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MODULAR INDUSTRIAL SOLAR RETROFIT PROJECT (MISR)

Robert L. Alvis
Systems and Applications Development Division 4725
Sandia National Laboratories
Albuquerque, New Mexico 87185
(505) 844-8573

MASTER

ABSTRACT

The intent of this paper is to describe a major Department of Energy (DOE) thrust to bring line-focus solar thermal technology to commercial readiness. This effort is referred to as the MISR Project. The project is based upon the premise that thermal energy is the basic solar thermal system output and that low-temperature, fossil fuel applications are technically the first that should be retrofitted. Experience has shown that modularity in system design and construction offers potential for reducing engineering design costs, reduces manufacturing costs, reduces installation time and expense, and improves system operational reliability. The modular design effort will be sponsored by Sandia National Laboratories with industry doing the final designs. The operational credibility of the systems will be established by allowing selected industrial thermal energy users to purchase MISR systems from suppliers and operate them for two years. Industries will be solicited by DOE/Albuquerque Operations Office to conduct these experiments on a cost sharing basis. The MISR system allowed in the experiments will have been previously qualified for the application. The project is divided into three development phases which represent three design and experiment cycles. The first cycle will use commercially available trough-type solar collectors and will incorporate 5 to 10 experiments of up to 5000 m^2 of collectors each. The project effort began in March 1980, and the first cycle is to be completed in 1985. Subsequent cycles will begin at 3-year intervals. The project is success oriented, and if the first cycle reaches commercial readiness, the project will be terminated. If not, a second, and possibly a third, development cycle will be conducted.

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Introduction

The Department of Energy (DOE) has supported solar thermal energy as an alternate energy source since the oil embargo. One of the solar system approaches that has been supported is the line-focus technology. Most of this effort has been in the support of parabolic trough-type collectors, and they have reached a point in development that they can produce thermal energy at 300°C and 60% efficiency.[1]

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The industrial sector of the U.S. is currently responsible for about 25% of the total U.S. energy consumption. Of this amount, 68% is used to generate heat for industrial processes.[2] Approximately 30% of all process heat requirements are with peak temperatures of 315°C (600°F) or less. This value increases to 52% when preheating is considered.[3] Thermodynamic theory indicates that if fossil fuel is to be displaced, the low-temperature fossil fuel applications, such as 300°C or less process heat, should be the first solar applications. A large market potential exists in this temperature range. The President, in his June 20, 1979, address to Congress, declared that 20% of the domestic energy demand will be supplied by solar and renewable resources in the year 2000. A concerted effort will be required to meet this goal. MISR is such an effort.

MISR Project Objective

The primary objective is to develop a modular solar thermal line-focus system offering near-term commercial readiness. Commercial readiness will be considered to have occurred when solar thermal systems have been developed to fulfill a specific demand, operate reliably, produce reasonable-cost energy, and a sufficient number of experiments have been conducted to lend credibility to the system's performance. In addition, it is considered necessary that system suppliers be developed which have proven solar systems to supply the market as it develops. Commercialization, which would be the next logical development activity, is not part of the MISR project, but the MISR results will be useful in developing a proper commercialization plan.

Strategy

The MISR project strategy is developed to be consistent with the approach that industry would employ before introducing a new product into their commercial product line.[4] MISR will define a market, assist industry in developing a system to supply that market, and obtain high-confidence-level system cost and performance data. These data are considered necessary in the development of a commercialization plan. The MISR project incorporates a modular system design approach which offers the potential of minimizing system costs by reducing one-of-a-kind engineering, and improving reliability by allowing the construction of the same system design many times. The first modular unit cost will include system engineering for a modular design, system definition, and system

operation and maintenance manuals. Subsequent units will not have these costs and should benefit from economics of multiple production which could result in potentially large system cost reductions.[5] The system suppliers are expected to be in a position to market follow-on systems outside the MISR project.

Project Activities

The activities of this project are shown in Figure 1. The inputs include the technology developed by both government and industry, the lessons learned from previous experiments, the industrial needs from the industry, and the determination of modular size and operating characteristics which will serve a significant portion of the industrial need by market and system analysis. This information will be assembled by an engineering firm into a set of specifications and guidelines (S.G.). This specifications and guidelines set will serve as a vehicle for technology transfer back to industry as part of a request for purchase (RFP) for industry detailed system designs and minimum hardware to characterize the design. It is anticipated that six awards will be made to industry for these final modular system designs.

A parallel activity will be the solicitation of industry thermal energy users which would be interested in using these system designs in a cost sharing arrangement. Up to 15 industries will be awarded contracts to prepare detailed proposals for buying one of the qualified modular systems, installing it at their plant, and operating it for a 2-year minimum period to obtain cost and performance data. The modular solar systems are expected to become the property of the participating industry at the conclusion of the experiment period. The 15 proposals are expected to yield up to 10 experiment awards.

The above activities are described for one of three possible experiment cycles. The first cycle will use conventional technology, the second cycle will use improved technology, and the third cycle advanced technology. The MISR Project is success oriented and, if commercial readiness is achieved by a cycle, then MISR will terminate.

Schedule

The MISR project began in March 1980. The Cycle 1 generic design is to be completed by February 1981. RFPs for industry-designed modular systems will follow immediately. Qualification tests of the accepted proposals should be complete by April 1982, and experiments at industries should be started in 1983. Results from Cycle 1 will be available in 1985. The second cycle will follow the first by about 3 years, and the third cycle will follow the second by another 3 years.

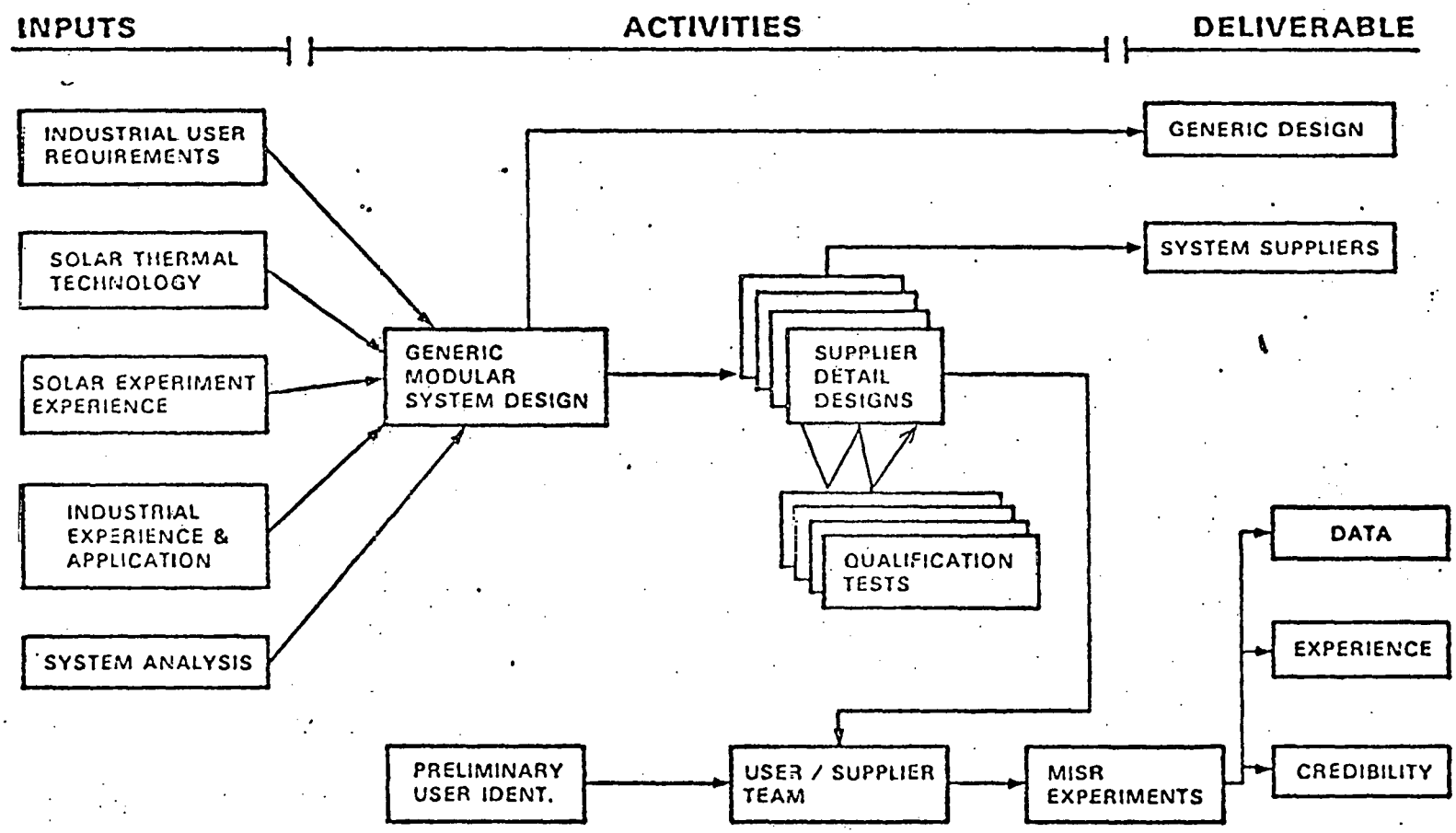

FIGURE 1. MISR PROJECT ACTIVITIES

Conclusions

The MISR project represents a major thrust by the DOE to bring line-focus solar technology to the point of commercial readiness. The approach is to use modular system designs in an effort to reduce system cost and improve reliability. High-confidence-level system cost and performance data will be obtained by allowing industry users to purchase modular systems from the suppliers and to operate them to obtain data in real operating environments. System suppliers should be in a position as a result of MISR to fulfill the developing market. The project is phased into three experiment cycles, but will terminate at the conclusion of the first cycle in which the objectives are attained.

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Acknowledgement

George Pappas, DOE/Albuquerque Operations Office, has been assigned project management responsibility. For additional MISR project information, Mr. Pappas may be reached at 505-846-5205.