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PHOTOVOLTAIC HIGHWAY APPLICATIONS: ASSESSMENT OF THE NEAR-TERM MARKET

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16 Abstract

A preliminary assessment of the near-term market for photovoltaic highway applications is presented. Among the potential users, two market sectors are considered: government and commercial. Within these sectors, two possible application areas, signs and motorist aids, are discussed. Based on judgemental information, obtained by a brief survey of representatives of the two user sectors, the government sector appears more amenable to the introduction of photovoltaic power sources for highway applications in the near-term. However, considerable interest and potential opportunities were also found to exist in the commercial sector. Further studies to quantify the market for highway applications appear warranted.

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SUMMARY

A preliminary assessment of the near-term market for photovoltaic highway applications is presented. Among the potential users, two market sectors are considered: government and commercial. Within these sectors, two possible application areas, signs and motorist aids, are discussed. Based on judgemental information, obtained by a brief survey of representatives of the two user sectors, the government sector appears more amenable to the introduction of photovoltaic power sources for highway applications in the near-term. However, considerable interest and potential opportunities were also found to exist in the commercial sector. Further studies to quantify the market for highway applications appear warranted.

INTRODUCTION

A major goal of the Department of Energy (DOE) National Photovoltaic Program is to raise solar cell array production from the present 300 kW/year to 500 MW/year by 1986; a corollary goal is to stimulate the demand of potential users to absorb this production rate. In order to achieve these near-term goals, various markets for which photovoltaics can provide a viable power source need to be penetrated. For the most part, however, these markets are latent. Many potential users are unaware or unsure of the benefits and the readiness of solar cell power for their applications. Unless such users, and the manu-

facturers serving such users, are fully cognizant of the solar electric option, their entry into the solar cell market may be greatly delayed.

Due to the complexity of getting photovoltaic systems into the marketplace, the government has an important role to fill. This is to share the risk of new venture development and to facilitate the transfer to technology to the users and manufacturers. In this endeavor it is a major objective of the Tests and Applications Project, managed by the NASA, Lewis Research Center (LeRC) for the DOE National Photovoltaic Program, to identify and cooperatively test, with selected users, applications judged to be cost-effective in the near-term. These near-term applications experiments are structured to engage the active participation and interest of the private sector; they are intended to lead to commercial development and marketing of photovoltaic-powered products. It is also expected that these experiments will provide a flow of application-related information to the technical community, especially the DOE Photovoltaic Program participants and contractors.

A category of applications termed Photovoltaic Highway Applications is discussed herein which appears potentially attractive for the introduction of photovoltaic power sources. This category was originally identified (1) because of indicated user interest from both Federal and State Highway Departments of Transportation, (2) because photovoltaics appeared cost effective in competition with an alternative power source for several of these applications, (3) because users have indicated interest in cost sharing experiments, and finally (4) because such experiments could assist in promoting a general awareness of photovoltaics as a power source for other potential applications.

DEFINITIONS AND TERMINOLOGY

For purposes of discussion, the Photovoltaic Highway Application Category has been divided into two major areas: signs and motorist aids (table 1).

Signs

The signs considered herein are limited to those requiring electric power for their function, that is, for illumination or motion. These signs fall into two general user sectors: government and commercial.

The government sector is composed of Federal, state and municipal highway agencies. The signs they use may be characterized as information, hazard warning, or control. A nocturnally illuminated sign which alerts drivers to the approach to highway interchanges is an example of an information sign. A dust storm warning sign which functions on remote command is an example of a hazard warning sign. An open/closed/ change lane sign is an example of a control sign.

The major portion of highway signs used by the commercial sector consists of billboards and other types of advertising signs. Also included in the commercial sector are railroad crossing signs and signals.

Motorist Aids

The "Motorist Aid" area of highway applications includes call boxes, rest stops, and information centers. Most, if not all, applications in this category fall in the government sector. Call boxes are those communication links placed strategically along highway systems in remote areas to enable motorists in trouble to call for assistance. Rest and information areas are sometimes combined, but in any case are often not situated near utility power. Power is used by both types of areas for illumination and occasionally for potable water pumping and sewage treatment. In the case of information areas, power is also used for displays such as those dispensing recorded information regarding selected areas of interest.

MARKET ASSESSMENT

A brief market survey was made in May, 1977 to obtain preliminary estimates of markets and the potential for photovoltaic highway applications. A list of the contacts made during this survey within the government and commercial sectors is presented in Appendix A. The major market segments and characteristics of this particular application category are discussed below.

Signs

The government market is probably more amenable at present to the introduction of photovoltaic powered signs, due to funding availability and statutory highway safety requirements. For example, the Highway Trust Fund Acts of 1973 and 1975 include $300 million for installing various types of warning signs and signals by 1983. The 1976 Highway Act allocated $80 million for a new technology demonstration program and $122 million for improved safety signal systems.

A particular example of a potential application cited by a U.S. Dpartment of Transportation official is the emerging market in changeable message signs. A sign of this type has been powered by photovoltaics since April 19, 1977 as part of a joint experiment between the Arizona Department of Transportation (ADOT) and the Lewis Research Center (fig. 1). The sign is one in a network of 40 radio-controlled highway signs, in the Phoenix-Tucson-Gila Bend region, erected 2 to 3 years ago by ADOT to alleviate chain-reaction accidents caused by low visibility driving conditions resulting from blowing dust. When conditions are such that dust storms are possible, the warning system is activated by a radio control link from a Department of Public Safety dispatcher in Phoenix. On signal the signs change from a normal "Interstate 10" directional information mode to "Dust Storm Alert, Radio 550/620/910." In addition to powering the changeable message, the photovoltaic power system also supplies electricity for lighting and for radio communications.

The remaining 39 signs are powered by propane fueled, 60-watt, thermoelectric generators. The photovoltaic system provides a less expensive operating system; ADOT estimates that when all signs are converted to photovoltaic power, they will save approximately $12,000 a year in sign operating costs.

Another potential market is the 7000 illuminated information signs to be installed on the Interstate Highway System by the mid-1980's. Still other possibilities are control signs which are widely used, but need further investigation to quantify their market potential.

The U.S. Department of Transportation officials contacted expressed interest in establishing working relationships with DOE and LeRC to educate states regarding the potentials of photovoltaic power systems and to develop their interest and participation in tests and experiments. Of eleven state Departments of Transportation surveyed, all but one expressed interest in photovoltaic power and requested more information.

In the commercial sector, the expected revenue from signs and outdoor advertising is estimated to be about $1.5 billion in 1977. The major portion of the outdoor sign market consists of 400,000 billboards, of which 160,000 are illuminated. However, present power requirements for illuminated billboards range from 3 to 5 kW. While it may not be feasible for photovoltaics to provide power for large billboards unless illumination level standards change, nothing is known at present regarding the market for small illuminated outdoor signs. Industry sources indicate that the outdoor adveristing market is quite inelastic. Hence significant price increases, if any, due to the use of photovoltaic systems may be absorbable. This brief survey pointed up a serious gap that exists in that the sign industry has little or no information regarding the capability of photovoltaics.

Another opportunity in the commercial sector is that presented by railroad crossing signs or signals. According to a study performed by Aerospace Corp. for ERDA (ref. 1), there are approximately 220,000

such crossings in the U.S., of which 170,000 are unprotected. However, most may not be eligible for federal aid or may be near utility power. A more detailed look at this segment is needed to determine the actual potential.

Motorist Aids

The Federal and State highway officials contacted have expressed interest in possible use of photovoltaics in highway rest areas. Officials in Georgia and Arkansas have already indicated their desire to enter into cost-shared experiments for rest area projects in their state. The overall market potential for these and other motorist aid applications will require additional investigation, however, to better define the market potential.

CONCLUDING REMARKS

Government markets will probably lead the way in the introduction of photovoltaic systems for highway applications because of available funding and statutory highway safety requirements. Further studies to quantify this market appear warranted.

It is not possible at this time to gauge the commercial sign photovoltaic potential. However, interest has been expressed by companies and trade associations in joint tests and demonstrations. Preliminary assessment indicates that photovoltaic power systems for large billboards will not be attractive unless illumination requirements are substantially reduced. Small signs may be a practical application.

APPENDIX - A GOVERNMENT AND COMMERCIAL CONTACTS MADE FOR MARKET RELATED INFORMATION

GOVERNMENT

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Swormstedt, Jerry
Signs of the Times Magazine
Cincinnati, OH

Tidwell, Roy
Office of Director
National Highway Inst.
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TABLE I. - PHOTOVOLTAIC HIGHWAY APPLICATION CATEGORIES

Category	Type	User sector
Signs	Information Hazard warning Control	Government (Federal, State, Municipal)
	Billboards On-site signs Railroad crossing signs and signals	Commercial
Motorist Aid	Call boxes Rest stops Information centers	Government

Photovoltaic powered dust storm warning sign on Interstste 10 between Phoenix and Tucson.