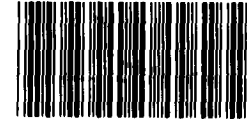


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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

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STATEMENT OF
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ASSOCIATE DIRECTOR, INTERNATIONAL DIVISION
U.S. GENERAL ACCOUNTING OFFICE
BEFORE THE
SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
ON
INDUSTRY VIEWS ON THE EFFECT OF PROPOSED
BUDGET REDUCTIONS ON THE ABILITY OF THE
U.S. PHOTOVOLTAICS INDUSTRY TO COMPETE
IN FOREIGN MARKETS

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today to discuss with you the views of members of the U.S. photovoltaics' industry concerning the effects that the proposed solar energy budget reductions may have on the industry's ability to compete in foreign markets. My statement and our recently issued report (ID-81-63, September 15, 1981) are based on a survey of the industry that we made in April and May of this year at the request of the Subcommittee.

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Our information is based on in-depth interviews with 30 representatives of private companies and experts involved in the photovoltaics industry. Our sample includes a cross-section of companies of various sizes and activities.

In considering the industry responses to our questions, one should keep in mind that these statements were made in April 1981, shortly after the administration had announced its proposed energy budget for fiscal year 1982, which includes a sharp reduction in funding for a number of programs, including photovoltaics.

THE NATIONAL PHOTOVOLTAICS PROGRAM

The oil crisis of 1973 created great interest in reducing the United States' dependence on imported petroleum. Solar energy is one highly regarded alternative to petroleum, because it holds the ultimate promise of being a nondepletable, nonpolluting, widely available power source. Photovoltaics--the direct conversion of sunlight into electricity--is one of the various solar technologies. The technology was developed to consistent reliability in the space program, but the cost of producing photovoltaic cells was much too high for most terrestrial applications.

Legislation since 1973 has been directed at reducing the cost of solar energy and accelerating its commercialization. These efforts culminated, for photovoltaics, in the passage of the Solar Photovoltaic Energy Research, Development, and Demonstration Act (Public Law 95-590), November 4, 1978, which mandated a 10-year, \$1.5 billion program of accelerated " * * research, development, and demonstration of solar photovoltaic energy technologies leading to early competitive commercial applicability of

such technologies * * *" with the long-term objective of producing " * * * electricity from photovoltaic systems cost-competitive with utility-generated electricity from conventional sources."

The photovoltaics program at the time of our survey included research, development, and demonstration projects. The objective was to reduce the cost of all elements of a photovoltaic system, including its installation and operation, to achieve cost/performance goals established by the Department of Energy (DOE).

Research and development funding has assisted the development of new, lower cost photovoltaic technologies. The cost per peak watt has declined dramatically, but the current average price, reported to be about \$10.00, is still considerably higher than the 1982 DOE goal of \$2.80.

In addition to concentrated R&D efforts, the program included both domestic and foreign market development and commercialization programs. The 1978 Solar Photovoltaic Energy Research Development and Demonstration Act recognized that (1) photovoltaic systems would become economically competitive in foreign markets sooner than in the United States because of the higher cost of conventional energy sources in most foreign markets, and (2) a healthy photovoltaic export market would expand the U.S. production base, which in turn would lower unit cost as economies of scale were realized in production. The lower cost would accelerate the technology's entry into the U.S. market. In response to this direction, DOE developed the International Market Development Program, which includes market analysis, export seminars for U.S. companies, and product exhibitions

and seminars overseas (jointly sponsored with the Department of Commerce) to encourage and assist small and "new-to-export" U.S. companies to enter foreign markets.

At the beginning of 1981, the United States also participated in or had under consideration a large number of joint projects under bilateral international cooperative solar energy agreements. A number of these projects involved photovoltaic systems demonstrations and/or tests and provided U.S. companies with additional sales opportunities and foreign market exposure.

This was the situation at the time the budget reductions were proposed.

PROPOSED BUDGET REDUCTIONS

This administration's fiscal year 1982 budget would reduce Federal expenditures on photovoltaic R&D to \$62.9 million, a 59 percent decrease from the fiscal year 1981 appropriation. It would completely eliminate the DOE International Market Development Program, for which \$4 million was originally budgeted for 1981. And, it proposed to eliminate specific funding for international cooperative solar energy agreements with other countries except for the U.S.-Saudi Arabia joint agreement (SOLERAS), now in its third year. Funding for this agreement would be stretched out. Although the Congress is considering higher funding than that proposed by the administration, it is the administration's requested budget reductions that our interviewees commented upon.

INDUSTRY VIEWS

It is difficult to generalize on the views of the firms and experts we interviewed because of the diversity of the sample firms - i.e., large firms and small ones, subsidiaries of major

corporations and independents, and R&D firms and manufacturers. The observation with the most general applicability is that firms which are highly dependent on Federal Government programs are also those which foresaw the most adverse consequences from the proposed funding reduction. Firms with primarily nongovernmental funding, especially the affiliates of major corporations such as the oil companies, foresaw little or no negative consequences. For example, about two-thirds of the firms we interviewed believed that the proposed budget cuts would reduce the ability of U.S. firms to compete in foreign markets. However, subsidiaries of the major oil companies felt that there would be little or no effect on the industry's ability to compete.

With this observation in mind, the industry views can be characterized as follows.

R&D programs

Government programs have supported research on a wide range of photovoltaic technologies. Nearly all the companies cited the value of the R&D programs in accelerating the development of the technology. There were some criticisms of various points of program management and contract administration, but the majority opinion was that a high level of Government assisted R&D is still needed for continued industry growth and for the United States to maintain its position vis-a-vis foreign competition. Support for R&D funding came from all subsets of respondents.

Foreign market development

Foreign market development includes foreign market analysis, overseas trade shows, export seminars, and overseas demonstration projects. Most respondents believe these activities are

important in facilitating exports. However, it was the smaller companies (those most lacking in export expertise and financial resources) which view foreign market development assistance from the Government as very important. The officials of subsidiaries of large corporations indicated they had little need for such assistance because they had access to the worldwide marketing operations of their parent corporations. However, even some of these officials believe there is a continuing need for enhancing public awareness of photovoltaics with trade shows and demonstration projects.

International cooperative agreements

The international cooperative agreements are designed to further solar technology and benefit both contracting parties. Most of the firms we interviewed felt that the U.S. industry had received little benefit from the projects initiated under these agreements. Obviously, the firms which received major contracts for these projects would not agree with this assessment. The general feeling in the industry is that the projects initiated under the agreements are not well integrated into the overall U.S. domestic program and that information generated from these projects has not been evenly disseminated throughout the industry. Officials of the Solar Energy Research Institute believe that the projects may be primarily justifiable on foreign policy grounds rather than on their contribution to the U.S. solar energy program.

Ability to compete in foreign markets

Most of the officials interviewed believe that U.S. technology is still ahead of that of France, Germany, and Japan-- the three countries that most of the companies perceive as their major competitors. Many, however, expressed concern that those countries could quickly overtake us if we greatly reduce our R&D budget. All three of these competitors appear to be seriously developing solar energy in general, and photovoltaics in particular. Budgetary support for such programs in all three countries appears to be increasing. Their solar energy programs provide assistance to their industries in developing technology and marketing.

In summary, most of the firms we interviewed believe that the development and rate of commercialization of photovoltaics is influenced by the level of Federal Government funding. Nevertheless, if the firms' responses are to be taken as a prediction, the impression we are left with is that a viable U.S. photovoltaics industry would survive the proposed budget cuts. However, our interviews indicate the industry will be different than that which we have today. Those firms more dependent on Federal programs may find it difficult to continue to participate in the development and marketing of photovoltaic products. A number of firms, both large and small, indicated that without Federal support they would reduce R&D efforts in new technologies, thus possibly slowing the development of lower cost advanced photovoltaics. Subsidiaries of major corporations with substantial

financial resources are least likely to curtail their R&D efforts and worldwide marketing.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions you may have.

SUMMARY OF INDUSTRY RESPONSES TO SELECTED GAO QUESTIONSBY SUBSETS OF RESPONDENTS (note a)

Question A: Will the PV industry ever reach the "take off" point where no Federal assistance is needed?

<u>Selected industry segments</u>	<u>Yes</u>		<u>Not sure</u>		<u>No comment</u>		<u>Total</u>
	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	
Small independent companies	2	33	0	0	4	67	6
Oil company subsidiaries	4	100	0	0	0	0	4
Other major corporations or subsidiaries	8	89	0	0	1	11	9
Other	<u>8</u>	73	<u>1</u>	9	<u>2</u>	18	<u>11</u>
Sample total	<u>22</u>	73	<u>1</u>	4	<u>7</u>	23	<u>30</u>
Commercially active companies	11	79	0	0	3	21	14
Other	<u>11</u>	69	<u>1</u>	6	<u>4</u>	25	<u>16</u>
Sample total	<u>22</u>	73	<u>1</u>	4	<u>7</u>	23	<u>30</u>
Exporters	9	82	0	0	2	18	11
Non-exporters	<u>13</u>	69	<u>1</u>	5	<u>5</u>	26	<u>19</u>
Sample total	<u>22</u>	73	<u>1</u>	4	<u>7</u>	23	<u>30</u>

a/Key to Sample Stratification is on page 15.

Question B: Did your company plan its PV capital investment on the basis of the Federal Government's commitment to spend \$1.5 billion on PV during the next 10 years?

<u>Selected industry segments</u>	<u>Yes</u>		<u>No</u>		<u>Do not know</u>		<u>No comment</u>		<u>Total</u>
	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	
Small independent companies	1	17	4	66	0	0	1	17	6
Oil company subsidiaries	0	0	4	100	0	0	0	0	4
Other major corporations or subsidiaries	2	22	6	67	1	11	0	0	9
Other	<u>4</u>	36	<u>3</u>	28	<u>0</u>	0	<u>4</u>	36	<u>11</u>
Sample total	<u>7</u>	23	<u>17</u>	57	<u>1</u>	3	<u>5</u>	17	<u>30</u>
Commercially active companies	2	14	11	79	0	0	1	7	14
Other	<u>5</u>	31	<u>6</u>	38	<u>1</u>	6	<u>4</u>	25	<u>16</u>
Sample total	<u>7</u>	23	<u>17</u>	57	<u>1</u>	3	<u>5</u>	17	<u>30</u>
Exporters	1	9	10	91	0	0	0	0	11
Non-exporters	<u>6</u>	32	<u>7</u>	37	<u>1</u>	5	<u>5</u>	26	<u>19</u>
Sample total	<u>7</u>	23	<u>17</u>	57	<u>1</u>	3	<u>5</u>	17	<u>30</u>

Question C: Are foreign companies or governments developing their technology at a faster rate than is the United States?

<u>Selected industry segments</u>	<u>Yes</u>		<u>No</u>		<u>Not sure</u>		<u>No comment</u>		<u>Total</u>
	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	
Small independent companies	2	33	2	34	0	0	2	33	6
Oil company subsidiaries	1	25	1	25	1	25	1	25	4
Other major corporations or subsidiaries	1	11	4	45	1	11	3	33	9
Other	<u>4</u>	36	<u>7</u>	64	<u>0</u>	0	<u>0</u>	0	<u>11</u>
Sample total	<u>8</u>	26	<u>14</u>	47	<u>2</u>	7	<u>6</u>	20	<u>30</u>
Commercially active companies	2	14	10	72	1	7	1	7	14
Other	<u>6</u>	38	<u>4</u>	25	<u>1</u>	6	<u>5</u>	31	<u>16</u>
Sample total	<u>8</u>	26	<u>14</u>	47	<u>2</u>	7	<u>6</u>	20	<u>30</u>
Exporters	2	18	7	64	1	9	1	9	11
Non-exporters	<u>6</u>	32	<u>7</u>	37	<u>1</u>	5	<u>5</u>	26	<u>19</u>
Sample total	<u>8</u>	26	<u>14</u>	47	<u>2</u>	7	<u>6</u>	20	<u>30</u>

Question D: How will the proposed budget cuts affect the U.S. photovoltaic industry's ability to compete in foreign markets?

<u>Selected industry segments</u>	<u>Cuts will hurt</u>		<u>Cuts will have no effect</u>		<u>No Comment</u>		<u>Total</u>
	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	<u>Num-ber</u>	<u>Per-cent</u>	
Small independent companies	4	66	1	17	1	17	6
Oil company subsidiaries	0	0	4	100	0	0	4
Other major corporations or subsidiaries	5	56	3	33	1	11	9
Other	<u>9</u>	82	<u>0</u>	0	<u>2</u>	18	<u>11</u>
Sample total	<u>18</u>	60	<u>8</u>	27	<u>4</u>	13	<u>30</u>
Commercially active companies	10	71	4	29	0	0	14
Other	<u>8</u>	50	<u>4</u>	25	<u>4</u>	25	<u>16</u>
Sample total	<u>18</u>	60	<u>8</u>	27	<u>4</u>	13	<u>30</u>
Exporters	7	64	4	36	0	0	11
Non-exporters	<u>11</u>	58	<u>4</u>	21	<u>4</u>	21	<u>19</u>
Sample total	<u>18</u>	60	<u>8</u>	27	<u>4</u>	13	<u>30</u>

Question E: Will the withdrawal of the U.S. Government from demonstration and commercialization slow the development and commercialization of solar energy?

<u>Selected industry segments</u>	<u>Yes</u>		<u>No</u>		<u>No comment</u>		<u>Total</u>
	<u>Num- ber</u>	<u>Per- cent</u>	<u>Num- ber</u>	<u>Per- cent</u>	<u>Num- ber</u>	<u>Per- cent</u>	
Small independent companies	3	50	1	17	2	33	6
Oil company subsidiaries	2	50	1	25	1	25	4
Other major corporations or subsidiaries	7	78	1	11	1	11	9
Other	<u>9</u>	82	<u>2</u>	18	<u>0</u>	0	<u>11</u>
Sample total	<u>21</u>	70	<u>5</u>	17	<u>4</u>	13	<u>30</u>
Commercially active companies	10	72	3	21	1	7	14
Other	<u>11</u>	69	<u>2</u>	12	<u>3</u>	19	<u>16</u>
Sample total	<u>21</u>	70	<u>5</u>	17	<u>4</u>	13	<u>30</u>
Exporters	8	73	2	18	1	9	11
Non-exporters	<u>13</u>	68	<u>3</u>	16	<u>3</u>	16	<u>19</u>
Sample total	<u>21</u>	70	<u>5</u>	17	<u>4</u>	13	<u>30</u>

Question F: If Government assistance is still needed, what forms should that assistance take?

<u>Selected industry segments</u>	<u>Market De- velopment and R&D</u>		<u>Market De- velopment only</u>		<u>R&D only</u>		<u>SBA Loans</u>		<u>No Comment</u>		<u>Total</u>
	<u>Num- ber</u>	<u>Per- cent</u>	<u>Num- ber</u>	<u>Per- cent</u>	<u>Num- ber</u>	<u>Per- cent</u>	<u>Num- ber</u>	<u>Per- cent</u>	<u>Num- ber</u>	<u>Per- cent</u>	
Small independent companies	1	17	2	32	1	17	1	17	1	17	6
Oil company subsidiaries	2	50	0	0	2	50	0	0	0	0	4
Other major corporations or subsidiaries	6	67	1	11	2	22	0	0	0	0	9
Other	<u>7</u>	64	<u>4</u>	36	<u>0</u>	0	<u>0</u>	0	<u>0</u>	0	<u>11</u>
Sample total	<u>16</u>	54	<u>7</u>	24	<u>5</u>	16	<u>1</u>	3	<u>1</u>	3	<u>30</u>
Commercially active companies	8	57	4	29	1	7	1	7	0	0	14
Other	<u>8</u>	50	<u>3</u>	19	<u>4</u>	25	<u>0</u>	0	<u>1</u>	6	<u>16</u>
Sample total	<u>16</u>	54	<u>7</u>	24	<u>5</u>	16	<u>1</u>	3	<u>1</u>	3	<u>30</u>
Exporters	6	55	3	27	1	9	1	9	0	0	11
Non-exporters	<u>10</u>	53	<u>4</u>	21	<u>4</u>	21	<u>0</u>	0	<u>1</u>	5	<u>19</u>
Sample total	<u>16</u>	54	<u>7</u>	24	<u>5</u>	16	<u>1</u>	3	<u>1</u>	3	<u>30</u>

KEY TO SAMPLE STRATIFICATIONSmall independent companies (75 or fewer employees)

Crystal Systems, Inc.
 DSET Laboratories, Inc.
 Energy Materials Corporation
 Free Energy Systems, Inc.
 Solenergy Corporation
 Sollos, Inc.

Oil company subsidiaries

ARCO Solar Industries
 Exxon Enterprises (Solar Power Corporation)
 Mobil Tyco Solar Energy Corporation
 SES, Inc.

Other major corporations or subsidiaries

Lockheed Missiles and Space Company
 Martin Marietta Aerospace Company
 Microwave Associates, Inc. (MACOM, Inc.)
 Motorola, Inc.
 Photowatt International, Inc. (Compagnie Generale d'Electricite)
 Spectrolab, Inc. (Hughes Aircraft Company)
 Thermo Electron Corporation
 Varian Associates, Inc.
 Westinghouse Electric Corporation

Commercially active companies

Acurex Corporation
 Applied Solar Energy Corporation
 ARCO Solar Industries
 DSET Laboratories, Inc.
 Exxon Enterprises (Solar Power Corporation)
 Ford, Bacon & Davis Utah, Inc.
 Free Energy Systems, Inc.
 International Rectifier Corporation
 Motorola, Inc.
 Photowatt International, Inc.
 Solarex Corporation
 Solenergy Corporation
 Sollos, Inc.
 Spectrolab, Inc.

Exporters

Applied Solar Energy Corporation
 ARCO Solar Industries
 DSET Laboratories, Inc.
 Exxon Enterprises (Solar Power Corporation)
 Free Energy Systems, Inc.

Motorola, Inc.
Photowatt International, Inc.
Solarex Corporation
Solenergy Corporation
Sollos, Inc.
Spectrolab, Inc.