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SPS Issues: The Need to Look Ahead

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The implementation of satellite power systems (SPS) will have a very broad impact upon the future generations of this world. SPS will have consequences in national economies, in political policy decisions, in attempts to achieve energy independence, and in international cooperation. Thus, there is a need for a systemic examination of SPS for the purpose of identifying potential problem areas and the issues related to those areas.

A systemic approach (e.g., Thorsheim, 1979; Toren, 1980) is a valuable perspective from which to evaluate SPS implementation as a reliable, safe, and cost-efficient energy supply of the future. It allows for the identification and examination of the individual issues and areas of concern, and has the added feature of recognizing the existence of interrelationships and interdependencies. A systemic perspective allows decision making to be based within a broad context.

This paper examines only a few of the numerous points to be addressed during the early stages of SPS research and development. Many of the problems that are encountered in the attempt to develop satellite power systems are not unique to this project. Therefore, results of research into SPS will have applications in many other areas. The AIAA in their Solar Power Satellites position paper (1979) states " ... that a great deal of the technology applicable to SPS systems is needed for other projected space applications." Perhaps some way could be found of coordinating and sharing research in these areas. The cost of SPS development may then become more justifiable.

Reliability

Reliability and the ability of an energy source to supply electricity without interruption will be important concerns for the future. Satellite power systems (SPS) are attractive because of their ability to collect and transmit energy almost 100% of the time that they are in operation. Such continuous power generation enables them to operate as base-load energy supplies, giving them an advantage over earth-based solar energy systems that will be affected by day/night cycles and atmospheric conditions (Glaser, 1979).

Reliable satellite power systems should be free from slowdown or shutdown. They will be more attractive if they are not susceptable to loss of power due to system damage, hardware failure, tracking error, sabotage, or military threat.

Because the reliability of each individual part of any system has a direct bearing on the total system reliability, a systemic perspective is valuable.

Safety

The biological and environmental safety of SPS will be important future concerns (Grey, 1978; Manson, 1980). Such concerns will be particularly important to the generations that will have to deal with any long-term effects of SPS implementation.

The examination of possible problem areas (e.g., long-term effects of microwave transmission, worker safety in outer space, and environmental impact) can be aided by a systemic approach. Variations in system design, operational procedures, and managerial policy will all have impact upon safety. Decisions affecting the safety of SPS will be more appropriate if they are based upon an understanding of the complex interrelationships involved in SPS.

Cost-efficiency

The future of satellite power systems will also be related to their cost-efficiency. The probability of SPS becoming a part of our energy future will increase if the system can provide base load electrical energy at costs competitive with other energy systems.

SPS could reduce the current dependence of nonrenewable energy supplies. The cost of that independence may be economically, ecologically, or politically greater than we wish to accept. We need to act now to study the problems and potentials of this energy system. Only after we gain a better understanding of the system as a whole can we hope to make intelligent decisions regarding its implementation.

Exploration into multinational funding for SPS needs to be supported. SPS will require large amounts of capital investment for research and development. Multinational funding would ease the burden for any nations wishing to develop satellite power systems. The development of a multinational SPS operational organization may reduce the risk of military action against any of the satellites in the system (Manson, 1979). Several nations are now demanding equatorial orbit sovereignty (Barna, 1979). A multinational SPS program would allow better negotiation with these countries. Cooperation on an international level could prove to be a major boost for the economic future of SPS.

The investment payback rate will be an important consideration. SPS will receive more support if its research and develop-

ment costs can be amortized within a reasonable time period.

Conclusion

The safety, reliability, and cost-efficiency of satellite power systems are all interrelated. A reliable and safe system will be less likely to incur extra costs because of slowdowns or shutdowns. Large investments occuring early in the development phase may be offset by increases in system reliability and safety. These increases would help the systems achieve their full economic potential.

Reliability, safety, and cost-efficiency are not the only issues in the SPS program. But they are important areas to examine, and a systemic approach can be a valuable tool.

Resources

AIAA Position Paper, Solar Power Satellites, Astronautics & Aeronautics, Vol. 17, No. 1, January 1979, pp. 14-17.

Barna, Becky. Wanted: Space in Space. DATAMATION, Vol. 25, No. 10, September 1979, pp. 87-89.

Glaser, Peter E. The Outlook for Solar Power Satellites. Paper presented at The Council for Energy Studies Conference on World Energy Economics IV, London, England, February, 1979.

Grey, Jerry. Testimony before Subcommittees on Advanced Energy Technologies and Energy Conservation Research, Development, and Demonstration and Space Science and Applications; Committee on Science and Technology; U.S. House of Representatives; Ninety-fifth Congress, Second Session, April 12, 1978. (No. 68).

Manson, Simon. Personal Communication, January 24, 1980. (Manager, Satellite Power Sytem Program, NASA, Washington D.C.)

Thorsheim, Howard I. General Systems Theory: A Logic-Of-Inquiry For Alternate Human Futures. Paper presented at the 24th Annual Meetings of the Society of General Systems Research, meeting with the American Association for the Advancement of Science, San Francisco, January 1980.

Toren, Brian K. The Meaning of General Systems Theory. System Trends, 2(3), 1980, pp. 3-4.