THE WORLD BANK GROUP ARCHIVES

PUBLIC DISCLOSURE AUTHORIZED

Folder Title:	Research - Energy 1975 / 1977 Correspondence - Volume 1
Folder ID:	1064741
Series:	Correspondence and Files Created for Research Projects in Support of Operations (Operations Policy Files)
Dates:	11/13/1975 – 03/18/1977
Subfonds:	Records of the Office of the Vice President, Development Policy (VPD) and the Development Policy Staff
Fonds:	Records of the Office of the Chief Economist
ISAD Reference Code:	WB IBRD/IDA DEC-01-02
Digitized:	03/29/2022

To cite materials from this archival folder, please follow the following format:
[Descriptive name of item], [Folder Title], Folder ID [Folder ID], ISAD(G) Reference Code [Reference Code], [Each Level Label as applicable], World Bank Group Archives, Washington, D.C., United States.

The records in this folder were created or received by The World Bank in the course of its business.

The records that were created by the staff of The World Bank are subject to the Bank's copyright.

Please refer to http://www.worldbank.org/terms-of-use-earchives for full copyright terms of use and disclaimers.

THE WORLD BANK
Washington, D.C.
© International Bank for Reconstruction and Development / International Development Association or
The World Bank
1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

PUBLIC DISCLOSURE AUTHORIZED

RETURN TO BANK ADMIN. &
POLICY FILES

Research - Energy 1975/77
Vol. I

The World Bank Group
Archives
1064741
A1994-055 Other #: 5 Box # 210455B
Research - Energy 1975 / 1977 Correspondence - Volume 1

DECLASSIFIED
WBG Archives

Research - Energy

March 18, 1977

Dr. Jyoti K. Parikh
IIASA
2361 Laxenburg
Austria

Dear Dr. Parikh:

This is to thank you for your communication of February 10 and March 4 and their very interesting attachments.

I have reviewed with some of my colleagues the outline of the Study on Energy and Development which you prepared following our discussions in Washington. In general we are satisfied with it and would like to go ahead on that basis and as soon as possible. However, for financial and time reasons, we find necessary to split the study in two.

A first one, corresponding to Part I of your outline would be financed from our Department's own consultants funds and could be started as soon as we reach an agreement.

The second part (Part II of your outline) will require using general Bank research funds, which can only be obtained after a relatively lengthy project selection process. We believe that presentation of some interim results of the first study would allow us to get the funding for this second phase.

In order to go ahead with the first study it will be necessary for us to receive from you a much more detailed outline, an schedule for completion of the various parts of the study, and an itemized cost estimate. We would want to review interim reports at suitable intervals, sometimes in personal discussions with you. We have prepared a brief outline (attached) of what the first study could consist of, which is very similar to your own Part I. It would include an analytical description of past and foreseen energy use in developing countries but will go beyond most available studies in that it will deal not only with the best known categories of demand and supply but would give special attention to the energy uses and supplies of the rural population bringing into focus the evolution of their needs with development, the role of non-commercial fuels and the technological and policy issues peculiar to this sector of the economy.

One point which should be clarified is if this study would be contracted with you or with IIASA. If contracted with you we need to be satisfied that IIASA does not object to the use of their data bank and other facilities.

I look forward to your response to the above. Please feel free to make any comments or suggest alternatives regarding our proposal.

Sincerely,

Efrain Friedmann
Energy Adviser
Energy, Water and
Telecommunications Department

Attachment

cc: Messrs. Saunders, Fallen-Bailey, Chopra.

EFriedmann:nc

Energy and Development with Special Reference to the Rural Sector

1. Introduction

Object of study. Brief summary and conclusions.

2. Past and Current Trends

Past and present energy consumption patterns will be described by country and/or suitable regional groups. Models would be developed to explain these patterns in terms of population, economic growth in the agricultural and non-agricultural sectors, relative prices of energy sources and other suitable parameters.

More specifically, energy use in rural areas will be examined. Requirements for subsistence level (i.e., cooking, heating) and additional requirements linked to rural development (i.e., irrigation, processing, etc.) and growth in rural incomes will be estimated. The role of commercial and non-commercial fuels in supplying rural energy needs at costs - monetary or other - which the population can afford will be discussed. The environmental consequences of use of non-commercial fuels, such as deforestation, soil erosion, health will be evaluated.

3. Projections of Energy Needs

Keeping the present and past commercial and non-commercial energy usage in view, models developed from cross-country studies of developing countries and time-series studies of developing regions will be used to estimate demand. This analysis would take into account the GNP originating

from agriculture and non-agricultural sector as well as rural-urban demographic structure. The projections of energy consumption would be consistent with specific prospects and scenarios of economic development of the various developing regions. The impact of higher energy prices will be examined.

4. Energy Supply Options

Overall country energy supply options may be briefly discussed. However, the main purpose of this section will be to discuss the optimal "mix" of commercial and non-commercial fuels which can be suggested to supply future rural energy requirements at least socio-economic costs. Suggestions for developing systematically the non-commercial and renewable energy sectors would be made.

Given the enormous mass of literature already available on "new technologies", description of these will be kept at a minimum, only its potential utilization over a time scale will be discussed.

Research - Energy
& Research - Water Supply & Sewerage

Mr. Anandarup Ray

February 14, 1977

Yves Rovani

Research Activities - Energy, Water and Telecommunications Department

Please find attached two lists relating to departmental research activities. List A, as requested, shows the documents resulting from research activities which were published in calendar years 1975/76.

Since the lead time between research and publication is often so long, a better indication of recent research activity can be obtained from List B, which shows the research topics addressed in FY76, with a rough indication of their relative importance in terms of staff time.

About half the department's time devoted to research activities in FY76 - one man-year of professional staff and one man-year of summer and other research assistants - was spent on departmental research activities. This relatively high proportion was spent preparing, complementing and disseminating projects financed by the Research Committee, as well as carrying out departmental research activities too small or too operational to qualify for Research Committee financing.

In FY76, emphasis continued to be on dissemination of results of pricing, village water supply, rural electrification and other past research.

State-of-the-art papers were prepared on insurance practices, petroleum prospects of oil-importing LDCs, etc., which would probably be defined as operational by the Research Committee.

A relatively large number of smaller studies, which would not warrant attention of the Research Committee were undertaken such as:

- development of a cheap, maintenance free hand pump for local manufacture and use in rural areas;
- economic cost of power outages in Jamaica;
- guiding research/economic analysis by Borrowers, such as Papua New Guinea study of telecoms usage;
- cost implications of variations in standards of water supply services.

We will likely spend more time on research in FY77 (about 1.5 professional staff man-year), and proportionately more on Research Committee financed activities in order to supervise (a) the new project on low cost technologies of water supply and waste disposal; (b) the final phase of the study in least cost investment of power distribution; and (c) the final phase of the Costa Rica telecoms research.

This should carry on into FY78, hopefully with the addition of more energy research activities.

Attachments.

YRovani:pa.

Table A: Selected Reports from

Energy, Water and Telecommunications Department, 1975-1976

EWT Department, "Rural Electrification", A World Bank Paper, October 1975.

EWT Department, "Village Water Supply", A World Bank Paper, March 1976.

*Anderson, Dennis, "Costs and Benefits of Rural Electrification - A Case Study in El Salvador". Public Utilities Series, RES 5, February 1975.

*Anderson, Dennis, and R. Turvey, Electricity Economics: Essays and Case Studies. Scheduled for publication by John Hopkins, December 1976.

BEICIP, "Petroleum Resources of Oil Importing Lesser Developed Countries". Consultant Reports, December 1975. (Distribution Restricted to Bank Staff Only).

Friedmann, Efrain, "External Financing of Power Expansion", Public Utility Note No. 19, October 1975. Also printed in Energy Policy and offered as No. 27 in the World Bank Reprint Series, March 1976.

Friedmann, Efrain and P. Bourcier, "Interim Guidelines for the Collection of Energy Related Data". Public Utilities GAS 11, July 1975.

Gellerson, Mark, "Costs of Electric Power Outages: A Review". Public Utilities Series RES 8, August 1976.

Julius, DeAnne, "Economic Costs of Electric Power Outages: Methodology and Application to Jamaica". Public Utilities Series RES 7, August 1976.

Journey, W. K. and R. Middleton, "A Handpump for Rural Areas of Developing Countries". Public Utilities Series RES 9. October 1976.

Mukherjee, Shishir, "Energy Demand Forecasting: A Review". Public Utility Note No. 26, February 1977.

*Overseas Consultancy Service, "Standards of Urban Electricity Distribution CFE, Mexico". Consultant Report, October 1975.

Rohatgi, P. K. "Potential of Solar Water Heaters in India". Consultants Report, due February 1977.

Rydell, Ferd, "A Report on Public Utility Insurance and Practice". Public Utilities Series GAS 11, January 1977.

*Saunders, R. J., J. Warford and P. Mann, "Definition and Role of Marginal Cost in Public Utility Pricing: Problems of Application in the Water Supply Sector". Public Utilities Series RES 6, July 1976. To be published soon as a World Bank Occasional Paper.

*Saunders, R. J. and J. Warford, Village Water Supply: Economics and Policy in the Developing World. A World Bank Research Publication, The John Hopkins University Press, September 1976.

*Saunders, R. J., and J. Warford, "Pricing and Investment in Telecommunications". Public Utilities Research Series, due March 1977.

Shipman, Harold, R. Saunders, J. Warford and Others, "Measurement of Health Benefits of Investment in Water Supply". Public Utility Note No. 20, January 1976. Reviewed in American Journal of Public Health, July 1976.

*WHO International Reference Center for Community Water Supply, "Reduction of Unaccounted For Water from Public Hydrants". Consultant Report, due March 1977.

---

*Reports prepared partially or completely from External Research Financing.

TABLE B

EWT Department Research Activities FY76

Code	Title	Time %	
Department Financed Activities			
R602	Petroleum Prospects of L.D.Cs	4	
R603	Rural Telecommunications Study	17	
R604	Borrowers Economic Research (Telecommunications)	8	
R607	Oil Potential of Oil Importing L.D.Cs	14	
R608	Public Utilities Insurance Practices	36	
R609	Energy and Rural Development	5	
R610	Urban Water Supply Standards and Design	6	
R612	Manually Operated Handpump Study	7	
R613	Employment Impact of Water/Sewerage Investments	-	
R614	Water Supply to the Urban Poor	2	
R615	Rural Water Supply Programs	1	
R616	Impact of Sewerage Installations on Water Consumption and Incremental Cost	-	
	Total Department Financed	100	(33.05) man years
Research Financed Activities			
67036	Property Values of Water Supply	1	
67037	Village Water Supply	5	
67039	Pricing and Investment in Electricity Supply	3	
67067	Standard of Urban Electricity Distribution	5	
67076	Pricing and Investment in Telecommunications	48	
67111	Public Utility Pricing and Investment	35	
67112	Reduction in Waste Water from Public Hydrants	3	
	Total External Research	100	(20.25) man years

Research Energy F244

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Those listed below DATE: February 10, 1977

FROM: Efrain Friedmann, Energy Adviser, EWT

SUBJECT: Seminar on Basic Technology and Economics of Oil and Gas, Coal and Geothermal Energy

1. In line with the increased involvement of the former Power Divisions in overall Energy resources development, several of you have suggested a seminar to increase staff knowledge on the technical and economic aspects of the fuel industries.

2. We have chosen to deal with this request by offering a first cycle of five lectures on oil/gas (3), coal (1) and geothermal (1). This cycle is designed to provide only the most salient and basic information of interest to Engineers and Economists. It should be followed later by seminars dealing more specifically with operational requirements (i.e., legal and financial aspects of fuel projects, etc.).

3. The outline of the Seminar is given in the attached Annex. The first 3 lectures dealing with the oil and gas industry are scheduled for April. Definite dates will be announced with about one week notice after current uncertainties on staff travel are clarified. Lecturers for these initial sessions will be Mr. Fallen-Bailey, Energy Resources and Technologies Specialist and Mr. P. Bourcier, Senior Energy Economist, of the staff of the Energy Advisory Unit of the Energy, Water and Telecommunications Department. The lectures on coal and geothermal are scheduled for May. For all these lectures we plan to use audio-visual aids obtained from industry and in the course of our own work.

4. The Seminar is strictly in-house. Each session will last from 2 to 4:30 p.m. with a coffee break and about 1 hour for discussion. In spite of heavy demands on their time we have opted for having our own staff as lecturers. We feel this will encourage questions, comments and exchange of ideas and facilitate developing a common CPS/Regional approach to operational work in these new areas.

Distribution

Messrs. Bronfman
Howell
Pollan
Rajagopalan
van Gigch
Wyss
Beach
Erkmen
Fish
Salazar
Wessels
Williams
Rovani
Sheehan

Attachment

ANNEX

SEMINAR

Basic Technology and Economics

of

Oil and Gas

Coal

Geothermal Energy

to be presented by staff of EWT/CPS

AGENDA

Lecture I. Petroleum Exploration and Development

Lecture II. Refining and Marketing of Oil and Gas

Lecture III. Transport of Crude Oil, Natural Gas and Refined Products

Lecture IV. Coal Exploration, Development and Utilization

Lecture IV. Geothermal Energy.

Outline of Lecture I

Petroleum Exploration and Development

Duration 1 hour + 1 hour discussion and question period

(i) General Introduction

(a) Brief historical review of the development of the oil and gas industry
(b) Size and scope of the oil industry
(c) World-wide distribution of oil and gas reserves and production

(ii) Techniques of Petroleum Exploration

(a) Physical and chemical nature and origin of hydrocarbons
(b) Nature of oil and gas reservoirs and accumulations
(c) Geological and geophysical surveys for oil and gas
(d) Drilling, testing, and logging of wells
(e) Onshore and offshore technology

(iii) Development of Oil and Gas Fields

(a) Drilling (onshore and offshore)
(b) Production (onshore and offshore)
(c) Gas/oil ratio and associated gas
(d) Reservoir Engineering
(e) Reserve estimates - volumetric, material balance methods
(f) Pressure maintenance
(g) Secondary recovery
(h) Infrastructure - roads, water, living accommodation, telecommunications

(iv) Costs and Economic Considerations

(a) Survey and exploratory drilling costs
(b) Development costs
(c) Economic evaluations
(d) Fiscal considerations

(v) Personnel and Training

(a) Number and types of personnel employed at different phases of exploration and production
(b) Training - professional
- artisan

(vi) Environmental and Safety Considerations

(a) Surveying
(b) Drilling - Blowout prevention
Fire hazards
Disposal of oil and mud
Special offshore conditions
Plugging and abandoning of wells
Protection of aquifers

(c) Production - Avoidance of spills and leakage
Fire prevention
Salt water disposal
Flaring of associated gas
"Sour gas" (hydrogen sulphide) problems

Outline of Lecture II

Refining and Marketing of Oil and Gas

Duration 1 hour + 1 hour discussion and question period

Part 1. Oil Refining

(i) (a) Historical review
(b) Scale of the industry
(c) Future perspectives
(d) Matching of refinery output and market demand

(ii) Chemical Processes in Refining

(a) Composition of crude oils
(b) Blended feedstocks
(c) Sulphur, salt, vanadium and other impurities
(d) Distillation
(e) Cracking and hydrogenation
(f) Maintenance schedules
(g) Process control and monitoring

(iii) Products of Petroleum Refining

(a) Product types and specifications
(b) Special requirements, blending, and additives
(c) Petrochemical feedstocks
(d) Testing and quality control

(iv) Infrastructure

(a) Siting and location
(b) Land requirements
(c) Water and power requirements
(d) Communications and access

(v) Economic Considerations

(a) Capital costs (including design and licensing costs)
(b) Operating costs, incremental costs, theory of the "marginal barrel"
(c) Economies of scale
(d) Economic evaluations
(e) Rates of return

(vi) Environmental and Safety Considerations

(a) Fire and explosion hazards and prevention
(b) Atmospheric and water pollution control (type of gaseous and liquid emissions)

(vii) Personnel and Training

(a) Personnel requirements - professional
- non-professional

(b) Training programs - professional advancement
- safety

Part 2. Petroleum Product Distribution

(a) Bulk transport of products
(b) Storage
(c) Retail marketing
(d) Pricing policies
(e) Marketing system - direct sales
- franchised vendors
(f) Competition in marketing
(g) Standards of products and quality control
(h) Economics of petroleum products marketing

Part 3. Natural Gas Distribution

(a) Technical aspects of distribution system
(b) Economic aspects of distribution system
(c) Seasonal and peak loads
(d) Pricing policies
(e) Metering and control systems

Outline of Lecture III

Transport of Crude Oil and Natural Gas

Duration 1 hour + 1 hour discussion and question period

Part I. Pipelines

(i) Oil Pipelines

- (a) Physical characteristics and requirements
- (b) Construction
- (c) Operation and maintenance
- (d) Storage and reserve capacity

(ii) Gas Pipelines

- (a) Physical characteristics and requirements - capacity
- (b) Construction
- (c) Operation and maintenance
- (d) Storage reserve capacity
  - Underground storage
  - Liquefaction
  - Pressurized Pipeline
- (e) Peak demand and seasonal loads
- (f) Gas processing and pipeline gas specifications

(iii) Legal and Fiscal Considerations

- (a) Right-of-way
- (b) Common carrier status
- (c) Taxation

(iv) Costs and Economic Considerations

- (a) Design and Planning
- (b) Surveys
- (c) Construction costs
- (d) Operating costs
- (e) Economic evaluation and rates of return

(v) Personnel Requirements

(vi) Environmental and Safety Considerations

- (a) Safety factors and accident hazard
- (b) Buried and unburied lines
- (c) River crossings
- (d) Underwater pipelines
- (e) Spillage clean-up and repair techniques
- (f) Corrosion prevention and cathodic protection

Part 2. Oil Tankers

(i) The Tanker Fleet

(a) Historic development
(b) Structure of present tanker fleet
(c) Ownership

(ii) Types of Tankers

(a) "Clean" and "dirty" tankers
(b) Combination carriers (ore, grain, etc.)
(c) VLCC's
(d) LNG tankers and LPG tankers
(e) Motive power - steam vs. diesel

(iii) Operation of Tankers

(a) Loading and unloading
(b) Terminal and harbor facilities
(c) Cleaning and ballasting
(d) Tankers and the Suez Canal

(iv) Economic Considerations

(a) Construction costs
(b) Operating costs
(c) Long term charter and the "spot" market
(d) Structure of tanker charter rate schedules
(e) "Flags of Convenience"
(f) Financing practices

(v) Environmental and Safety Considerations

(a) Spillage and spillage control methods
(b) Ballast decontamination
(c) Fire and explosion hazards
(d) Navigational and shipwreck hazards

Outline of Lecture IV

Coal

Duration 1 hour + 1 hour discussion and question period

Part 1. Coal Exploration and Development

(i) Coal Industry

(a) Historical perspective, origins of the industry
(b) Scale of industry
(c) World-wide distribution of coal reserves
(d) Future perspectives

(ii) Coal Deposits

(a) Nature and origin of coal deposits
(b) Types and chemical composition of coals
(c) Geology of coal

(iii) Coal Exploration

(a) Geological and geophysical surveys
(b) Reserve estimation
(c) Bulk sampling and testing
(d) Costs

(iv) Coal Mining

(a) Planning and design of coal mines
(b) Open pit mines
(c) Underground mines
(d) Equipment requirements
(e) Personnel requirements and training
(f) Safety
(g) Economic considerations - costs and pricing
- productivity
(h) Inter-fuel competition

(v) Coal Transport and Storage

(a) Road and Rail
(b) Pipelines
(c) Storage problems - spontaneous combustion

Part 2. Coal Utilization

(i) Coal as Fuel

(a) Historical
(b) Power generation and steam raising
(c) In the metallurgical industry
(d) domestic and smokeless fuels

(ii) Coal in the Chemical Industry

(a) Coke and gas manufacture
(b) Coal tar and synthetic dye industry
(c) Synthetic liquid fuels

(iii) Environmental Considerations

(a) Atmospheric pollutants and their control
(b) Water pollution and control
(c) Subsidence in underground coal mining
(d) Restoration of land surface in surface mining
(e) Economic cost

Outline of Lecture V

Geothermal Energy

Duration 1 hour + 1 hour discussion and question period

(i) Nature of Geothermal Energy

- (a) What is geothermal energy
- (b) World-wide distribution and present status of development

(ii) Geothermal Exploration and Development

- (a) Geological and geophysical surveys
- (b) Drilling
- (c) Reserve estimation
- (d) Types of geothermal field
- (e) Field management and production history
- (f) Economic considerations
- (g) Characteristics of geothermal fluids
- (h) Environmental and safety considerations

(iii) Utilization of Geothermal Energy

- (a) Power generation
- (b) Process heat
- (c) Space heating
- (d) Economic considerations
- (e) Environmental aspects

Research Energy

Mr. J. Warford

February 10, 1977

Efrain Friedmann

Economic Research for Energy

1. In connection with Mr. Baum's recent remarks regarding identification of Research and Policy areas needing CPS attention, I will like to suggest two areas related to Energy.

2. The first is a reappraisal of the "Interrelation of Energy and Development." Much work is being done in this field but mostly in the context of the industrial countries, particularly the U.S. This latter research will not answer similar questions as they are posed in the LDC's, as the pattern of energy use is too different.

3. The second would focus on the "Energy use and needs in rural areas - past trends and future options." LDCs use primarily firewood and other non-commercial sources of supply in the rural areas. The past and future role of these as well as modern and newer forms of energy needs to be studied.

4. Research in both areas might lead to policy papers. Perhaps with your staff's help, consultants and Research Committee funds, we could undertake research in one or both subjects. Could we discuss.

cc: Mr. Rovani

EFriedmann:mb

Africa Drought Relief
✓ 2 ~~Admin/Policies Files~~ Research Energy

Mr. A. Meimaris, WAPA3 February 4, 1977

F. van Gigch, WAPDR

(1) Visit of Mr. G. R. Bazin, Manager of Solar Cell Pump Department, Pompes Guinard
(2) Visit of Messrs. J. Houle and R. Logan, Bechtel Corporation
February 3, 1977

(1) Meeting with Mr. Bazin

Mr. Bazin came to the Bank to talk about his firm's work on the utilization of solar energy to pump water. He gave me some brochures (attached) and promised to give us more information about costs and performance of their systems. In a nutshell, the present systems has individually a maximum capacity of 5 kilowatts. They can pump water for the irrigation of 10 ha at a cost of US$9,000 per ha. Their systems require no maintenance and there are no recurrent expenditures. Although the investment cost is higher than the diesel system, the cost per m^3 of water is cheaper. He expects in the near future some major innovations in the production of the cells, which at present represent 80% of the investments, and thus a considerable decrease in costs. They will have demonstration activities in Senegal (Bambey), Mali and Niger. Mr. Bazin was interested to know whether the Bank could finance some "applied research" on the matter.

I told him that the kind of financing he was seeking is more of research and development, the benefits of which would essentially be for his firm. I also told him that in general when we finance research, if at all, it is in cases where the results become public property. I thought offhand that the kind of financing he was seeking is not suitable for Bank intervention but that we would look into the matter. I think that the use of solar energy has some future particularly in the Sahel and we should not be indifferent to these developments. I would like to discuss this with you on your return and you should touch base with them the first opportunity you are in France.

(2) Visit of Messrs. Houle and Logan

The gentlemen from Bechtel were exploring the possibilities of working in West Africa. I told them the policy of the Bank regarding consulting firms and gave them a general rundown of our work in the field of irrigation. An interesting point is that they had identified a project in Matan in Senegal based on groundwater which is refilled by the floods of the Senegal River. The estimated cost for two crops is about US$6,000-7,000 per ha, all development included. This project is now in the hands of AID but the Government resists this course of action because it believes it would preclude later development under the Manantali Dam. We should look into this matter.

FvanGigch:db

Attachment
cc: Mr. A. R. Whyte

Research Energy

Mr. Efrain Friedmann, Energy Adviser (EWTDR) January 7, 1977

Mr. Charles G. Gunnerson, Consultant (EWTDR)

Energy, Fossil Fuels and Climate

I am enclosing a copy of a recent Energy Research and Development Administration report, "The Global Carbon Dioxide Problem".

This report summarizes and evaluates available information and models and concludes that CO_2 from fossil fuels will be an increasingly important matter, which will result in both climatic, ecological and social impacts. The authors state:

> "Finally, there is also the really serious ethical question of the commitments which we and our children may be making for scores of generations to follow; the immediate commitment to the rapid consumption of the accessible reserves of fossil carbon and the commitment to future changes in the world environment which seem impossible to reverse for many centuries to come".

The report was kindly provided to me by Dr. Ralph Rotty. He has also agreed to present a briefing or seminar for you and other Bank officials which will give us an opportunity to question him as to the validity of the basic data, assumptions and sources of ideas presented in the report. He would schedule his presentation on the occasion of one of his fairly frequent visits to Washington. Please advise me as to how I should proceed.

cc: Dr. R.M.Rotty

CGGunnerson:sp

Research Energy

December 21, 1976

Mr. A.D.K. Hardie
Allan View
The Haining
Dunblane
PERTHSHIRE, SCOTLAND
UNITED KINGDOM

Dear Mr. Hardie:

Thank you for your letter of some months ago forwarding the notes on charcoal making in Iran. I regret not replying earlier, but have been away travelling extensively and fallen behind with correspondence.

The method you describe would seem a substantial improvement on the traditional one-use earth kilns commonly used in East Africa and I agree, could have application in Mwanza/Shinyanga. We would be glad to receive a more detailed description of the process which you have kindly offered to provide. Some key questions which would seem to need following up include :

(a) Is a special quality of clay needed for lining the base?

(b) Are there draught-control apertures in the base? If not, are these provided in some other part of the structure?

(c) Is the continuous unloading of charcoal effected through the base?

(d) Can the superstructure be fabricated from local clay alone?

(e) From what materials could the platform be fabricated?

I hope you have had an interesting stay in Iran.

Best wishes,

Yours sincerely,

Sydney A. Draper.

cc. Messrs. MacLeod
Spears
Keil

Research Energy

December 14, 1976

Mr. Martin B. Zimmerman
Research Associate in Management
MIT Energy Laboratory
Cambridge, Mass. 02139

Dear Mr. Zimmerman:

It just came to my attention that you are working on coal as part of the energy research team at MIT and wrote a paper titled "Long Run Mineral Supply: The Case of Coal in the U.S."

My work for the World Bank involves projection of global energy balance and a study on the prospects for coal on the world-wide basis. In this connection I am very much interested in your paper mentioned above. Could you kindly send me a copy of the paper? Also of great interest are studies on coal that you may have produced subsequently. I also hope that this could serve as the beginning of continuous mutual fertilization on matters relating to coal.

I am looking forward to your reply.

Sincerely,

Boum Jong Choe
Commodities and Export Projections
Division
Economic Analysis and Projections
Department

BC:rc

Research Energy

October 1, 1976

Energy Industries Ltd.
4303 - 11th Street, N. E.
Calgory, Alberta T2E 6K4
CANADA

For the Attention of Robin W. Smith

behind file ✓

Dear Sirs:

Thank you for your letter of August 3, 1976, with attached literature on your natural gas compressor units.

Regarding your wish to bid on any Bank-financed projects requiring such units, we would like to advise that the Bank does not maintain registers of firms wishing to receive invitations to bid. On Bank-financed projects such invitations are issued directly by the concerned project authorities after they have internationally advertised their intention to call tenders.

We hope this information will be helpful to you.

Yours faithfully,

Geoffrey Evans
Industrial Projects Department

GEvans:siv

cc: Messrs. Fuchs
Dewey

Research Energy

Messrs: Beach, Erkmen, Fish, Salazar, Wessels, Williams
E. Friedmann

September 30, 1976

Geothermal Energy Projects

There are indications that the Bank is increasingly being asked to assist in financing geothermal projects. In view of the relative novelty of this form of energy supply, I should like to draw your attention to the fact that EWT Department now disposes of the services of an expert in this field, Mr. D. G. Fallen-Bailey, who has joined the Department as Energy Resources and Technology Specialist.

Before joining the Bank last August Mr. Fallen-Bailey was Senior Technical Adviser (Mineral Fuels) with the United Nations in New York. During that period he worked on geothermal developments in a number of countries, among which were Chile, Costa Rica, Nicaragua, Honduras, El Salvador, Turkey, Jordan, Kenya, Taiwan, Solomon Islands, and the Philippines. From 1965 to 1968 he was Project Manager of the El Salvador Survey of Geothermal Resources, during which period the Ahuachapan steam field was discovered.

Mr. Fallen-Bailey is a qualified petroleum engineer and geologist who worked in the international petroleum industry for many years, in addition to his work for the United Nations. He is experienced in petroleum exploration and development, as well as petroleum administration and legislation, and has some experience of coal development. Mr. Fallen-Bailey is available to provide advice and assistance upon request in the areas of his expertise.

cc: Messrs. Bronfman, Howell, Pollan, Pouliquen, Rajapolan, Wyss
Messrs. Rovani, Sheehan

Files

EF:jr

248423 WORLDBANK

ENELCI ABIDJANO

248423 WORLDBANK

ENELCI ABIDJAN

INCOMING TELEX Research energy MC

1976 SEP 21 AM 9:37

From: Abidjan - Sept. 21, 1976

Distribution

Mr. Chenery

A L'ATTENTION HOLLIS B. CHENERY

XX

YUXOXQW 3)

TELEX NUMERO 667

==========

MINISTER DIAWARA PRESIDING DYMPODIUM AFRICAN ENERGY PROSPECTS

ORGANISED BY CONSERVATION COMMISSION WOLRD ENERGY CONFERENCE ON

TUSDAY 12TH OCTOBER ABIDJAN HOPES YOU WILL BE PRESENT TIMS HAS

DETAILS

REGARDS..... RUTTLEY..... SECRETARY GENERAL.

ABIDJAN LE 21/9/76

Research - Energy

le 19 juillet 1976

Monsieur Bernard Renard
Attaché Industriel
Ambassade de France aux Etats-Unis
Suite 620
1100 Connecticut Avenue, N.W.
Washington, D.C. 20036

Cher Monsieur,

Je vous remercie de votre lettre du 12 juillet et de la communication de la brochure de la Société Française d'Etudes Thermiques et d'Energie Solaire. Je vous remercie en outre de l'article qui fait le point des réalisations géothermiques françaises.

Je communique ces documents à mon collègue Yves Rovani, Directeur, Département de l'énergie, de l'hydraulique et des télécommunications.

Avec mes remerciements, je vous prie d'agréer, cher Monsieur, l'expression de mes meilleurs sentiments.

B. Chadenet

Bernard Chadenet
Vice-Président

cc: Mr. Christian Finne

BChadenet/rh

Research - Energy
Rec'd July 14
Ack'd July 19/76

AMBASSADE DE FRANCE
AUX ETATS-UNIS

LE CONSEILLER COMMERCIAL
CHEF DES SERVICES DE L'EXPANSION
ECONOMIQUE AUX ETATS-UNIS

Suite 620
1100 CONNECTICUT AVENUE, N.W.
WASHINGTON, D.C. 20036

TELEPHONE: (202) 223-6710
TELEX: 248320 FRCC

Référence à rappeler:

02373

BR/ce/ 682

Le 12 juillet 1976

Monsieur Bernard Chadenet
Vice Président
Org., Plan. and Personnel Management
Room E 1204
World Bank
1818 H Street, N.W.
Washington, D.C. 20433

Monsieur,

Faisant suite à notre entretien du 6 juillet, je vous communique la brochure de la Société Française d'Etudes Thermiques et d'Energie Solaire.

Cette société a conçu et réalisé depuis plusieurs années une gamme de pompes solaires à capteurs plans qui fonctionnent dans de nombreux pays, notamment pour des installations d'irrigation. C'est au Mexique que la SOFRETES a réalisé la première station solaire opérationnelle à turbo-alternateur produisant de l'électricité qui est utilisée pour l'alimentation en eau potable d'une ville de 10.000 habitants.

Je joins à cette documentation un article qui fait le point des réalisations françaises en matière de géothermie.

J'espère que cette documentation au sujet de ces réalisations françaises dans le domaine des énergies nouvelles vous sera utile.

Je reste à votre disposition pour vous fournir les renseignements complémentaires dont vous pourriez avoir besoin.

Je vous prie d'agréer, Monsieur, l'expression de mes sentiments distingués.

P.J.

Bernard Renard
Attaché Industriel

TECHNIQUES ET RÉALISATIONS FRANÇAISES EN MATIÈRE DE GÉOTHERMIE

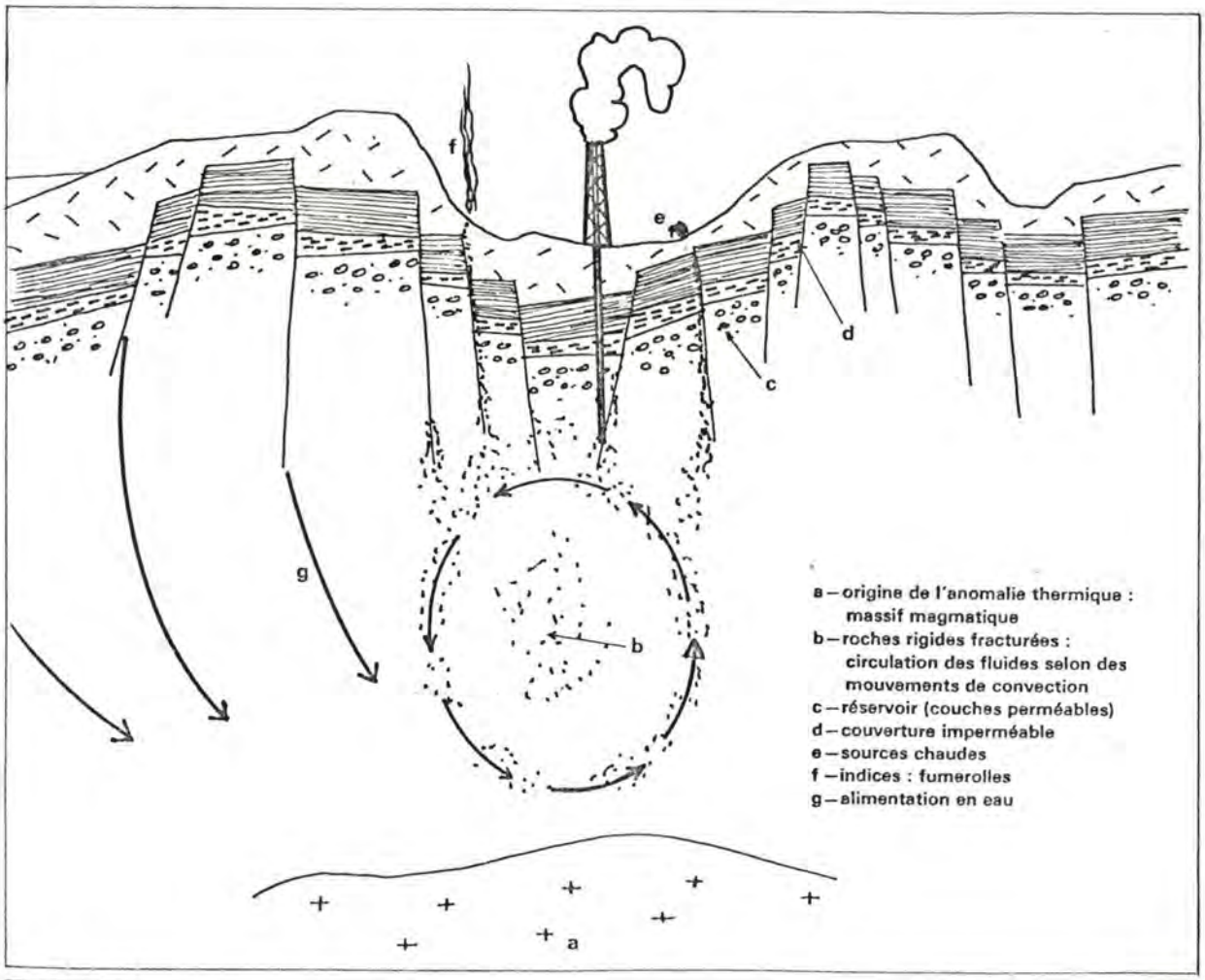
Historique

On sait que depuis la haute antiquité, l'existence de sources de chaleur favorisées par des formations poreuses ou fissurées dans certaines structures géologiques, s'est traduite par l'exploitation de ces sources chaudes, principalement à des fins thérapeutiques.

Plus près de nous, au début de ce siècle, en Italie, à Lardarello, cette énergie a été utilisée pour la production de l'électricité sous forme de vapeur naturelle. Depuis 1920, en Islande, le chauffage de serres et de maisons a utilisé la géothermie. A partir de 1950, en Nouvelle Zélande et en Californie des recherches plus systématiques furent entreprises.

C'est également à cette époque que les chercheurs français ont approfondi l'étude des problèmes de circulation des fluides d'origine superficielle qui se réchauffent en profondeur, deviennent plus légers et tendent de ce fait, à remonter en se substituant aux fluides plus froids.

Cette circulation convective a notamment été mise en évidence par un savant français M. Jean Goguel qui, à partir des résultats obtenus sur le champ géothermique de Lardarello, a mis au point pour la première fois, un modèle schématique de champ géothermique(*).



B-1-76-100-1

(*) *Réf. Jean GOGUEL : «Le régime thermique de l'eau souterraine»* (Annales des Mines)

Depuis des installations se sont développées à l'étranger : au Japon, en U.R.S.S., en Hongrie.

En Islande, en 1970, 40 % de la population était déjà chauffée par l'énergie géothermique grâce à l'utilisation de sources d'eau chaude très nombreuses variant de 48 °C à 128 °C ; en effet, ce pays bénéficie d'un climat à fréquence élevée de températures comprises entre 0° et 10°, particulièrement favorable à la géothermie.

En Hongrie, des conditions exceptionnelles ont permis l'utilisation directe de l'eau de forage pour les installations de chauffage urbain, des serres et pour les piscines.

L'analyse approfondie des résultats obtenus a montré que l'élévation de la température observée avec l'augmentation de pr(ondeur, dénommée « gradient géothermique », 'est en moyenne de l'ordre de 1 °C, pour 30 mètres ; toutefois il apparaît que certaines régions ont un gradient nettement plus élevé.

Une distinction est faite entre la haute et la basse énergie contenue dans les sources de chaleur, la haute énergie étant nécessaire pour la production d'électricité, alors que la basse énergie est intéressante dans diverses applications pour le chauffage.

La température qui caractérise la limite entre basse et haute énergie varie de 150 °C à 180 °C.

Situation en France : en France métropolitaine, seule existe, en quantité importante, à court et moyen terme, de la basse énergie. Dans les départements d'Outre-Mer, de la haute énergie pourrait être mise en valeur ultérieurement.

Basse énergie en France

Les nombreux forages effectués pour la recherche des gisements pétroliers dans la métropole ont permis de faire une première analyse des différents réservoirs d'eau chaude susceptibles d'être exploités (*).

La volonté de développement de la géothermie lorsque la crise énergétique est survenue, s'est affirmée, et le gouvernement français a pris plusieurs dispositions, qui sont de deux ordres :

— Développement industriel avec l'aide du Ministère de l'Industrie et de la Recherche (D.G.R.S.T. — Délégation Générale à la Recherche Scientifique et Technique — (Comité Géothermie).

— Etudes techniques sur :

- la gestion des réservoirs - l'étude des nappes,
- la conception des installations,
- les problèmes de thermique.

a) Développement industriel avec l'aide du Ministère de l'Industrie et de la Recherche.

Quatre projets de géothermie sont opérationnels.

A Creil dans la région parisienne, 4.000 logements, dont 2.000 en habitat ancien et déjà chauffés avec un combustible traditionnel, sont en cours d'équipement. 2 doublets, c'est-à-dire 2 puits d'extraction et 2 puits de réinjection sont installés. Trois pompes à chaleur sont prévues en plus des échangeurs, afin d'améliorer le rendement, en réinjectant l'eau refroidie dans les réservoirs. 72 à 75 % des besoins énergétiques doivent être couverts avec l'eau puisée à 60 °C environ.

A Villeneuve-la-Garenne, dans la région parisienne, 1.700 logements pourvus de chauffage par le sol, installés déjà depuis 10 ans, sont en cours de raccordement à un doublet géothermique. Une technologie particulière y est appliquée quant à la nature des matériaux mis en œuvre (tuyauterie (casing) en polyester).

A Mee-sur-Seine également dans la région parisienne, on assiste à la réalisation de la première phase d'une opération importante portant sur 6.000 logements, 50.000 m² de bureaux et des équipements collectifs, qui nécessitera 4 doublets de forage. 70 % des besoins énergétiques doivent être couverts par la géothermie.

A Mont de Marsan dans le sud de la France, il s'agit de chauffer toute une zone de la ville comprenant des immeubles anciens et d'autres à construire. Le pompage de 200 mètres cubes d'eau douce à 65 °C, dans ce cas particulier — qui se situe dans une zone au climat moins rigoureux que celui de la région parisienne — permettra de couvrir 90 % des besoins énergétiques dans des conditions intéressantes puisqu'il n'est pas envisagé de réinjection.

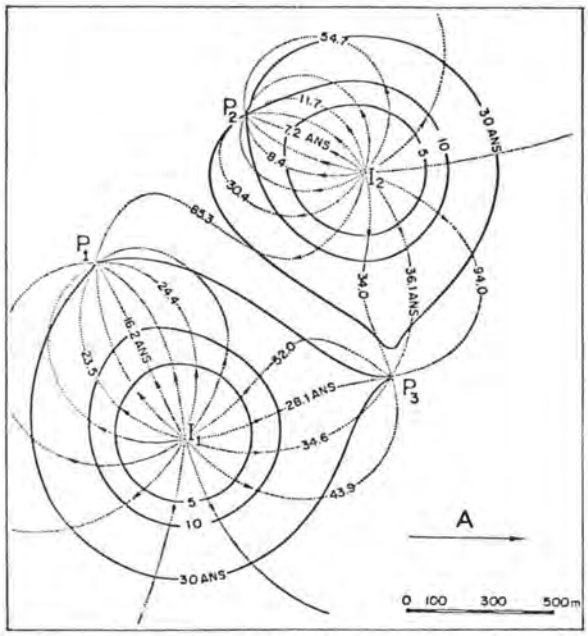
(*) *Une première expérience a été réalisée à Melun l'Almont en 1970 qui a fait apparaître la faisabilité de l'exploitation géothermique (premier prix de l'énergie 1975 attribué à M. P. Maugis) avec l'utilisation de la réinjection d'eau*

Une quinzaine d'autres dossiers très avancés existent mais ne sont pas encore arrivés au stade de l'étude financière. Toutefois, il est intéressant de noter que des groupes industriels ayant une assise financière suffisante pour couvrir les risques techniques d'exploitation et de forages s'intéressent désormais à la géothermie en France.

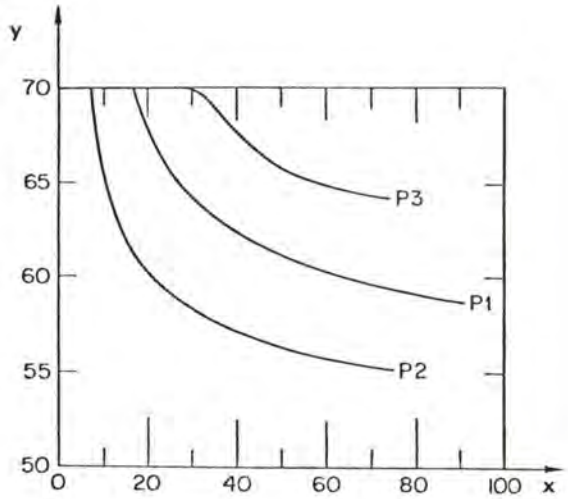
b) Etudes

La gestion des nappes d'eau chaude a fait l'objet d'études particulièrement poussées au B.R.G.M. — Bureau de Recherches Géologiques et Minières. La réinjection dans les roches du réservoir et des épontes de l'eau refroidie jouant le rôle de vecteur, entraîne vers le puits de production, une récupération de la chaleur stockée.

Des abaques ont été établis pour calculer l'écartement des puits en tenant compte de la hauteur de l'aquifère, de la porosité des épontes et du débit de soutirage pour une durée de 30 ans d'exploitation à titre d'exemple ; d'autres permettent de calculer la durée d'exploitation avec variation du débit... etc...



B-1-76-100-2
A - écoulement naturel 1 m/an



B-1-76-100-3
x : temps (années)
y : température (°C)

Le B.R.G.M. a également mis au point des modèles numériques de simulation dans le cas de plusieurs puits afin de déterminer les implantations optima des puits pour une ville nouvelle par exemple.

Conception des installations

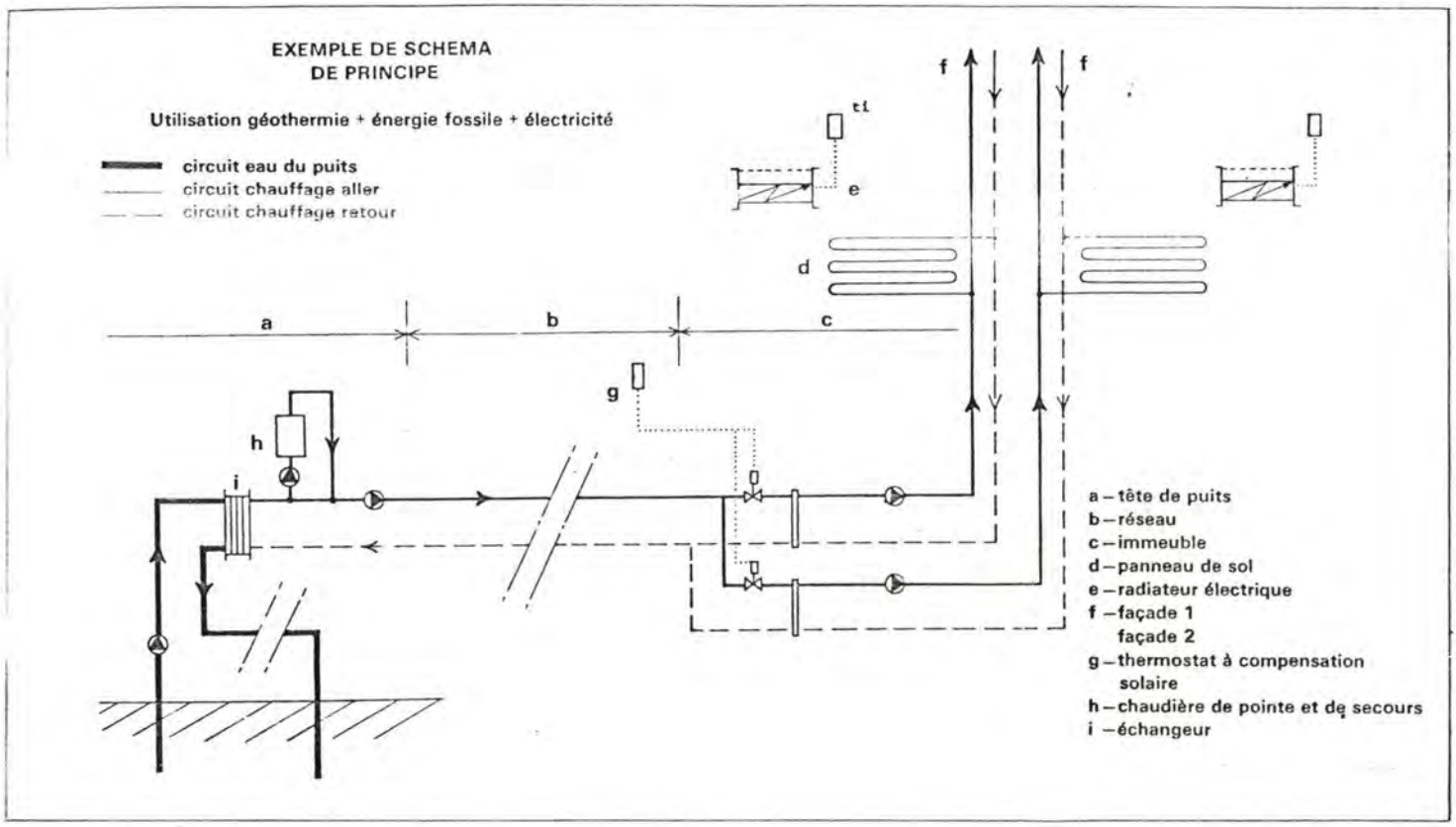
Les puissances calorifiques disponibles d'un forage géothermique sont proportionnelles au débit du puits d'extraction et à l'écart de température à l'échangeur.

La température de départ est déterminée par celle de l'eau de forage à quelques 2 ou 3 degrés près.

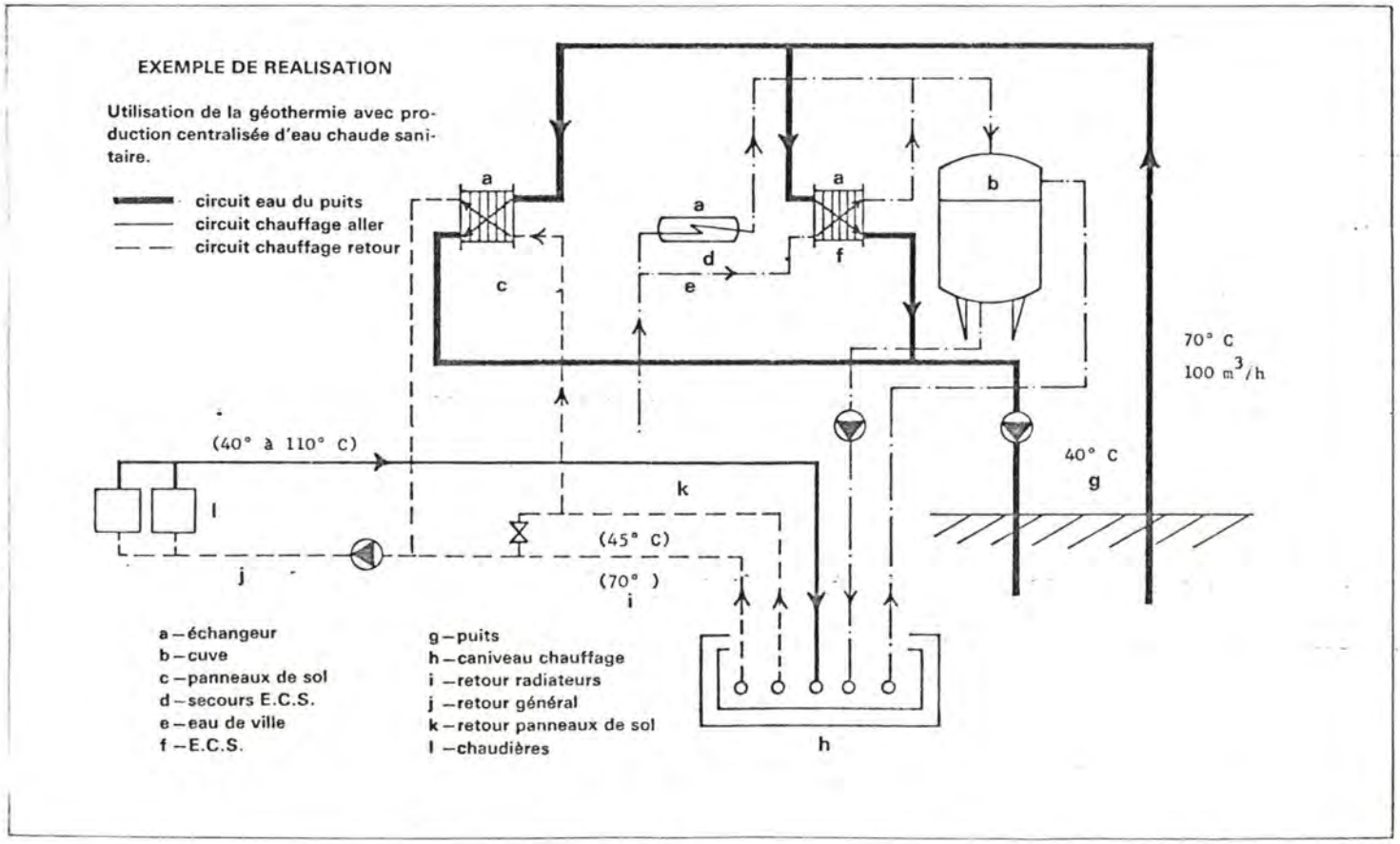
Les retours des installations raccordées se font à des températures variables suivant les types d'installations. Ce sont donc ces retours des installations qui conditionnent pour la plus grande part le rendement des installations géothermiques.

Inventaire des systèmes utilisés en fonction des problèmes de thermique

Les types d'installations de chauffage les plus facilement utilisables aussi bien dans le cas des habitats existants, qu'en cours de construction, sont, actuellement, ceux utilisant le chauffage par la dalle de plancher dont les retours se font à des températures de l'ordre de 30 °C.



B-1-76-100-4



B-1-76-100-5

L'utilisation des réseaux d'eau chaude sanitaire sont également très intéressants pour abaisser les températures de retour des circuits. Des études sont poursuivies sur des schémas de montage de tels réseaux associés à des compléments de chauffage traditionnel assurant l'appoint et le secours. D'autres études portent sur les régulations dont le rôle est capital, puisque les chaufferies d'appoint utilisant des combustibles importés, sont sollicitées en permanence par le jeu des régulations.

L'utilisation d'échangeurs et de pompes à chaleur, associée à la notion d'abaissement de la température des retours, fait enfin l'objet de nombreuses études appliquées.

Les études et les expériences françaises en basse énergie, se sont révélées dans les enceintes internationales d'un intérêt capital, et elles y jouent un rôle pilote.

Haute Energie

Les recherches entreprises par des groupes d'études industrielles et scientifiques (B.R.G.M., EURAFREP, etc...) ont révélé des possibilités dans les départements d'Outre-Mer, en Guadeloupe et dans le Territoire des Afars et des Issas, notamment, qui sont des encouragements pour la technique française. De telles équipes, par leur compétence, peuvent être déléguées pour des projets et être opérationnelles pour des réalisations dans le monde entier, y compris lorsqu'il s'agit d'installations de centrales géothermiques qui sont étudiées en liaison avec les bureaux d'étude, E.D.F. — Electricité de France — et les constructeurs français.

MINISTERE DE L'INDUSTRIE ET DE LA RECHERCHE

Direction des Mines
Service de la Géologie, des Minerais, Métaux et Matériaux de Construction
99, rue de Grenelle
75700 PARIS - FRANCE

Tél. : 555.93.00

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

Research Energy 87

TO: FILES

DATE: January 16, 1976

FROM: E. Friedmann EF

SUBJECT: Energy for Rural Areas - UNDP - ERDA - USAID - World Bank

1. Today I chaired a meeting with representation of the above mentioned institutions (list of participants attached) to discuss possible cooperation in Research and other technical assistance activities related to the problem of energy for rural areas. Mr. C. Weiss had sent the invitations, but he was sick and unable to participate.

2. The meeting was a veritable tour de force over the many sides of this extremely complex subject, with interesting contributions from all attendants. Many views and suggestions for action were outlined. Among current and planned activities reported were: the publication in the near future of a NSF report on "Energy and Rural Development" and other on "Biogas systems." A USAID project for FY77 of several in-country studies in LDC's focussed on energy use in rural areas, sources of supply, costs, potential for improvements etc. An ERDA funded market study of solar cell application, currently in the U.S. but likely to be extended to some LDC's.

3. Some participants stressed the importance of improving the operation of the non-commercial traditional energy supply systems by better forest management, more efficient stoves, increased used of local labor and materials. Others offered solutions based on mass production (local or foreign) of new equipment (biogas generators, windmills, etc.).

4. It was decided to put in writing and circulate specific proposals within the next 3 weeks as preparation for a future, more decision oriented meeting which would take place in the Bank. It is obvious that the institutions participating would like to be helpful in this field but are uncertain about where the priorities are and which is a feasible approach.

5. Participants also agree to circulate selected references on the subject and Mr. Palmedo of BNL offered to have a graduate student carry out a more thorough literature survey.

cc: Messrs. Rovani, Yudelman
Weiss, Pak, Bourcier

EFriedmann:mb

WORLD BANK, JANUARY 16, 1976

Norman L. Brown	ERDA (International R&D Programs) (202)376-4322
Jack Vanderryn	ERDA (International R&D Programs) (202)376-4319
Clint Stone	US AID (TA/OST) (202)632-7971
Jerome (Sam) Bosken	US AID (TA/OST) (202)632-7971
Jerome Kahan	State Department (202)632-8995
Martin Prochnik	State Department (OES) (202)632-4413
Russell J. deLucia	Meta Systems Inc.
Vinod Mubayi	BNL
Philip Palmedo	BNL (516)345-2316
A. B. Harland	UNDP (Director Technical Advisory Division) (212)754-4745
Efrain Friedmann	World Bank, Energy Adviser (202)477-5346
Simon J. Pak	World Bank (Office of Science & Technology) (202)477-6921

INTBAFRAD WSH

INCOMING TELEX

Research Energy

RECEIVED

VAN MEURS OTT

Distribution:
Mr. Friedmann
Mr. Rovani

NOVEMBER 13, 1975

1315 NOV 3

ATTN MR. EFFRAM FRIEDMAN

ENERGY ADVISOR

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

FURTHER TO OUR TELEPHONE CONVERSATION:

PROPOSAL FOR STUDY ON CURRENT ENERGY SITUATION IN DEVELOPING COUNTRIES.

AAA VAN MEURS AND ASSOCIATES LIMITED OTTAWA, CANADA WOULD PREPARE BEFORE OCT. 1, 1976 A 1200 PAGE REPORT ON MOST IMPORTANT AVAILABLE ENERGY INFORMATION ON ALL DEVELOPING COUNTRIES.

BBB THE INFORMATION TO BE SUMMARIZED WOULD COME FROM THE MOST IMPORTANT BOOKS AND JOURNALS ON ENERGY, REPORTS OF INTERNATIONAL CONFERENCES, WHERE POSSIBLE UNPUBLISHED BUT NON-CONFIDENTIAL REPORTS MADE BY VARIOUS ORGANIZATIONS AND WHATEVER INFORMATION CAN BE OBTAINED FROM DIRECT RESEARCH IN AND CONTACTS WITH THE VARIOUS DEVELOPING COUNTRIES.

CCC INFORMATION WOULD DEAL WITH ALL ENERGY SOURCES INCLUDING NON-CONVENTIONAL SOURCES.

DDD FOR EACH DEVELOPING COUNTRY THE FOLLOWING SUBJECTS WOULD BE DEALT WITH

1. GENERAL DATA AND GOVERNMENT ENERGY AGENCIES
2. ENERGY RESOURCES AND RESERVES
3. ENERGY PRODUCTION, PRODUCERS AND CONVERSION
4. ENERGY DEMAND, USE, CONSERVATION AND DISTRIBUTORS
5. ENERGY TRANSPORTATION, IMPORTS AND EXPORTS
6. ENERGY COSTS AND PRICES, COMPETITION AND MARKETS
7. ENERGY POLICY, LAWS AND CONTRACTS
8. ENERGY RESEARCH AND EDUCATION
9. ENERGY PLANS, PROJECTS AND PROJECTIONS
10. ENERGY PROBLEMS AND SOLUTIONS

EEE THE LENGTH OF THE DESCRIPTION FOR EACH COUNTRY WOULD OF COURSE DEPEND ON THE AMOUNTS OF ENERGY PRODUCED AND CONSUMED, AND THE AVAILABILITY OF THE DATA. HOWEVER THE AVERAGE LENGTH WILL BE 10 PAGES AND THE MAXIMUN LENGTH 50 PAGES. QUALITY OF REPORT WILL DEPEND ON QUALITY OF INFORMATION THAT CAN BE OBTAINED BY 3-4 ECONOMISTS AND ENGINEERS DURING AN 8 MONTH SEARCH. HOWEVER FOR THE 20 LARGEST DEVELOPING COUNTRIES AMPLE INFORMATION ON THE 10 SUBJECTS CAN BE GUARANTEED. FOR MOST OTHER COUNTRIES INFORMATION WILL AT LEAST BE ADEQUATE.

FFF IT IS CONTEMPLATED THAT AT LEAST 5 CLIENTS WOULD BE INTERESTED IN SUCH A REPORT. ON THIS BASIS THE REPORT WOULD COST 00,000 DOLLARS PER CLIENT. COSTS WOULD BE LESS IF MORE CLIENTS WOULD BE INTERESTED.

GGG PLANNED STARTING DATE OF PROJECT FEB. 1, 1976.

HHH IF INTEREST WOULD BE HIGH IN PUBLICATION, DISCUSSIONS CAN BE HELD WITH ONE OR MORE CLIENTS TO EVALUATE POSSIBILITIES FOR THE ISSUANCE OF A REGULAR PUBLICATION IN FUTURE YEARS.

III PLS FOR MORE INFORMATION CONTACT VAN MEURS AND ASSOCIATES LIMITED

PHONE (613) 722-6214

TELEX 053-4467 VAN MEURS OTT

PLS DO NOT WRITE BECAUSE OF CANADIAN MAIL STRIKE.

REGARDS

DR. A.P.H. VAN MEURS

PRESIDENT

VAN MEURS AND ASSOCIATES LIMITED

OTTAWA ONTARIO CANADA