

SMALL WIND ENERGY  
FOCUS GROUP RESULTS

Prepared for  
The Department of Energy

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SECTION I  
INTRODUCTION

This report of the focus group research on small wind energy systems was prepared for the Department of Energy as part of the Commercialization program. The purpose of this research is to evaluate the potential for commercialization of small wind energy, to determine the barriers to development of this resource, and to judge what actions are required by the Federal Government to promote commercialization.

The research reported herein discusses the issues of commercialization as examined by a focus group consisting of key individuals from various organizations involved in small wind energy development. The report addresses the following questions:

- . Are small wind energy systems feasible for commercialization?
- . What is the nature and extent of the market for small wind energy?
- . What barriers and opportunities are critical to the commercialization of small wind energy systems?
- . What actions, if any, should be taken by the Federal Government to bring about successful commercialization of small wind energy?

These questions are examined from the perspective of the respondents in the focus group. Their attitudes, perceptions, opinions and knowledge provide the basis for the data and conclusions 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 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 representatives 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, distributors, 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 THE GROUP

The research reported herein concerns the commercialization of small wind energy systems. The focus group was held in Boston, Massachusetts from 12:30 to 3:30 pm on July 28, 1978. Dr. Francis Campos, Associate Study Director of Market Facts, Inc., served as moderator for the group.

There were 7 respondents present at the focus group representating the following types of organizations and viewpoints:

- . State Department of Energy
- . Foundation financing commercialization
- . Engineering
- . Consumer of small wind energy systems
- . Large manufacturers involved in small wind energy
- . Small manufacturers involved in small wind energy
- . Wind energy researcher

SECTION II  
SUMMARY AND MAJOR CONCLUSIONS

This section of the report presents the major conclusions of this research. These conclusions are organized around a matrix of barriers and actions that represent DOE's conceptions of the commercialization issues.

To summarize, the respondents feel that the commercialization of small wind energy is feasible under the following circumstances:

- . If Government support is provided for R & D aimed at wind machines larger than 2kW with the goal of developing safer, simpler, and more reliable machines.
- . If Federal loans or loan guarantees are provided to industry to meet capital requirements for development and, in some cases, operations.
- . If large demonstration programs are funded or encouraged by the Federal Government to promote acceptance of small wind energy among utilities and industry.
- . Such demonstrations should be managed by technically competent personnel and monitored to provide data for further development.
- . If further research concerning the wind resource is conducted at both regional and local levels to assist siting decisions.
- . Incentives to the utilities should be provided to remove institutional barriers to their adopting small wind energy. The major problems are lack of capacity credit for wind energy and subsidies for oil and nuclear fuels.
- . Local institutional barriers such as zoning and building codes and increased property assessments should be overcome with federal assistance.
- . Educational inputs should be undertaken by the Federal Government to overcome problems of awareness and acceptance of small wind energy.

A. FEASIBILITY OF COMMERCIALIZATION

Small wind energy systems are believed to be commercially feasible under the right circumstances. Small wind machines in the 1 to 2 kW range are reported to be successfully marketed at this time. The success of larger machines up to and including the area of about 25 kW is believed to be likely if the appropriate technological research and development is supported. The development effort should be directed toward the mass production of reliable, safe and simple machines in the opinion of the respondents. They further believe that the effects of this effort should be demonstrated through projects that provide managed, in-use tests of large numbers of machines.

Small wind energy can be used to produce electricity or mechanical energy. The success of a particular installation is believed to depend substantially on the specific application of the energy produced. The general problem is seen as alleviating the irregular nature of the energy source - wind.

The respondents feel that commercialization should proceed in a set of overlapping stages. Support for research and development should continue. Demonstrations programs should be established on a larger scale than the Rocky Flats project. These programs would increase awareness of wind energy as well as provide a data source for further development. The respondents feel that facilities for large scale production should be developed by industry with some financial assistance provided by government.

Parallel to this technological and industrial development, they feel that a program of education for awareness should be implemented. Furthermore a program to obtain cooperation from and incentives for the utilities is perceived to be necessary for the development of an electrical small wind energy market.

The following discussion of small wind energy markets, barriers, and actions provides a rationale and justification for the feasibility statement presented above.

B. NATURE AND EXTENT OF THE MARKET

Since small wind energy can produce either mechanical or electrical energy, the respondents feel that the market can include a broad range of applications. It is believed that a substantial market can be found for applications for which variations in wind energy production are not critical or for which energy storage is possible. Heating or cooling of insulated containers of water is a commonly mentioned storage system. Wind energy may also be used to supplement or replace energy from conventional sources.

The respondents feel that small wind machines can be used alone to generate small amounts of electricity or in groups to generate large amounts. Although the market for single machines are expected to be large, the respondents feel that users who purchase a large number of machines will make up an important fraction of the market potential. It is felt that utilities and large industries should be given incentives for purchasing a battery of small wind machines for generating electricity.

The market is felt to be limited to some extent by wind conditions and siting problems. The requirements of wind rate and consistency are believed to be important factors in the efficiency of a wind energy system. The respondents feel that enough favorable regions have been identified to support a viable market for small wind energy systems.



They believe that full development of the utility market for small wind energy can only be achieved if a means of granting capacity credit can be developed.

The financial status of many small companies involved in small wind energy commercialization is believed to be unhealthy. Many of these companies are perceived to need capital for continuing operations as well as research and development. Since many companies plan new production of wind systems, much capital is seen as necessary in preparation for this production.



The respondents feel that direct financial assistance to the manufacturers would be an important factor in facilitating commercialization. There was some feeling that some small manufacturers need capital both for operations and development. The respondents believed that such incentives to the small wind manufacturers would be more effective than incentives to the purchasers.

E. REACTIONS TO DOE'S THINKING ON COMMERCIALIZATION

The respondents feel that the technical barrier of reliability and safety was a "show-stopper" - by far most important barrier to commercialization. They place more emphasis on its importance than the DOE commercialization profile.

They also feel that industry immaturity is a barrier that will decline in importance over the next few years. This barrier is perceived as less important than its rating on the DOE profile.

Awareness and acceptance was considered to be a more difficult barrier than the DOE profile would indicate. The respondents feel that information and education are important actions needed to reduce public skepticism of wind energy.

Finally, the barrier of high cost is perceived as less important for commercialization than indicated on the DOE profile. The respondents feel that mass production techniques similar to the auto industry can bring costs down considerably, once a simple, reliable and safe design has evolved.

Among actions, the respondents agree with the DOE profile that demonstration projects would have high overall effectiveness in removing a number of barriers. The demonstrations are seen to have a number of impacts that would promote the commercialization of small wind energy systems.

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.

A. COMMERCIALIZATION ASSUMPTIONS

The respondents disagree with some of the assumptions they believe that DOE has made with respect to the development of small wind energy. In particular they feel that the distinction between small and large wind machines is inappropriate and prefer to distinguish managed and unmanaged systems. Finally, they feel that DOE's commitment is too low to alternative energy sources in general and small wind in particular. They believe that commercialization would proceed more rapidly if more attention were paid to small wind energy.

The following discussion examines the respondents' analysis of what they believe to be the DOE assumptions regarding the commercialization of small wind energy.

Some respondents objected to the distinction between small and large wind energy programs. They feel that this distinction is based on the assumption that electrical utilities would be the primary users of large wind energy systems but would not be users of small wind systems. Many respondents feel that pools of small wind machines would be a better solution to the generation of electricity for utilities. Such a collection of small machines is believed to offer superior reliability and redundancy to one or two large machines. They feel the emphasis on this application of large machines forces an artificial distinction between large and small machines.

The respondents believe that a more meaningful distinction could be made between managed and unmanaged wind systems. Such a distinction is believed to differentiate between use by utilities and industry from use by individuals and organizations with less technical expertise. These differences in technical facilities are seen to have implications for the maintenance and management of such systems that would place a limit on the sophistication of unmanaged systems.

Finally, the respondents perceive a weak commitment on the part of DOE to alternative energy sources in general and small wind in particular. They feel that the major thrust of DOE's effort is toward nuclear energy as the major technological response to the energy crisis. They further believe that the DOE commitment to wind energy is primarily concerned with large wind systems. They believe that wind energy offers a number of advantages over nuclear energy, including environmental safety and the renewable nature of the resource. Moreover, small wind energy is seen as more ready for commercialization than large systems. They hope that DOE will respond more favorably to the needs of small wind energy development in the future.

## B. INDUSTRY STRUCTURE

The respondents feel that the small wind energy industry should model itself after the automobile industry in the following ways: assembly line production techniques, large quantities of production, a simple, reliable product, and a broad infrastructure for service and maintenance. If such a pattern is followed, they believe that the problems of industry immaturity will progressively resolve themselves. Furthermore, they feel that a large capital base is needed to support technological innovation, refinements of reliability and safety, and tooling for production line techniques.

The following is an examination of the respondents' expectations and beliefs about the industry structure of small wind energy systems.

The respondents feel that the development of a small wind energy industry should emulate the early automobile industry. One respondent believes that, "we need a Model T" that could be produced in large volume using standardized assembly techniques. The justification is felt to be that the initial price is a large barrier to the commercialization of small wind energy systems. By following Henry Ford's example, they feel that they could bring the price low enough so that small wind energy costs could be competitive with other energy sources.

They believe that one of the important characteristics of the commercial success of the Model T was that it was a simple, reliable machine that anyone could afford. In

this way, costs could be kept low enough to encourage widespread use of these machines.

A further characteristic of the small wind energy industry that is believed to be desirable is a support infrastructure of service and maintenance. The respondents believe that the ready availability of repair and routine maintenance services would enhance the marketability of these machines.

At the present time, the respondents perceive the industry as immature but developing quickly. They believe that industry immaturity is a barrier that will be steadily decreasing in its importance. The rate of that decrease depends on the experience that can be obtained in the design, manufacture and marketing of these machines.

The implementation of such an industry structure is believed to depend largely on capital support. Since many of the small companies do not report having strong financial reserves, they must receive some form of assistance to continue their production goals. The most effective forms of assistance are believed to be long-term loans or loan guarantees. Some companies that are still in the development stages are believed to need operating capital as well as financial assistance for the long term.

C. NATURE AND EXTENT OF MARKET

The respondents feel that small wind systems lend themselves to a wide variety of applications. The concensus is that the potential market is large, but that acceptance of wind energy at this time is low. Furthermore, they feel that steps must be taken now to promote the expansion of a large market in the near future. Such steps include large demonstration programs, government procurements, education programs for utilities as well as the general public, and siting studies.

A discussion of the respondents perceptions of the present and future market for wind energy follows.

Much of the discussion in the focus group concerned the wide variety of applications for small wind energy. Two widely different applications were presented by respondents who rely on small wind energy. One system is used for heating and cooling of office space. Another is used to pump water at a noncritical rate. Other applications of wind energy were discussed in which problems of smoothing the energy supply were either irrelevant or overcome by some energy storage system.

The respondents are confident that a large number of applications for wind energy exist and that more applications will be discovered as wind energy becomes more economical.

At the present time, however, they believe that the general public is skeptical of the practical nature of wind

energy applications. A majority of the utilities are believed to be equally skeptical. The utilities are further confronted by a number of alternative energy sources that are perceived to be more heavily subsidized than wind energy.

From these perceptions of the general market and the utility market, the respondents feel that the government should take steps to improve the level of acceptance of wind energy in these areas. The action should consist for the most part of demonstrations of the safety, reliability, and economy of wind energy. Furthermore, the results of these demonstrations should be communicated to the markets.

The consensus of the meeting was that a large number of demonstrations should be implemented, although there was some difference of opinion over whether these should be managed or unmanaged projects. The issue was partially resolved when the respondents acknowledged that the mutual effects of demonstrations and development of technology requires careful management while the demonstration of essentially "finished" products could be unmanaged.

Various mechanisms for promoting these demonstrations were discussed. The Rocky Flats test site is not considered to be a sufficient demonstration to promote market acceptance. One respondent proposed that a large aluminum company be subsidized for the purchase of a large number of small wind machines. A "farm" of these machines could be used to produce electricity which is used heavily in the manufacture of aluminum. Such a demonstration could be intensively

managed and the respondent feels that substantial development could take place in such a project. Other respondents feel that a similar demonstration could be accomplished by a utility company. It is believed that such "farms" would consist of about 100 small machines.

Other respondents considered the possibility of government procurements, perhaps by the military. The possibility of military assistance in development was also considered.

The demonstrations are seen as providing a market for the manufacturers as well as demonstrating the credibility of wind energy. The respondents strongly favored such demonstrations for the following reasons:

- . The sales of machines would provide needed income for wind energy companies.
- . The demonstrations would validate the feasibility of wind energy machines at the level of the individual machine.
- . The demonstrations could validate the theoretical superiority of systems of small machines over a single large machine.
- . The existence of such demonstrations would make wind energy more familiar to the market and the public, increasing the level of acceptance.
- . Closely monitored demonstrations could provide a source of data under field conditions that would contribute to further technological development.

The government was seen as further contributing to the acceptance of wind energy through an educational campaign that would familiarize the general public with wind energy systems. Some respondents feel that DOE has met with delays in reporting results. One effect of these delays is to slow

the educational process. The more rapid publication of research results is seen as furthering the promotion of acceptance of wind energy.

Another action that is encouraged by the respondents is the study of wind siting problems at the regional and local levels. The respondents are aware of studies of wind activity for relatively large regions. They feel that studies that deal with local areas would be of the influence of trees and other wind barriers would be valuable in finding the most efficient locations for wind machines. Even more precise siting studies are seen as desirable. One respondent felt that a subsidized wind level assessment for a specific customer would provide effective marketing assistance.

D. TECHNOLOGICAL BARRIERS

It is believed that substantial technological refinement is necessary before wind energy machines can be considered ready for the commercial market. The principal problems are perceived to be those of reliability, safety, and simplicity. Further technological development is needed before larger machines (greater than 2 kW) are considered ready for large scale marketing. The demonstration projects are expected to provide data that would facilitate technological refinement. Economic assistance is also perceived as necessary for manufacturers to continue the refinements needed for developing a marketable machine.

What follows is a discussion of the respondents beliefs about the technological barriers to commercialization and the actions that they believe would remove these barriers.

The respondents feel that the largest commercially available wind machine is a foreign import that is rated at 2 kW. They agree that there is a clear need for larger machines that are also capable of being delivered "off the shelf". The principal barriers to such machines are considerations of reliability, safety, and simplicity.

Respondents who are users of wind machines report some level of difficulty with reliability. One respondent feels that such users are "tinkerers" who enjoy working on their machines. There was some debate over whether the issue of reliability was more important for managed or unmanaged systems, but the consensus is that an acceptable

level of reliability has not been achieved in machines larger than 2 kW. This is felt to represent a substantial barrier to commercialization at the present time.

A second technological barrier is felt to be that of safety. Although there was some disagreement among the respondents about the level of seriousness of unsafe operation of wind machines, representatives of manufacturers did not believe the machines were safe enough. One respondent reported that, to his knowledge, about 25% of the machines had "thrown their blades." This was generally seen as an unforgivable safety hazard in any environment.

A third barrier is perceived to be the simplicity of the machine. The demands of high efficiency are believed to be a large factor in the relative complexity of contemporary machines. Furthermore, these machines often have interconnections with electrical systems which are also subject to failure.

The respondents feel that these technological barriers can be overcome in a reasonable time span of perhaps two to four years. The demonstration projects would serve to provide a substantial body of data from which to base technological advances. Financial support for the research and development necessary to overcome these barriers is believed to be needed as mentioned above.

E. INSTITUTIONAL BARRIERS

The respondents see a number of institutional conflicts acting as barriers to the commercialization of small wind energy development. Setting standards for testing and labeling wind energy systems is believed to present a relatively minor problem of coordination between industry and the responsible agency. Zoning and building codes are perceived as local barriers whose impact depends on the levels of awareness and acceptance by the public at large.

The remaining barriers both involve the utilities and pose more serious problems. A utility surcharge for wind energy users is seen as one of the most important barriers to commercialization since it would erode much of the possible savings in energy costs. An important barrier to the adoption of wind energy by the utilities is seen as the lack of capacity credit given for wind energy. The respondents feel that this is the most serious barrier to the adoption of wind energy by utilities.

The following is a discussion of these institutional barriers and some possible actions that would reduce their impact.

The respondents do not feel that the development and application of standards for testing and labeling small wind energy systems presents much of a barrier. They anticipate that such labeling would consist of energy ratings at various wind speeds. Such a procedure is not seen as unreasonable.

The impact of zoning and building codes on small wind energy systems is not expected to be large. The respondents do not believe that the wind market will be primarily suburban homes. As public and technical awareness and acceptance of small wind energy increase and as demonstration projects resolve the safety issues, these barriers are expected to diminish.

The most serious problems are believed to concern the electrical utility companies and their regulators. The imposition of a utility surcharge is seen as the single most important barrier to commercialization. The effect of a surcharge is expected to undermine any economic advantage that wind energy might have. The respondents feel this is unfair since many sources of energy are subsidized. They believe that rates should be restructured in ways that would recognize the true cost of energy and in ways that would provide an incentive to the wind energy user.

Another serious barrier to commercialization is believed to be the lack of incentive for utilities to develop wind energy. The utilities could serve as a large market for wind energy systems, however the respondents report that capacity credit is not given for wind energy. As a result, they believe that the economics of wind energy depends only on the fuel savings that the utilities experience at peak wind levels.

The respondents proposed a number of possible mechanisms for energy storage that might result in capacity credit being

given for wind energy. Improved switching capabilities might improve the storage potential of the grid. Another suggestion was that energy be stored in the form of thermal energy, either heat or cold. The respondents believe that further investigation is warranted into these and other alternatives that might result in capacity credit for wind energy.

APPENDIX

TABLE 4  
 COMMERCIALIZATION PROFILE FOR SMALL WECS  
 (All Markets)

DOE DOCUMENT		BARRIERS		ECONOMIC			INITIAL DEPLOYMENT				ENVIRONMENT		INSTITUTION			
		TECHNICAL		Site Specific Costing	Altered Financial Planning	High Cost	Awareness & Acceptance	Fragmented/Dispersed Market	Infrastructure	Product Liability	Market Uncertainty	TVI, Noise, Aesthetics, Safety	Utility Surcharge Issues S Codes:	Testing & Labeling F	"Product" F	Zoning & Building L
BARRIER IMPORTANCE		3	4	2	2	4	2	2	2	3	3	1	5	3	2	2
FUNCTIONS	SECTOR															
INFORMATION																
Technology Development	F	5	5	2	1	5	2	2	2	4	3	4	3	5	4	3
Demonstrations	F	4	4	3	4	4	5	4	4	3	4	4	3	4	3	4
Mass Media/Information Centers	S	2	2	4	4	2	5	4	3	3	4	5	1	4	4	5
Siting and Economic Tools	FS	1	4	5	4	4	4	5	3	1	3	3	1	4	1	3
Market Studies	F	1	2	4	2	4	3	5	3	1	5	3	1	1	1	3
Applications Testing	F	4	4	4	4	4	4	4	4	3	5	4	3	4	4	4
REGULATION																
Standards (Consensus)	P	3	3	2	2	2	3	2	3	4	3	4	2	5	5	5
Rate Restructuring	FS	1	1	3	4	5	3	3	2	1	4	1	5	2	1	1
Warranties	P	4	2	3	3	2	4	3	3	3	3	3	1	3	5	3
Import Quotas	F	1	1	1	1	1	1	1	3	1	2	1	1	1	1	1
FINANCIAL INCENTIVES																
Loan Guarantees (User/Manufacturing)	F	1	2	2	3	3	3	2	4	2	2	1	1	3	2	2
Long-Term Low Interest Loans	F	1	3	1	3	4	3	2	3	2	2	1	2	2	1	1
Graduated Payments Loans	F	1	2	1	3	3	3	2	2	1	2	1	2	1	1	1
Accelerated Depreciation	FS	1	2	1	3	4	2	2	3	1	2	1	2	1	1	1
Federal Insurance	F	1	2	1	2	3	3	2	3	5	2	1	1	2	4	3
Government Procurements	F	3	3	2	1	3	2	2	3	3	2	3	2	4	4	2
TAXES																
Tariffs	F	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
Fuel Surcharges	FS	1	2	1	2	4	3	3	3	1	3	3	4	1	1	1
Tax Credits	FS	1	2	1	2	2	2	2	2	1	2	1	2	1	1	1

## 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 industry 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 sources 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).