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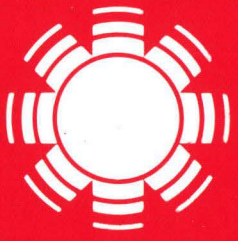

SERI

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A Division of Midwest Research Institute

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A REVIEW OF THE WIND PROGRAM AT SERI

IRWIN E. VAS

JUNE 1979

PREPARED UNDER TASK NO. 3520

PRESENTED AT A MEETING OF THE AMERICAN WIND ENERGY ASSOCIATION, SHERATON PALACE, SAN FRANCISCO, CALIFORNIA, APRIL 16-19, 1979

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FOREWORD

This report was written in compliance with Contract Number EG-77-C-01-4042 for the Division of Solar Technology of the U.S. Department of Energy. The author wishes to acknowledge both the support of DOE and the assistance provided by the staff of the Solar Energy Research Institute in the preparation of the material.

Neil H. Woodley, Branch Chief
Systems Analysis

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ABSTRACT

SERI has a comprehensive mission for each of the solar technologies. The SERI Division titles—Research, Analysis and Assessment, Technology Commercialization, Academic and International Programs, Information Systems, and Administration and Technical Services—indicate SERI activities in all areas of solar energy.

SERI's activities in wind energy began in mid FY78* with the management of the Wind Energy Innovative Systems (WEIS) Program. The FY79 wind tasks, in addition to continued management of the innovative systems program, include cost estimating methodology studies, several utility analytical studies, and environmental and legal studies of wind energy conversion systems. The proposed FY80 tasks include market and impact studies, innovative systems studies, and information dissemination and commercialization including quality assurance and standards development activities. The proposed tasks are based on the assumption that SERI is principally responsible for the Research and Analysis element of DOE's Federal Wind Energy Program.

*FY78 is for the period October 1, 1977 to September 30, 1978.

SECTION 1.0

INTRODUCTION

The Solar Energy Research Institute (SERI) was mandated by Congress in 1974 to serve as the U.S. Department of Energy's (DOE) lead institution for solar energy research, development, and demonstration. After a detailed selection process, the Midwest Research Institute (MRI) was chosen to manage SERI for DOE. MRI is a not-for-profit research institute with headquarters in Kansas City, Missouri, with SERI as one of its divisions. Operation of SERI commenced on July 5, 1977, in interim administrative and laboratory facilities located in Golden, Colorado. SERI is programmatically responsible to DOE's Assistant Secretary for Energy Technology, and to DOE's Chicago Operations Office for business, financial, and contractual matters. The SERI mission as mandated by Congress is comprehensive, involving each of the solar energy technologies: photovoltaics, biochemical conversion, thermal conversion, solar heating and cooling of buildings, industrial process heat, ocean thermal, low head hydroelectric, and wind energy conversion. It is anticipated that the SERI staff will be approximately 650 persons by the end of FY79. SERI's functions are to:

- assume principal responsibility for the performance and management of solar research, development, and demonstration programs and projects;
- provide planning and analysis support to DOE in the development of national solar energy policies, program plans, and strategies;
- conduct market analyses and assessments of institutional barriers to the introduction of solar technologies on a national and international basis;
- undertake a major role in U.S. participation in international solar energy programs; and
- collect and disseminate information about solar energy and construct education and training programs.

Work performed by SERI is based on the analytical assessment of problems and issues associated with solar energy development, input from researchers, private industry, and the public, and programmatic direction from DOE.

SERI is organized into six functional divisions with Dr. Paul Rappaport as Director and Dr. Michael Noland as Deputy Director. The current organization of SERI is shown in Figure 1-1.* A brief statement on the divisions and their functions follows.

The Administration and Technical Services Division provides support for the technical divisions. This division includes secretarial, personnel, accounting, contracts, and procurement functions.

*This organization is scheduled to change in mid-May 1979.

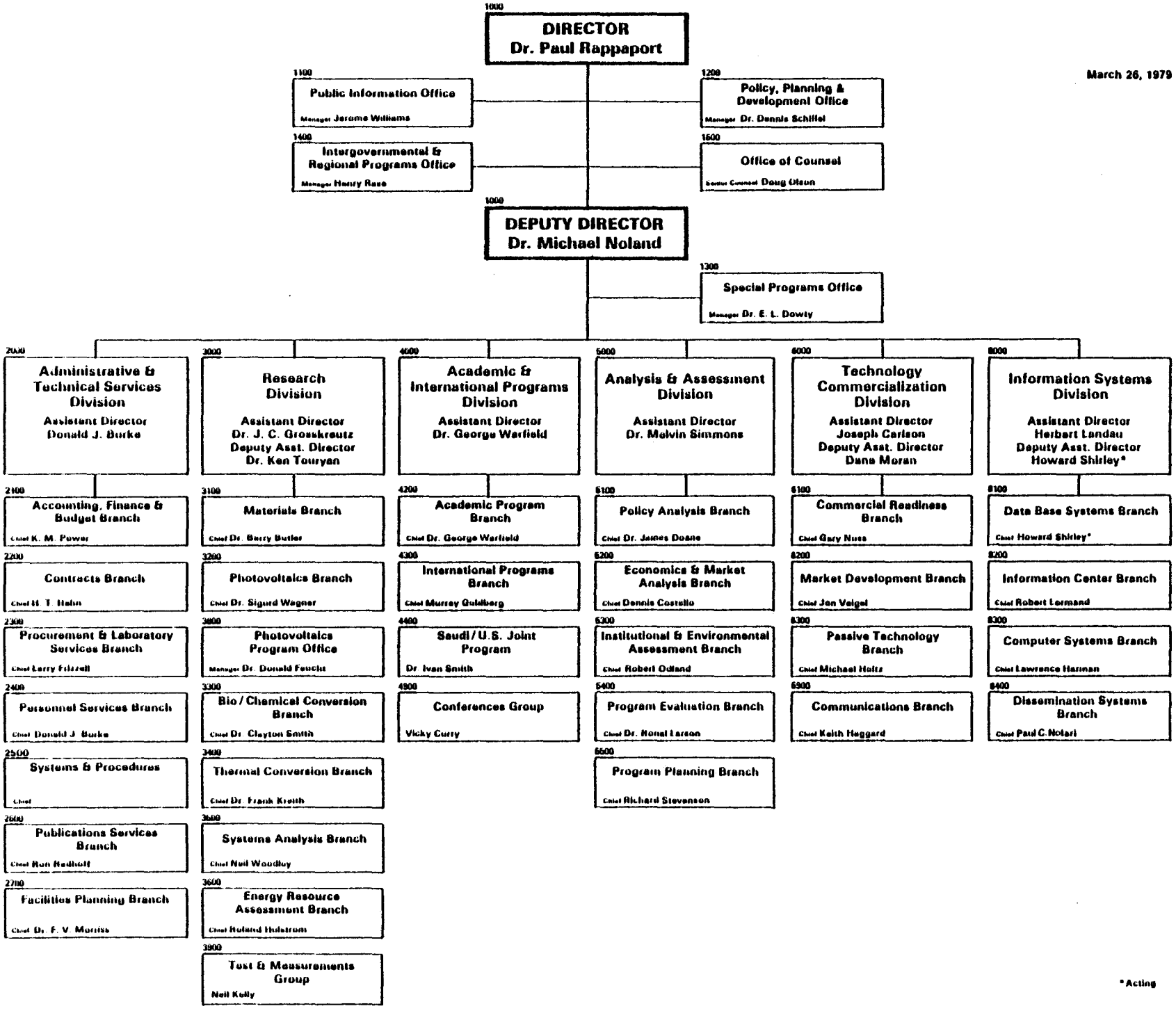

Figure 1-1. SERI ORGANIZATIONAL CHART

The Research Division provides advanced technical alternatives for solar energy conversion, as well as the technical information needed for selection among these options. The division also supports DOE in the technical management of selected research programs and the development of major solar energy experimental test facilities.

The Analysis and Assessment Division performs the analytical investigations required to support the development of national solar energy program plans and strategies. The division directs economic feasibility analyses and studies the environmental, institutional, and social factors that influence the use of solar technologies.

Academic and International Programs Division conducts substantial programs in information dissemination, education and training, national conferences, and workshops. SERI is fostering U.S. participation in international solar energy programs.

The Technology Commercialization Division conducts a broad range of activities to stimulate and accelerate both the demand for and supply of solar technologies. The division collects and distributes information on materials, markets, standards, legal and regulatory requirements, market barriers, consumer attitudes, and technical information.

The Information Systems Division provides support for the other divisions with respect to computer and literature services. The SERI Solar Energy Information Center is to be the world's most comprehensive collection of solar energy information.

The responsibility for performance and completion of a task or project resides with the Task Leader and the cognizant Branch Chief. All tasks and projects are part of a program. The functions of the Program Oversight Council are to review and guide progress in the program area, prepare annual program plans, administer the presentation and negotiation of annual program plans, and recommend actions relating to ongoing activities. The Council consists of the Chairman, Program Leader, Program Manager, and members.

The Chairman is a member of the senior management staff and provides guidance and direction to the entire program area. He is eventually responsible for the program area.

Integration of the program activities is conducted by the Program Coordinator/Leader. He ensures that the elements which constitute the program, both in-house and subcontracted, are communicating effectively. He is responsible for producing the annual program plan, reporting on the overall program area, and is the principal interface with DOE.

Responsibility for subcontracted external projects is assigned to a Program Manager. Individual projects are assigned to a Project Manager who administers the project with the assistance of appropriate staff from Contracts and Procurement.

The remainder of this paper concerns the Wind Energy Systems Program, and associated wind activities at SERI in support of the Federal Wind Energy Program.

SECTION 2.0

SERI WIND ACTIVITIES

2.1 INTRODUCTION

Support of the U.S. Wind Energy Program has focused on the technological and engineering development of wind machines. Significant studies have also been completed on market analyses, wind characteristics, system siting, and environmental and institutional impacts. Battelle-Pacific Northwest Laboratories is the prime contractor for system siting studies. NASA-Lewis is the prime DOE contractor for large horizontal axis wind turbines. Rockwell International, Rocky Flats is responsible for small wind systems. Sandia Laboratories, Alburquerque, is responsible for the development of the vertical axis Darrieus wind turbine. Currently SERI's research and analysis activities include the management of the innovative wind systems program, investigations relating to utility wind energy planning tools, and environmental and legal issues of small wind turbines. SERI recently initiated the development of information dissemination and commercialization efforts in wind energy.

2.2 WIND ENERGY INNOVATIVE SYSTEM (WEIS)

The objective of this program is to determine the technical and economic feasibility of innovative systems. All the research work performed in this program is subcontracted. At the present time a total of eight research, development, and demonstration (RD&D) studies are being funded including studies of various types of augmentation systems and electrofluid dynamic type systems. A listing of the projects is given in Table 2.1. All the projects include theoretical thermodynamic and aerodynamic studies to confirm energy viability, performance characteristics, and capabilities. The initial studies are followed by model designs and tests, economic evaluations, and finally, an establishment of concept cost competitiveness. There is no doubt that many innovative systems can develop energy; however, the cost competitiveness of the concept determines whether or not it will find acceptance in the energy market. For those concepts that have the potential of being cost effective, additional proof-of-concept tests will be conducted. From these tests, cost, performance, and engineering data will be developed to determine, with reasonable accuracy, the cost of energy for a manufactured system.

During early FY79, six short studies were funded in response to a solicitation on generic studies of wind energy systems. The objectives of the studies are to review and evaluate innovative wind systems and to provide recommendations and suggestions as to their potential. A listing of the projects and subcontractors is provided in Table 2.2.

To promote activity in the area of advanced systems, an RFP was released earlier this year entitled "Research and Development of Advanced and Innovative Concepts." A total of 37 proposals were received in response to this RFP. It is anticipated that multiple awards will be granted during July 1979. A conference is being planned to provide an opportunity for presentation and peer evaluation of the technical studies. The Wind Energy Innovative Systems Conference is scheduled for May 23-25 in Colorado Springs, Colorado. In addition to technical papers presented on the eight RD&D studies and six generic studies, review papers of the major wind program areas are to be presented. The objectives of the current studies and activities are to evaluate advanced and innovative systems and to accelerate the development of potentially viable systems.

Table 2-1. RD&D Subcontractors

Project Title	Subcontractor	Prinicpal Investigator
Innovative Wind Turbines (VAWT)	West Virginia University	Richard E. Walters
Diffuser Augmented Wind Turbines (DAWT)	Grumman Aerospace	Ken Foreman
Tornado Type Wind Energy Systems (Tornado)	Grumman Aerospace	James T. Yen
Tests and Devices for Wind/ Electric Power Charged Aerosol Generator (EFD)	Marks Polarized	Alvin M. Marks
Electrofluid Dynamic Wind Driven Generator (EFD)	University of Dayton Research Institute	John E. Minardi
Energy from Humid Air (Humid Air)	South Dakota School of Mines and Technology	Thomas K. Oliver
The Madaras Rotor Power Plant Phase (Madaras)	University of Dayton Research Institute	Dale H. Whitford
Vortex Augmentors for Wind Energy Conversion (Vortex)	Polytechnic Institute of New York	Pasquale M. Sforza

Table 2-2. Generic Studies Subcontractors

Project Title	Subcontractor	Principal Investigator
A Definite Generic Study of Augmented Horizontal Axis Wind Energy Systems	Aerovironment, Inc.	Peter Lissaman
A Definite Generic Study of High Life Device Wind Energy Systems	Aerovironment, Inc.	Peter Lissaman
A Definite Generic Study of Augmented Horizontal Axis Wind Energy Systems	Tetra Tech, Inc.	Mark Harper
A Definite Generic Study of Augmented Vertical Axis Wind Energy Systems	New York University	Martin I. Hoffert
A Definite Generic Study of Sail Wing Wind Energy Systems	Washington Univ. Tech. Associates, Inc.	K. H. Hohenemser
A Definite Generic Study of Vortex Extraction Wind Energy Systems	JBF Scientific Corporation	Theodore R. Kornreich

2.3 COST ESTIMATING AND ENGINEERING ANALYSIS OF INNOVATIVE WECS

This task is directed towards the evaluation of engineering feasibility of innovative systems and the development of cost estimating techniques appropriate for these systems. The task is expected to provide a suitable screening methodology for checking the engineering feasibility of innovative systems as well as the total manufactured and installed cost.

As part of this task, early cost studies contained in Design Study of Wind Turbines 50kW to 3000kW for Electric Utility Applications performed by General Electric and Kaman Aerospace, were reviewed, compared, and critiqued. Two machine sizes—500 and 1500 kW units—were investigated by both manufacturers for electrical generation into a utility grid. Life cycle costs were developed based on total costs of sets of five 1500 kW machines.

A short term study was initiated to develop a methodology for evaluating an innovative WECS's reliability and safety: system availability, probability of system failure and associated maintenance costs. A model has been developed which accounts for each component of the system failure characteristics, inspection information and costs, time for repair, etc. Results from the model simulation indicate the system availability due to defective or substandard operation, mean time to failure, yearly maintenance and repair costs, etc. From these results, guidance is provided in identifying critical components, identifying redundancies and determining optimal inspection schedules.

The major effort of this study is to develop a methodology for evaluating innovative wind systems. The purpose of this study is to provide consistency in the evaluation of innovative systems and to include all aspects—performance, reliability, generation and maintenance costs—in the review process associated with each stage of an innovative wind system concept. The identified stages are the proposal, development, pre-production and production stages of a concept's evolution.

2.4 UTILITY ANALYTICAL MODELING

The objective of this task is to develop the capability of performing electric utility WECS value analysis studies at SERI. Pertinent computer programs will be made available for public use. Since the electric utility industry is the most likely market for the large Wind Energy Conversion Systems (WECS) presently under development, it is important to be able to evaluate the value or worth of WECS when operated in the utility environment. Several studies have been funded to investigate this area. The major studies were performed by General Electric for the Electric Power Research Institute (EPRI) and JBF Scientific and Aerospace Corp. for DOE.

The computer programs needed to meet this objective include traditional electric utility planning models and a wind model. The utility models needed include a program to evaluate the reliability of a wind generating system, a program to estimate wind system operating costs and a program that can aid in the optimal expansion of a generating system. The wind model requires a program capable of converting hourly wind data to an estimate of hourly electric energy production from a wind machine. For organizations such as PUCs, state energy offices, etc. with well-developed utility planning programs, the programs needed might be just a methodology and/or wind models to augment their own tools. For potential users not presently utilizing planning programs, it may be

necessary to provide all programs required or make possible remote access to a computer facility on which these programs have been installed.

In support of this task, the prominent utility production cost models in use by the electric utility industry have been identified, information collected, and features and capabilities compared and evaluated. One of these models which meets SERI's requirements is to be acquired for use in additional studies. Information is being collected on several electric utility expansion planning models. A nonproprietary model is desired and a selection for testing will be made in the near future. Information has also been collected on the wind models that have been used in previous studies. Several will be acquired and tested at SERI. One will be selected for possible improvement and incorporation into a methodology suitable to study the value of WECS to electric utilities.

The major results of this study are to be available in early FY80. A user's manual and computer program for wind derived generation will be available.

2.5 ECONOMICS OF SMALL WECS TIED TO THE UTILITY GRID

The purpose of this task is to determine the value of small wind energy conversion systems (SWECS) in terms of energy generating capability and capital savings. The value on a macroscopic level is the aggregate of energy savings and the value of new conventional generating capacity displaced or delayed, less the cost of equipment such as meters and safety devices which are required with SWECS. The value on the microscopic level—to the individual user—depends in large part on the utility rate structure. This rate structure can be assumed to be based on the apportioned demand, energy, and customer costs for each individual customer. The apportioned demand, energy, and customer costs, in turn, depend on the customer's average load, peak demand, and size of SWECS. Thus, the value to the customer of a SWECS of a given size depends on the users average load and peak demand, and in fact on more detailed description of the energy demand as a function of time.

To compute the savings to the utility-user aggregate associated with a given penetration of SWECS, it is necessary to determine the fuel displaced (and the mix of fuels displaced) and the new generating capacity displaced or delayed. Other considerations such as spinning reserve may have some impact on savings and should also be investigated. In addition, there will be incremental costs specific to SWECS which should be charged against the savings. These costs are associated with safety measures which must be taken to minimize possible dangers to utility line workers, and additional meters to record electrical energy fed back into the grid.

These savings and costs due to SWECS in the aggregate are a function of the diversified load, the diversified power output of the SWECS (negative load) and the correlation between load and wind power output. The savings and costs apportionable to an individual SWECS owner cannot be determined in the same way as the aggregate because each SWECS owner should share in the general benefit of diversification. Therefore the method of determining the value given by an individual SWECS will differ from the method of determining the value given by the aggregate. Bound up with the same set of issues is the question of the relative value of energy sold by the utility to a SWECS user and energy bought back by the utility from the SWECS user's surplus.

The break-even cost of a SWECS of a given size can be determined from the calculation of the value of a SWECS to the individual user. Also, if market prices as a function of SWECS size are known or can be estimated, then the optimal SWECS size for a particular user can be found.

The methodology is dependent upon the market penetration of SWECS. If the cost of SWECS production can be quantified, then it may be possible to find the penetration of SWECS which provides the optimum value to the utility-user aggregate.

After the results of the conceptual mathematical modeling phase have been obtained, computer simulations of a specific utility (probably a synthetic utility) will be run. These simulations, the ones suggested by the results of the conceptual analyses, will serve both to validate and to apply the results of the conceptual modeling phase. The results of this effort would lead to a proposed rate structure based on the above apportionment of SWECS value to individual SWECS owners and an investigation of possible side issues such as the impact on SWECS value of the SWECS owner's willingness to accept interruptible back-up (reduced reliability) from the utility.

2.6 LIABILITY ISSUES ASSOCIATED WITH SMALL WIND MACHINES.

The liability task is the first step of what should be a comprehensive analysis of selected legal issues affecting the deployment of small wind systems. The objective of the liability task is to provide policy options for DOE, the wind energy industry, and others to assure that liability issues associated with small wind systems do not impede the increased use of such systems. This effort will be coordinated closely with other wind energy related studies. The study consists of three phases:

- formulation of the critical issues,
- development and analysis of policy alternatives, and
- refinement of the proposed policies.

Likely applications and hazards are to be identified in the formulation of the critical issues. Legal tort liabilities are to be analyzed using historical analysis (windmills and wind generators), analysis of other technologies in their early stages (airplanes, automobiles, etc.), and analysis of contemporary law. The results will be a basis for the formulation of the liability issues. This effort will expand upon the general survey research contained in Legal-Institutional Implications of Wind Energy Conversion Systems prepared by George Washington University and Barriers to the Use of Wind Energy Machines: The Present Legal/Regulatory Regime and a Preliminary Assessment of Some Legal/Political/Societal Problems by Taubenfeld et. al. The analysis will include a search of other applicable research efforts identified below.

In the second phase, development and analysis of policy alternatives, alternatives will be developed for addressing the previously identified liability issues. These alternatives will include commercial insurance, federal guarantees, industry funded programs and others as identified. The alternatives will be analyzed as to their legal aspects, economic impacts, protection of the public, protection of people who may be liable, and ease of implementation. Advantages and disadvantages for each alternative will be developed from this analysis.

In the third phase, refinement of the alternative policies, the alternative policies will be subject to further review and analysis. Comments will be solicited from representatives of the parties concerned with the liability issues. Analysis will be conducted as to how the alternative policies relate to each other and to the existing policies. The alternative policies then will be modified as required and refined to produce an integrated set of policy options.

These efforts are currently underway, and it is anticipated that this particular study will be completed by the end of the fiscal year. It is anticipated that other legal issues will be addressed in FY80, including the following:

- impacts of building codes and ordinances and possible modifications;
- impacts of aesthetic controls (such as private convenants) and possible policy charges;
- impacts of zoning regulations and possible modifications;
- ensuring future wind accessibility in urban areas;
- definition of when a wind system becomes a utility, the implications, and possible policy changes; and
- relations with utilities such as rate structure, refusal to provide service, and sell-back of power.

Alternatives for addressing the liability issue plus the above legal issues will assist DOE and the industry to identify remaining barriers to the deployment of small wind machines.

2.7 ENVIRONMENTAL IMPACT ASSESSMENT OF SWECS

During this fiscal year, SERI plans to perform an environmental impact assessment of wind energy conversion systems sized between 1 to 100 kW. The analysis is to focus on both utility-interconnected and utility non-interconnected SWECS. For systems not tied to utility grid, SWECS with and without energy storage subsystems will be investigated. The assessment will be subdivided into two phases. During Phase I, the environmental implications of large scale manufacture of SWECS components, and transport of components to deployment sites, will be examined both qualitatively and quantitatively. Several generic machine designs ranging in size from approximately 5 to 60 kW will be studied. Investigation parameters will include: materials requirements; materials availability for selected production levels; air emissions, water effluents, and solid wastes associated with materials acquisition and processing, and component fabrication; and environmental effects resulting from transport of systems to deployment areas.

Phase II will focus on the environmental effects resulting during installation and operation of SWECS. Factors which will be considered include: land use requirements, noise levels, release of toxic substances from energy storage systems (if applicable), and possible interference with electromagnetic radiation. Results of each phase will be reported separately. The total effort is planned to be completed in early FY80.

2.8 TECHNICAL INFORMATION DISSEMINATION

Several programs exist at SERI which address more than one solar technology. One such program is the Technical Information Dissemination (TID) program which is intended to coordinate, support, and augment existing information activities for five solar technologies.

The wind task in TID focuses on activities which support the earliest appropriate commercialization of wind energy research and development results. Several general groups or "audiences" are important to this commercialization process. Their information needs, level of technical expertise, and interest in alternative energy sources will vary. Researchers within DOE and under contract to DOE need timely and accurate accounts of R&D results. Private researchers should benefit from federally funded research since they are in the position to commercialize the results. Other interested individuals who can affect commercialization such as lawmakers, investors, educators, citizen advocates, and others should be made aware of progress as it is made. Finally, the general public, including potential end users of wind energy, should be made aware of important breakthroughs and how these may affect their lives.

Activities will be developed as needs are identified and gaps are found in the existing information materials and dissemination channels. The following types of efforts are planned and others added as appropriate:

- abstracting important reports for wider distribution,
- repackaging information for specific users,
- synthesizing reports for a specific purpose,
- developing case study material for publication,
- publishing lists of information sources,
- supporting focused workshops, and
- production of audio visual materials.

The intent of these efforts is that the widespread distribution of this information will result in better understanding of the issues relating to wind energy.

2.9 MARKET DEVELOPMENT

With world and national events putting pressure on the renewable technologies to produce tangible results more quickly, SERI is working with other agencies to accelerate the commercialization process for wind energy. The Congress, DOE, the Regional Solar Energy Centers, and the American Wind Energy Association have made vigorous proposals to speed up market development for wind systems.

Several activities at SERI are directed at accelerating the commercialization process for wind energy. One activity is to increase the personal contact with the producers and users of wind systems to gain a comprehensive and up-to-date picture of what information is available and how to interpret it. Conferences, briefings, site visits, and task

forces are some of the mechanisms for keeping the principal actors in the commercialization process in touch with the real world. A second general activity at SERI will be to identify and provide the tools and information developed by many agencies to assist planners in public and investor-owned utilities to design WECS capability into demand projection for new sources of power. Decisions about initiating and funding wind energy projects are not often made by planners; so SERI will also participate in briefings and other activities to reach the policy makers and decision makers in the utilities.

While those activities are going on, SERI is also developing a methodology for assessing both qualitatively and quantitatively the commercial readiness of each of the solar technologies. Both direct and indirect indicators are being used. Wind energy was selected as one of the first solar technologies to be analyzed. According to preliminary indications, wind energy shows significant potential for successful implementation.

SECTION 3.0

PROPOSED RESEARCH EFFORTS, FY80

In FY80, it is proposed that SERI assume the lead role in the Research and Analysis element of the Federal Wind Energy Program which includes market and impact studies, innovative systems studies, and information dissemination/commercialization.

3.1 MARKET AND IMPACT STUDIES

Planned analysis and assessment research in FY80 will be divided into two categories: economic, market, and policy research; and environmental, legal, and institutional assessments. Several research projects are planned in the economic, market, and policy area. Key U.S. markets for small (less than 100 kW) wind systems will be identified and assessed. Expected results from the project include a report on potential SWECS markets and identification of key markets which need further investigation. The second project is a detailed assessment of WECS in selected markets. Two markets, irrigation and another agricultural utilization, are to be assessed in FY80. The third project is the wind strategy analysis. The current DOE strategy for achieving wind program goals will be delineated and examined for effectiveness. Four alternative strategies will be developed and compared to the current strategy. The strategy analysis will also address the economic and administrative costs and potential benefits of selected incentives.

Within the economic, market and policy area there are several utility-related tasks, the first of which is a continuation of the ongoing utility analytical modeling task. The planning tools will be improved in accuracy and in capability to model the output of innovative WECS. They will be applied to many utility systems, including the new candidate sites when data becomes available. This work will also be directed toward the establishment of WECS cost goals, rate-related issues, and the economic consequences of WECS ownership. Another project is the investigation of some of the technical problems relating to the interconnection of WECS with utility grid networks. In a related area, SERI is to have the responsibility of managing the study of wind machine value to selected utilities as WECS candidate sites. These results will extend the current knowledge of the economic potential for WECS in the utility market, and provide further performance data for WECS relative to specific site data.

Three research projects are included in the environmental, legal, and institutional impacts category. Results of several FY79 SERI tasks will be integrated within the first project. Environmental effects associated with machines will be cross-matched with the environmental impacts and socioeconomic county-level indicators (developed during FY79) to identify potential deployment sites where impacts should be relatively minimal. The land-use and siting constraints project will focus on land requirements and feasibility of multiple land-use options. Results will be incorporated into a decision tree designed to facilitate WECS siting procedures. Legal aspects of WECS deployment will be the subject of the final project. Included will be identification of barriers to WECS deployment under three model building codes, private and public aesthetic controls which may affect deployment, barriers under various zoning ordinances, and legal requirements for WECS/utility interface.

3.2. INNOVATIVE SYSTEMS

Subcontracted studies of innovative systems which indicate the potential of being cost effective are to be actively pursued during FY80. Other activities during FY80 include the issuance of RFPs relating to advanced/innovative systems and dissemination of technical information through a Conference/Workshop. To complement the subcontracted studies, a major in-house effort is dedicated to the development of a standard methodology for evaluating the cost of wind systems. This methodology is important in the evaluation of the cost competitiveness of innovative systems.

3.3. INFORMATION DISSEMINATION AND COMMERCIALIZATION

The Technical Information and Dissemination Program will continue to coordinate and support national information dissemination activities. The commercial readiness assessment of specific systems will be updated and used to guide market development and TID activities. Planned market development for commercialization of wind systems for FY80 will support the joint DOE Office of Energy Technology/Office of Conservation and Solar Applications plan developed in early FY79 for small wind systems and in mid-FY78 for large wind systems. SERI's actions will complement those plans to accomplish commercialization objectives in keeping with the overall thrust of the National Program for Accelerated Commercialization. Tasks will include dissemination of information packages, co-sponsorship and participation in workshops and seminars, site visits, and assistance to industry.

Quality assurance and standards development activities for WECS will be initiated in support of early commercialization of wind energy systems.

SECTION 4.0

CONCLUDING REMARKS

SERI commenced its wind activities approximately one year ago by assuming management responsibilities of the innovative systems program. Beginning with this fiscal year, additional studies relating to environmental, legal, and utility interface and costing were undertaken. Results of these studies will be used to provide guidance and direction to work proposed for FY80. Further work in market and impact assessments, value analysis, quality assurance, and information dissemination is planned for FY80. These studies are proposed to implement the Research and Analysis element of the Federal Wind Energy Program in its efforts to accelerate the development of wind energy.