LOW HEAD HYDROPOWER

FOCUS GROUP RESULTS

Prepared for

The Department of Energy

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The viewpoints that comprise the findings and major conclusions of this report are those of the focus group discussants and not those of the Department of Energy or its contractor, Market Facts, Inc.

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SECTION I

INTRODUCTION

This report presents the major conclusions and findings which were obtained from a focus group discussion concerning Low Head Hydropower. The purpose of the information generated by this focus group is to provide input for the Department of Energy in two decision-making areas:

1. To evaluate the barriers and opportunities associated with the successful commercialization of Low Head Hydropower.

2. To evaluate the appropriate federal actions for promoting and facilitating commercialization of this technology.

The technology represented by Low Head Hydropower was selected for research and evaluation as a candidate for commercialization because of the potential opportunity of reducing energy consumption.

Prior to the OPEC embargo, only large projects could be justified in the United States because of the high capital cost requirements. It is now felt that many of the 50,000 existing dams in the United States can be economically retrofitted for hydropower.

The primary questions put before the discussion group participants were:

-Is commercialization of Low Head Hydropower feasible?

-What is the nature and extent of the market for this technology?

-What barriers and opportunities are critical to the commercialization of Low Head Hydropower?

-What actions, if any, should be taken by the Federal Government to bring about successful commercialization of this technology?

The opinions, attitudes, and knowledge of the participants in the group discussion provide the basis for the information presented in this report.

A. BACKGROUND

Recent energy "crises" of various types, combined with growing public awareness of the depletion of natural resources and the deterioration of the environment, have led to increased efforts to discover alternative energy sources and new methods of conserving energy.

The petroleum shortage is an example of an energy crisis. The United States is increasingly dependent on uncertain foreign oil supply. This fact was underscored by the Arab oil embargo of 1973-74. Total imports of petroleum products have grown from approximately 20 percent of our requirements in 1970 to nearly 50 percent in 1977. According to long-range government projections, if present consumption trends continue, domestic and and world sources combined may not be adequate to meet the expected U.S. demand for petroleum.

Faced with these and other energy problems, the Federal Government and the Department of Energy (DOE) have become increasingly involved in the area of energy consumption and conservation. The result of this involvement has been the promulgation of a growing body of regulations, on the one hand, and the active support of the research, development and implementation of energy technologies, on the other hand. These activities will ultimately have a tremendous impact on American society with strong implications for economic, physical, social and psychological issues.

In the area of energy conservation, a number of technologies have been supported. Some examples of these technologies are given to illustrate their impact. High-efficiency electric motors have already been developed in private industry. DOE is considering what actions could be taken to increase their use by the nation's industries since these motors account for a substantial proportion of the electricity we consume. The further development of electric or hybrid vehicles could reduce the amount of gasoline consumed, thus decreasing our dependence on foreign oil imports. Retrofitting home oil furnaces with the more efficient flame retention heads could reduce fuel oil consumption. In light of recent oil shortages during harsh winters, this conservation measure could have a broad impact on the economy as a whole in addition to reducing the owner's fuel bills.

There is a need to develop new sources of energy that will reduce our vulnerability to energy crises and foreign

energy supplies. The variety of sources is illustrated by the following examples. The development of shale oil resources could provide a substantial supply of domestic oil. The installation of low-head hydropower plants in existing dam sites could provide a widespread source of clean energy that would have minimal effect on the environment. The development of wind energy technology is another source of new energy that could reduce oil consumption by replacing some of the use of oil-fired generating plants.

To further these goals of energy conservation and development, the Department of Energy is conducting a program of commercialization for a number of energy related technologies. The intent of this program is to promote conservation of energy and use of new energy sources by bringing these technologies to the market place. By encouraging the widespread use of the appropriate technologies, DOE can attain the goal of energy efficiency.

The commercialization program requires that DOE evaluate a number of energy technologies in terms of their commercialization potential. The particular questions that need to be answered for each technology are these:

- Is the commercialization of this technology feasible?
- What is the extent and nature of the market for this technology?
- What barriers or opportunities can be identified as critical to the commercialization effort and what is the relative importance of each?
- What actions, if any, should the federal government take to promote commercialization of these technologies?

Since the technologies that are candidates for this program vary widely in their technical maturity and economic circumstances, the answers to these questions will have a substantial impact on the course of the commercialization processes.

B. RATIONALE FOR FOCUS GROUPS

The commercialization program is now at the stage of evaluating the commercialization potential of various energy technologies. As a means of guidance in decision-making, DOE requires comprehensive input from key individuals associated with these technologies. Such individuals include representa-atives from government, industry, and environmental groups whose knowledge and expertise enable them to provide input to the decision-making process. The complexity of the issues and interrelationships surrounding those energy problems makes the contributions of such qualified people essential.

The focus group methodology is ideally suited to such an information gathering effort. A focus group brings together a number of individuals whose discussion of the relevant issues is led by a trained moderator. The rationale for such a group discussion is that the interaction of the respondents will produce a more thorough understanding of the topic than would interviews conducted individually. This effect is due in part to each respondent's contribution to the others as well as to the nature of the leadership exerted by the moderator.

The information needs of DOE require input to policy decisions from outside DOE. Such input is best obtained by identifying target populations of organizations and individual roles within those organizations. From these populations, qualified respondents can be selected who represent a variety of opinions about and attitudes toward the commercialization of a particular technology. Such representation helps assure

coverage of the commercialization issues from many viewpoints - developers, manufacturers, distributers, purchasers and users.

The reader should be aware that focus groups have certain critical limitations that must be kept in mind when interpreting data derived from this technique. One must be cautious in making generalizations and drawing definitive conclusions from any qualitative research data, since the information obtained is not only based on a small number of cases, but relies upon a volunteer sample. Such a sample could not be statistically representative of its assumed universe even if it were many times larger. As a result, these findings should be viewed primarily in the context of discovery, offering working hypotheses to be validated with quantitative techniques, if that is the desired goal.

Overall, this report should be read as primarily qualitative, providing insights into perceptions and knowledge of these technologies. The major questions to be answered by the research will describe WHAT, HOW and WHY participants know, think and feel about the issues, with less emphasis to be placed on HOW MANY know or think and feel in given ways. As a result, not every respondent would agree with each conclusion of the report.

Finally, the conclusions presented in this report and the findings on which they are based represent Market Facts' objective analysis of the information derived from the focus group respondents. That is, they do not represent any particular point of view held by Market Facts. Instead, the report is based on the knowledge, perceptions, attitudes and opinions of the respondents as brought forth in the focus group.

C. PROFILE OF GROUP

The group discussion on Low Head Hydropower took place on July 24, 1978 at the Mayflower Hotel in Washington, D.C. Dr. James T. Heisler, Vice President of Market Facts, Inc., was the moderator for the group.

Nine persons took part in the group and discussed the subject from these business background perspectives:

- Turbine manufacturer
- Civil engineer
- Federal regulatory agency
- Financial executive serving utilities
- Architect/engineering firm executive
- Army Corps of Engineers
- Trade association
- Environmental organization.
- Stationary Engineer.

SECTION II

SUMMARY AND MAJOR CONCLUSIONS

The major conclusions are as follows:

1. Commercialization of Low Head Hydropower is considered to be feasible. The primary restraints are financial: having adequate financing for the projects and being able to get a 'fair' price for the energy produced.

2. There is a good market potential for small hydropower. The United States is said to be the hottest hydro market in the world. Out of 50,000 dams, approximately 10 percent are suitable for development of Low Head Hydropower and all 5,000 could be marketed because "if you can generate power somebody can use it." Public utilities, especially, are a good market for hydropower. Municipalities and cooperatives, other large users, require money and knowledge in order to move into small hydropower.

3. The major barrier is economic, especially the cash flow gap, cost of feasibility studies, and costly civil works rehabilitation.

4. The most important action required for the development of Low Head Hydropower facilities is front-end financing which would be used for feasibility studies and license application, as well as construction.

5. Assisting with financing through loans and grants is the main role the Government can play. Higher priority should be given to small Hydropower and the time for processing license applications should be shortened.

SECTION III

MAJOR FINDINGS

This section of the report presents the detailed results of the focus group. These results are the basis for the conclusions drawn in the previous section. Low Head Hydropower is not as controversial a subject as other energy-related technologies under review so there was general agreement among the participants about most of the aspects of the technology covered during the discussion.

A. FEASIBILITY OF COMMERCIALIZATION

It is the consensus of the participants that commercialization of Low Head Hydropower is feasible, but mainly if it can be accomplished economically.

In this regard, one person posed the rhetorical question, "Why did small hydro disappear?" His answer was that "When you had $80 a kilowatt for coal and oil powered plants and 80 cents to $1.50 residual, you could produce power for four to four and a half mils. As a consequence, big became better." Another participant stated that you "cannot get a fair price for hydropower if there's not dependable capacity -- you need a good stream or storage." He added that the reluctance of utilities to pay a fair price is a deterrent and the reluctance of environmentalists to give a little will knock out a fair number of projects. Because of this attitude, it was felt that "how many of the 50,000 dams are feasible is anybody's guess -- probably around 10 percent."

Another part of the economic problem with Low Head Hydropower is the investment required. It was pointed out that it "requires a large front-end investment" and that "going from the High Head to Low Head Hydro with 25 percent capacity, you're talking about a lot of dollars for kilowatt hours. One way of keeping costs down on kilowatt hours is to build sites that already have dams in place." An example of a new contract in New England was cited which gives the developer a fair price. A level price will be paid for the entire life of the financing period. They will be paying more than the

power costs in the initial years (about 43 mils per kilowatt hour in first year compared with an actual cost of 25 mils) but in about five years, the costs cross over.

It was agreed that standardization of equipment would help bring costs down. Going to Low Head of five to 15 megawatts or less and trying to tailor design to the site, "You're running cost up. We must move toward picking units off the shelf," take them and tailor the site. "One caveat to standardization -- we shouldn't discourage European manufacturers from coming into the market to assure competition." The representative of a turbine manufacturing company disagreed with this thought because "We are not allowed to sell in Japan, therefore it's not very American to invite them in."

The costs of feasibility studies and preparing application for a small hydro site (estimates of this cost ranged from $10,000 to $50,000) also were mentioned in discussing the financial problems of Low Head Hydropower. Exemplifying this thinking is this statement: "If you can cut cost of feasibility studies you can make this small hydro a lot more appealing. When you add costs of planning stages and licensing -- this can add up."

Municipalities and cooperatives, for instance, are large users of power, but they have neither the front-end investment monies to move into small hydropower nor adequate knowledge of it.

Another problem is that "Hydro has been relegated to short periods, peaking hours, and small units, "therefore, changing old dams into peaking sites becomes hairy." From the environmental aspect, it was felt that there should not be any pressure "for too much peaking in the Low Head Hydropower areas because of the environmental impact."

Some of the economic difficulties and justification problems could be alleviated "if somebody did innovative work in up-storage. We need a linkage between hydroprojects and something else -- electrical storage linkage and water storage linkage (for instance)."

While there is some resistance to Government involvement, it is considered necessary to the development of Low Head Hydropower.

"Where would we be without Federal involvement -- very few projects would have gone ahead without PRDA's* We have 56 PRDA's -- the data generated should convince other people that these projects are feasible."

Thoughts expressed about the possible role of the federal government in the development of small hydropower are discussed later in this section.

* Program Research and Development Announcements

B. NATURE/EXTENT OF MARKET

Unlike many products, the market for Low Head Hydropower cannot be clearly defined nor easily quantified. There is felt to be a good potential (participants agree that the United States is the "hottest hydro market in the world") but the cost problems must be resolved before demand can be stimulated.

The following quotes show the group's feeling about the market:

> "Private utilities have to look for more sources of power than they have before and, therefore, any power they can get their hands on is twice as valuable as under normal circumstances. Hydropower is worth three times ordinary power.
>
> "5,000 sites (10%), even 2,500, is one helluva market and all sites could be marketed. If you can generate power, somebody can use it."

California, specifically, was said to be the place to develop hydropower because "utilities will pay a fair price" for it.

C. BARRIERS/OPPORTUNITIES

Barriers and opportunities were revealed throughout the group discussion. The following summary comes from the review of the matrix which was presented to the participants.

1. Barriers

Among the technical/economic barriers, the cash flow gap, cost of feasibility studies - site specific and costly civil works rehabilitation were felt to be more insurmountable than shown.

Of the environmental barriers,dam safety, peaking use versus run of river, and fish ladders are more serious than DOE holds them to be. In the case of fish ladders the reason given is that it is "merely a matter of costs -- an economic issue." EIS* required for each site, on the other hand, is not as much of a barrier as DOE rates it.

Of the two initial deployment barriers."no recent project as guides"was rated lower than shown in the matrix.

Of the federal barriers, costly FERC licensing is more of a barrier than DOE perceives it to be.

Water rights, one of the institutional barriers, was rated difficult to cope with in the West but of relatively little consequence in the East.

2. Actions

In general, the participants were in agreement with the impact-values shown for the various actions that might be taken to overcome barriers to the commercialization of small hydropower.

As far as Cost of Feasibility Studies are concerned, forgiveable loans were felt to be just as effective as or more effective than grants (which should be discouraged).

* Environmental Impact Statement

For the sale price of power produced barrier, price guarantees are held to be more effective than government power purchase and PUC regulation would be more effective than perceived by DOE.

Actions pertaining to fish ladders elicited considerable discussion, with the opinion being expressed that "If the fish ladder is needed, it should have been in there a long time ago. Probably for that reason, it seems justified that the governments -- state or federal -- do something about it (rather than expect the powerhouse to bear the cost of it)".

D. GOVERNMENT ROLE

The experts who participated in this group discussion agree that there has to be government involvement to make the commercialization of Low Head Hydropower successful. This opinion is not completely unanimous, as will be noted from the remark made by one of the participants: "The more we can get away from government involvement, the faster the jobs can go ahead."

The main function of the government should be funding in the form of grants and loan guarantees. This money is generically identified as "front-end money"; more specifically, it is required for applying for a license, feasibility studies, and construction.

Slowness in processing license applications is a serious problem. The suggestion was made that the licensing time be reduced to 90 days from receipt of application. This was included in a letter sent to Secretary Schlesinger and Members of Congress. Also suggested in this letter was the request that the short form license application cover units up to 20,000 horsepower, not just those up to 2,000 horsepower. Another complaint about government procedures was the need to send in 60 copies when filing for a permit. According to one participant, "Some of our clients are losing interest because of the obstacles."

Besides financial assistance, "DOE has to take strong, effective leadership to get the right program." Another

participant generalized that "there will be benefits from a standard approach to small hydro in broader policy areas (as there will be benefits from manufacturers' standpoint of going to standardization)."

Naturally, the role of government goes beyond funding and improved efficiency. "Unless the federal government puts some real emphasis or push to this thing you aren't going to get very much." Also, it's a matter of setting proper priorities: "The Secretary (of DOE) says we're going to go for it, but on the priorities that he has within his agency, it's at the bottom of the barrel. The priorities are wrong. You talk about environmental problems -- you look at geothermal, man, you haven't even scratched the surface on it and it's one of the most important programs in DOE."

APPENDIX

Page 1

Commercialization Profile For Hydroelectric Resource Development

BARRIERS → / ACTIONS ↓	High Capital Cost (4)	CASH FLOW Gap (3)	Cost of Feasibility Studies-Site Specific (3)	Sale Price of Power Produced (4)	Standardization of Turbine Machinery (1)	COSTLY CIVIL WORKS Rehab. (1)	Automated Control Technology (1)	GRID Management Systems Stability (1)	DAM SAFETY (2)	Peaking use vs. Run of River (3)	Point Sources of Pollution (2)	FISH LADDERS (2)	EIS Required for each Site (3)
I. INFORMATION		4	4							4		3	0
F Handbooks													
F Demo Programs					3	3	3	3					
F Technical Assist.												1	
F Technical Studies					3	3	3	3	2			2	
F Utilization Experiments	3												
II Financial Incentives													
F Tax Credits	3	2							3				
F Low interest loans	4	4											
F Rapid Depreciation	2	1											
F Govt. Power Purchase	3	5		5									
F Loan Guarantees	3	4											
F Grants	3		5									5	
F Price Guarantees	3	5		5									
F Forgiveable Loans			4										
F Indust. Rev. Bonds	3	3											
S State Assistance Grants			3						3			5	
F Fed'l. Interest Supplement	3	4											
III Coordination													
S P.U.C. Cooperation				3									
T Utility Cooperation				4									
F Federal Interagency Coordination										1	2	2	
P Financial Institutes.													
S State Agencies										1	2	2	2
L Local Agencies										1	2	2	2
P Environmental Orgs.										1	2	2	2
P Insurance Cos.													
IV Regulation													
S P.U.C				3									
F FERC		3											
F EPA		3									2		2

DOE DOCUMENT

Page 2 COMMERCIALIZATION PROFILE - Hydroelectric Resource Development

		INITIAL DEPLOYMENT	RESOURCE AVAILABILITY	FEDERAL					INSTITUTIONAL State + Local				NON-GOVT	
	BARRIERS →	No Recent U.S. + Foreign Projects as Guides	Competing Current Uses	Costly LACK OF WATER Resource Info.	FERC Licensing	Inter-agency Review Delays	WATER Resource Impacts	FEDERAL PROJECTS	Judicial Authority	Environmental Jurisdict.	OTHER Jurisdict	Insurance	No Financing Assistance Experience to Small, dispersed Intermittent Sources	Utility
	ACTIONS →	(3) (2)	(3)	(1)	(3)	(3)	(1)	(3)	(2)	(3)	(3)	(3)	(2)	
I	INFORMATION													
F	HANDBOOKS	3			3	3							3	(3)
F	Demo Programs	4			3	3	3			2	2		3	3
F	Technical Asst.	3		5										3
F	Technical Studies	2												3
F	Utilization Experiments													
II	FINANCIAL INCENTIVES													
F	TAX Credits													
F	Low Intst. Loans													
F	RApid Deprec.													
F	Govt Power Purse													
F	Loan Guarantees													
F	Grants				3									
F	Price Guarantees													
F	Forgiveable Loans				3									
F	Indust. Rev. Bonds													
S	State Assistance Grants				3									
F	Fed. Intst. Supp.													
III	COORDINATION													
S	P.U.C. Cooperation									3				3
P	Utility Cooperation													3
F	Federal Interagency Coordination		1		3	3	2							
P	Financial Institutes.												3	
S	State Agencies				3		3	2	3	2	3			
L	Local Agencies													
P	Environmental Orgs.											2		
P	Insurance Cos.													
IV	REGULATION													
S	P.U.C.													
F	FERC				3	3								
F	EPA				3	3								
V	ALL the Fed. Programs													
F	Federal Insurance													

(5)

DISCUSSION GUIDE

I. Introduction

A. Topic and Purpose of discussion

B. Discussion format

C. Background of participants

1. Organization identity
2. Role of organization in technology
3. Individual's role

II. Current State of the Energy Technology

A. What is the current state of the art?

B. To what extent has the technology advanced over the years?

C. What have been the characteristics of this advancement?

D. What will be the net effect on energy output in short-term? Long-term?

III. Commercialization

A. Is the technology understood and far enough along in its development that it can be commercially implemented?

B. Is industry physically and psychologically ready to accept and implement the technology?

C. What are the likely markets for the technology: Consumer? Governmental? Industrial?

D. Are these markets physically and psychologically ready to accept and utilize the technology?

E. Are any of the following barriers to commercialization What are they? How are they barriers? How important are they?

1. Technological barriers
2. Economic barriers
3. Social barriers
4. Political barriers
5. Environmental barriers

F. Do any of the following present themselves as opportunities or facilitators of commercialization? What are they? How are they opportunities? How important are they?

1. Technological factors
2. Economic factors
3. Social factors
4. Political factors
5. Environmental factors

G. What, if any, information should be provided to insustry and the public to enhance the acceptability of the technology? In what form should it be conveyed? Who should provide the information?

H. Financial considerations

1. What are the estimated costs associated with the commercialization of the technology?
2. What are the sourees for these funds? Why these sources?

IV. Impacts

A. What if any, impact will there be on the following as a result of commercialization?

1. Physical environment
2. Social structures
3. Political structures
4. Economic structures
5. Labor market

B. How important are these impacts?

V. Role of the Federal Government in commercialization of the Technology?

A. Should the government exercise a role?

B. What role is desired or necessary?

1. Provide findings?
2. Favorable legislation?
3. Provide knowledge?
4. Provide equipment, materials and facilities?
5. Other?

C. What departments and agencies should be involved?

VI. Presentation of and Reaction to DOE Thinking

A. (Present concept statements to participants)

B. General reactions

C. Are these plans realistic/feasible given the:

1. Current state of technology
2. Realities of the market place
3. Realities of social, economic, political structures?

D. (Focus on specific aspects of the concept statement. Included here:)

1. Has DOE realized all of the opportunities and barriers? Are there others? How important is each?
2. Has DOE presented all of the possible solutions to the barriers? Are there others? What is the relative likelihood of success of each solution?
3. Is DOE's time schedule realistic/feasible?

VII. Summary

(The discussion will be reviewed with the participants in order to develop "bottom line" statements about each critical issue).