. Particularly important was the departmental reorganization in July 1979 that created the Energy Department (EGY). This move formally eliminated the last of power's links with water supply and telecommunications, which until 1975 had formed the "Public Utilities" sector. It also meant broadening CPS efforts to cover all aspects of the energy field including oil/gas, renewables, and comprehensive sector work. The results have been beneficial. Emphasis on oil/gas and other energy sources, including coal and fuelwood, has increased. An integrated approach to energy sector planning focusing on resource assessment and efficiency pricing has been developed. Renewable energy sources and conservation have become significant activities to which full-time staff have been assigned. Electric power has also benefitted from these changes even though its initial CPS establishment, like that of telecommunications, had been drawn on to support diversification and increased activities in oil/gas and water supply.

Staff Resources

3.16 The Power Advisory Unit (PAU) in EGY comprises two full-time authorized positions: The Power Adviser and a Senior Power Engineer. In addition, the Financial Adviser (EGY) and a Senior Economist in the Policy and Economic Unit spend about two thirds of their time on power-related activities. Some additional effort is also contributed by other staff, e.g., the Senior Adviser for Operations, and the New Energies section. As a whole, the Department is now able to provide about 3 staff years/year of staff input into the power program. These resources are augmented by about 1.5 staff year/year of consulting services, applied exclusively to the small research program. The power advisor position was added only in mid FY80. Formerly, this was a shared task of the Senior Adviser for Operations.

3.17 Power advisory work is fully integrated into the EGY policy and advisory function. Power-related work declined from 5 staff years in 1974 in EWT to an average of 2.7 staff year/year in FY78-80 as effort was shifted into general energy policy work. As one result, the preparation of power-related policy papers and guidelines declined precipitously in the review period. This should not be inferred as a misallocation of resources because (i) energy is a vital subject and must have priority in the allocation of available resources and (ii) much of the energy policy work, e.g. pricing of depletable

resources and alternative energy sources, is relevant to electric power. This does mean, however, that the level of staff resources available for work on power is adequate only to deal with direct project-related advice, mandated policy work such as the World Development Report and this policy paper [1/], and the minimum level of contact with consultants, manufacturers, aid agencies and the like that can be managed without being totally uncooperative. For example, in FY78-80 lending-related activities accounted for half of the unit's work (two thirds of the staff work load); research and policy work took up one fourth, and the remaining fourth was spent on training, personnel matters, external relations, and similar activities.

3.18 The zero-base-budget exercise undertaken in mid-FY78 in accordance with a corollary recommendation from the CPS Task Force proposed a "realistic" CPS power program of 6 staff years/year in FY81 and FY82. This figure did not include consulting assistance for research nor any effort for oil/gas and other non-power aspects of the energy program and was based on a smaller FY81/82 power lending program than is actually being undertaken. Several steps are being taken by EGY/PAU to try to bridge the resource gap: the appraisal review process is becoming more selective with differing levels of reviews for engineering, finance and economics depending on the characteristics of the particular project; computerization of sector statistical data and supervision files should improve efficiency; and preparation of some staff guidelines are being included as part of research contracts rather than being done in-house. Nonetheless, since these improvements will be marginal at best, it will continue to be necessary to set realistic priorities for the many tasks identified in conjunction with this paper. These recommendations, and others, are described in Annex I. As to staffing, one position is to be added in FY83 (probably a hydro specialist) to increase support to direct operations (PAU provided virtually no direct operational support to the Regions in FY78-81). This effort would be fungible among the three disciplines. In the medium-term, establishing a technical core group of 3 to 6 specialists to provide direct technical support to regional operations would enhance project quality and may improve operational efficiency. This group could include professionals with in-depth experience in thermal generation, hydro-mechanical equipment, system operations, distribution engineering, rural electrification programs, system planning, rate-making, utility finance, accounting and billing, and perhaps nuclear power. A link to the energy assessments unit would permit early attention to technical issues as part of country sector reviews.

1/ Preparation of this SSSP absorbed 20% of the staff time available for power-related work in FY81 and 82.

D. "Intellectual Infrastructure"

Policy Guidelines

3.19 The principal policy guidelines for lending in the power sector are set out in OMS 3.72, which also covers Water Supply, Sanitation and Telecommunications. This OMS was last revised in 1978, and perhaps should be subject to a further revision to separate power from the other sectors. In addition, a large volume of material (some 65 titles) prepared since 1973 has been distributed to power staff in the form of Public Utility Notes--now called Energy Notes--(PUN/EGY), Research Papers (RES), and Guidelines and Standards (GAS), under the aegis of EWT/EGY departments. These are supplemented by Staff Working Papers, Sale Publications and Reprint Series documents which are published by or available through the Bank's Publications Unit. Energy related material is listed and summarized in the EGY publication, "Document Series Index", which is distributed annually to power and energy staff. The purpose of the various EGY document series and the table of contents of the April 1980 issue of the Index are reproduced as Annex IV to indicate the scope of the material covered by these publications. In general, four types of papers are represented: "think pieces" on the general energy situation, ad-hoc state-of-the-art statements on energy options and technologies, research efforts, and "how to" guidelines.

3.20 Despite the volume of material in the PUN/GAS document series, it is not comprehensive. It reflects to a large extent either externally-mandated papers on topical subjects or the specialties of the specific individuals who were available for research. Thus, while the series includes what is probably the most extensive list of titles available on economic pricing of electricity, there is surprisingly little on the financial aspects of pricing and practically nothing on techniques of economic system planning and design, and specific technologies such as small-scale hydro. Papers covering some of these subjects have been prepared on an ad-hoc basis but have not been incorporated in the formal series index. To rectify this, as time is available the EGY power unit staff will prepare summaries of recent papers and research efforts covering, for example, hydropower development in the developing countries, forecasts of power sector investment needs, summary of power sector country data sheets, thermal generating plant efficiency improvement, and similar studies which have been undertaken since the EWT/EGY reorganization. The department, and the power unit in particular, intends to review the present documentation system and institute procedures to ensure that original studies and policy formulation documents are properly recorded and catalogued and not lost in the press of day to day activities.

3.21 In 1979 the Bank's research activities in electric power were reviewed by a panel of outside experts. Annex I contains a summary of the findings of the panel, and recommendations for a future research program in power to deal with the many issues that have become prominent since the panel's review. These include system planning, conservation, loss reduction and demand management, and audit of organizational performance. The present level of research, 2.5 staffyears in FY82 or about 2% of the Bank's total research effort, funded almost entirely from the EGY budget, is not adequate and more participation in the Bank's formal research program would be

justified. This should be feasible, but in the past such participation has been constrained because EGY was unable to provide staff time to manage a larger research program.

3.22 No comprehensive sector policy document for power is currently in print and available for distribution outside the Bank. The last (only) such document is the 1971 Sector Working Paper "Electric Power". While this paper stressed the institution building and resource-transfer objectives of power lending which were then dominant in the sector, it is clear that current policy has moved substantially beyond this narrow concern to include e.g. treatment of electric power as an integral part of the energy sector, and economic pricing. A comprehensive background paper was prepared in draft for the 1980 energy policy paper, "Energy in the Developing Countries" and it would probably be desirable to use this, and other material, to prepare an updated version of the sector paper, but resources for this task are not available. Consequently, there is no current plan within EGY to prepare such a paper, or to rationalize and update the PUN/GAS series except for possibly reorganizing the material to discard obsolete and irrelevant documentation to ease the reading burden on new staff. Research activities related to this effort are described in Annex I.

Technical Literature

3.23 Apart from individual periodical subscriptions and the power divisions' own small reference shelves, the main sources of power-related technical literature in the Bank are the Energy Library,[1/] periodicals circulation, and of course the Non-Regional Information Center (NRIC) and the Joint Bank/Fund Library. In addition, a complete file of "black books" for power projects currently under supervision and preparation is maintained by EGY/PAU and is available for reference use by power staff.

3.24 Under the present system, principal technical journals are circulated to CPS departments and regional power divisions, often with as many as six stopping points. This process can take months. Thus, any periodical having time-value information (procurement advertising for Bank-financed projects, announcement of conferences and seminars) becomes virtually useless to the people at the end of the circulation list. While the divisions themselves can improve the circulation process by keeping reader lists current and following up on the circulation, even this is not satisfactory for time-value material. Divisions should consider requesting their own subscriptions to principal technical journals. "Engineering News Record" (project advertising), "Public Utilities Fortnightly" (finance and accounting), "Electrical World", and "Water Power" are recommended publications, but each division may have its own preferences. The cost of this service would be small compared to the benefits to the staff of being kept up to date, particularly in view of the fact that six of the seven divisions rate the present service as "unsatisfactory" (the seventh maintains its own subscriptions to the principal periodicals).

1/ Located in the Energy Department, D563.

E. External Relations

3.25 The Power Advisory Unit is often the first point of contact for consultants, contractors and suppliers in the sector interested in doing business with the Bank or participating in Bank projects. Although general seekers of information are dissuaded from contacting the regional power divisions, queries on specific projects are necessarily referred to the appropriate divisions, and individuals often arrange their own meetings independently with regional staff. Therefore the power unit's role cannot be characterized as "centralizing" such contacts despite a general regional desire for EGY/PAU to play this role. In addition, the unit fields general queries from research organizations and other aid institutions on power in the developing countries and the Bank's role; often these requests reflect an imperfect understanding of the Bank's function (one recent request was for "complete information on hydropower in Africa"). There has been a substantial increase in the volume of such queries following publication of the 1980 energy policy paper.

3.26 Dealing with such contacts absorbs a large amount of the unit's time. On the basis of a 3-month sample of such activities, about 15% of the unit's time is so occupied and therefore it should be considered a major activity. Given the importance of this task to the Bank as well as to those initiating the contact, a high degree of selectivity and tact is necessary to keep this task within manageable limits. Dissemination of the results of these contacts is also a problem. In appropriate cases brochures and descriptive material are circulated to the regional divisions and in rare cases dealing with state-of-the-art advances, short briefing sessions are arranged (15 such seminars in FY 78-80) but more systematic circulation through a power newsletter or similar device could also be considered.

Conferences and Seminars

3.27 Given the Bank's role as the leading international financing institution in the power field, participation in international power activities is meagre. Although reasonably well represented at major conferences such as the World Energy Conference in Munich in 1980 (5 Bank staff, one of whom was from a regional operating division), the Bank's power sector is seldom represented at such major forums as ICOLD, CIGRE, UNIPEDE, OLADE, IAEA, etc. (See Annex V for abbreviations). In the FY 78-80 review period, power staff attended only 3 such activities, most of which were directed to specific-interest areas (e.g. Ecuador mini hydro). The Bank is not an official member of any of these organizations, and routinely declines requests to participate in most technical conferences. Since there is no single UN-sponsored agency dealing with electric power and energy, we have no convenient UN tie in this sector thus the channel usually used in other sectors for contacts with the international community is lacking.

3.28 Aside from partial isolation from the international technical community, which may have some impact for example on recruitment, it is difficult to identify any serious negative consequences of the de-facto noninvolvement policy. Nonetheless, the Bank's international associates have a right to

expect a greater degree of leadership and participation in activities related to the development process. It is unrealistic to expect any direct change in this policy with the present level of resources; however, EGY/PAU does expect to increase contacts with and participation in UN-sponsored programs in power and energy such as the U.S. New and Renewable Energy Sources conference effort, the U.N. Centre for Natural Resources, Energy and Transport (UNCNRET), and the IAEA. In particular, closer ties with IAEA are mandatory. An attempt will be made to work with IRD to coordinate and disseminate more information to regional staff on external professional and technical activities, but there are no specific plans for EGY/PAU attendance at such conferences in FY 82. Regional staff may participate on an individual basis as has been the custom but this attendance will not be coordinated by EGY/PAU, although we would appreciate being informed of such attendance.

F. Professional Development

3.29 Professional development activities for power staff have received very little formal encouragement or attention. As in most other sectors, the Bank considers individual professional development to be the responsibility of the staff member. The Bank's stated policy on attendance at external seminars, short courses and professional meetings is quite reasonable and approval for participation in such activities is usually obtained promptly from department directors, with registration fees paid by the training unit of PMD. This is a liberal policy but unfortunately Bank procedures tacitly discourage professional development activities. Thus, although relatively frequent internal technical seminars are arranged, attendance is often sparse because time spent on such activities merely increases staff overtime. In the case of external seminars and conferences unit managers normally approve travel for such activities only if it can be arranged in conjunction with other operational travel. Partly as a result, the training unit arranged only 13 such activities for power staff in FY-78-80, in which 9 staff (16%) participated. Moreover, representation by division was skewed--participating staff came from four of the seven divisions. Although these figures understate actual participation since the activities undertaken by staff locally and on their own time are not recorded, clearly this level of participation is below any reasonable standard of professional development. For example, some professional registration boards in the U.S. are considering legislation which would require a minimum of about 3 days per year participation in a related continuing education program as a pre-requisite for renewal of professional registration. Recently the Energy Library has attempted to collect and disseminate information on power-related short courses and seminars, but to be effective this should be formally incorporated in the Bank's training activities.

3.30 Membership in professional associations, too, is very much an individual thing. No formal records of such membership are kept in the Bank and there is no explicit effort to encourage or recognize membership in professional societies, at least for power staff. Based on a survey of power staff, only half of the power engineers and virtually none of the financial analysts and economists maintain active memberships in professional societies. Of those that do maintain memberships, most have two or more; typically

membership in the Institute of Electrical and Electronic Engineers (IEEE--an international organization, but largely U.S. membership), and often the IEE (U.K.) or an equivalent institution in the home country. Of the 20% of power engineers that were trained in specialties other than electrical engineering (civil, mechanical), about half maintain memberships in their respective technical societies. About one-third of the power engineers are registered professional engineers or the equivalent and have membership in a professional association of engineers (e.g., U.S. National Society of Professional Engineers, NSPE). Less than one-third of the financial analysts are chartered accountants, certified public accountants (US), or the equivalent.

3.31 Membership in professional organizations appears to have declined over the years as staff members allow their memberships to lapse. This is understandable since annual fees in professional societies now are $150 or more. As one financial analyst said, "I feel 10 years behind, but I have other uses for the $400." Clearly, some effort by the Bank to encourage participation in professional societies would be desirable. This could range from simply encouraging members of local chapters of technical societies to publicize meetings and encourage guest attendance, to keeping formal records and acknowledging professional society recognition and most importantly, to reimbursing part or all of the membership fees as is common in industry in the U.S. and elsewhere. The benefits of such programs are large. For the professional, it could mean a sense of being part of the professional community, and for the Bank, a recognition of its standing among professional societies, including access to recruiting systems sponsored by these societies.

SECTOR SUPPORT STRATEGY PAPER

ELECTRIC POWER

SUMMARY OF RECOMMENDATIONS

Sector Work

New issues in the power sector require expansion and refocus of the Bank's power sector work including:

- deliberate use of electric power to promote development (1.02) through acknowledging inter-sectoral links, especially to industry, in sector work (1.07);

- a 3-year preinvestment study program, perhaps using UNDP resources (1.19);

- evaluation of the impact of power sector programs on government fiscal policy and resources as a principal analytical goal (2.07);

- opportunities for oil savings through electrification of other sectors (2.40), training and safety programs in nuclear-eligible countries (2.52), and identification of new resources such as small-scale hydro (2.54).

Programming and Preparation

The enhanced sector work program should be used to identify lending programs in priority countries (1.16) through CPPs. Project identification and preparation work should take account of:

- a significant increase in technical assistance and engineering loans and credits to accelerate project identification and to address issues such as operational efficiency (1.19);

- opportunities for new style projects including maintenance and rehabilitation, conservation and efficiency (1.22) (2.40);

- prospects for innovative financing packages to organize co-financing, and formal incorporation of co-financing into the lending process (2.23), which may in itself justify lending (2.01), and

- use of the preparation process, including project briefs, for "upstream" reemphasis of institutional autonomy (2.04), identification of specific legal undertakings (2.15), and identification and allocation of co-financing, including prospects for increasing financing from private and commercial sources (2.26).

Pricing Policy

The principal goal of electricity pricing should be economic efficiency through:

- relating tariff requirements to long-run marginal costs, supplemented by the more traditional measures to ensure financial viability (2.12);

- dialogues with borrowers, stressing the intent of the financial covenants rather than their form (2.16) (2.18), and resisting anti-inflation excuses for not increasing prices (2.08), and

- taking the lead in reconciling differing pricing policies among the various development finance institutions (2.13).

Procedures

The policy modifications imply new approaches to staff work in the sector including:

- shifting the tariff analysis in appraisals from a financial approach to one which emphasizes economic efficiency (2.12), and standardizing the IERR calculation to permit meaningful comparisons across the sector (2.34);

- reviewing the form of financial covenants and identifying non-financial criteria for measuring management performance (2.19);

- more rigorous financial analysis to support innovative financing plans and more responsive measures to deal with shortfalls in financial performance (2.20);

- introducing new alternatives into system planning (2.32) including i.a. loss reduction and risk analysis (2.32) (2.41) at a much earlier stage than is done at present;

- more attention to project implementation arrangements at the appraisal stage to minimize risk of delays (2.45);

- analyzing rural electrification projects in accordance with more stringent criteria, to be augmented by an OED study of Bank-financed R.E. projects (2.47);

- adding project components to quantify renewable energy resources (2.59);

- a possible need for a revision of the power sector OMS and a new sector policy paper (3.19) (3.22), as well as updating policy guidelines (3.20) and improving such matters as monitoring of dam safety (2.57) and dissemination of developments in international accounting (2.10), and

- integration of power sector research into the Bank's formal research program with emphasis on conservation and demand management, rural electrification, price elasticity, and similar issues (3.21).

Staffing and Professional Development

Coefficients for power sector operations are among the lowest in the Bank, the legacy of a project-oriented style using minimum staff (two-man teams). Adjustments to deal with the issues outlined above include:

- changing divisional staffing structures to reflect the increase in economic work (3.02);

- flexibility in allocating posts, recruiting, and organization to achieve marginal efficiency improvements (3.05);

- cautious increase of joint activities with other development finance institutions (3.13);

- budget recognition of the wide variations in manpower coefficients in the sector (3.14);

- adopting a formal training program as part of a Bank-wide professional development program, and providing the necessary resources (3.08) (3.29);

- for the power advisory unit, setting realistic priorities for the additional tasks identified in this paper, and possible establishment of a core group of technical specialists (3.18);

- obtaining division subscriptions to technical journals (3.24), and

- improved participation in international technical activities (3.26) and Bank sponsorship of professional society memberships for staff members (3.30).

ANNEX I

POWER SECTOR STATISTICS AND PROCEDURES

A. Investment Requirements and Bank Lending for Electric Power

1. "Energy in the Developing Countries", August 1980, included an estimate of the LDC investment requirement for electric power in 1981-90. This estimate is summarized in Table 1.

Table 1. LDC ELECTRIC POWER INVESTMENT 1981-90
(Commitments, 1980 price levels) 1/

	1981-1985		1986-1990	
	GW	$bn	GW	$bn
Generating Capacity				
Thermal	62.4	47	81.7	69
Hydro	47.4	47	54.3	69
Nuclear	6.8	22	27.9	29
Geothermal	1.0	2	0.9	4
Sub-Total	117.6	118	164.8	171
Associated Facilities				
Transmission	-	17	-	24
Urban Distribution	-	18	-	24
Rural Distribution	-	16	-	26
Sub-Total		51		74
Total	117.6	169	164.8	245

1/ The distinction between commitments and disbursements in the power development program is particularly important because of the long construction times required for power projects and the consequently long disbursement periods. Because of growth rates, commitment requirements will exceed disbursements by one-third or more in any given year. This paper uses commitment estimates rather than disbursements because they better reflect financing needs.

2. Tables 2A, 2B and 2C show Bank lending for electric power in the three years FY78, 79 and 80 respectively. Data is given for project components, loan amount, co-financing, and staff input for project processing. The relatively large amount of co-financing (60% of Bank lending) and the total project costs (four times the amount of Bank lending) are noteworthy.

Table 2A
FY 78
BANK LENDING FOR POWER BY SUBSECTOR, AND TIME INPUT

Region	Country	Project	Hydro & Assoc. Trans.	Oil/Gas Thermal & Assoc.Trans.	Coal Thermal & Assoc.Trans.	T & D and General	Rural Electrif.	Total Bank/ IDA Loan	Co-Financed Amount	Total Project Cost	Man Wks Pre-App.	Man Wks App.	Man Wks Negot.
			US$ Millions										
EA	Madagascar	Andekaleka	33					33	67.8	116	103.6	57.2	39.0
	Mauritius	Power Transmission				15	15	15	-	18.9	21.1	28.2	10.7
WA	Liberia	Power IV		6		4		10	19.38	31.55	6	63.8	15.9
	Sierra Leone	Power III	1	7				8	5	15.2	14.6	74.3	26.6
EMENA	Syria	Regional Electrification					40	40	34.2	135.8	12.4	67.5	22.4
	Yemen, P.D.R.	Wadi Hadramout Power					5	5	-	28.3	27	70.5	11.0
	Yugoslavia	Middle Neretva Hydro	73					73	-	402.6	10.2	38	8.3
EAP	Fiji	Monsavu-Wailoa Hydro	15					15	34.9	54	20.1	53.0	15.6
	Indonesia	Power VII		84		25		109	-	161.53	6.8	61.6	15.2
	Philippines	Rural Electrification					60	60	-	160.5	12.5	50.3	6.2
	Thailand	Pattani Hydro	43			7		50	-	144.6	25.9	54.9	30.9
	Thailand	Rural Electrification I					25	25	15	110	11.3	29	12.7
SA	India	Korba I Thermal			200			200	-	439	6.3	23.2	11.9
	India	Trombay Thermal			105			105	-	209.4	5.2	18.8	9.7
LAC	Guatemala	Chixoy Hydro	57			15		72	203	414.1	14.2	88.2	12.9
	Brazil	South-SE Distribution				120	10	130	-	2,346.8	36.3	56.3	20.0
	Colombia	San Carlos I Hydro	126					126	70	421.3	34.9	65.9	8.8
	Colombia	500 KV Interconnection				50		50	40	167.2	75.7	33.0	7.7
	Jamaica	Power II				20		20		36.1	23.2	47.6	7.8
	Total		348	97	305	256	140	1,146	489.28	5,412.88			

Table 2B
FY 79

BANK LENDING FOR POWER BY SUBSECTOR, AND TIME INPUT

Region	Country	Project	Hydro & Assoc. Trans.	Oil/Gas Thermal & Assoc.Trans.	Coal Thermal & Assoc.Trans.	Geothermal & Assoc. Trans.	T & D and General	Rural Electrif.	Total Bank/ IDA Loan	Co-Financed Amount	Total Project Cost	Man Wks Pre-App.	Man Wks App.	Man Wks Negot.
			---US$ Millions---											
EA	Kenya	Olkaria Engineering Loan				9			9	-	15.5	-	0.1	4.2
WA	Guinea	Power Eng. & Repairs					1		1.1	-	1.2	27.9	2.3	3.4
EMENA	Egypt	Shoubrah El Kheima Generation		139			12	3	139	205	465.9	21.6	62.9	18.6
	Jordan	Power III						42	15	0.5	53.5	17.1	66.7	13.5
	Morocco	Village Electrification							42	-	85	54.5	67.9	13.2
	Romania	Turceni II Thermal			70				70	-	482.7	5.8	32.5	9.9
	Yemen, Arab Rep.	Power I					10		10	9	59.6	18.4	65.1	10.5
EAP	Indonesia	Power VIII			175				175	-	374.2	29.6	36.9	12.3
	Thailand	Bang Pakong Thermal	80						80	22	297	6.7	26.7	15.7
SA	Bangladesh	Greater Khulna Distribution					28		28	8.5	44.2	21.7	34.4	6.1
	India	Ramagundam I			250				250	-	511	16.3	9.5	4.8
	India	Rural Electrification II						175	175	-	400	33.6	64.3	14.2
	Nepal	Kulekhani Hydro Suppl.	15						15	12.3	26	3.7	4.9	2.5
LAC	Brazil	COPEL 2nd Power Distribution					95	14	109	-	361.66	26.1	38.3	7.0
	Costa Rica	Power VI					34		34	1.3	56.2	5.7	25.4	12.4
	Haiti	Power II		10			6.5		16.5	20.5	43	10.1	36.4	13.4
	Honduras	Nispero Hydro	12	14			4.5		30.5	3.5	58	11.0	34.8	16.1
	Colombia	Nesltas Hydro	84						84	-	260.8	5.8	75.5	8.1
	Colombia	San Carlos 1 Hydro	72						72	-	156.1	35.6	24.6	16.4
		Total	183	243	495	9	191	234	1,355.1	282.6	3,751.56			

Table 2C
FY 80
BANK LENDING FOR POWER BY SUBSECTOR, AND TIME INPUT

Region	Country	Project	Hydro & Assoc. Trans.	Oil/Gas Thermal & Assoc.Trans.	Coal Thermal & Assoc.Trans.	Geothermal & Assoc. Trans.	T & D and General	Rural Electrif.	Total Bank/ IDA Loan	Co-Financed Amount	Total Project Cost	Man Wks Pre-App.	Man Wks App.	Man wks Negot.
			---US$ Millions---											
EA	Kenya	Olkaria Geothermal				40			40	20	89	28.9	63.1	32.2
	Madagascar	Andekaleka Hydro (Supp.)	10						10	14.4	43	-	0.9	3.1
	Sudan	Power III	45				20		65	139	290	31.1	90.1	20.8
WA	Nigeria	Lagos Distribution					100		100	35	222.7	33.2	56.6	17.2
	Senegal	Power Eng. & Tech. Assistance					3.3		3.3	-	4	3.2	12.7	5.2
EMENA	Egypt	Power III	57	57			4	9	127	49.6	677.8	22.4	68.8	15.5
	Cyprus	Power Trans. & Distribution					16		16	-	39.6	60.7	54.0	9.5
	Turkey	Karakaya Hydro	120						120	156	1,160	49.1	120.8	36.0
EAP	Fiji	Power II	15.5						15.5	21	50	16.2	33.9	10.1
	Indonesia	Power IX			175		78		253	139	694	6.6	43.7	11.5
	Korea	Gojeong Power			115				115	-	657	36.4	26.2	12.9
	Malaysia	Power IX	50						50	71.9	232.9	8.5	51.6	20.6
	Thailand	Khao Laem Hydro	80						80		261.9	4.6	52.8	13.2
	Thailand	Rural Electrification II						75	75	29.5	270	-	36.7	8.5
SA	India	Farakka Thermal			250				250	-	499.4	5.4	47.2	10.5
	India	Singrauli II			300				300	100	914.3	4.4	49.5	20.5
	Pakistan	WAPDA III Power					45		45	92.5	506	8.4	63.1	37.5
	Sri Lanka	Power VI					19.5		19.5	20	63.3	32.2	28.7	8.7
LAC	Argentina	Yacyreta Hydro	210						210	1,155	3,781.0	40.5	115.5	47.0
	Brazil	CEEF Distribution					110	4	114	100	314.0	12.3	22.6	11.7
	Colombia	Bogota Distribution					87		87	-	182.2	20.1	80.0	14.1
	Colombia	Guadalupe Hydro	71				54		125	-	228.3	31.6	17.9	7.8
	Honduras	El Cajon Hydro	125						125	315.1	582.7	78.9	53.9	42.7
	Panama	Power V					23		23	-	35	17.9	24.5	3.8
	Uruguay	Power V					24		24	24	52.5	53.1	105.5	11.5
		Total	783.50	57	840	40	583.8	88	2,392.3	2,482.0	11,950.1			
Summary, FY78-80			1,314.5	397	1,640	40	1,030.8	462	5,355.4	3,253.88	21,114.54			

3. Table 3 shows Bank lending for various periods from 1958 onward. Except for a drop in FY 72-75, Average lending in real terms has been remarkably constant. The large increase from 1976 onward in the average number of projects processed each year should be noted.

Table 3. ELECTRIC POWER LENDING, FY 58-86

	FY58-67	FY68-71	FY72-75	FY76-81	FY82-86*
Annual Average, current $m	288	420	529	1353	1681
Annual Average, 1981$m	1575	1522	1161	1634	1404
Annual Average, No. Projects	12	15	13	19	20

* Projected

Programming Bank Power Lending

4. Table 4, which is based on a 5-year review, shows the expectations versus the actuality of power projects in the pipeline in mid-FY74. It points out that projects mature at different times and are added or dropped randomly. In other words, the concept of an orderly progression from identification to preparation to appraisal is not applicable to power projects.

Table 4. PLANNING AND ACTUAL POWER LENDING, FY74-78

	FY74	FY75	FY76	FY77	FY78	Total
	No. of operations					
Planned, of which	27	28	23	19	20	117
Actual, in FY Planned	15	4	7	5	4	35
" Earlier	0	2	2	1	4	9
" Delayed	9	14	7	9	7	46
Dropped	3	8	7	4	5	27
Added in Period	1	8	8	9	7	33
Actual Operations	16	11	20	17	19	83

5. The relative softness of the program, even in the year immediately following the forecast year, is typical of the sector. For example, in December 1976, 26 projects were included in the FY78 operations program. By December 1977, this figure had dropped to 24 of which 19 were actually approved. We suspect that the forecasts have improved somewhat as indicated by the data shown in Table 5 but the lack of incentives for developing a lending strategy in power remain.

Table 5. POWER LENDING OPERATIONS

	FY79		FY80		FY81		FY82	
	No.	Amount $m	No.	Amount $m	No.	Amount $m	No.	Amount $m
Operations Program as of:								
12/31/77	28	1674.0						
12/31/78	24	1727.1	33	2311.0				
12/31/79			30	2647.6	24	1744.1		
12/31/80					25	1985.0	42	2658.0
Actual Lending $m	18	1354.9	25	2392.3	17	1323.0	30*	2500.0*

* Estimate.

6. The large difference between the operations and lending programs is characteristic of the power sector as indicated by the large percentage of "standby" projects (typically 40% of the operations program). The relatively large increase in the agreed operations program (29%) over the last four years is also signficant because this is being done without any assurance of specific additional resources, implying that resources will need to be diverted to lending operations from other activities in the sector if this program is to be achieved. The large year-to-year variations in lending are also typical, even though average annual lending is quite stable (para. 3).

Bunching

7. Because of the high proportion of 'S' projects, the bunching experience in this sector is somewhat more severe than the Bank average, as indicated below (data for FY 78-80):

% of Projects Presented in Quarter	I	II	III	IV
Power	5	18	19*	58*
Other Bank	11	19	25	45

* 70% in last four months.

So far, regional managers have been able to cope with this situation by judicious scheduling of staff without adversely affecting the timing of supervision visits and other work. However, some effort to relieve the sector of this burden would undoubtedly be worthwhile. Among other unfavorable aspects, the bunching problem is also apparent at earlier stages--80% of the yellow cover reviews in FY81 were scheduled in two 3-week periods--one in February and one in September. Thus, what is widely perceived as the principal EGY/PAU advisory function (the yellow cover review) is, in fact, a

marginal activity. Although there was some improvement in bunching in FY 80, the actual program for FY81 and forecasts for FY82 based on signed timetables show no change in this pattern.

B. Role of Electricity in the Energy Sector

Electricity and Energy Balances

8. The conventional presentation in energy balance tables understates the role of electricity in the energy sector because (i) electricity is a hybrid in that it is both a primary commodity and a secondary product (electricity produced from hydro, nuclear and geothermal sources is primary energy; that produced from fossil fuels plus that from primary sources is secondary energy), and (ii) electricity is a premium "fuel" because of its convenience, and because it permits high efficiencies in end-use conversion.[1/] Therefore, for other than large-scale low-quality heating applications, the electricity option is not necessarily a less efficient route from primary fuel to end use. The share of electricity in the commerical energy mix can be shown in three ways:[2/]

	Electricity	Petroleum	Coal, other
(1) as Primary Energy:			
Developed countries	4%	73%	23%
Developing countries	3%	82%	15%
(2) as Secondary Energy:			
Developed countries	15%	74%	11%
Developing countries	10%	79%	11%
or			
(3) adjusted for end-use efficiency:			
Developed countries	35%	56%	9%
Developing countries	25%	66%	9%

Presentation in the latter form, adjusted for end-use efficiencies, is probably a more accurate reflection of the real role played by electricity in

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1/ Low conversion efficiency (25-30%) is often cited as a major disadvantage of electric energy derived from thermal stations. However, this conclusion may not be warranted when one looks at the end use of energy. Electric motors are 85% efficient compared with an in-service efficiency of 15-20% for diesel engines; electric cookers and water heaters are twice as efficient as oil, kerosene, or gas-fired units, and electric lighting is several orders of magnitude more efficient than competing lamps. Moreover, electricity is usually derived from lower quality fuels, and electric equipment (e.g. motors) is usually less expensive than utilization equipment for other "fuels".

2/ Data for 1978 from U.N. World Energy Supplies, Series J.

the energy picture. It is partly for this reason that EGY/PAU recommends using the thermally-generated input equivalent (10,500 Btu/kWh, or 0.25 kgoe/kWh) as a conversion factor when comparing electrical energy with other energy forms. Presentation in the latter form also helps explain electricity's high share of total energy investment.

C. Operations Procedures in the Power Sector

9. Power project work is characterized by quite low average coefficients for lending operations, as shown as Table 6. This is derived historically from the Bank's practice of using small teams (typically, one engineer and one financial analyst) for project appraisal and supervision. Over the past six to ten years the Bank has introduced a substantial number of mandatory features into the project process.[1/] While these innovations produce better reports and projects, there is growing concern among operations staff that we have overreached the resulting efficiency improvements and that consequently the traditional planning and engineering aspects of projects are receiving less than optimum attention, with perhaps a corresponding decrease in the direct technical assistance content of power operations.

Identification and Preparation

10. Given the diversity of projects in the sector and the wide range of manpower assigned to this activity, it is difficult to generalize or to identify significant trends. Manpower constraints play a large role in this process, with the preparation of most projects left to borrowers and their consultants with only minimum input or guidance from Bank staff. Project identification at the CPP stage is commonly quite general ("Power III") except where rural electrification has been identified as a socially desirable undertaking. Increased use of the Project Brief system in the review period has proven beneficial by focussing on project content and likely issues (co-financing requirements) at an early stage. However, in most cases the late stage of Bank involvement (the typical first project brief was issued only ten months before appraisal) left insufficient time for any meaningful contribution to the feasibility study or development program formulation. [2/]

1/ Project briefs, issues/decision papers, identification of poverty-target beneficiaries, expanded economic analysis and mandatory IERR calculations, efficiency prices, environmental impact analysis, presentation of consultants' costs, semi-annual and quarterly disbursement estimates, efficiency and social price adjustments in economic analyses, energy resource assessments, formal post-completion evaluation, etc.

2/ This situation changed significantly in FY81. Project Briefs are now prepared routinely and discussed by EGY/PAU and others so that substantially more issues are being identified and resolved prior to appraisal. In some cases, this has led to delays in projects, and manpower coefficients are likely to increase, but overall the change is perceived to be very worthwhile.

Table 6: RANKING OF SECTORS FOR FY 78-80 BY AMOUNT OF LENDING, NO. OF PROJECTS, STAFF TIME AND STAFF NOS.

	Amount of Lending		Projects		Input to Lending Operations		Staff Years/	Operational Staff as of 9/30/80		CPS "Other Output"	
	US$Millions	%	No.	%	Staff Years	%	Project	No.	%	Staff Years	%
Agriculture	9,250	30.9	256	35.0	959.8	45.7	3.7	301	32.8	77.4	41.6
POWER	4,893	16.4	62	8.5	108.1	5.1	1.7	52	5.7	9.9	5.3
Transport	4,442	14.9	99	13.6	235.2	11.2	2.4	136	14.8	34.0	18.3
IDF	2,650	8.9	73	10.0	137.7	6.6	1.9	85	9.3	17.1	9.2
Water Supply	2,025	6.8	54	7.4	107.8	5.1	2.0	59	6.4	17.1	9.2
Industry	1,744	5.8	30	4.1	117.4	5.6	3.9	59	6.4	n.a	-
Education	1,288	4.3	51	7.0	157.3	7.5	3.1	73	7.9	30.8	16.4
PL/SAL	1,085	3.6	17	2.3	-	-	-	-	-	n.a	-
Urban	1,027	3.4	31	4.2	133.9	6.4	4.3	56	6.1	n.a	-
Oil and Gas	497	1.7	17	2.3	52.1	2.5	3.1	32	3.5	n.a	-
Telecommunication	462	1.5	11	1.5	22.5	1.0	2.0	14	1.5	n.a	-
Population	315	1.0	10	1.4	50.2	2.4	5.0	37	4.0	n.a	-
Tourism	163	0.6	7	1.0	18.9	0.9	2.7	-	-	n.a	-
Technical Assistance	63	0.2	12	1.7	-			15	1.6	n.a	-
Total	29,904	100	730	100	2,100.9	100		919	100	186.3	100

Note: Data is aggregate for three years FY78, 79 and 80.

11. The increased emphasis on project preparation is leading to earlier focus on conditions precedent to appraisal such that the timing of appraisal itself has become a useful tool in achieving project objectives. Thus, conditions of appraisal related to completion of sector or project studies, identification of outline financing plans (co-financing) and compliance with undertakings under previous loans/credits are increasingly common. In general, it appears that increased emphasis on project preparation activities has been beneficial in securing earlier resolution of issues and in fostering action by governments on such matters as financing, although the increasing complexity of projects now increases the importance of preappraisal action.

Appraisal Practices

12. Project justification generally is well defined by the time the appraisal mission departs and therefore the emphasis during appraisal is on the institutional characteristics and especially the financial forecasts, since preliminary financial statements are seldom available in the Bank prior to appraisal. Still, the focus on program schedules occasionally leads to situations where appraisals are undertaken before it is entirely certain as to whether all required information (for example, financial forecasts) will be available.

13. The small-team approach characteristic of power operations inhibits a detailed sector review in conjunction with each appraisal and therefore, for example, an appraisal of a generation project will have little to say about distribution, and vice-versa. Full sector coverage on a routine basis is further inhibited by the fragmentation of the sectors in most countries whereby different agencies are responsible for generation and distribution, or for separate geographical regions. Some increased emphasis on formal sector work and energy sector assessments has helped to fill this gap. However, a more deliberate effort to ensure full sector coverage either through judicious project selection or emphasis on "soft" areas by means of ad hoc sector reviews is necessary, particularly with the increased significance on demand management, efficiency, the structural adjustment approach, and sector lending.

14. As in most other sectors, power appraisal reports are highly stylized documents. Format and organization may differ slightly in accordance with regional preferences or project characteristics but in general the way in which the discussions on such subjects as sector resources, organization, training and staffing, the development program, project description, engineering, procurement and disbursement, finance and tariffs, and the economic analysis are handled varies little from report to report. This has the advantage of ensuring completeness and consistency (some regions use appraisal report checklists for this purpose, and more general use is probably worthwhile) but it also has the disadvantage of discouraging discussion of new subjects which do not fit the usual mold. For example, in projects whose justification depends critically on efficient implementation, something more than the usual short paragraph on project execution would be useful. This would be especially true in cases where co-financing may dictate how project procurement is to be packaged, or where a large part of the work is to be done

by force account. In the latter, specific details on the amount of staff and equipment available and the scale of work compared with past activities is relevant. An updated checklist or guideline for appraisal reports may be needed to assist in avoiding these errors of omission.

15. Although there was little specific change in the FY78-80 review period, there has been a substantial improvement in the organization and consistency of appraisal reports. These documents appear to meet the decision-making needs of the Board and other critical audiences. It should be noted however that the increased emphasis on economic analysis, treatment of the sector, and similar areas has been accomplished in many cases, at the expense of the description and analysis of the details of the project. For example, it was once standard practice to include in the appraisal report graphics showing growth in demand and the construction schedule, drawings of the project, and an Annex with engineering details of the project. Now these kinds of presentations are rare. Much of this material can be extracted from the Project File, so their omission from the reports does not imply that these parts of the project are not well appraised. However, because of the increase in co-financing activity it may be desirable to reintroduce in appraisal reports a more complete discussion of the nuts and bolts of the project.

16. The organization and depth of the appraisal review process is similar to that of the other sectors; jelling of ideas and Divisional position at white cover, substantive review by Department and CPS at yellow, minimum external review at green (which serves as the basis for negotiations), and review by the Division for editing at the grey/buff stage. This works well enough, although some concern has been expressed about the possible lack of substantive external review of the President's Reports, the final drafts of which are often not available until the grey cover stage. There is also some inconsistency among the regions with regard to the drafting of loan documents; some (especially those with a large complement of newer staff) do not play an active role in converting the recommendations of the appraisal report into legal undertakings. Given the significance of these documents (the only substantive residual element of the appraisal process) more attention to this phase of appraisal is warranted. Consistency of treatment of financial covenants in particular is an issue which may warrant more input by CPS beyond the yellow cover stage than is provided by the present review procedures.

Supervision Practices

17. Project supervision absorbed 23% of divisional work effort in the FY78-80 review period. This is not significantly different from experience elsewhere in the Bank. Effort applied to supervision increased slightly over the period but not enough to offset the increase in the number of projects under supervision in the sector (136 as of September 30, 1980). Overall, the average coefficient dropped slightly, from 6.9 staff weeks in FY78 to 6.5 staff weeks per project in FY80, the lowest coefficient of any sector.

18. As with project appraisal, supervision effort spent on individual projects varies widely from less than 1/2 staff week per year to over 30 depending on the stage of execution, project issues, etc. Again as with

appraisal, there is no clear correlation with type of project, region, co-financing or other characteristics, but there is a country correlation. Power projects are not immune to problems in "difficult" countries despite their infrastructure character. 1/

19. Managers necessarily display flexibility in using resources for supervision. Supervision missions are usually combined with preparation or other activities, although rarely with appraisal. Exceptions to this rule usually involve "repeater" cases dealing with the same entities where supervision is an integral part of the appraisal and in such cases, separate supervision reports may or may not be issued. Multi-country missions are common and one-man missions are frequent. In fact, comprehensive supervisions are becoming rare. Most supervisions are addressed to specific issues or "fact-finding", with well over half of the supervision effort being directed to financial issues, especially performance under pricing and earnings covenants. The result is that monitoring of on-going projects in non-borrowing countries has sometimes been neglected (Ireland, Sri Lanka). In general, the constrained schedules leave little scope for in-depth examinations to anticipate future financial or implementation problems. In this respect, the inclusion of monitoring indicators in loan agreements has not been particularly useful, even though effort is made to update them. This is because either specific targets are lacking so trend analysis is not meaningful or data is not available for cross-correlation with other countries or borrowers. The recent focus on utility management capabilities in the U.S. and elsewhere has generated much interest in management audit techniques but little of this has evolved to the point where it is transferable to Bank operations. Nevertheless, EGY/PAU is attempting to identify management audit techniques which can be effective in improving organizational and financial efficiency so that we can have an alternative to our usual prescription -- tariff increases.

20. Because of the issue-oriented nature of most power supervision missions, full supervision reports in accordance with O.M. 3.50 are infrequent. Instead, most divisions use a streamlined format consisting of the Form 590, a page or two of explanatory text (sometimes following the "compliance with covenants" outline), and the usual draft letters as annexes. Aides-memoire are not seen frequently but those divisions that do use the procedure consider it useful. The uniformity of approach has proven useful to managers (and to EGY/PAU) in facilitating review of mission findings and focusing promptly on issues raised by the missions.

21. Procurement activities account for most of the supervision workload of engineers and about half of the total supervision effort. Three divisions have procurement specialists assigned to this task and in general this system works well--regional consistency is assured and these procurement specialists tend to stay more up to date than their colleagues on current procurement

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1/ See FY80 Fall Project Implementation Review for a discussion of this issue.

issues and policy. The disadvantages include a variable workload (the procurement workload is not sufficient to justify a full-time position in most divisions) and some lack of coordination with the project officers. Occasional use of resident representatives for procurement work has been tried without much success. The Inter-American Development Bank has power sector representatives in its major countries, using this supervision activity as a training program, and seems satisfied with the results but proposals for a similar system for the Bank have been met with lukewarm response. If additional resources are to be provided, managers would prefer to use these to augment their "sub-critical" staff.

22. Power procurement tends to be quite complex. Pre-qualification is used extensively for civil works. The long disbursement periods for many contracts makes choice of proper escalation formulae mandatory, and the high premiums placed on efficiency demand precision in specification requirements for bid evaluation, tests, and performance clauses. Given the complexity of this work and the wide range of technical and commercial issues faced in most power procurement activities, disputes and problems are surprisingly rare and this in itself is a compliment to Bank staff dealing with this work. Nonetheless, recent contacts with consultants and others indicate a need for improvements in specifications and evaluation criteria for energy conversion equipment since the capitalized cost or benefit associated with marginal differences in efficiency can be of the same order of magnitude as the first cost of the equipment. EGY/PAU is undertaking a small research program to provide staff guidelines for specifications for power generating equipment.

23. Power was not identified as one of the sectors with major problems in the Fall '80 Project Implementation Review. Power projects with moderate and major problems were close to the average Bankwide, and inconsistencies due to Form 590 rating criteria were no better or worse than other sectors. However, the trend of projects with moderate and major problems was upward, from 50% in FY78 to 60% in FY80, due primarily to difficulties in making tariff and price adjustments to meet rising costs. Although the trend dropped, to 47%, in the Fall '81 project implementation review, this seems to reflect more a shift in the perception of the seriousness of defaults under financial covenants rather than a real improvement since the trend of such defaults continued to rise--two thirds of the earnings covenants were not being met as of end-81.

Economic and Sector Work

24. In FY78-80, 18 formal energy sector reports were produced; 12 by the regions and 6 by EGY. Of these, 7 were sector studies, 3 were sector reviews and 8 were sector memos. Each of these considered energy an integrated sector and in general provided an issues-oriented focus which was useful in dealing with the macro-economic issues generated by the post-1974 oil crisis. Even so, economic and sector work has not played a significant role in power division work programs. In FY78-80, it accounted for only 4% of direct operational effort and half of this was spent on formal reports, the bulk of which was on three large studies (Yugoslavia, Indonesia, Thailand). This apparent lack of emphasis on sector work has several causes. First, electric power is not perceived as having had a large impact on development and it

receives little emphasis in country economic reports and CPP's. Therefore, there is little demand from the Programs side for sector work as an input to country economic planning. Secondly, unlike some other sectors, countries having a defined lending strategy supported by a series of power projects have been rare. Thus, there has been little direct operational benefit from sector work in terms of identifying issues to be treated through a series of lending opportunities. Finally, because of the sectoral approach to power project lending, whereby the emphasis is on least-cost program planning, institution building and adequate financial performance in the sector, the project is automatically placed in a sectoral context thus making separate "sector" work redundant.

25. Much of the appraisal work really deals with sector issues and is, in fact, sector work. One possible benefit of increased emphasis on upstream sector work, as recommended in this paper, would be a reduction in effort on this aspect of the appraisal which would release resources for more work on the project issues. For these reasons, the formal sector work activities described in OMS. 1.13 are not given high priority by power division staff. In fact, "informal" sector work (that which does not result in a report) plays a much larger role in the sector. Sector notes, not entered into the formal PAB code system, are frequently prepared as "pre-project briefs" or as inputs to CPP's. The sector work component of project briefs recorded as project preparation effort, is large.

D. Power Advisory Unit Procedures

Project Review Process

26. The Power Advisory Unit participates in the project review process in three principal areas: (i) technical advice and review, (ii) Bank policy and guidelines, and (iii) staff training. The intensity of participation varies with the stages of the project cycle. Thus, the major comments on project concept and related engineering questions are often raised at very early stages in response to project briefs or more likely, during simple informal discussions with staff.

27. Procedural issues usually surface at the issues paper/decision stage and concern questions like calculation of foreign exchange costs, disbursements, choice of borrower and onlending but the timing of this review is inconvenient for addressing most of the major policy and operational issues--at that stage it is too late to address issues such as pricing and the sector development program since these points should have been an integral part of the appraisal, yet it is too early to agree on specific financial targets on other undertakings since the analytical work on which to base these decisions has not yet been completed. This latter problem can be managed during the later stages of appraisal, but the former requires more specific input as early as the CPP stage, although pre-mission issues meetings have been quite useful in some circumstances to assist staff in developing a strategy to deal with the issues expected to be encountered during appraisal.

28. Advice concerning methodologies for calculating rates of return and similar issues are dealt with during the preparation of yellow cover appraisal reports, although also at the preparation stage. The major input on financial matters usually can take place only after the issuance of the yellow cover report since it is only at this stage that the detailed financial statements and analysis are available. Similarly, specific discussion of institution-building recommendations and project implementation arrangements is possible only after these are spelled out in the SAR. Training needs, such as guidance for new staff on presentational format, Bank policy on nebulous issues such as treatment of customer contributions and shareholder equity often become apparent only at the yellow cover stage and are independent of project complexity. EGY/PAU also coordinates review comments from other CPS sector departments and PAS and conveys these comments to the regional divisions.

Quality Control

29. In accordance with current Bank policy, responsibility for project quality rests with the Regions. CPS acts only in an advisory capacity as necessary to provide functional support. In EGY/PAU this function is exercised selectively, but some degree of input is provided in every project. An issue, however, is emerging as a result of the policy of selecting unit managers on the basis of their management capabilities rather than on their technical expertise, and because Assistant Projects Directors are no longer expected to have technical knowledge of their assigned sectors. More specifically, only 4 of the 7 regional divisions have managers with pre-Bank experience in electric power. Thus, technical review of projects above the staff level is becoming increasingly less common; this is a situation which may not be acceptable in view of the relative number of newer staff and the limited technical capacity in some sub-disciplines. The present EGY/PAU review procedures provide some backstopping in such cases and, pending the adoption of some system (e.g. matrix management) that would provide technical review capacity at the regional level, EGY/PAU will continue to provide support in this area.

30. As an interim step, EGY/PAU has offered to coordinate a "peer-panel" system to provide assistance to staff in identifying and dealing with technical issues at the project preparation and appraisal stage. Meetings with colleagues, probably from other regions, knowledgeable about the particular issues (e.g. operations and dispatch, financial management systems, distribution design, power pools) would be arranged on a voluntary basis. This has not met wide acceptance, and a similar system initiated several years ago by TWT/Water Supply quickly fell into disuse because regional managers did not support it. Also, substantial effort to develop a "resources file" is necessary since the personnel records of individuals commonly do not include data on areas of expertise. Nonetheless, the potential benefits of such a system would seem to justify the effort to gain managerial support and to develop the necessary data base and administrative procedures.

31. The regional power divisions have expressed a desire to retain the present system whereby EGY/PAU provides some degree of review for all projects and have requested informal reviews even in cases where the yellow cover review has been waived. This is particularly valid as issues (e.g. training

of new power staff) often surface only at this stage of the review process. The yellow cover review is necessarily selective in view of the "lumpy" nature of the activity and the large increase in the operations program. For example, the several aspects of appraisals (engineering, finance, economics) commonly receive differing levels of review (or no review), depending on the characteristics of the particular project. Also, under the present system, if no new issues are raised at the appraisal stage of the review process, a formal meeting may not be held. In these circumstances waiver of yellow cover reviews result in minimal savings of advisory unit effort. For this and the above reasons, even though more than 10% of the reviews will be "waived" in FY82, specific targets for such waivers are not considered necessary.

Supervision and Audit

32. Supervision accounts for less than 5% of EGY/PAU effort, and most of this time is spent on the review of draft project completion reports and preparation for the annual audit-review seminar. Supervision reports (some 200 per year) are received in the unit and scanned for items of significance. When issues occur and as time permits, marked-up reports are returned to the region with requests for clarification or indication of intended action. In the few cases where this is done, no formal record of these comments is maintained nor is any attempt made to keep track of performance trends, monitoring indicators, etc. except when the same issue occurs repeatedly, as in the present case of non-compliance with earnings covenats. The EGY/PAU overview function would benefit from a statistical analysis of supervision findings and hopefully this can be started once computer capability is made available to the unit.

33. The annual review of OED power sector audits conducted by EGY/PAU in the past has attracted little attention from the regions for two reasons: (i) relatively few projects are reviewed each year -- only 6 in 1980, and (ii) the issues raised are either perennial (failure to meet the earnings covenants) or they are not perceived as being relevant to on-going operations. For example, cost overruns still appear as major problems in projects now being covered by completion reports, but the revised guidelines and practices on contingency allowances and preparation status (O.M.S. 2.28) are considered to have long ago done as much as possible to anticipate or control unexpected cost increases. In order to make these reviews more issues-oriented, with the 1980 review EGY/PAU departed from the strict format of simply reviewing the issues raised in PPAR's for projects completed in the calendar year. Instead, a concerted effort was made to address the issues that appeared in projects presently under supervision. The results were worthwhile and the meeting was well attended. In the future, however, more involvement of the regional divisions in determining the agenda and schedule will also be attempted. Ideally, an annual seminar for power staff similar to that conducted for water supply staff would be useful, both to transfer information and to provide a vehicle for lateral communication among staff of the regional divisions, but again resources for such an activity simply are not available. Given the large number of new staff, EGY/PAU has arranged a series of power economics seminars, and will expect to repeat these from time to time. The issues raised in this SSSP have provided a useful focus for these seminars.

E. Power Staff Characteristics

34. Engineers and financial analysts are the dominant technical specialists in the power divisions:

Power engineers	33
Financial Analysts	25
Economists	7

As with most technical specialists in the Bank, labels can be misleading. For example, while all of the engineers do, in fact, have formal training in engineering, five of the financial analysts and six of the economists also have university degrees in engineering, indicating that the technical penetration is much deeper than might be inferred from the titles. Despite a deliberate effort to identify qualified female candidates, there are no women in this staff complement.

35. As of September 30, 1980 power engineers had an average of 5.2 years of Bank experience. The upper limit was 11 years and the distribution fairly uniform. The average experience of financial analysts was about the same (4.6 years) but skewed, and nearly three quarters of them had less than five years experience. However, by mid-1981, after the addition of new power engineers is taken into account, average Bank experience drops to about four years, and one-third have less than two years experience in the Bank. This uneven experience distribution has been taken into account in formulating the training activities proposed in this paper.

36. The average age of power engineers, 51 years, increased slightly over the FY78-80 review period. Only four engineers (15%) were under 45, and 12 (nearly half) were age 55 or over and thus eligible for retirement, although it is expected that most will elect to stay until their normal retirement date. Conversely, 11 financial analysts (58%) were under 45 and only two over 55. Their average age (43) declined slightly in the review period. This profile has not changed significantly over the years. Typically, power engineers are seasoned mid-career specialists while financial analysts tended to be younger. Economists were somewhere in between.

37. The age and experience profile has tended to affect mobility and promotion within the Bank. Thus, only two engineers have moved elsewhere in the Bank (outside the sector) since the 1972 re-organization--one to EDI and one to departmental administration. No Bank staff from outside the sector have been appointed as power engineers. Conversely, at least six financial analysts have moved from power into other functions (notably to field offices and IFC). Moreover, half of the current complement of financial analysts came to the power sector from elsewhere in the Bank (5 from the YP program). This relative lack of mobility for technical specialists needs to be taken into account in formulating career development goals and guidelines for staff because, given the relatively advanced point in their career when power engineers join the Bank, it is unrealistic to engender career expectations outside the sector for most. On the other hand, contrary to the impression held by most financial analysts, their prospects for transfer and promotion outside the sector are quite good.

38. Recent experience has shown that it is nearly impossible to attract qualified power staff from Part II countries, barring political instability or other abnormal circumstances, (which in fact, have played significant roles in past recruitment). Qualified candidates from these countries generally have senior management or high level government positions with substantial perquisites and the Bank cannot offer compensation packages which are attractive to these individuals. Consulting firms occasionally provide candidates, and the IDB's resident representative training program has proven to be a good source of qualified staff but it is questionable whether we can continue to tap this because of adjustments in IDB's staffing policy. As for Part I candidates, whereas the Bank is only marginally competitive with utilities and consultants in Western Europe, it can and still does attract some qualified individuals from U.S. consulting firms, utilities and government organizations but identification of these individuals is difficult. Advertising in U.S. journals produces a large volume of replies (300-plus in November 1980-January 1981) but few qualified candidates, and even when acceptable candidates are identified rejection of the Bank's salary offer is not uncommon. Personal contact through attendance at professional conferences and direct recruitment efforts have proven to be essential in recruiting high caliber staff, and the Bank should be more aggressive in using such means. Staff referrals, an important source of qualified candidates in the past, are playing a declining role partly because staff do not perceive themselves as part of the recruitment mechanism, but also because there is a sincere concern that the Bank may not be the exciting place to work that it once was.

F. Research

Research Review Panel

39. The Bank's research activity in Energy, Water and Telecommunications was reviewed by a panel of outside experts in October 78 - March 79. The five-member panel which was chaired by Mr. M. Boiteux, President of Electricite de France was organized in response to a recommendation by the Bank's Board of Directors that such a review be carried out in each principal sector. Briefing material for the panel, including an overview of past research in 1972-78, is available in document PUN 44. The panel's recommendations were published as PUN 44a (May 1979).

40. The salient features of the 1972-78 program were:

-- In the seven years, power-related research absorbed a total of6.7 staff years of direct effort and $450,000 in other expenses (consultants, travel) of which two major projects accounted for most of the expenditure (5.3 sy, $250,000). They were: Problems and Issues in Rural Electrification ("Rural Electrification", October 1975 policy paper), and Pricing and Investment in Electricity Supply ("Electricity Economics", 1977, a research publication published for the Bank by Johns Hopkins University Press);

-- In FY74-77, EWT advisory staff spent in total 2.7 staff years on power-related research, or 0.7 sy/year;

-- In FY77, considered to be a typical year, expenditure on power-related research amounted to about $200,000 (including staff time), or only 2 1/2% of total Bank expenditure on research in that year.

-- The future research program in power was expected to continue the work on power pricing and reliability standards for rural areas. A research project on autogeneration/cogeneration was planned, as well as "multi-sector" research on the fiscal implications of public-utility revenue objectives, consumer relations and the role of co-financing.

41. In light of the above, the review panel recommended the following with regard to electric power:

-- No significant change in resources applied to electric power research.

-- Wider dissemination of the results of research activities in rural electrification and power pricing.

-- Future research should include:

public utility pricing under conditions of inflation, research into social pricing to determine implications for income redistribution, institution building.

-- No further work in valuing economic benefits of electric power.

-- Further integration of power work with other energy work.

-- More regional stimulation of research proposals; better coordination and collaboration with research activities of other departments.

New Issues

42. These recommendations were made in the context of FY73-77 operations when lending for power was expected to stabilize at about $900m/yr (contrast $2400m in FY 80). Further, this was before the real implications of the energy crisis on Bank operations had been evaluated, and at a time when the small advisory staff was preoccupied with laying the groundwork for the move into oil/gas operations. Not surprisingly, many research topics which have now emerged as issues were not considered by the panel. Among these are:

-- Implications of construction delays on project justification;

-- conservation, loss reduction and load management in distribution, thermal and hydro generation;

-- valuing embodied energy and pricing in enclave projects for world-traded commodities (aluminum, fertilizer);

-- impact of price elasticity and oil substitution on load forecasts;

-- guidelines for multi-purpose project optimization;

-- problems of long transmission lines with light loads;

-- organization and financing of small-scale hydropower development;

-- consistent criteria for evaluating hydroelectric resources;

-- definitive methodologies for economic evaluation of rural electrification projects;

-- reconciling economic and financial pricing objectives for public utilities;

-- performance audit monitoring criteria;

-- fiscal and budegary constraints on the magnitude of power development programs;

-- review of computer models available for power system planning and operations;

-- improved methods of load management, hydrologic forecasting, and system operations;

-- role of electric power in industrial development, etc.

43. Each of the above subjects is an issue in one or more of the power projects in the prospective 5-year lending program. At present the resources available for power research (about 2.5 staff years in FY82, including consultants) are being applied to priority issues, principally loss reduction and small-scale hydro, which are believed to have the greatest scope for inmediate application in the operations program.

Next Steps

44. Past work on the supply side has stressed system planning and the economics of supply. The Department now has available a power system planning model (WASP) which has been upgraded from version II to version III. This is an up-to-date and versatile analytical tool for verifying the appropriateness of generation expansion programs proposed by borrowers and/or consultants. Similarly, consultants reviews of recent developments such as the thermal generation efficiency study will be incorporated in the PUN/GAS series. On the demand-side, work on pricing issues has been consolidated through dissemination involving both documentation (e.g., the book Electricity Economics, staff Working Paper 340 on "Electric Power Pricing Policy", and the forthcoming book, Electricity Pricing in Developing Countries, and tariff seminars in four regions (South Asia, East Asia and Pacific, Latin America and Caribbean, and East Africa). Considerable success has been achieved

particularly in the LDC's, but the effort to consolidate previous gains must be maintained. This is especially important with the present emphasis on application in operational work (appraisal reports, standard terms-of-reference to consultants for tariff studies, helping borrowers to carry-out tariff studies themselves, etc.). In this regard, a very modest EGY contribution is required to help the EMENA and West Africa regions hold tariff seminars. Otherwise, no new research or documentation is required in this field.

45. Ongoing Research in rural electric networks and distribution system loss reduction will be incorporated in guidelines/checklists useful to operational staff. The final report of research project 671-86, Standards of Rural Electrification (R.E.) is expected to be completed in 1981. The study involves the review of existing R.E. institutional frameworks and engineering standards and practices in LDC's, the development of an economic-engineering model to optmize network design, and the practical implementation of the methodology in two case studies of R.E. networks in Costa Rica and India. Because of the increase in R.E. lending, the almost complete dependence on consultants for network design, and the very diverse (and sometimes inappropriate) practices adopted in different countries, the results of the research project should be quickly adapted for application in project work.

46. Research project R633, on Distribution System Loss Reduction is expected to be completed by mid-1982. This study includes a review of the recent techniques for reducing distribution losses, the development of an economic-engineering model and computer programs for optimizing technical loss levels, and application of this methodology to several LDC distribution systems. With the recent increases in energy supply costs, and the unacceptably high levels of system losses in many LDc's, loss reduction has a high priority. In fact, there is good reason to suggest the adoption of a policy of routinely assessing system losses during any power lending operation and, if necessary, the setting of acceptable loss targets (akin to financial targets) for utilities. The development of a guideline/checklist based on this work will have a high priority.

47. As noted above, demand management and conservation should receive high priority in the research program. Load/demand management and conservation in the power sector are closely related to broader efforts for the whole energy sector. The principal focus is on load control, etc., associated with methods of so-called "hard" demand management that are particularly effective in the short-run. Work in this area supports previous Bank research in two ways. First, load control techniques are complementary to and should be closely coordinated with the soft techniques of demand management such as pricing, financial incentives, and so on. As described earlier, the Bank has already paid considerable attention to the latter methods, which are more useful in the longer run. Secondly, hard demand management encourages conservation by users which parallels the system loss reduction research related to the supply-side (i.e. the utility). Load control techniques are well-advanced in the industrialized countries. A research study to review the state-of-the-art, recommend promising areas for application in LDC's, and carry out several pilot studies perhaps in conjunction with ongoing lending operations, should have high priority. The main

potential for application would be in industry, and the research should include a study of how such consumers use electricity, their sensitivity to changes in the level and structure of prices, flexibility of production processes with regard to substitution between electricity and other forms of energy, as well as between energy, capital and labor, etc. The benefits in terms of more efficient use of generating capacity (e.g., a shift from peak to off-peak use) and lower consumption may warrant substantial investments in advanced solid state metering, microprocessor based switching, etc. Through its contacts with suppliers and outside agencies (EPRI, EEI, USAID), EGY/PAU is attempting to identify state-of the art studies in this field, so far without success. It may be necessary to support research in this field for developing policies, guidelines and checklists which Bank staff and consultants could use routinely to recommend to borrowing utilities, and for preparing outline TOR's for energy audits and efficiency studies of large users.

48. The research panel recommended that the Bank support the research needed to monitor and adapt new technologies including cogeneration and autogeneration, larger scale mini-hydro programs, wind and solar generation, and so on. At present there seems to be little need for the Bank to devote resources to the technology of alternative energy sources, but work on the application and evaluation of these sources is not well organized elsewhere and may be an appropriate Bank activity. However, only work on small-scale hydro is being considered under the power research program; other technologies are being covered by the office of the New Energy Sources Adviser.

COMPARISON OF ELECTRIC POWER LENDING AND POWER INVESTMENT

Low Income Countries	1977 GNP/Capita $	Mid-1977 Population Millions	FY76-80 Power Lending ($m)	FY81-85 Identified 1/ Lending ($m)	FY81-85 Recommended Lending ($m)	1981-85 Power Investment 2/($m)	Bank Lending as % of Investment
Seychelles	60	0.1	-	-	-	10	-
Bangladesh	90	91.2	33	88	200	800	25.0
Lao PDR	90	3.2	-	-	15	60	25.0
Ethiopia	110	30.2	-	40	80	200	40.0
Mali	110	6.1	-	15	15	45	33.3
Nepal	110	13.3	41	96	110	200	55.0
Somalia	110	3.7	-	-	10	20	50.0
Burundi	130	4.2	-	20	20	40	50.0
Chad	130	4.2	-	-	20	40	50.0
Rwanda	130	4.4	-	-	-	30	-
Upper Volta	130	5.5	-	-	35	70	50.0
Zaire	130	25.7	-	15	150	450	33.3
Burma	140	31.5	-	80	80	400	20.0
Malawi	140	5.6	25	27	50	220	22.7
India	150	631.7	1,337	2,225	2,600	29,000	9.3
Mozambique	150	9.7	-	-	-	70	-
Cape Verde	150	0.3	-	-	8	20	40.0
Niger	160	4.9	-	-	15	50	30.0
Afghanistan	160	14.3	10	35	-	400	-
Equatorial Guinea	160	0.3	-	-	-	20	-
Comoros	180	0.4	-	-	-	30	-
Guinea-Bissau	180	0.7	-	-	12	30	40.0
Pakistan	190	74.9	95	30	300	2,900	10.3
Sierra Leone	190	3.2	8	12	40	300	13.3
Tanzania	190	16.4	30	60	70	350	20.0
Benin	200	3.2	-	-	-	10	-
Sri Lanka	200	14.1	32	35	60	500	14.5
Gambia	210	0.5	-	-	-	10	-
Guinea	220	5.0	1	41	50	100	50.0
Haiti	230	4.7	33	26	35	100	35.0
Lesotho	240	1.3	-	-	-	20	-
Madagascar	240	8.1	43	15	35	150	14.5
Central African Rep.	250	1.9	-	-	-	30	-
Kenya	270	14.6	90	-	100	300	33.3
Mauritania	270	1.5	-	-	-	20	-
Uganda	290	12.0	-	-	25	70	35.7
Sudan	290	16.9	65	30	110	330	33.3
Angola	300	6.6	-	-	-	300	-
Indonesia	300	133.5	740	745	800	3,400	23.5
Togo	300	2.4	-	-	12	30	40.0
Low Income Subtotal	-	1,202.0	2,583	3,635	5,057	40,125	12.6
Middle Income Countries							
Egypt	320	37.8	314	-	600	6,100	9.8
Cameroon	340	7.9	-	-	39	300	13.0
Yemen, P.D.R.	340	1.7	5	9	20	50	30.0
Ghana	380	10.6	57	50	120	400	30.0
Honduras	410	3.3	135	-	40	900	4.3
Liberia	420	1.7	12	23	15	60	25.0
Nigeria	420	79.0	100	250	250	4,700	5.3
Thailand	420	43.8	295	120	300	3,900	7.7
Senegal	430	5.2	3	-	15	60	25.0
Yemen A.R.	430	5.0	10	10	40	150	26.7
Philippines	450	44.5	118	175	420	5,500	7.6
Zambia	450	5.1	-	-	40	90	44.4
Djibouti	450	0.3	-	-	-	50	-
Sao Tome & Principe	460	0.1	-	2	2	5	40.0
Congo, People's Rep.	490	1.4	-	-	-	50	-
Papua New Guinea	490	2.9	-	-	40	320	12.5
Guyana	520	0.8	-	20	35	300	11.7
Swaziland	530	0.5	-	10	15	70	21.4
Botswana	540	0.7	-	-	30	100	30.0
El Salvador	550	4.2	39	40	85	300	28.3
Morocco	550	18.3	91	-	105	500	21.0
Bolivia	630	5.2	25	-	40	230	17.3
Ivory Coast	690	7.5	33	108	120	400	30.0
Jordan	710	2.9	15	10	40	300	13.3
Colombia	720	24.6	544	790	500	3,100	16.1
Paraguay	730	2.8	-	-	-	50	-
Mauritius	740	0.9	15	13	20	100	20.0
Ecuador	790	7.3	-	70	70	950	7.4
Guatemala	790	6.4	127	80	80	300	26.6
Korea, Rep. of	820	36.0	115	110	160	9,000	4.0
Nicaragua	830	2.4	22	-	40	450	8.9
Dominican Rep.	840	5.0	-	-	15	300	5.0
Peru	840	16.4	59	60	60	700	8.6
Tunisia	860	5.9	14	20	30	700	4.3
Syria	910	7.8	40	-	60	650	9.2
Malaysia	930	13.0	107	-	100	1,100	9.4
Algeria	1,110	17.0	57	80	80	1,300	6.2
Turkey	1,110	41.9	156	-	400	10,000	4.0
Mexico	1,120	63.3	-	-	-	12,000	-
Jamaica	1,150	2.1	20	25	25	150	16.7
Lebanon	1,150	2.9	-	-	40	250	16.0
Chile	1,160	10.6	35	-	50	800	6.3
Panama	1,220	1.8	65	45	45	400	11.2
Costa Rica	1,240	2.1	34	45	45	400	11.2
Fiji	1,330	0.6	30	-	20	100	20.0
Brazil	1,360	116.1	737	605	600	30,500	2.0
Uruguay	1,430	2.9	24	20	20	600	3.3
Romania	1,530	21.6	120	215	200	6,500	2.8
Argentina	1,730	26.0	325	-	250	13,700	1.8
Barbados	1,770	0.2	-	5	12	100	12.0
Cyprus	1,830	0.6	-	-	30	130	23.0
Suriname	1,870	0.4	-	18	30	300	10.0
Portugal	1,890	9.6	36	-	80	1,500	4.7
Yugoslavia	1,960	21.7	153	180	250	8,000	3.1
Oman	2,160	0.8	1	-	25	350	7.1
Middle Income Subtotal	-	761.1	4,108	3,208	5,948	129,025	4.6
TOTAL (95 countries)	-	1,963.1	6,691	6,843	11,005	169,150	6.5

1/ Very few projects identified for FY85.
2/ 1980 $.

POWER SECTOR ISSUES IN LDC'S

COUNTRY	INSTITUTIONAL					FINANCIAL				
	MANAGEMENT /ORGANIZATION	RESOURCE STUDIES/ DEVELOPMENT PLANNING	EFFICIENCY IMPROVEMENTS	SECTOR COORDINATION	REGIONAL COOPERATION	PRICING/RESOURCE MOBILIZATION	LAST-RESORT LENDING	CATALYZE CO-FINANCING	SUPPLEMENT CO-FINANCING	CAPITAL TRANSFER
EAST AFRICA										
Botswana	x				x			x		
Burundi	x	x	x		x	x	x			
Cape Verde	x	x					x			
Comoros	x	x				x	x			
Djibouti		x				x				
Ethiopia		x			x				x	
Kenya		x			x				x	
Lesotho	x		x			x		x		
Madagascar		x	x						x	
Malawi		x	x		x	x		x		
Mauritius			x	x		x		x		
Mozambique		x				x				
Rwanda	x				x		x			
Seychelles				x			x			
Somalia	x		x	x		x		x		
Sudan		x		x		x		x	x	
Swaziland	x	x						x		
Tanzania		x			x	x			x	
Uganda	x	x		x	x	x	x			
Zaire	x		x		x					x
Zambia	x				x	x				x

POWER SECTOR ISSUES IN LDC'S

COUNTRY	INSTITUTIONAL					FINANCIAL				
	MANAGEMENT/ORGANIZATION	RESOURCE STUDIES/ DEVELOPMENT PLANNING	EFFICIENCY IMPROVEMENTS	SECTOR COORDINATION	REGIONAL COOPERATION	PRICING/RESOURCE MOBILIZATION	LAST-RESORT LENDING	CATALYZE CO-FINANCING	SUPPLEMENT CO-FINANCING	CAPITAL TRANSFER
WEST AFRICA										
Angola		x				x				
Benin	x	x		x	x	x				
Cameroon		x				x				
Central African Republic	x	x	x			x				
Chad				x				x		
Congo		x							x	
Equatorial Guinea	x		x				x			
Gambia				x	x	x				
Ghana	x	x			x			x		
Guinea	x					x				
Guinea-Bissau	x					x				
Ivory Coast		x		x	x			x		
Liberia		x							x	
Mali	x						x			
Mauritania		x	x				x			
Niger		x				x				
Nigeria	x	x		x					x	
Sao Tome & Principe		x				x				
Senegal		x		x						
Sierra Leone		x			x					
Togo		x			x	x				
Upper Volta		x			x	x				

POWER SECTOR ISSUES IN LDC'S

COUNTRY	INSTITUTIONAL					FINANCIAL				
	MANAGEMENT/ORGANIZATION	RESOURCE STUDIES/ DEVELOPMENT PLANNING	EFFICIENCY IMPROVEMENTS	SECTOR COORDINATION	REGIONAL COOPERATION	PRICING/RESOURCE MOBILIZATION	LAST-RESORT LENDING	CATALYZE CO-FINANCING	SUPPLEMENT CO-FINANCING	CAPITAL TRANSFER
EUROPE, MIDDLE EAST & NORTH AFRICA										
Afghanistan	x	x	x			x	x	x		
Algeria		x		x	x	x			x	x
Cyprus			x			x	x	x	x	
Egypt	x	x	x	x		x		x		
Jordan		x		x				x		
Lebanon							x			x
Morocco		x		x	x	x		x	x	
Oman	x	x	x	x		x			x	
Portugal				x		x				x
Romania					x					x
Syria	x	x	x	x	x	x		x		
Tunisia		x	x	x		x		x	x	
Turkey	x	x	x	x	x	x		x		x
Yemen Arab Republic	x	x	x			x	x	x		
Yemen, People's Democratic Republic		x				x				
Yugoslavia				x	x	x			x	x

POWER SECTOR ISSUES IN LDC'S

COUNTRY	INSTITUTIONAL					FINANCIAL				
	MANAGEMENT/ORGANIZATION	RESOURCE STUDIES/ DEVELOPMENT PLANNING	EFFICIENCY IMPROVEMENTS	SECTOR COORDINATION	REGIONAL COOPERATION	PRICING/RESOURCE MOBILIZATION	LAST-RESORT LENDING	CATALYZE CO-FINANCING	SUPPLEMENT CO-FINANCING	CAPITAL TRANSFER
SOUTH ASIA										
Bangladesh	x	x	x		x	x	x	x		
Burma		x	x			x	x			x
India			x	x	x	x				
Nepal	x	x	x							
Pakistan	x	x	x	x		x		x		
Sri Lanka		x	x			x		x		
EAST ASIA & PACIFIC										
Fiji		x				x			x	
Indonesia	x	x	x	x		x		x	x	x
South Korea	x								x	x
Laos	x	x	x		x	x	x			
Malaysia		x	x		x	x		x		
Papua New Guinea		x				x		x		
Philippines		x	x					x		
Thailand	x	x			x					
LATIN AMERICA & CARIBBEAN										
Argentina			x		x				x	x
Barbados	x	x	x		x	x			x	
Bolivia	x	x		x				x	x	
Brazil		x		x	x	x			x	x
Chile		x	x	x		x		x		

POWER SECTOR ISSUES IN LDC'S

COUNTRY	INSTITUTIONAL					FINANCIAL				
	MANAGEMENT/ORGANIZATION	RESOURCE STUDIES/ DEVELOPMENT PLANNING	EFFICIENCY IMPROVEMENTS	SECTOR COORDINATION	REGIONAL COOPERATION	PRICING/RESOURCE MOBILIZATION	LAST-RESORT LENDING	CATALYZE CO-FINANCING	SUPPLEMENT CO-FINANCING	CAPITAL TRANSFER
LAC (continued)										
Colombia			x	x						
Costa Rica			x		x	x		x		
Dominica		x	x						x	
Dominican Republic	x	x				x				
Ecuador		x	x		x	x		x		
El Salvador		x	x		x				x	
Guatemala		x	x	x	x					
Guyana	x	x		x	x	x			x	
Haiti	x	x	x			x	x	x		
Honduras			x		x			x	x	
Jamaica		x						x	x	
Mexico					x					x
Nicaragua			x	x		x		x		
Panama			x			x	x		x	
Paraguay			x		x				x	
Peru		x	x						x	
Suriname		x	x		x					
Uruguay	x			x	x				x	

SUMMARY OF POWER SECTOR

POLICY AND GUIDELINE MATERIAL

The various EGY document series are described in the Index as follows:

Public Utilities Notes/Energy Notes

Energy Notes are information of "state-of-the-art" papers on energy sector related subjects. They are used to: provide perspective on subjects of current interest (Public Utility Pricing and Inflation); disseminate information on the operational significance of ongoing research; explain the origin of current research and help retrieve past work (Utility Pricing Studies); summarize, for the benefit of a broad audience, the contents of bulk research papers (Energy Demand Forecasting); or draw attention to innovative operational work. These notes are issued under the sole responsibility of the Energy Department and do not represent statements of Bank policy. They can be communicated to interested individuals outside the Bank with the exception of PUN 7, due to its unfinalized status; and PUN 13 which forms part of the World Energy Conference papers.

Guidelines Series

The Guidelines Series includes a variety of papers on economic, financial and technical subjects. Some of them result from the natural sequence of EGY's innovative tasks--research, policy papers, guidelines; others from EGY's studies of operational techniques, methods or procedures; while still others reflect changing Bank practices in the utility sectors. Gudeline papers are circulated in draft to the division chiefs and a selected panel of staff in the regions and other departments. Any disagreements of substance are thoroughly discussed. For those guidelines which prescribe actions, procedures, or methods, staff are expected to observe the guidelines unless there are convincing reasons to support a departure.

Research Series

Papers in the Research Series represent the result of analytical and expository studies which are considered to be of interest to operational staff. This index covers three types of research: (1) departmental papers, (2) draft reports, and (3) Bank research publications. The practice is to signal in this index interesting draft papers generated by ongoing research and to issue self-contained "pieces" as departmental papers without waiting for the particular research project to be completed and finalized for publication. These papers are issued under the sole responsibility of the department and, as they have not been cleared with the countries concerned and/or processed through other Bank departments, may not be distributed outside without an ad hoc judgment. None of these are to be regarded as statements of Bank policy.

EGY DOCUMENT SERIES

SUBJECT INDEX

April, 1980

Page No.

POWER

Power: General

Page No.

Power: Pricing

Power: Rural Electrification

Record

OFFICE MEMORANDUM

TO: Files

DATE: April 30, 1982

FROM: Alexander Shakow, CPD

SUBJECT: Minutes of the Operations Policy Subcommittee Meeting of April 28, 1982

Present:

Members: Messrs. Stern (Chairman), Baum, Chaufournier, de la Renaudiere, Kirmani, Kraske, Lari, Thalwitz, Vergin, Wright.

Others: Ms. Artus, Ms. Pratt, Messrs. Hattori, Wood, Chernick, Kopp, Shakow.

Use of the SDR as a Unit of Account

1. Mr. Wood explained that the paper was prepared in response to a request by the Executive Directors last year for a study on steps the Bank might take to use the SDR as its unit of account. He noted that the paper gives cautious endorsement to the use of the SDR as a reporting currency; comes down hard against the SDR's use as a unit of denomination for Bank borrowings and repayments, and straddled the fence on the use of the SDR in planning and programming Bank operations. He was particularly anxious to have the OPSC views on the operational implications of using the SDR in planning, programming and monitoring Bank lending (section 4 of the draft paper).

2. Committee members were skeptical that the marginal and quite uncertain benefits of introducing the use of the SDR in operations would offset the very substantial operational difficulties and confusion that would result. Among the points made were the following:

1) Experience with IDA commitments being denominated in SDRs demonstrates the disutility of such a change, for SDRs are not used as a practical tool but only appear in loan and other documents as an amount converted into SDRs after all the calculations have been made in dollars.

2) Unless the Bank's entire system of finance and accounting moves to the SDR base, the advantages in moving to it in operations would be minor.

3) Many complications and confusion would ensue if the Bank used SDRs for its project work and other donors, co-financers, borrowers et al did not do so. The possible benefit of protecting against future cost overruns was considered to be de minimis. The statistics in the draft which purport to demonstrate this benefit were thought to be of dubious validity.

4) The paper's caution about the potential cumulative effects of several individual steps was well taken, but it was not

possible to predict the nature of those cumulative effects and therefore difficult to discuss the impact with borrowers. So far, the limited shift to SDR usage has not affected borrowers, but if it was introduced into Bank project and planning operations more broadly, it would be significant to them.

5) If SDRs were introduced to CPPs et al, this would suggest conversion of standard economic and financial indicators, including debt statistics, commodity prices, etc. This was considered impractical and would put the Bank out of step with the outside world.

6) If the SDR were to be adopted more broadly by the financial world, then it would make sense for the Bank to do so; if not, then it would probably be a high-cost, confusing change. It was noted, for example, that no regional banks use SDRs for operational purposes (though the EIB does use ECUs).

3. The Committee concluded that since it was not proposed to denominate Bank assets in SDRs, there was no sense in converting loan commitments; if reporting of aggregate commitments in SDRs for financial sheets was desired, that was no particular problem; to do more internally or externally would be very confusing; any such actions should come as part of a wide-scale conversion of the total system. The Committee recommended that Mr. Wood incorporate the strong negative side of this issue in the revised paper.

Cleared with Messrs. Wood
Chernick

AShakow/ww

FORM NO. 89
(7-81)

THE WORLD BANK

ROUTING SLIP	Date: May 26, 1982

OFFICE OF THE PRESIDENT

Name	Room No.
Managing Committee	

	To Handle		Note and File
	Appropriate Disposition		Note and Return
	Approval		Prepare Reply
	Comment		Per Our Conversation
	Full Report		Recommendation
	Information		Signature
	Initial		Send On

Remarks

I attach for information
Minutes of the Operations Policy
Subcommittee Meeting of April 28, 1982.

From

William S. Humphrey

OFFICE MEMORANDUM

TO: Files

DATE: April 30, 1982

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Cleared with Messrs. Wood
Chernick

AShakow/ww

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

File
OPSC
Sub-Comm
WHA
5/6.

TO: Distribution Below

DATE: April 30, 1982

FROM: E. Bevan Waide, Director, CPD

SUBJECT: Staff Review on Science, Technology and the World Bank of the 1980s

1. On Thursday, May 13, 1982, Mr. Herman van der Tak will chair a staff review of the attached PAS paper on Science, Technology and the World Bank of the 1980s. The meeting will be held in Room D-556 at 2:30 p.m.

2. The paper reviews the importance of science and technology to development and then considers the World Bank's role. A broader and more active long-term Bank program is recommended.

Attachment

Distribution

Attendance

Messrs. van der Tak (Chairman)
Alisbah, B.
Burki, S.J.
Churchill, A.
de Azcarate, L.
Dubey, V.
El Darwish, A.S.
Evans, J.
Fuchs, H.
Gue, A.
Gulhati, R.
Habte, Aklilu
Hasan, P.
Hendry, J.
Holsen, J.
Jaycox, E.V.K.
Kapur, S.
Kirmani, S.
Lejeune, M.
Mozoomdar, A.
Pfeffermann, G.
Picciotto, R.
Richardson, R.
Rovani, Y.
Stoutjesdijk, E.
Thalwitz, W.
van der Meer, S.
Vergin, H.
Willoughby, C.
Yudelman, M.

For Information

Messrs. Stern
Baum
Wright
Humphrey
Ms. Pratt

Science, Technology and the World Bank of the 1980s

The attached paper recommends that the Bank explicitly recognize the importance of science and technology to development and adopt a systematic, long term approach to work on this subject.

The paper contains a substantial number of specific recommendations, but given current resource constraints and other pressures on the Bank it is clear that not all of the recommendations can be implemented immediately. Thus, the approach suggested by the paper should be considered a policy framework within which specific activities can evolve over time. In fact, in many areas this process is already underway to some degree.

Discussion of the paper might best focus on the major recommendation that systematic attention and encouragement should be given to science and technology issues in Bank operations and the steps the Bank might take to strengthen its work in this area.

Draft
Feb. 3, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

EXECUTIVE SUMMARY

Science and technology is universally recognized as a critical element of development.

- Economic returns on agricultural research in LDCs frequently exceed 40%.
- Improved technology for wheat and rice production has increased LDC agricultural output by $3-4 billion.
- Malaysian research has kept natural rubber competitive on world markets.
- Low-cost cookstoves for the poor can help save endangered forests and help decrease the cost of fuelwood.

Yet the level of LDC attention to science and technology is low.

- Only 3% of the world's research and development takes place in LDCs, and only 12% of its scientists and engineers live there.
- Research on malaria comes to only 2¢ per infected person, compared to $850 per cancer patient in the US.
- Existing aid efforts fall far short of the need.

Lack of attention to science and technology has contributed to diverse disasters: the destruction of the tropical forests; the decline of the jute industry; crop failure in Pakistan.

The Bank has accomplished much in science and technology, both in promoting research and in developing local scientific and technological capacity.

- Projects have supported $1 billion in agricultural research and $2.6 billion in scientific and technological education.
- The Consultative Group on International Agricultural Research mobilized $140 million in 1981 to support 13 international programs, of which $14.6 million came as a grant from the Bank administrative budget.
- Bank research on appropriate technology has developed new low-cost approaches to civil works construction and to urban sanitation.
- Bank projects, totaling $118 million, encourage technological innovation in industry.

- IFC has invested $2.6 million in 3 venture capital companies.

- The Bank has helped develop capacity for project design and implementation in many countries and sectors. For example, it helped build Brazilian highway engineering to international standards.

The Bank has unique advantages for work in science and technology.

- Its has money, influence, an understanding of development, and concern for social problems.

- It can scale up successful innovations.

- It can help build local technological capacity and at the same time involve it in major investment projects.

- It can plan and fund large-scale research on critical global problems.

- It can influence national policies to encourage research, innovation, and more appropriate choice of technology.

But compared to its potential, the Bank's current activities are modest. Its approach is unduly cautious and unsystematic.

The report therefore recommends:

- The Bank should make scientific and technological development an explicit objective.

- The Regions, relevant support departments, and IFC should develop a plan to strengthen its work in science and technology.

  Example: Each CPS sector department should consider national and global needs for research, development, pilot tests, and the building of technological capacity in the sector in which it works.

- The Bank should revise its policies and procedures so as to encourage initiatives in science and technology.

- The Bank should increase its lending for research, development and pilot tests.

- The Bank should provide grants to research of broad potential application.

- The Bank should announce its policy on science and technology in the President's annual address, and convene a high-level advisory committee.

Draft
February 3, 1982
CONFIDENTIAL
Do Not Cite

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

Charles Weiss, Jr.
Room E1036, Ext. 76525/6
Science and Technology Adviser
Projects Advisory Staff
Central Projects Staff

The World Bank
1818 H Street, N.W.
Washington, D.C. 20433

DRAFT
Feb. 3, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980S

Table of Contents

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

Summary and Recommendations

i. Science and technology have changed the world beyond recognition several times in the last few centuries, and will no doubt do so again within the next decades. Science and technology have played a key role in the development of the United States, Western Europe and Japan.

ii. In the developing countries, investments to date on research, innovation and the development of technological capacity have given high rates of return through increased agricultural production, improved health and nutrition, more effective development of natural resources, and better choice and operation of imported technology. For example, improved technology for the production of wheat and rice have added $3-4 billion to world annual agricultural output, and have transformed most countries of South and South-East Asia into net food exporters.

iii. By contrast, neglect of the scientific and technological aspects of development has been a major factor in a number of unhappy experiences in the fields of agriculture, energy, and environment. For example, long-standing neglect of technological capacity and research has left South American governments unprepared to deal with the flood of immigrants now pouring into the fragile ecosystem of the Amazon valley.

iv. Despite their high potential contribution to development, investments in science and technology in developing countries have been relatively limited. Only 12 percent of the world's scientists and engineers work in developing countries, and only 3 percent of the world's investment in research and development takes place there. For example, only 26 U.S. cents per farmer was spent on agricultural research

in developing countries in 1975, compared to about $175 in the United States. Research expenditure on malaria amounted to 2 cents per infected person in 1978, as contrasted with $850 per cancer patient in the United States.

v. The Bank would open up new opportunities in renewable energy, health, agriculture and other sectors if it increased its support to research and development needed to produce technical advances in these fields. For example, the development and widespread use of high yielding trees and other energy crops could make a major contribution to combatting deforestation, stemming balance of payments losses due to imported fuels, and opening up new avenues of rural development.

vi. By improving the capacity in developing countries for making scientific and technological decisions, the Bank would make possible sounder patterns of development--sounder because they are rooted in the countries' own perceptions of their needs, resources and capabilities, more conserving of energy and the environment, and more suited to creating productive jobs.

vii. Science and technology is a key underpinning for all stages of development, in both the modern and the traditional sector. Exclusive reliance on foreign technology--the present pattern in most developing countries--too often results in the use of expensive, inappropriate technology. Moreover, for some problems such as tropical diseases and farming systems for the small farm, adequate technology is not available and is unlikely to emerge without research and development specifically directed to these problems in developing countries.

viii. The private sector plays a critical role in the development of technology and technological capacity. But even in the most advanced

countries, private investment in research, development and commercial innovation is insufficient to meet national needs, especially in fields where market incentives are lacking. For this reason, Japan, most European countries, and many advanced developing countries encourage and supplement technological innovation in the private sector by government action. In most developing countries, the private sector, including both commercial firms and voluntary organizations, is more flexible and efficient than its public counterparts, but is unaccustomed and ill-equipped to invest in research or in innovative technology, especially when commercial markets for the new product are not assured. Development assistance agencies could make a substantial contribution to technological development if they helped private firms to undertake these risky activities.

ix. More generally, the present efforts of the international community to assist the technological development of less developed countries, while substantial, fall short of the need for such assistance. The Bank is well placed to fill many of the gaps in the international effort to mobilize science and technology for the benefit of developing countries, in areas where other international institutions are unlikely to be effective and in which the interest of the private sector has up to now been limited. The limited work of the Bank in science and technology to date has been very effective and should be substantially expanded.

x. The Bank can help to expand the general level of scientific and technological capacity and activity through its lending. It can develop imaginative ways of collaborating with the private sector to stimulate innovation and to introduce improved technology. It can also play a leading role in efforts to link local scientific and technological capacity with production, to scale-up successful innovations, to plan and carry out

large-scale research on scientific and technological problems facing the entire developing world, and to improve the awareness and understanding of the scientific and technological dimension of development among policy makers and the entire development community.

xi. Science and technology forms part of the normal project work of the Bank. Most Bank-financed projects use existing production technology, which is identified, transferred and adapted to the particular conditions of the project. Local people are trained to implement and operate the technology. Bank-financed projects occasionally improve existing technology or even develop and introduce a new technology.

xii. In addition, the Bank has made a good start towards a program of specific support to the scientific and technological development of its member countries. Its support to education and agricultural research and extension amounted to $2.6 billion and $0.98 billion, respectively, through June 1981. The Bank supports pilot and demonstration projects, the building of local technological capability and the promotion of innovation within enterprises. The International Finance Corporation has invested $2.6 million in technologically oriented venture capital companies in three countries. The Bank Group's operations in each of these areas have in general been effective.

xiii. The Bank's scientific and technological work also includes grant contributions to the Consultative Group on International Agricultural Research (CGIAR) totaling $69.5 million from 1972 to 1981, in support of 13 international research programs on the major foodcrops and agro-ecological zones of the developing world. The improved technology for rice and wheat production referred to on page one of this summary was developed by two of these laboratories.

xiv. The Bank has also made a contribution of $2.5 million to international health research in 1981. It has supported research, amounting to $3.0 million, which has resulted in low-cost technological options that will greatly increase the productivity of investments in sanitation and in civil works construction. And it has provided technical assistance to national technology policy, especially regarding measures to promote the local consulting and engineering industry, which plays a critical role in the choice of technology suited to local conditions.

xv. The Bank has succeeded in contributing to scientific and technological development on a scale and with an approach that cannot be matched by other development assistance organizations. Nevertheless, compared to the overall size and scope of the Bank's operations, its efforts in science and technology are modest. Science and technology are not given systematic attention, nor is the Bank's work in this field widely known.

xvi. The Bank misses important opportunities because it lacks a strong policy emphasis and a systematic approach to technology. Staff tend to be cautious in approaching innovations in this area, and to assign them a low priority compared to other requirements of the lending program. Even the large-scale implementation of technology developed through the Bank's own research, as for example in low-cost road construction, is lagging for this reason.

xvii. There is a plentiful supply of ideas, both inside and outside the Bank, on the basis of which the Bank could develop a portfolio of projects and non-lending activities of high potential payoff. Discussions with

potential borrowers indicate a high level of interest in the possibility of Bank assistance in this area. A Bank initiative in science and technology would have substantial impact.

Recommendations

xviii. The Bank should decide to make scientific and technological development an explicit, high priority objective of its work. It should strengthen and expand the Bank's activities in science and technology and give them greater visibility.

xix. The Bank's objective in so doing should be: to build technological capacity in its borrowers and to encourage the use of that capacity to analyze practical problems and to implement the corresponding solutions; to improve the assessement and choice of technology by its borrowers and guide it towards the solution of outstanding development problems; to promote international research and diffusion of technologies specific to the problems of the developing world; and to improve the understanding of the scientific and technological dimension of development.

xx. The Regions, the relevant support departments, and the IFC should develop plans to strengthen and expand their activities in science and technology, each using the means appropriate to its functions and objectives.

xxi. For example, each of the Central Projects sector departments should consider measures to increase the Bank's attention to science and technology in the sector in which it works. The measures appropriate to a particular sector might include any of the following: increased lending for research, for high-level training and for scientific and technological infrastructure; more explicit attention in sector policy work and in the

project cycle to technological issues, such as the choice of technology, the development of technological capacity and the promotion of technological innovation; explicit forecasts and assessments of developments in technology which are likely to influence future policies and operations; support to development, pilot tests and demonstrations of promising new technologies (e.g., in renewable energy); collaboration with the private sector in promoting the design and commercialization of promising industrial products or processes that are unlikely to be developed without public support; cooperation with non-governmental organizations in their work of developing and diffusing low-cost technology; or a global public research program on the pattern of the CGIAR.

xxii. The agriculture and the water supply/sanitation sectors have already developed such a technological strategy. As a next step, the energy, education and health sectors should follow their example. In addition, there should be a systematic effort to examine key subsectors (e.g., building construction, agricultural machinery, post-harvest storage and transport, animal draft power, communication in remote areas), where improved technology and increased technological capacity could have a wide-ranging effect. Finally, each sector should address the problem of keeping its technical staff up-to-date with advances in science and technology. This problem is particularly acute because of the neglect of staff training in the past.

xxiii. As another example, program departments should give more attention in country programming and economic work to the scientific and technological elements of national development strategy, as they affect the Bank's lending program and its policy dialogue with and advice to member

governments. Efforts in this direction are already underway in a number of countries. This work should be guided and synthesized in such a way that taken as a whole, it constitutes a contribution to the general understanding in the development community of the role of science and technology in development.

xxiv. Similarly, the International Finance Corporation (IFC) should continue to increase its investments in venture capital companies in developing countries, and should explicitly seek out profitable investments which use advanced or innovative technology (e.g., microcomputers) and which lead to the manufacture of new products designed to address social problems (e.g., agricultural or educational equipment). Discussions with the private sector in developed and developing countries could lengthen this list of ideas for expanded cooperation with the private sector in science and technology.

xxv. The Bank should encourage project lending for research, for development of technological capacity, and for pilot testing and demonstration of innovations, as elements of its project lending. As regards research, a policy paper has already recommended increased lending for agricultural research. Lending in support of industrial innovation at the enterprise levels should also be increased. Pilot projects should be supported in such fields as renewable energy and labor-intensive civil works construction. Bank technical assistance should contribute to the overall needs for development of local technological capacity, for example in pre-investment and engineering.

xxvi. The Bank should also make a systematic effort to strengthen its policies and procedures so as to facilitate and encourage its scientific

and technological work. It should be more willing to accept the risks, staff costs and longer time horizons typical of such projects. The identification of priorities for research and for the testing and diffusion of new technology, and the preparation and promotion of proposals for research programs, pilot tests and demonstrations, should be a normal part of Bank work. Staff and administrative resources should be allocated for this purpose.

xxvii. The Bank should expand its financial and technical support for high priority scientific and technological research, and should be prepared to devote part of its administrative budget or its profits for grants to such research. This might take the form of contributions to global programs, comparable to the Consultative Group on International Agricultural Research (CGIAR) and the Special Program for Research and Training on Tropical Diseases (TDR). The Bank should also establish a Bank Scientific and Technological Research Budget for the funding of specific research undertakings.

xxviii. Cross-disciplinary research on the scientific and technological dimension of development, such as the work currently underway on the acquisition of technological mastery in the modern industrial sector, is a critical underpinning to the proposed expansion of Bank operations in this area. The Bank should allot higher priority to the preparation and funding of such research, in view of its importance and its relative neglect in the past.

xxix. The Bank's efforts in science and technology could increase substantially within the present staffing and organizational framework, through increased focus by the operating and sector departments. A central

promotional and support staff is also needed. The present Science and Technology Unit is very small for this purpose.

xxx. For the longer run, the Bank should consider other measures for expanded financial and staff support to research, depending on the evolution of the Bank's financial situation and of its support to research in economics and the social sciences.

xxxi. The Bank should launch its expanded activity in science and technology with a public information effort. This should include prominent mention in the annual address by the President of the Bank to the Board of Governors and perhaps a special address to an audience of distinguished scientists and technologists. It should convene an ad hoc scientific and technological advisory committee to review the activities of the Bank in this field, as well as the recommendations made in this paper.

Draft
Feb. 3, 1982

SCIENCE, TECHNOLOGY AND THE WORLD BANK OF THE 1980s

I. Science, Technology and Development[1]/

1.01 The introduction of new technology for industry, agriculture, power, communications, and public health has led to dramatic gains in the developing countries. The economic returns to investment in science and technology are substantial; in agricultural research, they frequently exceed 40 percent a year. In a particularly favorable case, the annual rate of return on investment in rice research by the International Rice Research Institute (IRRI), an internationally funded laboratory in the Philippines, is estimated to be about 80 percent through 1975.

1.02 The scientific and technological dimension of development is not limited to research work. It also includes the capacity to make technological decisions in designing and implementing projects, assessing their social and economic impact, selecting and acquiring technologies, and, when necessary, adapting them to local conditions and promoting research and innovation. These skills in a country, a sector or an institution, taken together, are for brevity called its technological capacity. The contribution of this capacity to development is harder to quantify, but it is at least as important than that of research and innovation.

1/ In this paper, we use the definition of technology in Webster's Third New International Dictionary (Springfield, MA: G.&C. Merriam, 1966) as "a technical method of achieving a practical purpose," where "technical" signifies "having special and usually practical knowledge, especially of a mechanical or scientific subject." We consider that these "technical methods" include both the tools and equipment, and the know-how, institutions and policies needed to apply them to a problem.

As used in this paper, the term "technological development" includes research, innovation, and the building of technological capacity in the sense defined in para 1.02.

1.03 Yet developing countries have given little policy attention to science and technology, and their direct investment in this area has been relatively low. The Organization for Economic Cooperation and Development (OECD) estimates that only 12 percent of the world's scientists and engineers work in developing countries, while only 3 percent of the world's investment in research and development takes place there. The total annual expenditure in the poorest developing countries in 1978 for agricultural research has been estimated at 26 cents(US) for every person dependent on agriculture for a livelihood, as opposed to $1.25 in the better off developing countries, and about $175 in the United States. Worldwide expenditures on tropical disease research are miniscule compared to the amounts spent on cancer and heart disease. Research expenditures on malaria, for example, amounted to only two cents per infected person in 1978, as contrasted with more than $850 per cancer patient in the U.S. alone. The total world research budget for all tropical diseases in 1975 amounted to only $30 million.

The Contribution of Science and Technology to Development

1.04 In favorable cases, a modest investment in science and technology can bring benefits unattainable in any other way. Conversely, inattention to or mismanagement of science and technology can lead to serious problems. Indeed, even successful applications of science and technology may give rise to secondary problems that require careful attention.

1.05 Some examples follow, first of dramatic contributions of science and technology to development.

(a) New technology has made possible self-sufficiency in food and competitiveness of an export commodity:

* High-yielding varieties of wheat and rice, first developed in international laboratories and then adapted and diffused by national researchers and extension workers, helped to transform India from a significant importer of food grains in the 1960s to a marginal exporter in the mid-1970s.

* Careful attention to agricultural and technological research has allowed natural rubber to compete effectively with synthetic rubber in world markets, despite predictions made at the end of World War II that it would follow natural indigo to extinction.

(b) Technological innovation has made possible new approaches to health, population and nutrition:

* The introduction of the bifurcated needle for quick vaccination of large groups of people, and the invention of the technique of concentrating vaccination efforts in areas where sources of infection are known to be prevalent--instead of mass vaccination of the entire population--were turning points in the successful campaign of the World Health Organization (WHO) to eradicate smallpox.

* The development in the 1960s of renewable means of contraception--the pill, the intra-uterine device and the injectable contraceptive--made possible the establishment of national programs of population control.

* Specially formulated, nutritious, low-cost soft drinks and packaged cereals, marketed through commercial channels under the trade names Vita-Soy and Incaparina, respectively, have substantially reduced urban malnutrition in Singapore and Guatemala.

(c) Space technology has opened new possibilities in insect control and in resource planning:

* Better understanding of the meteorological patterns that influence breeding, swarming and migration of desert locusts, together with satellite monitoring of climatic features that are favorable to them, have greatly reduced the threat of the desert locust in the Middle East and East Africa.

* Use of satellite imagery, accompanied by appropriate use of aircraft and ground survey, has made land use planning much faster, cheaper and more comprehensive.

(d) Local engineering has contributed to energy self-sufficiency and to the fulfillment of basic needs:

* Brazil has been able to mount a major program to promote the economical production of fuel ethanol in large part because of its ability to adapt and

manufacture competitive equipment for crushing, fermentation and distillation.

* The present high level of competence in the profession of sanitary engineering in Latin America is largely the result of a program, financed by the Rockefeller Foundation in the 1930s and by the Institute for Inter-American Affairs in the 1940s, which combined high-level training with job placement within the country.

(e) Local capacity makes possible better choice of imported equipment and mutually beneficial relations between local companies and transnational corporations:

* A competent engineer in the Ministry of Industry in Burundi rejected proposals for import of an expensive brick-making machine whose capacity far exceeded local needs, and instead identified and obtained approval for the purchase of a much smaller machine.

* Strong engineering groups in subsidiaries or joint venture companies in Korea, Argentina and elsewhere have adapted or developed technology needed to solve local production problems, and thus enabled their companies to export products and machinery based on this local technology.

(f) Government support to innovation can spur science-based industry:

* The Korean Technical Assistance Corporation, a venture capital and investment company spun off by

the Korean Institute of Science and Technology, has established six companies to manufacture export products based on local technology.

* Subsidies provided by the Government of Israel (and financed by the Bank) to the development of products for export using local technology, have made it possible for a small Israeli electronics company to become, in three years, the second largest producer of tomographic scanners in the world.

1.06 Technologies now in the experimental or pilot stage promise substantial contributions to vexing development problems.

(a) Low-cost technology can help slow deforestation:

* Simple cookstoves, made of clay and sand and constructed by local artisans for $10-25, have been readily adopted by test groups of housewives in Guatemala, Upper Volta and elsewhere, and are reported to reduce the consumption of firewood by 50 percent.

(b) Low-cost technology can bring sanitation within reach of the urban poor:

* A Bank research project on low-cost technology for waste disposal found that there are many technologies between the unimproved pit privy and water-borne sewerage that can be recommended for wide-scale replication. A community can initially select a low-cost technology in the knowledge that, as its socio-economic status rises, it can upgrade by a known series of improvements--unlike conventional

sewerage, for which large investments and large waterflows waterflows are needed from the outset.

(c) Basic and applied biological research using advanced techniques promises to decrease agricultural production costs:

* Research on nitrogen-fixing bacteria and other microbiological topics promises to allow plants to obtain nitrogen fertilizer from the air and to increase the availability of other nutrients from the soil, thus decreasing chemical fertilizer requirements by as much as 20 percent.

1.07 On the negative side, the following examples may be given:

(a) Failure to adopt available modern technology may be costly:

* Consistent neglect of the principles of modern marketing and of the need for integrated agricultural and industrial research has been a primary factor in the rapid decline of the market for jute, a principal export of Bangladesh and India.

* Failure to incorporate existing germplasm for rust resistance into high-yielding varieties of wheat distributed to Pakistani farmers caused the crop failure of 1977-78, which led to food imports and significant problems in the balance of payments.

* Neglect of the basic principles of integrated pest management led to disastrous failures of the cotton crop in Peru and Mexico, and to a serious reduction in the quality of the cotton produced in the Bank-financed Rahad project in Sudan.

(b) Neglect of research and innovation can also be costly:

* Absence of adequate technological packages, resulting from underfunded and understaffed research programs and institutions, has been an important factor in the adoption of destructive development patterns in ecologically fragile regions, such as the humid tropical forests of the Amazon River valley.

* Worldwide failure to develop and apply technology for the efficient use of renewable sources of energy during the years of cheap fossil fuels has exacerbated the foreign exchange burden from imported fossil fuels after the price increases of the 1970s.

* Inadequate support to forestry research throughout the developing world has hampered efforts to find sustainable technology for production of valuable hardwoods and of fast-growing trees with which to combat deforestation.

* Failure to pursue a vigorous program of research on alternative pesticides has left the Bank-financed River Blindness Control program in West Africa without a readily available, ecologically acceptable pesticide to use if, as now seems likely, the blackfly that carries the disease develops resistance to the pesticide currently in use.

(c) Modern technology may produce inappropriate results in developing countries:

* Strategy followed by previous governments in Iran and Algeria dictated the choice of advanced technology for its own sake, in the hope that a new generation would grown up accustomed to the use of modern technology. This strategy was not accompanied by efforts to improve traditional technologies or to strengthen traditional social structures, and led to a high cost in unemployment, in over-reliance on foreign technical assistance, and in social and political disruption.

* Use of highly mechanized techniques of land clearance and log skidding, rather than cheaper and less destructive manual methods using chain saws, has transformed into useless wasteland large tracts of virgin jungle in South America, Indonesia, and West Africa, which had been planned as the sites of large-scale colonization projects.

* Bank-financed livestock projects in Kenya and elsewhere have promoted American-style, market-oriented beef-ranching. This system was not accepted by nomadic pastoralists, who needed the subsistence they obtained from traditional technology, with the result that production for commercial markets fell well short of that predicted.

Needs for National and International Action

1.08 Almost all the modern technology used in developing countries is imported from the developed countries, either as equipment, know-how or technical services. The availability of this foreign technology has made it possible for developing countries to benefit from scientific and technological advances made in all parts of the world.

1.09 But this exclusive reliance on foreign technology has its costs. First of all, foreign technology is often not suited to local conditions. It may be too large in scale, too demanding of scarce resources (especially capital, foreign exchange, energy and skilled manpower), or inappropriate to local culture or ecology.

1.10 Secondly, foreign technology may not be available to address problems and opportunities which are specific to developing countries and hence have not attracted the attention of researchers and suppliers of technology in the developed countries. For example, the only preventive measures and treatments available to combat parasitic diseases affecting tens of millions of people are expensive, difficult to administer, ineffective or toxic.2/

1.11 To overcome these difficulties, developing countries require local skills for mobilizing technology--that is, for assessing local needs and resources, selecting and adapting technologies suited to local conditions, acquiring these technologies at a fair price, and developing new technologies when this is necessary. If this technological capacity does not exist, as is too often the case in developing countries, a

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2/ A partial list of such diseases includes filiariasis (a family of diseases which includes elephantiasis and river blindness), trypanosomiasis (African sleeping sickness and Chagas' disease, its South American counterpart), and leishmaniasis (a disfiguring disease, one variety of which, kala azar, is fatal).

country must depend on the unchecked judgment of foreigners for the mobilization of technology, which is therefore more expensive and less efficient than it would otherwise be.

1.12 Scientific and technological capacity is a critical element in all stages of the development process. In its early stages, scientific and technological development is primarily concerned with the choice and implementation of imported technology, the development of human resources, and the establishment of basic scientific and technological infrastructure, typically beginning with higher education and with agricultural research and extension. At this stage, trained manpower is limited, and is stretched very thin in its efforts to address the many pressing development problems requiring scientific and technological expertise. Yet even these limited resources are frequently not applied effectively. The technological needs of the poor majority are particularly likely to be neglected.

1.13 In the more advanced developing countries, the basic scientific and technological infrastructure is typically in place: universities, technical libraries, agricultural and industrial laboratories and extension services, bureaus of standards and other basic technical services, a reasonable supply of scientists and engineers, a set of professional organizations, a consulting and engineering industry, capabilities for the processing of large quantities of information and for the use of other advanced technologies, and engineering and research units in the larger enterprises.

1.14 In these countries, imported technology is "transferred," in the sense that local people learn to operate it and usually to manage the installation. But the technology is not usually mastered to the point

where local technologists could adapt it in response to a local situation or a problem encountered in operation, or could design a similar plant without extensive outside help, let alone develop an indigenous technology or develop new products suited to local markets. This pattern of reliance on "undigested" foreign technology has isolated local technologists from the economy that they are supposed to serve, and has made it difficult for them to make the contribution of which they are capable.

1.15 In these countries, moreover, economic policies that affect wage levels, interest rates, exchange rates, and tariff levels have frequently been responsible for a pattern of technological development that is inappropriate to local factor endowments and that fails to create a sufficient number of productive jobs. Social programs aimed at improving the life of the poor or at helping the development of the informal sector only occasionally include encouragement to scientific and technological research and innovation. There is little demand, either from the market or from government programs, for the development of simple, low-cost technology, and few inducements tending to overcome the natural isolation of the country's technological resources from the problems of the poor.

1.16 In a few, more advanced developing countries, manufactured exports are already competitive with those of industrialized countries across a broad range of product lines. While these countries still depend for the most part on imported technology, it is likely that scientific and technological research, development and innovation will soon become important elements of their market competitiveness in some sectors. These countries are beginning to export technology in special situations and to confront many of the problems of technology policy and management typical of the more advanced industrialized countries.

1.17 The encouragement of scientific and technological research has been a function of government since the Industrial Revolution and indeed (in the specific case of military technology) since ancient times. The governments of Japan, France, Germany and many other European countries have developed explicit strategies for encouraging technological development. Among developing countries, science and technology policy is particularly important in Korea, Brazil, India, Mexico, Malaysia and China.

1.18 The economic justification of government intervention in support of scientific and technological development lies in the fact that the benefits from technological innovation accrue to many firms and also to consumers and thus exceed its value to the individual firm that produced the innovation. Even if this were not so, individual firms may be too small or too risk-averse to undertake the level of research, development and innovation which in the aggregate could be optimum for the industry or the country. Finally, the ordinary workings of the capital markets in most developing countries discourage risky ventures based on unproven technology, however promising they may be.

1.19 In principle, government policies intended to promote technological development should balance measures intended to increase the supply of improved technology with measures intended to increase the demand for such improved technology. Supply-oriented measures include funding universities, training programs, laboratories, technological institutes, patent offices, bureaus of standards and research granting agencies. Demand-oriented measures include policies and programs intended to have a

direct effect on the willingness of the productive sector 3/ to use improved technology--subsidies or tax incentives for research and development in industry, subsidies or other encouragement to specific innovations, government regulation of or intervention in private negotiations concerning commercial transfers of technology, and special taxes earmarked for training or research. Indirect measures to increase demand for improved technology include: liberal trade policies, properly valued exchange and interest rates, tariff structures that encourage local processing, price structures that encourage local production and improved product quality, and environmental or other administrative regulations which impose requirements that can be met only with improved technology. Demand-oriented measures can be effective only if a minimum level of manpower and infrastructure is already in place.

1.20 The efforts of the international community (other than the Bank) to promote the development of local technological capacity in the developing countries, and to support research and innovation on scientific and technological problems specific to the developing countries, are briefly summarized in Annex I to this report. While many individual projects and programs have produced important results, collectively these efforts fall far short of the needs for this type of assistance.

1.21 Recent attempts to bridge the quantitative gap by creating new sources of funds have not been successful. An attempt to create a new institution in the United States for this purpose failed, while the United Nations Interim Fund for Science, Technology and Development is struggling for survival.

3/ The productive sector is that part of the economy, whether publicly or privately owned, which produces goods and services.

1.22 Existing efforts, moreover, have difficulty in dealing with a number of special problems connected with the scientific and technological dimension of development. These are: (i) the lack of mutual understanding between scientists and technologists, on the one hand, and development planners and aid administrators, on the other; (ii) the gap between the laboratory and the productive sector; (iii) the fact that many problems of scientific and technological research are global in scope and cannot be efficiently tackled in isolation by any single country; (iv) the inadequate understanding on the part of researchers on development issues of the role of technology; and (v) the special needs of the individual inventor or researcher and of the informal and small-scale innovator.

1.23 The first of these problems is the lack of mutual understanding between scientists and technologists, on the one hand, and development planners and aid administrators, on the other. Political leaders and economic planners are generally unfamiliar with science and technology, and focus their planning on the short term, without adequate consideration of the impact of their decisions on scientific and technological development, and, conversely, of the effect of likely scientific and technological advances on their development plans. For example, economic planners may decree a sudden shift from protectionist to liberal trade policies without taking appropriate measures to strengthen the technological competitiveness of local firms. Officials may decide to protect a given industry or to raise the price of a commodity without taking into account technological changes that will make it obsolete. Large, long-term investments may be planned on the basis of a given currently available technology, with inadequate consideration of alternatives and no provision for research to ensure that better technology will be available in the future. Public officials may be unwilling to implement the special measures needed to

ensure the effectiveness of scientific and technological institutions, and to assure the motivation of researchers and other technologists and to encourage them to pursue their careers in their home countries. Perhaps most important, policy makers may be too ready to believe in the automatic effectiveness of market forces in inducing appropriate choice and development of technology, ignoring such market imperfections as inadequate information on technological alternatives, insufficient firm and market size to support research and development, and non-availability of capital to finance innovative projects not fully backed by collateral.

1.24 On the other side of the fence, scientists and technologists in developing countries have too often chosen research problems because of their international interest or their intellectual attractiveness rather than for their local relevance. Even scientists and technologists with an interest in practical local applications of their research may find their work frustrated by their own lack of understanding of its broader context. For example, they may carry out extensive projects to improve the quality of local building materials without taking into account the constraints of market demand and capital availability that make cheap, low-quality materials more profitable to the manufacturer and the contractor.

1.25 The conceptual gap between the two groups also leads to the neglect of institutions and policies needed to ensure that science and technology is closely linked to the economy. It is common for neither group to recognize the importance of the consulting and engineering profession, not only as a source of business profits, but also as an element of local technological capacity that plays a critical role in local choice and implementation of technology.

1.26 The second special problem connected with the scientific and technological dimension of development is the gap between the laboratory and the productive sector. The productive sector in developing countries

is in general unaccustomed and ill-equipped to invest in research and development or in the commercialization of innovative technology. Financial institutions in most developing countries are averse to risk and usually lack the capacity to evaluate innovative technology. The annals of developing country laboratories and development assistance agencies are filled with stories of innovative technologies found to be especially suited to developing countries, that never received full-scale tests for want of financial, policy or institutional support, or because the inventor or research institution lacked the means, the drive, or the business acumen to advance beyond the prototype or the research publication. To be successful, most of these inventions would have required specific efforts to develop a pilot plant or manufacturing prototype suited to the needs of a particular manufacturer, and to help him develop products and markets, perhaps for an extended period. With a few exceptions,[4/] development assistance institutions have avoided this kind of close association with the private sector.

1.27 Examples of existing technologies which deserve increased attention of this kind include: (i) designs for improved low-cost bullock carts and animal-drawn implements, which could extend the working life of a bullock by 20-30 percent and greatly increase its efficiency; (ii) simple, low-cost methods for constructing earthquake-proof houses from adobe; (iii) technology for making cottonseed into high-protein meal suitable for human

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4/ The two most notable efforts to assist developing country manufacturers to fabricate and commercialize equipment designed to be specially suited to local conditions are those of the International Rice Research Institute (IRRI), one of the international laboratories supported by the CGIAR, and of the Intermediate Technology Development Group (ITDG), a British-based non-governmental organization. The two organizations design and promote low-cost equipment for paddy rice production, and for low-cost transport and small-scale energy generation, respectively.

consumption, e.g. as a milk substitute; (iv) low-cost, hand-operated looms and knitting machines capable of producing complex designs from a wide variety of fibers; (v) low-cost equipment for teaching primary and high school science, including an 80-power microscope that can be manufactured for about US$0.50.

1.28 A third special problem is the fact that many of the most important research problems affecting developing countries are global in scope and are best approached through global initiatives on the scale (although not necessarily in the form) of the CGIAR.

1.29 To develop such proposals requires a complex blend of technology policy, institutional design, and international and interagency diplomacy. This is expensive in staff time but offers prospects for major benefits. For example, research proposals could be prepared which could result in the development of new varieties of fast-growing trees for fuelwood and reforestation, of new crops for the production of energy on marginal land, and (in the longer run) of methods for predicting the monsoon on which hundreds of millions of people depend for their food supply.

1.30 The fourth problem lies in the need for interdisciplinary research on the technological dimension of development. A good deal is known about the role of prices and incentives on the choice of technology and on the speed and direction of technological development; the cost and benefits of research; the factors that have led to the development of indigenous technological capacity, especially in modern industry; the contributions of universities, research laboratories, technological institutes, consulting firms, and other scientific and technological

institutions to economic development and the techniques of managing these institutions to maximize their contributions.

1.31 But many broad questions remain unanswered. What are the trade-offs and reinforcements in the long and short run between growth, innovation and the development of local technological capacity--a concept which, as we have seen, extends considerably beyond research? How should a country with few technological resources deploy them for maximum effect? How can science and technology best be mobilized for the benefit of the poor? These and other questions demand a substantial long-term research effort. In the shorter run, much could be accomplished by a systematic effort to survey the links between local scientific and technological capacity and the productive system in a representative set of developing countries, and to strengthen these links by applying ideas that have already been developed in this field. Such an effort could greatly broaden the data on which existing ideas are based and could lead to the definition of issues needing research.

1.32 A fifth problem connected with international support of science and technology is the need for special measures to recognize and support "small science and technology" -- a domain which includes the senior researcher with at most a few assistants, the backyard inventor, the inventive entrepreneur, the shop-floor innovator, or the quasi-volunteer group. Governments and international agencies all over the world tend to concentrate on large institutions and programs to the neglect of this domain, despite the fact that much of the most innovative research in both developed and developing countries takes place there. Examples include: (i) discovery by a small group of researchers in a Brazilian university that certain free-living bacteria living in the roots of non-leguminous

plants can fix atmospheric nitrogen, a discovery that opened up new horizons on a process that could, if properly harnessed, save substantial amounts of artificial fertilizer; (ii) invention by an Indian engineer, working in his spare time, of an improved, low-cost, bullock-drawn tractor; (iii) pioneering work by small private organizations on improved gardening techniques, woodstoves, windmills, and many devices for the use of solar energy, well in advance of official research institutions; and (iv) invention by a poor farmer in Upper Volta of a system of low-cost dikes and culverts to slow run-off and increase percolation and hence the supply of underground water--at a time when foreign experts were promoting expensive storage dams. Special measures are needed to ensure support to these gifted individuals, both in educational institutions and in the private voluntary or commercial sector.

II. The Role of the Bank

2.01 The World Bank's comparative advantage in science and technology, as in other fields, results from its unique combination of financial resources, technical competence, policy influence and direct involvement in major investments. The Bank has made important contributions in science and technology, and the scope and effectiveness of its work in this area is increasing year by year. Still, considering its unique advantages for work in this field, these contributions fall far short of its potential.

2.02 The Bank has much more money than other UN specialized agencies or aid organizations whose main function is to support research and technical assistance in science and technology.

2.03 But more than this, the Bank's experience with the financing of large-scale development projects gives it insights into the practical problems of development, of building local technological capacity and of scaling up innovative technology, that are often not available to institutions concerned with funding and carrying out research. Its influence with political leaders and with the development community allows it to raise policy issues which, although not explicitly concerned with science and technology, have a critical influence on technological development. For the same reason, the Bank is in an excellent position to raise worldwide awareness of the importance of science, technology and development.

2.04 The Bank's links with the financial community and the private sector allow it to develop imaginative ways to collaborate with private industry to promote needed innovations. Its policy and orientation towards poverty are unusual for a technologically sophisticated institution,

and allow it to draw the attention of national scientific and technological institutions, and of the world scientific and technological community, to the problems of the poor. Its global exposure to development problems, and its experience in establishing the CGIAR and in assisting in the design of the TDR program, give it expertise in the problems of formulating and promoting global research projects. Finally, the Bank is well placed to become a leader in research on the technological dimension of development by virtue of its understanding of the economics of development and its experience with the practical mobilization of science and technology for development.

2.05 The Bank's work in science and technology is an adjunct to its normal activity but not the focus of that activity. As a result, the Bank has become a technological development institution without explicitly acknowledging the fact, much like Moliere's bourgeois gentleman who discovered he had been speaking prose all his life without realizing it.

2.06 This fact is both an advantage and a limitation. It is responsible for the great strength of the efforts of the Bank in science and technology, namely their emphasis on obtaining useful results and on putting them into practice on a large scale--precisely that area where other technological institutions are frequently weakest. On the other hand, science and technology has not received strong policy emphasis as such, nor has there been a systematic approach to seeking out opportunities to contribute to scientific and technological development.

What the Bank Has Accomplished in Science and Technology

2.07 The Bank has made important contributions in science and technology through the choice and implementation of technology in its investment programs, through its support to international research

projects, through its internal program of research on alternative technology and the choice of technology, through its lending for national research, innovation and technological development, and through its technical assistance in the choice of project technology and in the development of technological capacity. Annex II gives a list of documents prepared as background to this paper, describing different aspects of the Bank's work in science and technology.

2.08. Support to International Research. The Bank has helped to organize, and now presides over, provides the secretariat for, and contributes to the CGIAR, the largest and most important internationally-funded global research program on a scientific and technological problem of special interest to the developing world. The CGIAR supports 13 programs covering maize, wheat, rice, legumes, cassava, livestock and other major foodcrops of the developing world. The CGIAR mobilized $140 million for these programs in 1981, of which the Bank contributed about 10 percent. Bank contributions from 1972 to 1981 total $69.5 million.

2.09 Agricultural research by institutions currently funded by the CGIAR has made possible a greatly improved technology for rice and wheat culture which has been implemented on a massive scale world-wide. As has been noted earlier, this "Green Revolution" technology has made possible $3-4 billion worth of increased agricultural output, and has transformed almost all countries of South and South-East Asia from net importers to net exporters of food. While initial benefits from increased yields went for the most part to larger farmers with assured supplies of water and fertilizer, smaller farmers began within a few years to benefit in proportion to their holdings.

2.10 More recent research funded by the CGIAR has resulted in varieties which have given promising results in large-scale field trials of tropical potatoes, pulses (pigeon peas and chick peas), sorghums, millets and cassava. Important progress has also been made in research on farming systems, crop physiology, and animal diseases.

2.11 In May 1981, the Bank's Executive Board approved a $2.48 million contribution to the Special Program of Training and Research on Tropical Diseases (TDR), a program executed by the WHO which funds and coordinates research on six major tropical diseases: malaria, leprosy, schistosomiasis, filariasis, trypanosomiasis and leishmaniasis. The Bank previously acted as fiscal agent for the program and provided technical assistance in the design of its management system. The TDR program began only in 1977, but has already speeded the achievement of important scientific advances in the fight against four of these diseases.

2.12 Project Lending for Development of Scientific and Technological Capacity. The Bank has financed 223 education projects totalling $3.9 billion in 87 countries from 1963 through June 1981. Two-thirds of this lending, or $2.6 billion, was for education in science and technology.

2.13 The Bank has assisted in strengthening 36 state or national agricultural research and extension projects in 14 countries and has supported agricultural research components in over 300 projects in 80 countries. Bank support to agricultural research and extension has amounted to $982 million through fiscal year 1981.

2.14 Bank experience to date indicates that these agricultural projects are difficult but worthwhile. The Bank has generally succeeded in persuading governments to make the institutional changes needed to

encourage research institutes to cooperate more closely with each other and to focus more clearly on the practical needs of the farmer. In so doing, they have laid the foundations for the future development of new technologies for increased agricultural production.

2.15 The Bank has provided $118 million for projects to finance innovative government programs to encourage and help technological innovation in industrial firms in nine developing countries. For example, a project in Spain finances a governmental institution, run with entrepreneurial spirit, which has already begun to earn income from innovations it has catalyzed in the private sector. A project in Israel financed the development of the non-convective solar pond, a promising new method for generating process heat and electricity from solar energy that is attracting worldwide attention.5/ Projects now in preparation in seven countries will support a comprehensive upgrading of the mechanical and electrical engineering (machine making) industry, key subsectors with far-reaching ramifications on the technology in use elsewhere in the economy.

2.16 A number of activities are underway within the Bank that will increase its contribution to scientific and technological development in fields other than agriculture and industry. An experimental effort began in February 1981 to explore the possibility of using Bank educational lending as a vehicle for supporting the development of general scientific and technological capacity (university research, multidisciplinary technological institutes, bureaus of standards, geological and oceanographic survey and research, etc.). A few project components for lending in support of research on health, renewable energy, and ecology are

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5/ "And Now It's Pond Power," Time, 25 February 1980, p.39.

in preparation or the early stages of implementation. Some Bank nutrition projects have included incentives to the private sector to encourage the development and commercialization of low-cost weaning foods.

2.17 The Bank has financed the wide-scale implementation of the training and visit system of agricultural extension, through which extension professionals deliver timely and specific advice to small farmers on improved technologies they can afford to use. While quantitative measurement of the specific effects of extension is difficult, Bank-financed extension projects have apparently produced significant increases in production. Bank-financed urbanization projects are based on the sites-and-services and slum-upgrading approaches to urban shelter--low-cost methods by which poor people in cities build or improve their own houses with the help of credit, technical assistance, and low-cost infrastructure. The training and visit system of extension, and the sites-and-services approach to housing are examples of the application of technology that is specially suited to the needs of developing countries.

2.18 The Bank has also financed the application of advanced technology when this is appropriate to developing country needs, such as microcomputers for project planning, evaluation and management; advanced technology for telecommunications and distance learning; and pioneering applications of satellite remote sensing and data analysis technologies for mapping and resources assessment.

2.19 Direct Investment in Technological Innovation in the Private Sector. The IFC has invested a total of $2.6 million in venture capital companies in Spain, Brazil and the Philippines, and is considering similar investments in Kenya and Mexico. IFC investments occasionally use

innovative technology, examples being the production of fuel alcohol from cassava in Brazil, a project in Pakistan using an enzyme conversion process to produce high fructose syrup from broken rice, and the application in Egypt of a Chinese technology for producing ducks and fish from an ecologically balanced system. These projects are proceeding satisfactorily from both the commercial and the economic development points of view.

2.20 Internal Research and Policy Work. The Bank's research on labor-intensive civil works construction, highway design standards and alternatives to water-borne sewerage has established the viability of low-cost technological alternatives in these sectors. The Bank is now executing a UNDP project to test and demonstrate technologies for the recycling and re-use of materials from urban wastes. The Bank is also the executing agency for laboratory testing, field trials and technological development of manual pumps to supply water for drinking and for small-scale irrigation in rural areas, and for a project to test the use of solar pumping technology for similar purposes. It has formulated and published a global strategy for promoting technological capacity and research on the use of renewable energy in developing countries.

2.21 Some of the Bank's sector policy work, and its country economic and sector work[6/], provide excellent examples of ways in which technology

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6/ See, for example, the Bank sector papers on Agricultural Research (June 1981), Alcohol Production from Biomass in Developing Countries (September 1980), Forestry (February 1978), and Tropical Root Crops (April 1979); the agricultural sector mission to Northeast Brazil in 1974, the economic mission of 1974 to Pakistan, and the missions on the engineering industries of Korea in 1976 and of Thailand in 1979.

can be integrated into policy and operations. For example, Bank agricultural economists, along with their colleagues in other institutions, have helped to alert officials responsible for research on agricultural production technology in the Bank and in developing countries to the importance of research intended to deal directly with the problems of small farmers. Urban sector work brought home to the sanitary engineering profession in the Bank and worldwide the need for low-cost solutions to urban sanitation problems in low-income countries.

2.22 The economic research of the Bank has contributed to the understanding within the development community of the existence of technological alternatives in agriculture and industry and of the influence of institutional and economic policies on the choice of technology in these sectors. It has shown, for example, that introducing tractors does not necessarily increase the intensity of agriculture but may instead (depending on the local situation) lead to the enlargement of landholdings and the "tractoring out" of sharecroppers.

2.23 Bank research on telecommunications and on educational radio and television has been concerned with the economic impact of modern technology on developing countries, and has emphasized the need for choice of least-cost solutions (e.g. radio rather than television) and for special facilities to meet the needs of poor people (e.g. public telephones in low-income areas). Research is also underway on how several developing countries came to master modern industrial technology to the point where they now export it, and (in collaboration with OECD) on ways in which national development banks can contribute to technological development. The Operations Evaluation Department has carried out three studies of technology in Bank operations, namely, studies of rural development projects in sub-Saharan Africa, of the diffusion of innovation from

Bank-supported projects, and of the practice of the Bank in hiring local consultants.

2.24 Technical Assistance. Bank technical assistance[7/] helps build technological capacity through training and "institution building" in virtually all of its investment projects. It helps its member countries in the conception, design and execution of projects, including the choice and management of technology, especially for the generation and implementation of projects, and exceptionally, in the study and implementation of innovative technology. Several courses by the Bank's Economic Development Institute (EDI) include sessions devoted to the appropriate choice of technology and the encouragement of research and innovation.

2.25 The Bank, through the Procurement Unit of the Projects Advisory Staff, has provided assistance to eight countries in devising policy measures to assist the development of the local consulting and engineering industry, which plays a key role in the selection and design of technology in many sectors. In two of these, Indonesia and Bangladesh, specific practical advice is being provided directly to consulting firms or their trade associations. A series of technical assistance and investment projects executed or financed by the Bank over a period of 10-15 years was instrumental in the development of the consulting and engineering industry

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7/ Bank technical assistance embraces four main areas: (i) assistance financed by the Bank through projects, project components, and the Project Preparation Facility; (ii) assistance administered by the Bank and financed by UNDP or by the recipient country; (iii) assistance provided by the Bank through its staff during the project cycle, through country economic and sector work, and through the Economic Development Institute; (iv) assistance extended by the Bank in cooperation with UN agencies, especially through its Cooperative Programs. (See SecM 80-795, October 20, 1980).

to international levels of competence and competitiveness in the highway and power sectors in Brazil.

2.26 Finally, the Bank, through the Science and Technology Unit of the Projects Advisory Staff, has developed and has begun to assist two member developing countries (Senegal and Portugal) to implement an approach to the technological elements of national development policy. These policy measures are intended to develop and strengthen local technological capacity, in order to improve and guide the choice and assessment of technology and to affect the pace and direction of technological research and innovation.

What the Bank Can Accomplish in Science and Technology

2.27 The Bank has greatly increased its effectiveness in science and technology in the past few years, and could increase it much further through relatively modest extensions of each of a large number of existing Bank activities. First of all, in Bank project work, there would be substantial benefits from expanded lending for science and technology in such sectors as agriculture,[8]/ education, industry, health and energy. Such lending could take the form of projects entirely devoted to research--in which the sums of money lent are likely to be small relative

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8/ The Bank Sector Policy Paper on Agricultural Research (June 1981) concludes that "underinvestment in agricultural research appears to be substantial, and considerably more money could be invested in this activity with the expectation that returns would exceed both the opportunity costs of capital and the returns from most feasible alternatives in rural areas. . . . There are probably few alternative investment opportunities to which national and international funds could be dedicated that could so consistently yield returns as high as those from investment in carefully designed and managed agricultural research programs." (pp. 19-20)

to those involved in the usual Bank project. Alternatively, it could take the form of small research components "piggybacked" onto investment projects. Discussions with the governments of many Bank member countries indicate widespread interest in Bank assistance in this field.

2.28 Second, the Bank's links with the private sector, especially through the International Finance Corporation (IFC), could be exploited much more imaginatively than at present to promote technological innovation. For example, many of the most recent revolutionary advances in technology--microelectronics, genetic engineering, somatic cell culture,9/ are or will soon be ready to be introduced into developing countries through joint ventures. Moreover, there are many products that, if commercialized by the private sector in developing countries, could help solve important social and economic problems. Low-cost vehicles, teaching equipment, baby foods, and agricultural implements are a few examples. IFC investments could be used to promote the development and manufacture of such products.

2.29 Third, Bank country economic and sector work provides a natural context for analysis of national and sectoral policies for technological development, including those that influence both the suitability and the effect of technology, the development of indigenous technological capability, the linking of that capability to the economy, and its orientation to the problems of the poor.

2.30 Fourth, the contribution to the development of local capacity through Bank technical assistance could be made more systematic and could

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9/ Somatic cell culture is a technique that allows an entire plant to be grown from a single cell taken from a part of a plant other than the seed.

pay more attention to the development of skills for selection and creation of technology adapted to a given set of conditions, in addition to its present emphasis on skills for financial and economic decisions. Such technical assistance could be based on overall country strategy regarding the development of local capabilities within a particular sector or across sectors, leading to detailed design of the types of assignments best suited to the country, rather than responding to ad hoc requests, usually for help to prepare pre-investment studies, as is at present often the case.

2.31 Such a strategy would also be of particular importance in countries to which the Bank provides reimbursible technical assistance, as this is its main contribution to their development. Attention to technological issues in the courses of the EDI should also be increased. The Bank program to strengthen the planning capabilities of developing countries is another potential avenue--little used at present--to assist their scientific and technological development.

2.32 Fifth, Bank sector policy work is a rich source of guidance and ideas to scientific and technological reseachers, especially when the latter are willing to collaborate with economists and sociologists in their work. Such collaboration could result in the development of new approaches to Bank lending in the different sectors, creating opportunities analogous to those arising from the sites-and-services approach to urban shelter, and from the improved labor-intensive technology for construction of civil works and the alternatives to water-borne sewerage identified by the Bank.

2.33 Sixth, once such new approaches have been developed, the Bank could devote more effort than at present to proving them at the pilot stage and to ensuring that successful approaches are applied at full scale in its projects and are made known to the development community. This last

point is of particular importance. If experienced professionals are to accept radically new approaches, such as low-cost sanitation or labor-intensive construction of civil works, they may be required to re-examine the basic assumptions underlying their professional work. The spread of several technologies basic to the Bank's poverty work is at present limited by the supply of professionals who have undergone this re-examination--inside the Bank, in the developing countries, and in the consulting firms on which both must rely to provide technical assistance connected with investment projects in these sectors. The Bank is well placed to influence professions that exercise a critical influence over the design of projects, policies and research strategies in the sectors in which it lends.

2.34 Seventh, the analysis of key subsectors in which the incorporation of improved technology could have a wide-ranging impact throughout the national economy could be a source of projects with high pay-off to the Bank's developing country members. Examples include the building construction industry (including the building materials and contracting industries and the financial, regulatory and technological agencies that affect them), the agricultural machinery industry, the post-harvest storage and transport system, all aspects of the economy which affect draft animal power (including breeding stock, feed, implements, vehicle, animal health and slaughtering facilities), and communications facilities for the development of remote areas. The latter might include telecommunications, mass media, or low-cost systems of vehicles and infrastructure (such as pedal-powered trucks, moped and moped paths, or airships and airship ports as possible substitutes for investment in roads).

2.35 Eighth, as a natural outgrowth of work on the technological elements of sector policy, the Bank could develop global or regional research strategies in sectors in which research and innovation promises to open up new paths of development, including proposals for new global programs when these are appropriate. The one global program to which the Bank has made grant contributions over an extended period--CGIAR--shows the major gains that can be achieved through this kind of program, both directly through results of research funded by the program and indirectly through the influence of international research on national research programs. These results would not have emerged from research programs financed by the private sector or by governments of individual developed or developing countries.

2.36 There are other fields where a well-focused international program would promise major results of practical value to developing countries:

(i) Renewable energy technology, including biomass production, biomass conversion, and direct use of sun and wind;

(ii) Forestry, including industrial forestry, watershed management, biomass energy (fuelwood and methanol feedstock), humid tropical forest management, and agroforestry (trees as an element of systems for the small farm);[10/]

10/ World Bank and FAO, "Forestry Research Needs in Developing Countries - Time for a Reappraisal?," September 1981.

(iii) Population, especially efforts to formulate and commercialize new means of contraception based on existing research;

(iv) Oilseed production and processing technology, especially for cottonseed, coconuts and peanuts;

(v) Inventory and screening of species of potential economic value that are in danger of disappearance because of the worldwide destruction of tropical forest habitats[11];

(vi) Research on diarrheal diseases that kill millions of children annually.

2.37 Ninth, the Bank could also strengthen its working relationships with non-governmental organizations, which in many countries are natural vehicles for the diffusion of technology suited to meeting the needs of the poor, such as low-cost construction methods, improved cookstoves and other technologies for exploiting renewable sources of energy.

2.38 Tenth, Bank economic researchers, augmented by suitable expertise in technology and technology policy, could make a substantial contribution to the understanding of such issues as the technological strategies best suited to least-developed countries, and the likely impact on developing countries of world-wide advances in technology in such fields as microelectronics, energy-conserving technology, and artificial substitutes for natural commodities. The Bank, moreover, is in an excellent position, by virtue of the confidence it enjoys both in governments and in the

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11/ US National Research Council, "Research Priorities in Tropical Biology," (Washington, D.C.: National Academy of Sciences, 1980).

private sector, to carry out research on the contentious but critical subject of the role of the private sector in the development of industrial technology.

2.39 Finally, the post-evaluation work of the Operations Evaluation Department provides an excellent opportunity for the analysis of the Bank's experience with using technology in its projects, both to improve future operations and to share its experience with the development community.

The Bank's Approach to Science and Technology

2.40 The Bank has no explicit policy concerning science and technology. Over the years, senior management has lent its support to specific initiatives and the Bank's approach has gradually evolved. The focal point for science and technology in the Bank--the Science and Technology Unit in the Projects Advisory Staff of Central Projects--is active but very small, so that responsibility for science and

technology lies for the most part with organizational units to which this is only one of many competing considerations.12/

2.41 The Bank's approach to technology has evolved along with its overall approach to project lending. The "enclave" projects of the 1950s typically used proven, large-scale technology, designed and supervised by foreign consultants, executed by foreign contractors and supplies, and managed with the help of expatriates. By contrast, the rural development loan of the 1970s provided an integrated package of goods and services to raise productivity and living standards, used local staff as much as possible, incorporated extensive training programs, and emphasized lower-cost design and appropriate technology, giving greater opportunities for local contractors and sources of supply.

2.42 This shift in project objective and design has brought about a slow and uneven change in the attitudes of Bank operational staff

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12/ The balance between a central science and technology function and specific science and technology functions located with project staff is a familiar problem encountered in all large organizations that deal with science and technology, whether they are governments, departments of governments, or private corporations. The central function has these advantages: familiarity with the special problems of management and policy that are associated with science and technology, relative freedom from the pressure of day-to-day operations, so that it has time to concentrate on long-range problems, broad contacts with the scientific and technological community, respect for fundamental research, and receptivity to ideas that may not coincide with the received wisdom in a particular profession or sector.

On the other hand, a science and technology function close to the user has the advantages of intimate familiarity with the objectives and problems of the particular activity, close association with technologists who are experienced in the area, ability to test an innovation and to implement it quickly if it is successful, and a degree of immunity to desires to pursue technological elegance for its own sake, to build ivory towers dedicated to research of no practical value even in the long term, or to promote projects simply because they are technologically feasible or because they will build a bureaucratic empire for their promoter.

towards such issues as innovation, technological risk, the development of local capacity for pre-investment and research, and the use of local sources of technology and technological expertise in Bank projects and technical assistance.

2.43 The Bank's accomplishments in science and technology resulted, as described in the previous section, from individual initiatives. Some, like the CGIAR, came from proposals to the Bank and other organizations from outside foundations. But most resulted from the initiatives of individual staff members who "pushed them through the system", often overcoming on the way objections from managers at one or another level that "the Bank doesn't do this kind of thing." One of the the major tasks of the Science and Technology Unit is to develop such initiatives itself and to encourage and support good ideas that come from other parts of the staff.

2.44 One consequence of this decentralized, ad hoc approach is that the Bank's work on science and technology is not well known, nor is the Bank widely regarded as a technological institution. Neither its staff, its member countries, the development community nor the scientific community knows or expects the Bank to be active in this area or believes it particularly worthwhile to develop proposals for support by the Bank of some aspect of technological development. Consequently, relatively few proposals for supporting national or international technological and scientific initiatives come to the Bank from outside, and those that do come, receive limited ad hoc treatment.

2.45 Some of the obstacles faced by these innovators result from inescapable limitations on the Bank's effectiveness as a vehicle for scientific and technological development. First, a project loan is made through national government channels, which imposes procedures not always

suited to innovative work. Second, scientific and technological innovations often require sums of money which are small compared to the typical Bank or IFC investment project. They are therefore most likely to be attached as components to Bank projects in a related area. Third, scientific and technological research may require a time horizon that is long compared to the duration of the typical Bank project. Fourth, the requirement for the government to be the borrower or guarantor of a loan effectively excludes global, and most regional (inter-country) projects. Fifth, science and technology is traditionally associated with grant financing rather than loan financing. Governments--and indeed private companies--are reluctant to borrow for such risky and speculative undertakings.13/

13/ To be sure, there is no logical basis for this reluctance if the borrower can afford the debt burden and the research is important to its future. To take an analogy from private industry, a company whose share of the market was threatened by the absence of new products in its pipeline would be courting disaster if it did not borrow for research and development that it could not finance from internal resources.

Nor should lending terms for projects at the national level for scientific and technological development, education and agricultural and industrial research be more generous than those for any other type of project in the same country, as is sometimes argued. There is no reason to divert the International Development Agency (IDA) resources that would otherwise go to a poor country to support technological development in a country that is better off.

2.46 But more often, these difficulties are unintended results of the Bank's style of doing business. First of all, the Bank budgetary system relies on coefficients derived from historical averages. This tends to discourage new initiatives, especially in staff-intensive fields. The International Finance Corporation (IFC), for its part, works on a small profit margin and has only a limited promotional budget. Secondly, the time allocated to staff training throughout the Bank has been limited, so that technologists on the staff have had difficulty keeping up to date with developments in their fields.[14]/

2.47 In general, the choice of technology in Bank projects does not receive the searching management review given to economic and financial issues, nor does the review process concern itself with promoting efforts to identify possible innovations or local sources of technology. Technologists on the Bank staff are expected to be specialists; the hiring of technologically oriented generalists, for example in the Young Professionals program, is specifically discouraged.

2.48 The overall result of the Bank's approach to science and technology has been a record of outstanding accomplishments, distributed unevenly and somewhat haphazardly across sectors and countries and falling far short of its potential contribution. Its effectiveness in this area would greatly increase were it to develop an explicit approach to science and technology, to reexamine its policies and procedures so as to increase its effectiveness in this area, and to allocate increased resources for this purpose.

14/ These training issues are discussed in depth and detail in the report "Staff Training in the World Bank: An Evaluation and Needs Assessment," by Donald P. Warwick, Inc. (January 1981) which is summarized in a memo from Mr. Kaji to all Bank staff dated September 8, 1981.

III. A Broader Role for the Bank in Science and Technology

3.01 The broad conclusions of this report and its general recommendations are set forth in the Summary and Recommendations preceding the first chapter. They call for the announcement of Bank policy to encourage research, innovation and the development of local technological capacity, to be implemented by a plan covering both the Bank's lending and non-lending operations, as well as the direct investments of IFC in private industry. The following chapter sets forth these recommendations in more detail, so as to show their implications for the different aspects of Bank work, and for the work programs of the different parts of the Bank organization.

Science and Technology in Bank Lending

3.02 The Bank should: (i) lend more for research, high level training, and scientific and technological infrastructure; (ii) pay more attention to science and technology in the project cycle by which projects are conceived, planned, appraised and implemented; (iii) encourage and facilitate the inclusion of pilot tests and demonstrations of innovative technology in its projects; and (iv) experiment with new mechanisms and areas of interest through which technology can be mobilized for development. The ensuing paragraphs explore each of these ideas in more detail.

3.03 Scientific and Technological Research, Training and Infrastructure. The Bank should lend more for research, high level training and scientific and technological infrastructure, including university laboratories, sectoral and cross-sectoral technological

institutes, bureaus of standards, information and documentation centers, and geological and oceanographic surveys. Such lending should be based on appropriate review of sectoral or cross-sectoral needs, and may take the form of projects or project components. Support of such efforts should be a regular part of the lending program.

3.04 As regards lending for research, the policy paper on agricultural research[15]/ prescribes an increase in Bank support of agricultural research and extension from 9 percent to 12 percent of agricultural and rural development lending, or $550 million a year by fiscal year 1984. Bank financing of programs of government support to technological innovation in industrial enterprises should also be substantially increased in number and priority and made an important part of the Bank's regular work program. As a first step, one or more such projects or project components for technological development in industry should be launched in each of the fiscal years 1983 and 1984. The Bank should evaluate its experience and that of the Inter-American Development Bank and other development assistance agencies with such lending, and should incorporate the lessons of these experiences into the design of projects of this kind. The prospective completion of Bank loans for this purpose to Israel and Spain would provide a useful occasion for a first such review.

3.05 Science and Technology in the Project Cycle. Scientific and technological aspects should be considered systematically in the conception, design, appraisal and supervision of Bank projects. As provided in OMS 2.12, 2.20 and 2.21, alternative project design and technology should be reviewed during project preparation. The reasons for

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15/ Agricultural Research Sector Policy Paper: World Bank, Washington, D.C., June 1981.

the choice of a particular technology and for the rejection of others as a result of this review process should be noted in the Staff Appraisal Report and other operational documents. A greater effort should be made to involve local expertise in all phases of the project cycle, to build local capacity, to ensure that the technology used in the project is suited to local conditions, and to seek out and use local sources of technology. Scientific and technological project issues should be reviewed as appropriate by managers at the division, department, and higher levels, much as are economic and financial issues, with a view towards ensuring the use of the most suitable technology and strengthening the contribution of the project to the technological development of the borrower.

3.06 Pilot and Demonstration Projects[16]/. As one of the first steps in implementing the proposed new Bank technology policy, there should be a systematic effort to identify promising technologies requiring pilot tests and demonstrations in such fields as labor-intensive civil works construction, use of renewable energy resources, and ecologically-based production systems for the small farm (no-till farming, mixed farming systems that include tree crops, integrated pest control, etc.) and to develop projects in each region using these or other innovative technologies. Such demonstrations are of particular value in highlighting the organization and management problems inherent in scaling up the application of a technology, especially when the pilot test was carried out by a non-governmental organization and the full-scale project will be executed by the government.

16/ A pilot project is a test of a project design in a limited geographic area with intensive monitoring and evaluation. A demonstration is a more extensive test with less intensive evaluation, but still short of a full-scale application.

3.07 Bank staff should be encouraged to propose that the Bank fund pilot projects where funding is not available from other sources. Such pilot projects and demonstrations could take the form of components of larger investments, or when necessary to avoid delays, could be programmed as separate loans. Pilot tests of technology which could have widespread application in countries other than the site of the test, might be made eligible for grant financing through the technological research budget proposed in paragraph 3.20 of this report. Specific provision in the administrative budget would be needed to cover the extra consultant and staff costs needed for the preparation of such pilot projects. The experience of the Urban Poverty Program shows clearly that a small amount of resources, used to promote carefully selected innovations that might otherwise have been lost due to budget limitations, can make a major difference in project quality.

3.08 Technical Assistance. The Bank should ensure that its technical assistance contributes to the overall needs for development of local technological capacity in its member developing countries. In addition, the Bank should expand its program of assistance to national governments that are seeking to encourage the development of the local pre-investment ("consulting") and engineering industry, because of the critical importance of this industry in the selection of technology suited to local needs and conditions. Finally, the Bank should continue to develop its training program in national technology policy, and should develop and publish training materials so that its approach may be incorporated into courses given under other auspices. (See para. 2.26.)

3.09 New Approaches to Technological Development. The Bank should give more attention to problems which cut across sectoral lines, such as building construction, agricultural machinery, animal power, and communications in remote areas, and in which the development and commercialization of improved technology could have far-reaching effects. It should seek in its sector work to identify industrial products, such as low-cost baby foods or vehicles, which could embody improved technology that could help solve important social and economic problems (see para 2.28). The Bank should seek to identify such products in its sector work, and to promote their manufacture, either through its own projects or through investments of the IFC. For this purpose, IFC should be prepared to undertake investments smaller than its usual minimum; and to spend more than it usually does on promotion. Finally, the Bank should be alert to opportunities to finance the activities of established private voluntary organizations in their work of developing and diffusing low-cost technology suited to local conditions, when this is agreeable to the government and appropriate to project objectives.

Science and Technology in Bank Sector and Country Economic Work

3.10 The Bank should ensure that technological issues are systematially sought out and taken up in its country economic and sector work, including that underlying structural adjustment lending. As part of this effort, each Region should draw up an explicit work program of country economic and sector work oriented to scientific and technological issues, and designate a few country economic sector missions as pilot efforts. One element of such missions should be the collection, evaluation and application of basic data on scientific and technological capacity. A major purpose of this work would be to lay the groundwork for a systematic

approach to building local technological capacity through Bank projects and technical assistance. Guidelines for such missions have been prepared by the Science and Technology Unit of the Projects Advisory Staff, and will be redrafted to provide more detail during 1982. The work should be guided and synthesized in such a way that it will, in addition to its value to the countries being studied, constitute a contribution to the general understanding in the development community of the role of science and technology in development.

3.11 Bank sector policy papers should include forecasts of probable developments in global technology and of the likely evolution of the design of Bank projects in the sector, should define the outstanding global and regional technological problems in the sector, and should propose approaches to the development of technological capacity and areas of scientific and technological research that can be applied by Bank developing member countries, whether or not these would be financed by the Bank (see also paras 3.12 et seq.). Bank work on renewable energy[17/] provides one model for such work.

Research

3.12 The Bank should continue and expand its present support to technological research, and should incorporate a commitment to such increased support in its overall policy towards science and technology. The Bank should include in its work program and budget resources for the preparation, promotion, and implementation of proposals for research, and should institutionalize procedures for facilitating the consideration of

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17/ "Mobilizing Renewable Energy Technology in Developing Countries: Strengthening Local Capabilities and Research," "Renewable Energy in Developing Countries," and "Alcohol Production from Biomass in the Developing Countries," World Bank, July 1981, November 1980 and September 1980, respectively.

such proposals and for appropriate liaison with other funding agencies and with the scientific and technological community.

3.13 Depending on the technology involved, such research may take the form of development and demonstration of a new approach to Bank lending in a particular sector (see paras. 3.16 et seq.), a global research system, support to individual scientific and technological research projects, or cross-disciplinary research on the technological dimension of development.

3.14 While many aspects of the mobilization of science and technology for development can be supported by loans and credits, others--especially problems of interest to large numbers of LDCs--can be supported only by grants. For this reason, the Bank should be willing to provide grant support to high priority technological research in cases where the support of the Bank is justified and essential. Possible criteria for such grants are discussed in a separate paper.[18/] In brief, the paper recommends that the Bank consider grants for scientific and technological research when it is judged that such research promises a high payoff to the developing countries, and in particular to the poor; that other channels of research and technology transfer are insufficient; that Bank involvement is needed for the mobilization of finance; and that Bank staff input is needed at the technical level. These criteria are met by the two extant examples of Bank grant support to scientific and technological research, namely CGIAR and TDR. Additional examples of research areas that might be eligible for grant support include population, diarrheal diseases, forestry and energy crops.

18/ Criteria for World Bank Financing of Scientific and Technological Research, Science and Technology Unit, May 1979.

3.15 The Bank should consider that such grants are an important part of its task as a development institution. Staff and administrative resources should be allocated to the preparation and promotion of such proposals as a regular part of its work program and budget. The Bank's decision to make a contribution from its administrative budget to the TDR is an important step in this direction.

3.16 Research on New Approaches to Bank Lending. The previous section of this report recommended that each sector department identify needs for technological research that will make possible new approaches to development and to Bank lending in that sector. The necessary research might be carried out during the course of Bank lending, might be best suited to being financed by an agency other than the Bank, or might require a program of Bank-financed research. Programs of very broad scope may require a global research system (see para. 3.18). At least two sectors should begin such an identification effort during the next two years.

3.17 Once an innovation has proven successful in the laboratory and in pilot projects, the sector department should, in consultation with the Regions and, as appropriate, with outside agencies such as UNDP, develop a plan for testing and demonstrating it at full scale, for training of Bank staff, developing country officials and consultants in the new technology, and for its diffusion in the developing countries. Implementation of the new technology in projects financed by the Bank could be facilitated by the encouragement of pilot projects, and by the establishment of the technological research budget (see para .3.20).

3.18 Global Research Systems. The Bank should seek new opportunities to promote and support programs of international research on problems that face large numbers of developing countries, such as those addressed by the CGIAR, and should prepare and promote proposals for such programs, in cooperation with other organizations wherever possible. Their scale, scope and institutional form would vary, but should be commensurate with the problem. The Bank strategy for research in renewable energy provides the basis for a first such proposal. Other possibilities are listed in para. 2.36.

3.19 Further Support to Scientific and Technological Research. The World Bank--specifically including the IFC--should consider how best to channel funds into scientific and technological research, including pilot projects, demonstration projects, and commercialization efforts which require grant financing and which do not form part of any global integrated program of the sort proposed in the preceding section.

3.20 As a first step, the Bank should establish out of its administrative budget a technological research budget analogous to the present Bank Research Budget, which is limited largely to economic and social research. This would be used for technological research, development and engineering projects closely linked to the work of the Bank and supervised by the Bank. Some of these funds could provide grants to supplement Bank lending for pilot projects, which if successful will have widespread application outside the borrowing country, as discussed in para. 3.07.

3.21 Cross-Disciplinary Research on the Technological Dimension of Development. The Bank should increase its support to cross-disciplinary research on the place of technology in development, such as the work currently underway in DPS on the acquisition of technological mastery in the modern industrial sector. A special effort should be made to design research shedding light on the problems of countries with a relatively low level of technological development. In order to develop a pipeline of research projects worthy of such support, the Bank should devote resources to developing proposals in this area. In view of the relatively narrow experience of the staff of the Bank in such cross-disciplinary research, it should, in setting priorities and reviewing proposals for research, be guided in part by the opinions of persons outside the Bank who are familiar with research in technology policy.

Staff Implications

3.22 As its efforts in science and technology increase, the Bank should seek to maintain the great strength of its current work in this field, namely its close links to its operational work and hence to the productive sector in its member developing countries. For this reason, the bulk of the scientific and technological work of the Bank should take place as an integral part of the work of its operating and sector departments. While additional staff and budgetary resources for the purpose would greatly accelerate the development of a work program in this area, much can be accomplished with existing staff.

3.23 These efforts should be supported by a central science and technology unit to provide a cross-sectoral, global overview, and to stimulate and promote the broad range of technological activities recommended in this report. The objective of the unit should be to develop ideas to the point at which another part of the Bank will adopt them as its own. It should pass its ideas along to others as soon as it is practical to do so, in order to conserve its own resources for new initiatives.

3.24 The existing Science and Technology Unit of the Projects Advisory Staff, consisting as it does of two permanent professionals plus consultants, would have to be expanded to meet the needs of the expanded effort proposed in this paper.

Establishing the Image of the Bank as a Scientific and Technological Development Institution

3.25 A policy decision by the World Bank to become more active in science and technology should be accompanied by a public information effort at a high level, including prominent mention in the annual address by the President of the Bank to the Board of Governors and perhaps a special address to an audience of distinguished scientists and technologists on a suitably chosen occasion.

3.26 The Bank should stress, both internally and externally, its commitment to scientific and technological development, and should publicize the fact that it is actively seeking ways of promoting technological innovation and development of scientific and technological capacity and that it is willing to consider requests for assistance of this sort. Discussions with governments and the scientific and technological community, and an increased publications program, would further publicize the Bank's expanding work in this field.

3.27 To help the Bank frame its program in this area, an ad hoc scientific and technological advisory committee should be convened to review all the activities of the Bank in this field, the recommendations made in this paper, and other ideas that may emerge from discussion and review in the Bank. The committee would be a source of new ideas, a link with the world scientific and technological community, and a public symbol of the Bank's commitment to science and technology. It would consist of about a dozen distinguished scientists and technologists, development thinkers and persons who have direct experience in executing technologically oriented development programs in government or the productive sector at all levels of technological sophistication.19/

19/ This recommendation is similar to but much broader than that of the Bank's General Research Advisory Panel, which noted that the Bank has in the past supported both technological research and socioeconomic research, and that while the Panel report is limited to the activities of the Bank in social science research, particularly research in economics, the Panel "nonetheless believes technological research is important, and that technological and socio-economic research can often reinforce each other in very important ways--as shown, for example, by the international agricultural research centers. We are aware of the Bank's desire to review its position as far as technological research is concerned, and we believe there may be important opportunities for additional Bank financing. Accordingly, we suggest that a further panel (or panels) focusing on technological research might be helpful."

(Sections marked by (*) have not yet been approved by the agency whose work they describe)

Draft
Feb. 3, 1982

Annex I. Existing International Programs in Science and Technology for Development

Existing bilateral and multilateral efforts in science and technology may be briefly summarized as follows:[1]/

(i) Bilateral Programs

(a) The outstanding example of bilateral assistance to scientific and technological development in developing countries is the International Development Research Center (IDRC) of Canada, a virtually autonomous institution that is free from pressure to transfer resources and is specifically dedicated to the support of research and the development of the research capability of developing countries. The IDRC expended a total of US$32 million from 1980/81 for its various research activities and has a budget of US$37.5 million for 1981/82 (excluding administrative expenditures). A great part of the Center's financial support comes from the Government of Canada.(*)

1/ The size and effectiveness of existing bilateral and multilateral programs has never been adequately addressed, largely because of the cost and the difficulty of defining exactly what the "scientific and technological" elements of a given program are in the absence of generally agreed criteria. (The effort by the Bank to describe the "scientific and technological" element of its work, eventually published as "Science and Technology in World Bank Operations," took 30 man-months.) Moreover, donor countries have been reluctant to provide statistics that might be used as the basis for setting targets in the context of the North-South dialogue.

(b) Sweden has established an organization for the support of research and development related to developing countries, the Swedish Agency for Research Cooperation (SAREC), although on a smaller scale than IDRC and more closely related to the governmental Swedish International Development Agency. SAREC had a budget of US$22 million in Fiscal 1980 and US$25 million in Fiscal 1981.(*)

(c) In the Federal Republic of Germany, the Agency for Technical Cooperation (GTZ) plans and directs on behalf of the Federal Government all measures taken in the field of technical cooperation with developing countries. A part of GTZ called the German Appropriate Technology Exchange (GATE) serves as an information service on appropriate and innovative technology. GATE also plans, carries out and coordinates projects and programs of technical cooperation involving research and development, and initiates and supports cooperation between companies from developing and from industrialized countries.

(d) The British Government supports laboratories in Britain concerned with tropical health, the processing of tropical agricultural products, pests, agricultural engineering, tropical veterinary medicine, transportation, hydraulics, hydrology and other subjects of special concern to developing countries. In addition, there is a program of contracted research at various institutions in Britain and overseas. Special efforts are made to support indigeneous science and technology in developing countries and in particular to strengthen national facilities for agricultural research.

(e) France supports eight networks of tropical agricultural institutes in cotton, oilseeds,

livestock, food crops, agricultural machinery, tree crops, forestry and coffee. Each institute is headquartered in France, is affiliated with a series of institutions in Francophone Africa, and runs a program of global technical assistance. Through the Office for Overseas Scientific and Technological Research (ORSTOM), France also supports hydrological and meteorological surveys and other forms of applied scientific research. Various other French laboratories in public or private institutes or within universities devote part of their research to developing country problems, notably in the fields of tropical diseases, education and appropriate technology. France's research effort is almost entirely directed toward French speaking African countries.

(f) The United States supports a large program of research in its own and developing country laboratories on technology related to developing countries, in such fields as small farmer agriculture, fertilizer, tropical diseases and biomedical research related to population. It supports the building of institutional capability in developing countries for research on agricultural production research and related fields. It also supports applications of innovative technology in such fields as remote sensing and the use of mass media for education.(*)

(g) Virtually all bilateral assistance programs support training programs for developing country nationals in institutions in the donor country, as well as sister relationships between universities and laboratories in the donor country and developing countries.

(h) The Dutch foundation for the support of universities in developing countries provides support for science and technology through fellowships, technical

assistance, and assistance to the establishment and operation of university laboratories.

(i) Japanese aid to science and technology supports for the most part the transfer of Japanese technology to developing countries through private investment, especially in South-East Asia. Japanese aid also supports collaboration between Japanese technological researchers and those in developing countries.(*)

(ii) Multilateral Programs

(j) The UNDP finances technical assistance to scientific and technological institutions in developing countries, chiefly through projects executed by the specialized agencies of the United Nations. These agencies also support, through their regular budgets and through special funds that they administer, many regional and global programs of research and training. With some exceptions, the latter programs typically support the costs of coordination, and participants are expected to raise operating funds from other sources.(*)

(k) A recent institutional innovation, the global integrated research system, helps to overcome the limitations of the UN specialized agencies and has enabled the international system to deal with such global research problems as food-crop technology, tropical diseases and weather forecasting. Such systems include the Consultative Group on International Agricultural Research (CGIAR), the Special Programme for Research and Training in Tropical Diseases (TDR), and the Global Atmospheric Research Program (GARP).2/ These programs are

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2/ The GARP is a global program of the World Meteorological Organization costing several hundred million dollars a year. Although the GARP was not designed with the specific problems of developing countries in mind, much of the effort is for the study of the tropical atmosphere, and could lead to greatly improved technology for the forecasting of tropical weather, and in particular of the monsoons.

organized by multilateral organizations, but except for the GARP, the great bulk of their funds comes from bilateral aid programs.

(l) The Inter-American Development Bank has provided loans for scientific and technological development to a few Latin American countries. These loans have involved a component of grant money for technical assistance and for subsidizing interest rates. The Inter-American Development Bank has also established a special mechanism to ensure the use of "appropriate" technology in the investment projects it finances.(*)

(m) The International Foundation for Science (IFS), a Stockholm-based organization whose membership includes most of the national academies of science in the world, reviews and supports small, individual ($5,000-$15,000) projects in developing countries, on the basis of their relevance to the needs of the country as certified by local authorities and their scientific merit as judged by peer reviewers chosen from the international scientific community. An IFS award confers such prestige on an investigator in a developing country that he is often able to use it to attract additional support from other sources. The IFS has a current budget of about $2 million and supports research in the fields of aquaculture, animal production, vegetable oilseed and fruit, food fermentation and applied microbiology, mycorrhizia and afforestation, natural products, and rural technology.

(n) Upon the recommendation of the United Nations Conference on Science and Technology for Development (UNCSTED), held in Vienna in August 1979, the UN

General Assembly established a new voluntary fund, the United Nations Financing System for Science and Technology for Development, to be administered by the United Nations Development Programme (UNDP) pending establishment of permanent arrangements. The first pledging sessions attracted firm commitments of about $54 million to the Interim Fund which preceded the establishment of the Financing System. Of this, about $15 million has been paid in, far short of the goal of $250 million. Another pledging conference will be held during the first quarter of 1982. Efforts are being made to increase the level of funding, particularly by attracting funds from OPEC and traditional donor countries.

(iii) Non-Governmental Programs

(o) Professional organizations of scientists and engineers, such as the various international scientific unions, national associatons for the advancement of science, and national academies of science, maintain worldwide informal links among their members. A particularly fruitful example is the program of the Board on Science and Technology for International Development (BOSTID) of the US National Academy of Sciences, which has organized joint workshops and study groups with counterpart institutions in the developing countries, and has published a useful series of books on underexploited areas of science and technology with primary economic value to developing countries. BOSTID has recently received a $16.8 million grant from the United States Agency for International Development to support research based on its earlier work.

(p) The Rockefeller Foundation supports science and technology programs in agriculture, population, tropical diseases and energy policy. In its agricultural program, the Foundation fosters both basic research (conducted primarily at US universities) on plant genetics and animal diseases, and applied research on plant and animal food sources and appropriate agronomic practices. It also supports research on agricultural resource protection and sustainable food production on marginal land areas, and on the formation of food policies based on up-to-date scientific and technical knowledge. In its medical program, the Foundation supports research on reproductive biology and new contraceptive technology, diarrhea, parasitic diseases such as malaria, schistosomiasis, and trypanosomiasis, and on improved research methodologies in clinical epidemiology and population-based medicine.

(q) The Ford Foundation for many years has supported biomedical research aimed at developing improved methods of birth control, as well as applied research in the agricultural sciences. In its population work, assistance has gone for laboratory and clinical research in the United States and abroad on the complex biochemical and hormonal processes involved in reproduction and on a variety of drugs and chemical agents that interrupt or inhibit various stages of the reproductive process. In its agricultural program, the Foundation supports the network of international agricultural research centers in the less-developed world that seeks to increase production of various food crops. It has also supported national crops research programs in various countries, as well as research and training to improve the long-term productive capacity of land and water resources on which agriculture depends.

In a new effort, the Foundation is supporting research on the nutritional and associated health problems of infants and young children in the United States and overseas. It assists the work, for example, of the International Centre for Diarrheal Disease Research in Bangladesh, which takes an integrated approach to the treatment of diarrheal disease, malnutrition, and too frequent childbearing. Assistance has also gone for studies of the possible links between socially troublesome juvenile behavior and biological and nutritional impairments.

Annex II. Publications Prepared as Background to This Paper

As background for this paper, the Science and Technology Unit has prepared the following documents:

(i) A 10-chapter, 208-page report entitled, "Science and Technology in World Bank Operations," which comprehensively sets forth the Bank's work in this area, sector by sector. This report was published in July 1980.

(ii) A shorter version of (i), entitled "The World Bank as an Agent of Technological Development," submitted to the United Nations Conference on Science, Technology and Development (UNCSTED) held in Vienna in August 1979.

(iii) A manuscript book, entitled "Technology, Finance and Development," consisting of 26 chapters, each of which was signed by a member of the Bank staff or consultant and describes a Bank initiative in science and technology. This manuscript was completed in September 1980 and is under consideration by MIT Press.

(iv) A paper, prepared for the President's Council in May 1979, entitled "Criteria for World Bank Grant Financing of Scientific and Technological Research."

(v) A paper, originally prepared as an annex to this report, entitled "Some Policy Issues Related to Science, Technology and Development."

(vi) A report, prepared for the U.S. Executive Director in March 1978 and updated in February 1979, entitled "Appropriate Technology and World Bank Assistance to the Poor." Follow-up reports summarize Bank work on low-cost technology each year thereafter.

(vii) A symposium volume, "Mobilizing Technology for Development," prepared in collaboration with the Bank and published by the Overseas Development Council, the International Institute for Environment and Development, and Praeger Press, in preparation for UNCSTED.

These publications are available on request.

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WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Files

DATE: April 12, 1982

FROM: Alexander Shakow, CPD (OPSC Secretariat)

SUBJECT: Minutes of Operations Policy Subcommittee Meeting of April 7, 1982

Present: Messrs. Stern (Chairman), Ardito-Barletta, Baum, Chaufournier, Hopper, Husain, Knox, Wapenhans, Vergin, Wright, van der Tak, Waide, Chernick, Shakow

Poverty Focus Task Force Report

The DPS/CPS Task Force Report had been circulated to the OPSC as had a paper drawn from the report for use at a Board seminar scheduled for April 16. The Chairman explained that following the OPSC and Board discussions, a revised paper would be prepared for wider circulation within the Bank.

Several members stated that the paper was both timely and very good. They considered it an improvement over earlier versions on which they had been able to comment. Several suggestions were made, however, to clarify and improve the text, as follows:

- references to a political rationale for the poverty focus in the Conclusions and elsewhere in the text should be deleted as unnecessary and as a diversion from the main theme of the report;

- the reference on p. 12 to land redistribution ought to be rephrased to encourage Bank lending in support of land reform programs rather than to imply direct Bank financing of land purchase;

- more positive statements could be made on Bank efforts to alleviate the recurrent cost problems in projects (p. 10).

There were also brief exchanges on the following specific points, the subcommittee generally reinforcing the position found in the paper:

- the degree to which available evidence was convincing on the productivity gains from outlays on primary education et al (p. 2);

- the degree to which targeted subsidies for the poor could place more stress on investment and less on consumption (p. 12);

- the importance of considering the impact of structural adjustment programs on poverty; the Chairman stressed that Bank economic and sector work, if not the structural adjustment loans themselves, ought to focus on this issue and noted that the forthcoming Board paper on SALs makes this point as well;

- how much could be done for the bottom 20%? It was agreed that the paper was appropriately cautious on the subject. Several members gave examples of Bank projects now underway to try to reach this group.

The Chairman asked that other suggestions be given directly to Mr. Shakow for incorporation in the revised version following the Board Seminar.

Cleared: Mr. Chernick
Mr. Stern

AS:alm

OFFICE MEMORANDUM

TO: Operational Vice Presidents

DATE: April 5, 1982

FROM: Ernest Stern, SVP, Operations ES

SUBJECT: Graduation Papers

1. Graduation discussions must be initiated and papers prepared for all countries above the threshold of $2,650, plus Yugoslavia, before the end of FY1983. Papers must be submitted to the Board on all countries above the trigger, starting in FY83, even for countries where you wish to recommend that the graduation process not yet be started.

2. To ensure a systematic approach to graduation papers, I suggest the following:

- An initiating paper should be prepared spelling out a proposed graduation strategy, including the timeframe, program content during phase-out and likely post-graduation activities, and highlighting outstanding issues and options.

- This paper should be reviewed at an RVP-chaired session which, in addition to appropriate Regional staff, would include representatives from CPD, PAB and IFC.

- Thereafter, the Region should undertake preliminary consultations with the country.

- A revised paper incorporating the results of the country consultation should be submitted to the Operational Policy Subcommittee (OPSC) for discussion.

- After the OPSC discussion, final consultations should be undertaken with the Government, taking into account any changes resulting from the OPSC discussions. The Management will then submit the recommended graduation program to the Board. Wherever there remain major differences with the Government these should, of course, be noted explicitly in the Board paper.

3. CPD should be consulted on the timing of graduation discussions and the scheduling of papers; CPD can also provide assistance in the formulation of this paper.

cc: Mr. Waide
Mr. Chernick ✓

Graduation Papers for Uruguay and Yugoslavia

Points for Discussion

1. Since these papers will be the first to go to the Board under the IBRD Graduation policies discussed in January 1982, they may help create precedents. Separate notes on each paper are attached, but several questions common to both are addressed first.

2. Is the proposed time period appropriate? The Board paper indicated that graduation normally would be completed within five years although in very exceptional cases it might take longer. In both these cases, a five year minimum is proposed and the possibility of extension is explicitly raised. Two considerations argue for accepting the proposed five-year planning period: Both countries are undergoing a difficult period of adjustment to adverse external circumstances; and both appear to be receptive to the policy and institutional help the Bank can provide. If we accept these proposals, we may receive criticism from some Part I Board members that we are already, in these first two graduation cases, stretching the length of the graduation process beyond that proposed in the January Board paper. It would help to forestall such complaints if both papers were to make it clear that adverse economic developments would provide a justification for extending the graduation period only if these were clearly due to factors outside the control of the country.

3. Are the proposed lending trends consistent with Graduation policy and other constraints? In both bases, the levels proposed for FY83-87 are below actual lending in the FY78-82 period in nominal terms,[1/] which is consistent with the indications given to the Board last January about the probable trend in lending to higher income countries. It is implicit in both papers that these proposed levels are seen as upper limits, and they are explicitly conditional on improvements in policy.

1/ The amounts are compared below:

	Million $ Current		Constant 1982 $	
	FY78-82 Actual	FY83-87 Proposed	FY78-82 Actual	FY83-87 Proposed
Uruguay	204	160	229	137
Yugoslavia	1638	1625	1877	1359
	P.C.P.A. ($) a/		P.C.P.A. ($) a/	
Uruguay	13.9	10.9	15.5	9.3
Yugoslavia	14.5	14.4	16.7	12.1

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a/ Based on 1981 population in both cases.

4. How explicit should we be about the proposed country lending programs in such Board papers? While it is clearly desirable to arrive at an understanding with the graduating country about the probable level and conditionality of the lending program, it may reduce flexibility for both the Bank and the country to spell these out in detail in a paper for the Board. The Uruguay paper may go further than is desirable or necessary in this respect.

5. Uncertainty about Per Capita GNP Levels. The Bank's 1981 per capita GNP estimates for both Uruguay and Yugoslavia are marginally below the graduation level at present set for 1981 ($2830 in 1981 dollars). For both these countries, the estimates incorporate adjustments to the standard Atlas methodology because their exchange rates are considered to have been overvalued in recent years. On the basis of unadjusted exchange rates, Uruguay's 1981 per capita GNP would be $3420, while that of Yugoslavia would be $3350. While accepting that some downward adjustment is justified, it is difficult to argue that the adjustments (-17.6% and -16.7% respectively) are precise. Given the importance of the per capita GNP data as a trigger point, we suggest that the paper acknowledge that the data have been adjusted and are subject to a considerable margin of error.

6. The use of ICP data can help provide a firmer basis for judging relative income levels than can be obtained from exchange rate conversions. This would require establishing a graduation benchmark on the ICP scale. A proposal along these lines will be included in the forthcoming Issues Paper on updating the Bank's per capita income guidelines.

Attachments

Attachment I

URUGUAY: Graduation Paper

1. Conditionality of the Lending Program

The paper states (para. 15) that processing of the proposed lending program would be predicated on the restoration of consistent macro-economic policies and recommends the adoption of improvements in specific sector policies. The latter are spelled out in some detail: the paper is rather vague on the former although it seems in principle that such policy improvements are likely to be crucial. It would be useful if the Region could elaborate on what key macro policy changes are needed, and how important these are for processing the lending program.

2. The Outlook for Capital Requirements and Creditworthiness

Although there is no basis for questioning Uruguay's creditworthiness for the proposed lending program, it does seem important that a paper of this nature should include an evaluation of capital requirements, access to capital markets and creditworthiness. The paper should also include standard economic data and projections along the lines of those included in President's Reports.

3. Technical Assistance in the Formulation of a Development Program

It is surprising that Uruguay does not have a coherent public investment program. The paper mentions that the Government has requested Bank technical assistance in this area, but it makes no clear proposal about what the Bank should do in this respect. On the face of it, there would seem to be a strong case for a positive response, perhaps in the form of a loan for this purpose.

YUGOSLAVIA: Graduation Paper

1. Can the regional development objective be strengthened?

We note that in narrowing the objectives of the Bank's assistance strategy, the objective of redressing regional disparities has received less emphasis. Many would regard this as the most critical point. Moreover, it is monitorable, whereas some of the other objectives - e.g., increasing the efficiency of investment - are extremely difficult to monitor. We suggest that the Region be asked to elaborate on the rationale for selecting the objectives specified in para. 27 and on the potential for effectively monitoring these.

2. Conditionality

The lending level of $325 million per year is predicated on an assumption of good cooperation and progress in a number of policy areas: energy, agriculture, industry, cofinancing and macro-economic policies. Moreover, the length of the phaseout period to be reviewed in two years would depend on intervening changes in the international environment. As indicated above, the Region should make it clear to the Government that any lengthening of the period depends strictly on external events, but that shortening of the period or a reduction in the volume of lending could occur if inadequate progress is made on policy changes.

3. Are the cofinancing proposals satisfactory?

The present proposals should enable some increase in cofinancing to occur. But it is stated that part of the difficulties in the past have related to Yugoslavia's own banking laws which preclude domestic banks from actively seeking foreign loans (para. 45). One useful step to reinforce the strategy already proposed would be to press for relaxation of any such legal impediments, particularly as many of the broad policy measures for the graduation period are aimed at improving Yugoslavia's credit rating.