HCP/CS-4121
Volume 1 of 2
(Vol. 2: HCP/CS-4250)
Dist. Category UC-59,59a

Solar Energy Commercialization for European Countries

Volume 1

December 1978

Prepared by:
Payne, Inc.
Annapolis, Maryland

Prepared for:
U.S. Department of Energy
Assistant Secretary for Conservation
and Solar Applications
Office of Solar Applications
and Commercialization
Washington, D.C. 20545

Under Contract No. EG-77-C-01-4121

CONTENTS

OVERVIEW

As part of the information acquisition tasks of the ISCWG (International Solar Commercialization Working Group), two discrete but related activities were undertaken commencing in May 1978:

- o Interviews with United States industry, to determine the status of the solar sector's interest in, and actual entry into, the international solar market.

- o Visits to France, Belgium, West Germany, Italy and other European countries to obtain data on, and assess the scope and direction of government and industry solar programs; to assess energy and solar scenarios and solar applications; to identify areas of United States industrial or cooperative involvement and barriers to such involvement; and to develop an ISCWG *modus operandi* for subsequent overseas trips.

The first such subsequent overseas trips were made after the June 1978 Cairo Solar Energy Symposium, to the Middle East, Africa, and selected European countries. Those trips are reported separately.

Interviews with United States industry and with representatives of foreign solar-related firms and government officials, are a continuing ISCWG task.

All data acquired during the effort described above, was made available to and drawn upon extensively, by the International Panel of the Domestic Policy Review (DPR Solar) which was conducted from June to October 1978 under the direction of DOE.

This report covers the United States industry interviews and the ISCWG visits to Western Europe and Israel before and after the Cairo Symposium. Appendices (which are listed in the Table of Contents) contain detailed reports of interviews, brochures, field reports, and other supporting data. These volumes are held by the ISCWG and are considered sensitive because they contain data considered proprietary by United States and foreign sources; this data was provided the ISCWG on a discreet basis.

The interviews with United States industry (part A) are being conducted by members of and consultants to the *ad hoc* ISCWG with contributions from personnel from other agencies. The overseas visits and the ongoing interviews with foreign visitors to the United States (part B) are also conducted by ISCWG members and consultants. The pre-Cairo visits to Western Europe were undertaken by W. Corcoran, H. Yim, P. Patil, J. Duvivier, R. Spongberg, R. LeChevalier, and M. Brown. The post-Cairo to Europe visits were undertaken by H. Yim and R. LeChevalier.

D. Doyle and T. West have contributed to the acquisition and assimilation of data.

PART A INDUSTRY INTERVIEWS

Interviews with United States industry brought out the following major points:

- Whereas until the beginning of 1978 there was little interest on the part of United States industry in becoming involved in the international solar market, interest is rapidly rising as the promise of a large domestic market remains unfulfilled.

- United States solar firms marketing overseas are still in a minority. Many firms are hesitant to enter markets they do not understand, or join hands with foreign partners they do not know.

- Very few United States solar firms have set out deliberately to survey and enter the foreign market on the basis of known demand areas. Much of the foreign marketing and ventures with foreign partners have resulted from chance contacts or occasions. This pattern will almost surely be replaced by systematic marketing efforts, over the next few years.

- Most United States solar companies believe there is a very large potential market in the LDC's (less developed countries), which should be turned into demand with the help of loans from international financial institutions and aid from developed countries. The United States Government is seen as a large potential helper to United States industry, in such areas as providing market survey and product information, loans or guarantees to exporters, more support for R&D that is export oriented, by sponsoring solar trade fairs overseas, and so on.

The pre-Cairo ISCWG visits to France, Belgium, the Federal Republic of Germany and Italy, gave rise to the following major points and recommendations:

SUMMARY AND CONCLUSIONS

- Of the three countries visited which have ongoing solar programs, Italy offers the most potential for United States exporters but money is very tight. France has a serious interest in industrial and official cooperation, a strong solar program with funds, and a good solar climate. It offers the next best potential and perhaps the most immediate markets for United States exporters. West Germany has the most determined solar export program. Their domestic program is low technology and they have a defensive attitude regarding their higher technology export intentions.

- The pre-Cairo trip achieved its objectives in acquiring data on energy demand/supply, solar potential and capabilities, industrial activities and plans, and areas for United States opportunities. ISCWG methods were tested and can be improved as a result. An interim updated data base was acquired.

- Many excellent contacts were made and can be followed up by United States Government officials and private United States industry representatives. United States photovoltaics technology is the most immediately marketable item, followed by other high technology and know-how, and specialty engineering and hardware.

- The Europeans see the United States as a major solar market and the United States can expect pressure to import European technology and hardware.

- France and Germany are export oriented, mainly toward the LDCs. They constitute a gateway to the LDCs for United States firms in joint venture arrangements, but they also constitute vigorous and effective competition for unilateral United States industry initiatives in the LDC's.

- Due to the many variables no one can accurately predict the size of the LDC markets, but they are potentially colossal and United States assistance in making need turn into demand will be an important lever to assure a good United States share of these markets.

RECOMMENDATIONS

- Pending establishment of a permanent group to carry on essential ISCWG functions, ISCWG should continue to acquire market data, collate it and provide DOE with recommendations for action. Additional visits overseas should be planned to verify data already received, to discuss findings with United States officials and businessmen in Europe, to acquire necessary additional data from new and old sources, and to make recommendations to DOE as to future action.

- Future ISCWG overseas visits should be prepared as far ahead as possible. Meetings should be set up well ahead of time, and maximum use made of DOE representatives overseas.

- Visits to foreign industry by United States industry representatives (acting for the ISCWG) should be undertaken separately from team visits involving United States officials. Team visit objectives and contacts should be very carefully planned and executed.

- United States and local members of United States diplomatic and consular missions should be continually made aware of ISCWG thinking and plans, give their ISCWG input, and be invited to assist during and between visits.

- The recommendations of the DPR International Panel Draft Options papers of July and August 1978 contain several suggestions that would help the ISCWG achieve its ends. These include:

  - International solar market data acquisition and a global market survey.

  - Loans, loan guarantees, risk insurance and other incentives to United States export oriented solar firms.

- More incentives for United States export oriented solar R&D.

- General solar awareness and specific training programs.

- More use by the United States Government of solar trade fairs and trade center exhibits.

PART B. PRE-CARIO VISIT TO FRANCE

France was visited by six team members from June 4 to 8, 1978. One member returned for a brief visit to the solar fair in Nice, June 14 to 15.

Two team members visited Belgium, June 9 to 11, primarily to meet with officials of the EEC (European Economic Community) and the NATO/CCMS (North Atlantic Treaty Organization, Committee on the Challenges of Modern Society).

One team member remained two more days in France to make industrial contacts, June 9 to 11.

The entire team visited the Federal Republic of Germany (FRG) starting

June 9, and split into three groups in order to achieve maximum coverage in the limited time available before the Genoa Trade Fair.

The entire team then visited Italy, primarily to meet with members of the Italian solar community in Genoa where there was a solar trade fair, June 12 through 18. The team arrived in Genoa from various towns in Germany and Italy, by June 14 and the last team member left Genoa June 18.

One team member transitted the United Kingdom to inspect an EEC-oriented solar market survey recommended by the EEC. The survey was subsequently acquired by DOE.

FRANCE

CONTACTS

Government: CNRS/PIRDES (the solar R&D office of the state committee for scientific research)

SEN (secretariat for new energies)

CEA (atomic energy agency of France)

EDF (French national electrical utility company)

Industry: SOFRETES (quasi-governmental manufacturer/distributor of solar pumps)

ELF (national oil company)

RTC & LEP (Philips N. V. subsidiaries, in Photovoltaic (PV) research and manufacturing)

MOTOROLA FRANCE (importers of Motorola PV from the United States, planning manufacture in France)

SAINT-GOBAIN SOLAIRE (glass, insulation, solar systems)

SERI-RENAULT (solar systems designers, until recently SOFRETES shareholders)

SIDEM (desalination systems, planning to enter solar desalination field)

ALSTHOM-ATLANTIQUE (solar pumps, Rankine cycle engines, collectors)

SEP (space, terrestrial and marine propulsion systems; just purchased SOFEE, largest French solar collector manufacturer)

BERTIN (medium and high technology R&D collectors, heat exchangers, wind turbines)

Others: P. de BAUSSET, editor, FIGARO

G. LECLERE, French national TV and solar author

L. BOXER, IEA (International Energy Agency)

ENERGY SCENARIO

France is a net importer of energy and has suffered considerably from increased oil prices. Indigenous fossil fuel and hydro resources are insufficient for the country's current and future needs. A substantial nuclear energy program is in progress, aimed at supplying a large fraction of electrical energy demand in the next decade; it is also likely to produce higher cost electricity than currently acceptable. There are some tidal energy possibilities now being exploited but they are only able to supply a very small fraction of the demand. France has a poor wind regime, only a limited biomass potential, and north of the river Loire there is poor insolation. The nation has a long solar R&D history and excellent technical infrastructure.

GOVERNMENT SOLAR PROGRAMS

- Ten million francs national subsidy for solar domestic hot water systems; checks mailed to system purchasers, for about 20 percent of cost. Program successful since its inception in March 1978.

- Eight million francs R&D and demonstration program, giving contracts and grants to industry with a strong "buy French" and export orientation.

- Low interest loans for R&D to produce innovative prototypes, with repayment from profits.

- Active participation in international programs, including EEC and NATO/CCMS as well as bilateral programs with India, Iran, Brazil, Algeria, and others. These and the gifts of funds and/or solar equipment to other countries for political reasons (a strong French official motivation) accounts for most of the orders received by French firms for solar equipment, other than domestic hot water.

- An official energy conservation program includes very strict insulation for new houses (R30 to 40 for all-electric homes), thus paving the way for relatively smaller solar space heating arrays, more cost-effective systems, in the future.

- CEA now holds the major share of SOFRETES (solar pump manufacture), in effect a subsidy to this French manufacturer since almost all these pumps were gifts to foreign countries. The French solar market is almost entirely supported directly or indirectly by the government, whose main thrust is exports.

- Official missions overseas seek and exploit opportunities for French industry to find export markets. The French government is very much closer to French industry, and vice versa, than is true for the United States. French industry is more dependent upon government policies and subject to political pressures.

INDUSTRY SOLAR ACTIVITIES AND PLANS

- Industry sees only a limited near-term solar market in France, mainly confined to hot water (domestic and industrial), greenhouse and domestic/commercial space heating, and a limited number of remote PV applications.

- Although there is a good solar R&D and practical applications base, there have been some "horror stories" (SOFRETES pump failures and the St-Gobain office building in Madrid) and most French industrialists welcome United States technology, on license or joint venture bases.

- Like their government, French industries are export oriented and manned by good salesmen. Most of their solar products (90 percent of their PV and 50 percent of their FPC) are exported.

Most R&D is export oriented. Products being developed include solar absorption chillers, biomass conversion systems, wind energy systems, solar electrical generation systems, new types of solar pumps, and concentrating solar collectors for a variety of applications. The great bulk of this work is intended for the export trade.

- Production estimates:

	1975	1977	1978	1979	1980
Flat plate (M^2 x 1,000)	10	30	100	300	1,000
PV Cells (KWp)	--	20	100	200	400
Domestic H/W, new units (x 1,000)			150	350	?
Space heating, new units (x 1,000)		(500-1,000 by 1985)			

- Virtually no market surveys have been conducted by French industry, domestic or foreign. They tend to design and build products, then seek markets for them.

- Of about 130 French solar companies, 20 to 30 are considered substantive; in June 1978, eight had qualified for the national hot water subsidy program.

SOLAR CAPABILITIES AND POTENTIAL APPLICATIONS

- French government and industry capabilities in high as well as low technology are good to excellent. French technology can be expected to run about 2 years behind the United States, although in certain fields the French (and the Germans) may progress more rapidly than the United States; these fields could include storage systems, selective coatings, and automatic manufacturing processes for PV cells. In some areas French technology is receiving strong support from United States joint venture partners such as Arkla Industries and Solarex.

- Flat plate production capabilities appear to be well able to supply demand now and in the foreseeable future, although this may not be true after 1983 when many French sources believe that the level of solar applications in France itself will "explode" (their word).

- PV cell production, now in the hands of RTC only, is already behind demand. The arrival of ELF, Solar Power, Solarex, and Motorola on the French PV manufacturing scene in 1979 to 1981 will alleviate this situation. However, if French actions to increase their PV markets overseas (especially in the LDCs) are as successful as they predict, they will almost certainly have to look elsewhere for supplies of solar cells--to the United States, Japan, and West Germany primarily.

- Potential solar applications in France will include, in addition to the rapidly growing domestic hot water uses, space heating, greenhouse heating, remote PV for beacons, telephones, corrosion protection, and communications. Overseas the French are looking to large markets in (proportion to the funds that are made available for international commercialization), in: Village power, lighting, crop drying, desalinization, pumps, navigational and highway aids, TV and communications, air conditioning, industrial process heat, cookers, storage systems and battery chargers.

POTENTIAL FOR UNITED STATES MARKETS AND COOPERATION

France, much more than Germany, seems to welcome United States involvement in solar commercialization ventures. The most likely areas for marketing are in joint manufacturing ventures, licensing, and royalty agreements for United States technology, and the import of United States specialty engineering and hardware. Due to the high level of French technology and manufacturing capabilities it is most unlikely that exports of United States flat plate collectors and other bulky items will be sought by French importers.

United States manufacturers and product engineering firms are becoming more aware of the potential markets in France, and through France to the OPEC and non-OPEC LDC's. Many do not dare to seek to exploit these potential markets, or do not know how to do so. Like their French counterparts they are aware of the huge potential, the need for renewable energy conversion devices in the LDCs. But they do not know what they can do to turn that need into demand and then profit from the demand. United States Government assistance to United States industry in this area including dissemination of market data and appropriate financial aid, would go a long way toward shaping a new and useful situation in which French and United States solar companies work together to make and meet new solar markets. The areas for such cooperation could include all the technologies mentioned above.[1]

APPENDICES

Appendices include detailed reports of contacts, product data, and

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[1]See DPR Int'l Commercialization Options paper.

data, and specific statements by French officials and company officers regarding potential cooperation.

BELGIUM

CONTACTS

International: EEC (European Common Market, Energy Research Division)

NATO/CCMS (NATO Committee on Challenges of Modern Society)

Government: None; the purpose of this trip was to meet with EEC and NATO officials and to hold discussions with DOE representative R. Purple at American Embassy/EEC.

Industry: MARTIN PROCESSING (European office of Martin Processing Inc., Martinsville, Virginia)

BOCB (Belgian Overseas Consulting Bureau, an A and E firm active in LDCs)

PAUWELS INTERNATION (Electrical transformer and switching gear manufacturers)

(NOTE: Visits with Belgian industry were only to take advantage of "down" time during the weekend, and verify the level of Belgian solar interest/activity)

ENERGY SCENARIO

- EEC head of Energy Research, Dr. Strub, indicated that lack of adequate market studies is "European sickness". EEC did energy demand/supply study 1975 but claims it was low quality. EEC will require such studies from now on as precondition to EEC funding R&D or demonstrations.

- EEC viewpoint on European energy scene is derived mainly from each country's input so will be handled under each country section.

SOLAR PROGRAMS

- Belgian government has extremely small solar R&D program, administered through a half dozen universities. Some twenty demonstrations have been funded, mostly in the domestic hot water, space heating, and greenhouse heating fields. There is no Belgian subsidy program or industrial stimulation project. Insolation is poor in Belgium and there are no hydro, wind, tidal, OTEC, geothermal or biomass programs except limited government and industry interest in supplying specialty hardward and systems engineering to overseas markets, mainly LDCs.

- EEC has six R&D programs and will have a solar demonstration program for the first time in 1979. The R&D budget (augmented by 50 percent cost sharing by member countries) is $140 million for 1979 to 1984, twice that of the previous 5 years. $330 million has been recommended to the Council for the next 5 years for demonstrations, but may be trimmed back. The R&D programs cover solar heating (and a small cooling program), small (up to 1 MW) and large power systems, PV (the biggest dollar share), photochemistry (mainly hydrogen), biomass, insolation, and related meteorological data collection. The EEC program is described in the appendices.

- NATO/CCMS has not yet undertaken studies to assess solar market potential in Europe, but is interested in doing so. The

NATO/CCMS solar program is described in the appendices.

INDUSTRY SOLAR ACTIVITIES AND PLANS

Belgian solar industry is in its very earliest stage, and will direct such activities as it may undertake, to the export field with the exception of hot water and wind applications (when the Netherlands ceases to export cheap gas to Belgium--which could occur by 1981).

There are a few Belgian manufacturers of flat plate domestic hot water systems, and the number is increasing at a slow rate. Total production and demand are unknown since there have been no surveys and Belgium has failed to respond to requests for data from the EEC.

Although some 1,000 United States corporations have offices and manufacturing facilities in Belgium, none appear to be actively involved with Belgian firms in the solar field.

The brightest spot on the Belgian solar horizon appears to be the successful efforts by the Glaverbel firm, a Belgian-French glass manufacturer, to produce a flexible, tempered, super-thin (1 mm) glass suitable for solar collectors. The EEC energy research office believes that this product will have an excellent future.

SOLAR CAPABILITIES AND POTENTIAL APPLICATIONS

Belgian R&D capabilities are very limited at the moment, and not worth analyzing. Manufacturing capabilities are well beyond Belgian internal demand and are likely to remain so indefinitely; however, strong solar equipment demand in the rest of Europe or from the LDCs might well cause orders to flow into Belgium if other, more solar oriented, European manufacturers are swamped.

Potential applications within Belgium are limited not only by climate, but by the low rate of housing starts, a declining population, and (for the time being) cheap energy.

POTENTIAL FOR UNITED STATES MARKETS AND COOPERATION

There would appear to be a very limited potential market for United States solar technology and specialized hardware, which will grow only if United States industry seizes every possible opportunity to stimulate Belgian industry into joint ventures in the LDC market field.

There is the possibility that United States firms can engage in EEC R&D and demonstrations contracts if they show unique qualifications and are under subcontract arrangements to EEC firms. However, no United States firms have yet become involved in such activities and we doubt that this represents any market although it does represent a good area for cooperation. In fact, the EEC programs in R&D and demonstrations would be a good area for DOE/SERI cooperation.

GERMANY

CONTACTS

Government: DFVLR (German Aerospace Research Establishment)
BMFT (Ministry of Research and Technology)
BME (Ministry of Economics)

Industry: AEG-TELEFUNKEN (Well-known conglomerate, doing R&D plus manufacturing in PV and other solar fields)
STIEBEL-ELTRON (Conventional and solar domestic hot water and space heating)

BOSCH (Heat pumps, solar collectors, FAFCO/US swimming pool solar heater distributor)

MBB-(MESSERSCHMITT,-BOLKOW-BLOHM) (Large aerospace company, aircraft and space systems, high temperature process heat and solar electric generation for LDCs)

Others: University of Stuttgart, Institute of Physics and Electronics

Institute for Systems Technology and Innovative R&D, Karlsruhe

ENERGY SCENARIO

- Government nuclear and coal programs very strong; also energy conservation.

- No wind or biomass, tidal, or hydro progress likely.

- Solar regime poor in north, weak in mid-Germany, fair in south (up to 1,730 hours/year). Low temperature, diffuse solar applications are best suited to the climate.

- Net importer of oil, suffering from high prices. Coal stocks significant but unable to supply all demand.

GOVERNMENT SOLAR PROGRAMS

- Starting in mid-1978, large national domestic hot water subsidy program was initiated to lower prices and stimulate private investment. $4.35 billion was set aside for solar applications and conservation. Purchasers get checks up to 25 percent of system cost, or 100 percent in the form of tax credits.

- R&D support direct to industry totals about $27 million per year.

- Government supports few projects aimed at domestic market, such as the Philips/Aachen test house. The program is mainly aimed at stimulating exports, especially PV for LDCs. In effect, government supports low technology for home use, high technology for export.

- Main purpose of solar R&D cooperation with United States is to acquire United States technology. Government will not cooperate with United States in commercialization field, leaves that to industry (which it nudges in various directions).

- Objective is solar for 50 percent of housing stock by 2000, which equals 2 to 3 percent of total primary energy consumption or about 20 million tons of coal equivalent/year. Total solar objective is up to 50 percent of primary consumption by 2000, from all solar applications in Germany.

- Government buildings program, similar to that being set in motion in United States; limited scope so far. Many German buildings are multi-story and relatively unsuitable for solar.

- International programs with IEA, EEC, NATO/CCMS, plus bilateral aid programs with Mexico, India, Iran, Brazil, Philippines, Greece, and Spain.

APPENDICES

Appendices include reports of contacts with German officials which describe their programs, and a copy of the government program for 1977 to 1980.

INDUSTRY SOLAR ACTIVITIES AND PLANS

- Industry in Germany is in many ways analogous to that in France. Strong two-way government influence/involvement; export oriented; excellent infrastructure, manufacturing capability and R&D base.

The Germans are more organized and determined that the French. They plan to carve out a large export market in solar, and will almost certainly do so.

- o German solar exports will be similar to those that France seeks to export, and to the same customers. The German government helps industry's export efforts, as does the French government. German industry will be very competitive in the LDCs.

- o The Germans are behind the French in solar cooling, but may be moving ahead in portable power systems. They have made more and better market studies and are guided by them.

- o The Germans are already invading the French solar hot water market and plan to add space heating and greenhouse heating to that effort. They are serious and skilled.

- o The large German firms have formed a consortium and will have a substantial edge over smaller companies. However, no one is yet making money in the solar field in Germany.

- o Domestic hot water systems sales are about 20 to 40,000 M^2 annual rate at present, and climbing rapidly.

- o Unless there is a big price break, PV applications in Germany do not look attractive and industry is not looking for them.

APPENDICES

Attached as appendices are detailed reports of contacts, products, data, and specific statements by German officials and company officers regarding potential cooperation and solar activities in general.

SOLAR CAPABILITIES AND POTENTIAL APPLICATIONS

- o Germany has an excellent solar R&D and manufacturing base. Training of installers for hot water systems is at a high level, conducted by industry.

- o PV R&D and production, undertaken by companies with considerable experience in extra-terrestrial applications and United States know how, are at a very high level of quality. Prices are high but there is a determined effort to bring them down to about 3 to 5 DM per W_p by 1985.

- o There is no reason to believe that solar hot water and space heating equipment demand will outstrip supply in the foreseeable future. German hot water heater manufacturers are taking risks by installing factories prior to an assured market. However, much as in the case of France, factors will probably combine to bring about a large solar hot water market within the next 5 years.

- Although the level of wind energy effort is low, and the wind profile not very promising, there is a fairly substantial potential market in this area as conventional prices rise. Also, in urban waste conversion systems and energy storage systems, both possibly combined with solar.

- For the time being, most applications within Germany will respond to the climate/energy scenario and be in the low temperature diffuse sunlight field--domestic hot water for homes, swimming pools, some industrial and agricultural uses and some residential space heating. In general, however, Germany will concentrate on buildings conservation before helping industry's solar space heating efforts.

POTENTIAL FOR UNITED STATES MARKETS AND COOPERATION

- Germany does not seem to offer many possibilities for United

States solar firms, except as the United States firms are able to bring to the market high quality specialty hardware or know how. One such area could be the technology of making flat plate collectors perform better. Another would be in sophisticated controls, systems engineering or solar engines. But the Germans are at such a level of sophisticiation themselves that the United States will only be able to license or export truly excellent products.

- Joint ventures in third regions where Germany has less impact than the United States, may be an area for United States market development although generally the Germans prefer to go it alone using their own skills.

- On a government to government level Germany enjoys the tri and multilateral R&D demonstration projects which are already being carried out, and will seek to expand this with the United States. Concurrently they will seek to limit joint activities in solar commercialization.

- Despite the foregoing, it can be expected that many German firms will accept close associations with United States solar firms, in order to exchange technology or otherwise work to mutual advantage.

- Germany sees the United States as a major potential market for its technology and specialty hardware.

ITALY

CONTACTS

Government: No direct contacts were made with government offices, in order to leave maximum time to cover the Genoa Trade Fair. Contacts with Italian government officials were made on the return trip from Cairo and are reported separately.

Industry: ANSALDO (Well-known large government-owned industrial company, with R&D and sales in concentrating and FP collectors)

FIAT (Autos, industrial applicances, solar)

MONTEDISON (Chemicals, fibres, solar)

PIRELLI (Tires, chemicals, solar)

ZANUSSI (Applicances, solar)

MABOSSON (Pumps, solar)

GEDOL (Lubricants, solar)

CTIP SOLAR (Industrial plant-design and construction solar)

(See also brochures collected at the Fair, attached as appendices.)

Other: Palermo University

University of Calabria

Various non-Italian participants and visitors.

ENERGY SCENARIO

- Net importer of fossil fuels, suffering from high oil prices. Domestic stocks of coal and natural gas unable to meet demand.

- Good insolation, from 1,640 hours per year in northern Italy to 2,350 hours in southern Italy. Inconsistent wind regime, with no widespread applications possible. No tidal and few hydro possibilities.

- Expensive electricity for the average consumer. Prices rising continually. Winter heating load in most of country.

- Critical need for alternate energy sources.

GOVERNMENT SOLAR PROGRAMS

- No national subsidy for solar consumers. Tuscany (of which the traditionally progressive in town of Florence is the capital) has initiated a subsidy program, is asking the central government to follow.

- ENI charged by government with solar commercialization. But funds are very short and to date very little has been accomplished on government resources. Mostly private companies, quasi-government companies and universities have carried the burden on R&D and demonstrations.

- Government recognizes that Italy is ripe for solar, but is frustrated by lack of means. Cooperates almost frantically with international bodies (EEC, NATO, IEA, OPEC) and on bi and multilateral levels. Given an assist, the Italian government could open up Italy as a solar showcase.

- Limited government programs so far, and plans for the future, will be reported by the post-Cairo team. These R&D and demonstration projects have totaled 15,500 million lira only so far.

INDUSTRY SOLAR ACTIVITIES AND PLANS

- Italian industry includes a large number of very capable small firms which can convert rapidly and effectively to production of solar equipment. Radiator manufacturers from Palermo to Turin have already done so, with some success. The problem they all face is identical; lack of money in the hands of the consumer and no government subsidy or stimulation program.

- Very few Italian companies, however, are in solar energy only. They cannot afford to be. To most, so far, it is an unprofitable sideline.

- Italian firms do an exceptionally good promotional job, better than many United States solar firms. The Genor Solar Trade Fair was well planned and executed, with professional display and presentations.

- Italian industry sees the United States as a source of much needed high technology, of funds, and as a recipient of Italian solar hardware (which is unrealistic as yet). They are eager to make associations with United States firms for technology, joint ventures, licensing and royality arrangements, and imports of specialty hardward and systems engineering.

- Italy is both export oriented and domestic market oriented. Thus industry seeks to bring out products that will serve both purposes: hot water systems, high temperature arrays for multiple purposes, solar engines and pumps, greenhouse heaters, crop driers, village power and lighting systems, and so on.

- Production for the market to date is small; some 4,000 hot water systems installed, at $1,100 to $2,000 each (far above the British Petroleum thermo-syphon kits in Greece which sell for under $400 each). Italian labor costs and productivity are not matched to Italian energy needs and so the potential demand is still only in the "need" stage.

SOLAR CAPABILITIES AND POTENTIAL APPLICATIONS

- Capabilities in the low and medium temperature solar thermal fields are fair to good, with no realistic limit to progress. PV R&D and manufacturing is still basically imported although given enough funding there is no technological reason for it to lag behind that of France.

- o Italy can produce enough to meet its probable demand, in solar thermal applications, for the foreseeable future.

- o Requirements for foreign technology can readily be met as the market grows. However, the Italian solar market is as yet undefined by any known serious industry or government solar studies.

- o Potential applications within Italy include:

  - Solar desalinization
  - Village power and lighting
  - Domestic and industrial hot water
  - Heating and (longer term) cooling of buildings
  - Pumping and crop drying
  - Greenhouse heating
  - Communications and navigational aids in remote areas
  - Biomass conversion and urban waste reduction

- o In short, Italy has the same needs as many LDCs, the climate to address those needs, and the skills and manufacturing infrastructure to provide for them. In addition, Italy is export oriented and can readily export what is also of economic validity at home. It only lacks money and selected injections of technology for all this to take place.

POTENTIAL FOR UNITED STATES MARKETS AND COOPERATION

- Italy is a superb potential market for United States technology, systems engineering and specialty hardware. The obverse of the coin is that Italy sees the United States as a solar market and may require mutual exchanges or constrain United States exports to Italy.

- Given the right financial conditions, the United States could sell technology and specialty hardware to Italy in abundance. All that is required is a United States bilateral and international effort to stimulate solar commercialization in Italy--to prime the pump.

- Italy is also eager for government-to-government cooperation in many solar fields, in order to acquire know-how and demonstrate the benefits of solar energy to its public and industry.

- United States industry, assisted by the United States Government, could at once seize opportunities to commercialize solar energy in Italy and to build Italian industry for export in the Mediterranean basin. Italians will welcome United States industrial initiatives for joint ventures, licensing, and royalty agreements.

APPENDICES

Attached as appendices are brochures describing the Genoa Solar Trade Fair and the product and plans of many of the companies which exhibited there. It was an excellent show, well planned and well attended.