

SOLAR EUROPE

Newsletter of the Solar Energy Programme of the European Communities
Issued by the Directorate-General XII for Research, Science and Education

Changes in the European Communities

At the beginning of 1981 Greece became a new member of the European Communities. As a consequence, the number of stars surrounding the sun in our Newsletter sign was increased from 9 to 10.

Furthermore, under its President Mr. Thorn, 14 newly appointed Commissioners took up responsibility in Brussels.

The Solar Energy R & D Programme is maintained as before at DG XII with Director General Dr. Günter Schuster and the Energy R + D Division Head Dr. Albert Strub.

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Further information is available from:

Commission of the European Communities,
Directorate-General XII for
Research, Science and Education,
Rue de la Loi, 200,
B-1040 Brussels.

European Currency Unit (ECU)

Equivalent in European currencies as at February 1981

Belgium and Luxembourg	F	41.67
Germany, F.R.	DM	2.59
Netherlands	Fl.	2.81
United Kingdom	L	0.52
Denmark	Kr.	7.99
France	F	5.99
Italy	L	1231
Ireland	L	0.69
US	\$	1.23

EC completes world's first large-scale solar tower plant in Sicily

The European Community has completed the installation of the world's first 1 megawatt solar power plant, EURELIOS, at Adrano, Sicily, designed to deliver electrical power into the grid of ENEL.

EURELIOS will be brought to power within the next eight months. Similar plants are still under construction in Spain, France, Japan and the United States.

Half the cost of EURELIOS were borne by the European Community as part of its solar energy R & D programme. The other half comes from Italy, France and the Federal Republic of Germany.

Design and construction work has been performed by an industrial consortium consisting of Ansaldo Meccanica Nucleare and Ente Nazionale per l'Energia Elettrica (Italy), CETHEL (France), and Messerschmitt-Bölkow-Blohm (Germany). General Technology Systems (London) act as management consultants to the Commission.

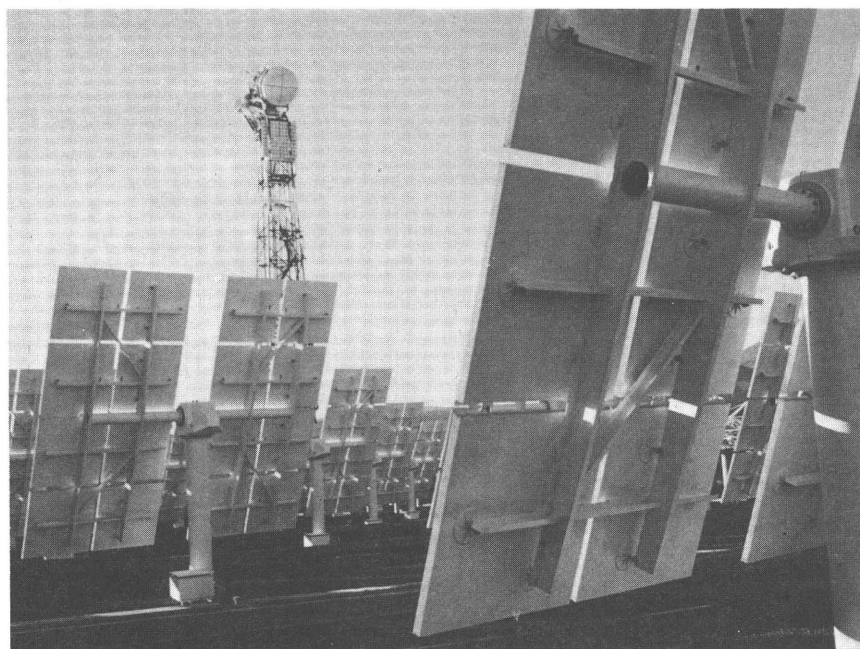
The plant is of the tower type: 182 large mirrors (heliostats) reflect the sun's heat into a receiver, in which steam is generated to drive a turbine. First tests have been successfully carried out.

The photo below shows Eurelios as it was in December 1980.

Technical data of Eurelios

Nominal rating 1 MW(el)
Thermal power 4.8 MW
Total mirror surface 6216 m²
Heat storage: 1/2 hour (molten salt + hot water)

Heliostats 112 × 23 m² mirror (MBB) 70 × 52 m² mirror (CETHEL)
Steam 512°C, 64 ata
Tower height 55 m



Workshop on medium-size photovoltaic systems Sophia-Antipolis, France,

In October 1980, the CEC organized jointly with the Commissariat à l'Energie Solaire (France) and the U.S. Department of Energy a workshop on medium-size (ca. 100 kWp) photovoltaic power systems. The workshop was attended by 90 persons from Europe and the United States involved in the design and construction of such systems. Most of the European industry competent in the field of photovoltaics and associated technologies, public authorities of EC countries, the US Department of Energy and US industry were represented.

The aim of the workshop was to inform European industry of the state of the art in the United States, in particular the problems encountered with US pilot plants built in recent years, and to evaluate and compare the 31 proposals from European consortia for the EC photovoltaic pilot programme (power range 30-300 kWp, January 1981 to June 1983). It was therefore a major step in the selection process of the EC pilot projects and gave specialists from Europe and the United States an opportunity to exchange views before attending the 1980 Photovoltaic Energy Conference in Cannes.

The four sessions were devoted to: US programmes and markets; US pilot projects; EC pilot projects; panel discussions (power conditioning); structures and wiring, grid connection and stand alone.

The proceedings of the workshop will be published in March 1981 by the D. Reidel Co., Box 17, 3300 AA Dordrecht, Netherlands.

Solar World Forum

Congress and exhibition
Brighton, UK, 23-28 August 1981

All those interested in solar energy are invited to attend this Congress organized by the UK section of the International Solar Energy Society. Major sponsors are the EC, the UK and US Departments of Energy, and UNESCO. All key topics on solar energy will be covered by invited speakers and by contributed papers. Discussions, rapporteur sessions and colloquia will round out the programme. Tours of solar installations and establishments are being arranged. Please contact:

June Morton, Administrator, UK-ISES,
19 Albemarle Street,

London W1X 3HA UK Telephone 01-493 6601.

Photovoltaic Solar Energy Conference

Cannes, France

27-31 October 1980

The Cannes conference was organized by the CEC in co-operation with the Commissariat à l'Energie Solaire, Paris, and the Institute of Electrical and Electronic Engineers, New York. With over 750 participants from 33 countries, representing manufacturers, designers, R & D institutions, Government agencies, educational establishments, electricity utilities, oil companies and users, it was the biggest yet, reflecting the ever-widening appeal of solar cell technology as a renewable energy option.

Emphasis was on system design, current and future applications, goals, markets and obstacles. There were 83 oral papers, 55 of which were invited from well known authorities. A further 113 papers were presented as posters. A special session was devoted to the prospects for photovoltaics in developing countries. Other sessions dealt with goals, markets and obstacles, strategies for cost reduction, silicon and module development, alternative solar cells, concentration, current applications, test experience, advanced systems and future applications.

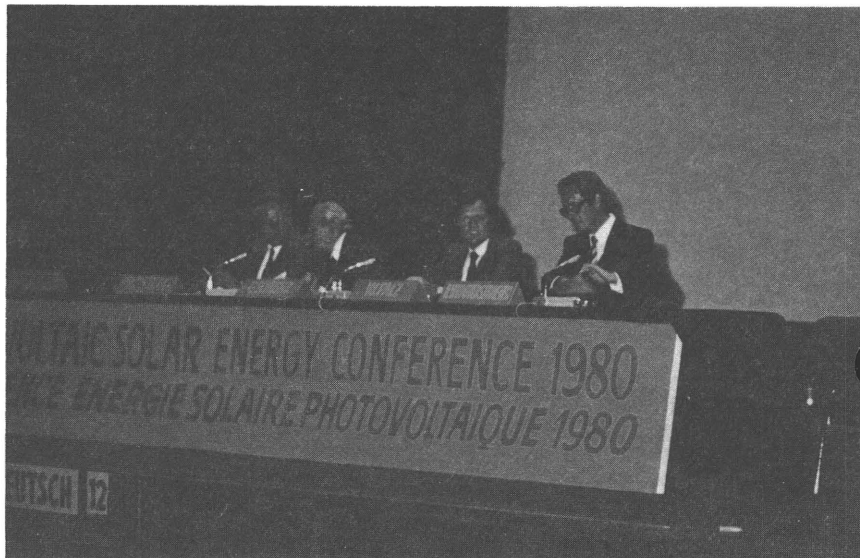
The Conference was complemented by an exhibition of photovoltaic products and systems, with the participation of 31 companies and organizations from Europe and USA. Of particular interest was the CEC's exhibit of models of proposed pilot projects. Another striking exhibit was Aerospatiale's 1 kWp photovoltaic concentrator, which was seen working. A public meeting entitled "Production Directe d'Electricité Solaire" was held after the Conference to inform the "man in the street" of the principles, state-of-the-art, applications and future prospects of solar cells.

Opening the session on goals, markets and obstacles, Dr. G. Schuster, Director General for Research, Science and Education at the CEC, said that encouraging progress was being made in cost reduction, and photovoltaic generators integrated with the grid could eventually make a significant contribution to Europe's electrical energy requirements.

Although the Commission, with national governments and international agencies, could stimulate research, development and demonstration, Dr. Schuster stressed that in the end it was industry that would have to produce and install photovoltaic systems. In Europe, the number of companies involved had increased from 3 to 12 in the past 18 months and total manufacturing capacity was expected to reach 6 MW/year by 1982, with module prices as low as \$10/Wp. The Commission offers help to any developing country wishing to use this new technology.

The proceedings of the Cannes Conference are available in March 1981 from D. Reidel Co. P.O. Box 17, 3300 AA Dordrecht, NL.

On the podium at the opening session. From left to right: Dr. Maycock, Director, US Photovoltaic Programme; Dr. Schuster, Director General for Research, Science and Education, CEC Brussels; Dr. Palz, CEC, Brussels; Professor van Overstraeten, University of Leuven.





On the podium at the opening session. From left to right: Dr. Chartier, Director, INRA; Professor Sir Herman Bondi, London; Mr. Moore, Under-Secretary of State for Energy, UK; Dr. Strub, Head of Energy R & D Division, CEC Brussels; Mr. Williams, Director General for Energy, CEC Brussels; Professor Hall, London.

Energy from biomass

CEC Conference at Brighton, UK, November 1980

As part of its expanding interest in fuels from biomass, the Commission of the European Communities in Co-operation with the UK Department of Energy and assisted by an international committee of experts, organised a Conference at the Brighton Centre to discuss all aspects of the biomass technologies and their utilisation. With 550 participants, the Conference brought together experts from many countries to present and discuss the most recent advances in research, development, demonstrations, design, manufacture, field testing and applications.

Papers were presented under four main topics: Resources; Conversion; New Concepts; Implementation. Keynote papers from invited specialists introduced each technical session. Contributed papers were presented in poster sessions where there was full scope for discussion. Rapporteurs finally presented an overview of specific topics discussed in the sessions.

The Conference made clear that biomass has much more than a marginal potential for some European countries, e.g. Denmark or Eire. But, more importantly, the world has to move away from undue dependence on individual sources of energy towards a plurality of sources. The Commission's own programme shows clearly that even biomass technologies whose individual contribution may be small in some countries can provide an aggregate impact on European energy supplies that is strategically significant.

In spite of the promise of biomass it has to be recognised that its successful development faces many problems and difficulties. Paradoxically these difficulties should be least in the short range future. Biological wastes from industrial urban and rural areas are already becoming economic as fuel savers. Furthermore, the problems and rising costs of conventional waste disposal methods will steadily emphasise the importance of alternative approaches. Nevertheless, these short range developments will be limited in the total contribution that biomass can make. Saturation of supplies will gradually set in.

When this saturation occurs, the collection and distribution infrastructure will be more developed than at present. This fact will make it much more attractive in the medium term to grow crops to supplement waste utilisation. The best use of biomass in each area will be determined according to its energy needs and the alternative energy sources that are available.

The conference recognised that biomass holds a special importance for the Third World countries. Indeed, they already make massive use of it, though not necessarily in the optimal way. The exact way these countries will develop the resource for optimum retrieval of energy and soil nutrients, will depend upon the needs both of local society and the ecosystem.

The proceedings of the Conference will be available in April 1981.

Munich Contractors' Meeting

The 25 contractors of EC Project D, Photochemistry & Photobiology, with participating research workers, attended a Contractors' Meeting in December 1980 at the Siemens Foundation, Nymphenburg Castle, Munich. Our host was Professor O. Kandler of the University of Munich who is a member of the Expert Group for Project D. This was the first coordination meeting in the 2nd EC Solar Energy R & D Programme.

Recent reports from photochemists in Europe and Japan have shown that it is possible to split water using visible light in the blue range. With suitable heterogeneous mixtures and complex particles comprising ruthenium compounds, titanium, platinum and dyes as catalysts it has been shown that hydrogen and oxygen can be obtained from water. Until recently this was only possible using photobiological systems, sometimes in combination with artificial catalysts. A number of our contractors are very active in this field.

In the photobiological field much interest now centres on the components of the chlorophyll membrane which splits water in visible light. This work is progressing rapidly with the recent development of new isolation techniques for the metal-protein-pigment complexes involved in the water splitting reaction. This is helped by newer knowledge on the genetic control of the membrane proteins in both algae and plants.

The combined photobiological-photochemical approach to the construction of a more stable solar conversion system is progressing slowly. The immobilisation of both chemical and biological components in semi-solid and solid matrices is one of the newer approaches being followed, in essence mimicks work done with isolated enzymes and whole cells. Attempts are being made for systems to fix carbon dioxide to organic chemicals in addition to systems evolving hydrogen gas.

The Project D meeting in Munich, hosted by the Siemens Foundation.



Commission selects first

The first series of 19 photovoltaic pilot plants, designed to prove that electricity can be generated directly from sunlight even in the more northerly parts of the European Community, has now been selected by the Commission in close collaboration with the Member States.

Negotiations have been successfully concluded in February so that contracts can start in March 1981. The rest of the year will be devoted mostly to design work. All plants will be ready by mid 1983.

Total cost of the projects is put at approximately 30 million ECU of which about one third will be borne by the Commission's budget.

Power ratings will run from small 30 kilowatt plants to one of 300 kilowatts to be built on the German island of Pellworm in the North Sea off the coast of Schleswig-Holstein. This will be the largest flatplate silicon installation in the world.

The photovoltaic cells work not only in direct sunlight but also in diffused light and even in the rain. They are therefore a promising alternative source of energy which could help reduce the Community's dependence on imported oil.

The plants (see details on facing page) will be built by international consortia involving private enterprises, electric utilities, universities, regional and governmental authorities. Each Member State will host at least one project.

There is a wide variety of applications, among them: rural and island electrification, water pumping, water disinfection and desalination on islands, ice-making for an agricultural cold store, power supply to a TV and radio transmitter and to a vacation centre, power management control of an airport, and hydrogen production for a factory manufacturing semi-conductors.

In some cases, the photovoltaic pilot plants will be combined with other energy generators, e.g. a run-of-river hydro-electric generator, wind generators, or even solar thermal collectors heating a swimming pool with the pumps being powered by a photovoltaic generator. In many cases, the photovoltaic generators will feed surplus electricity into the public electricity grid.

One pilot plant will be installed next to Eurelios, the Community's 1 MW solar power plant which is described on page 1 of this Newsletter. This will provide a unique opportunity for making a direct comparison between photovoltaic and thermodynamic solar generators.

1 Corsica (F)

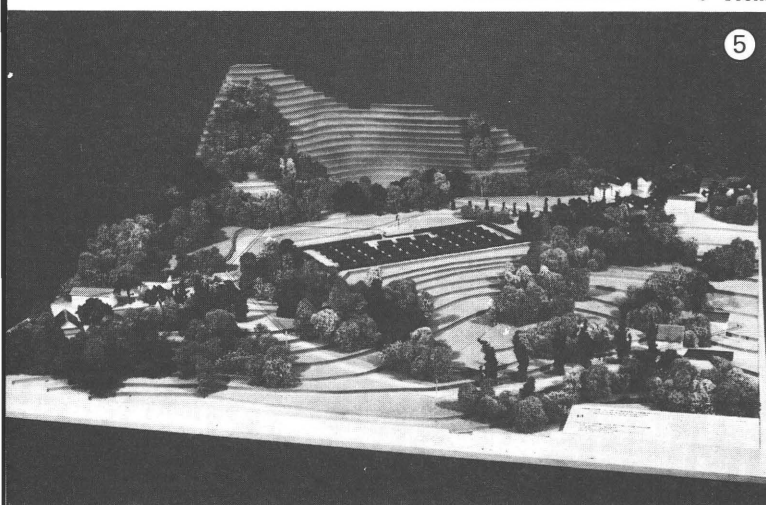
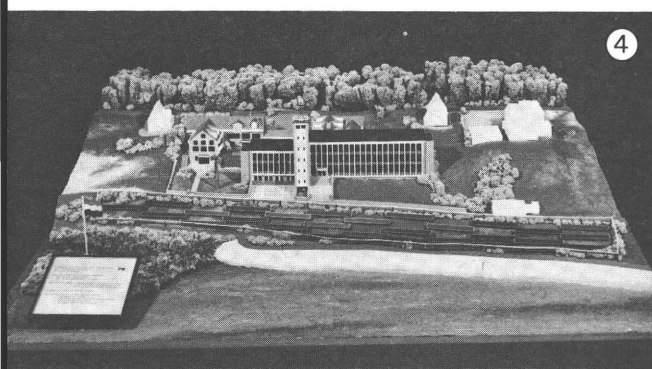
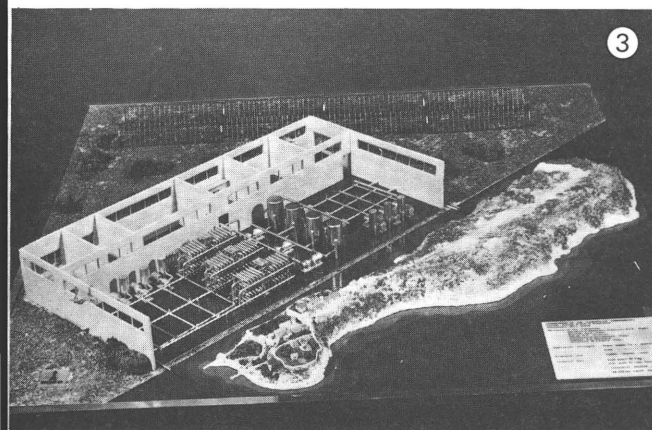
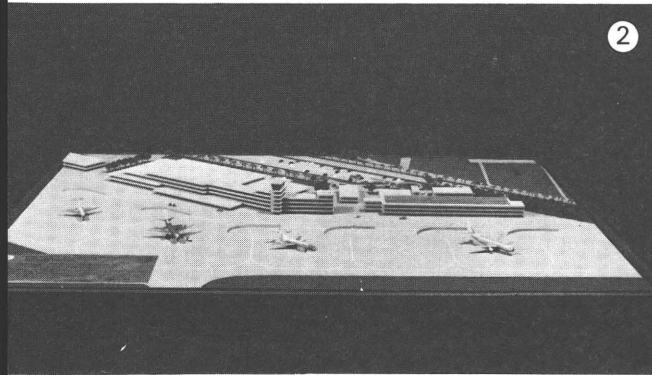
2 Nice Airport (F)

3 Tremiti Island (I)

4 Terschelling Island (NL)

5 Réunion Island (F)

6 Pellworm Island (D)



photovoltaic solar generators

Technical data of photovoltaic pilot projects

Peak power in kW	Site	Application
300	Island of Pellworm (Germany, FR)	Power supply for a vacation centre (Kurhaus)
100	Vester Beogebjerg near Korsoer (Denmark)	Power supply to a village
100	Kythos Island (Greece)	Power supply to a village
80	Alicudi Island (Italy)	Electrification of an island with 120 inhabitants
80	Marchwood near Southampton, later Scottish island (United Kingdom)	Power supply to the grid
70	Verona (Italy)	Fresh water pumping
65	Tremiti Islands (Italy)	Water desalination
60	Réunion Island, Indian Ocean (France)	Power supply to 100 dwellings situated in a former volcanic crater
50	Montpellier (France)	Power supply to FM transmitter of Télédiffusion de France
50	Nice (France)	Nice airport power management and control
50	Fota Island, near Cork (Ireland)	Electricity for a dairy farm
50	Terschelling Island (Netherlands)	Power supply to a marine training school
50	Crete Island (Greece)	Electrification of an isolated village
	Giglio Island (Italy)	Water disinfection, icemaking for agricultural coldstore
44	Rondulinu Cargese, Corsica (France)	Power supply to dwellings, a dairy and a workshop, plus water pumping
40	Chevetogne, Province of Namur (Belgium)	Powering solar heated swimming pool
40	Adrano, next to "Eurelios" plant	Comparison with thermodynamic solar system of Eurelios
30	Olen, Province of Antwerp (Belgium)	Hydrogen production by electrolysis for Hoboken semi-conductor factory
30	Erpeldange (Luxembourg)	Peak power supply to grid in combination with hydrogenerator

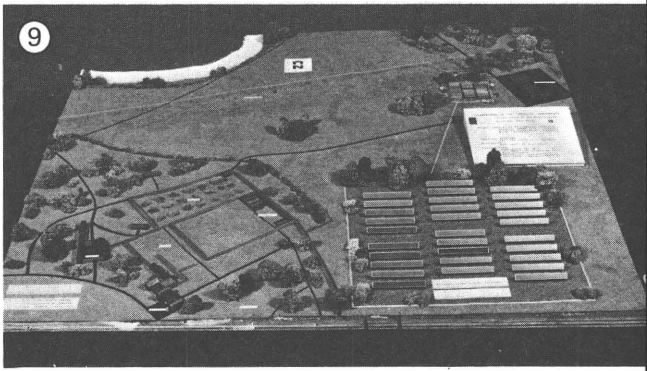
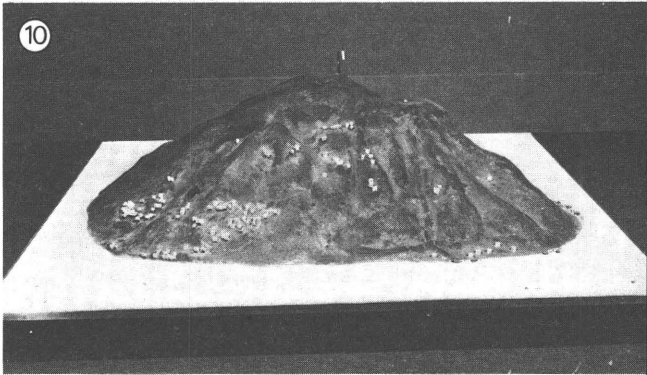
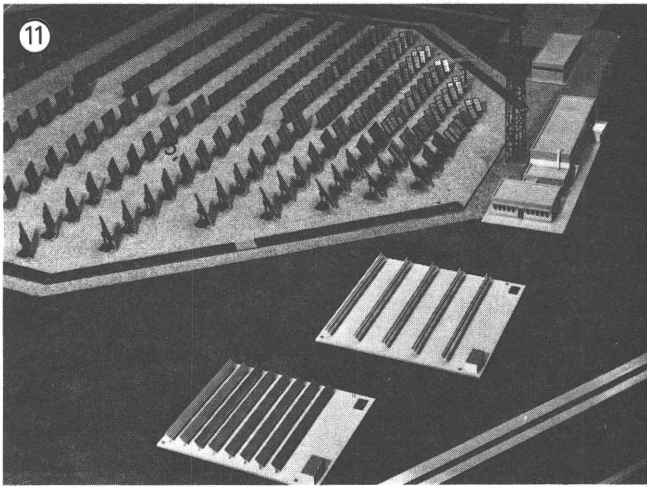
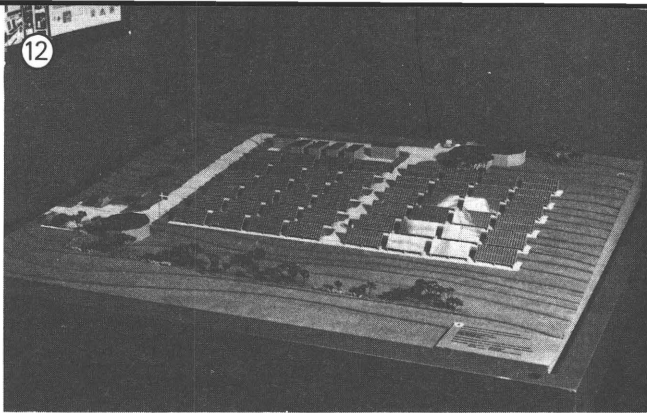
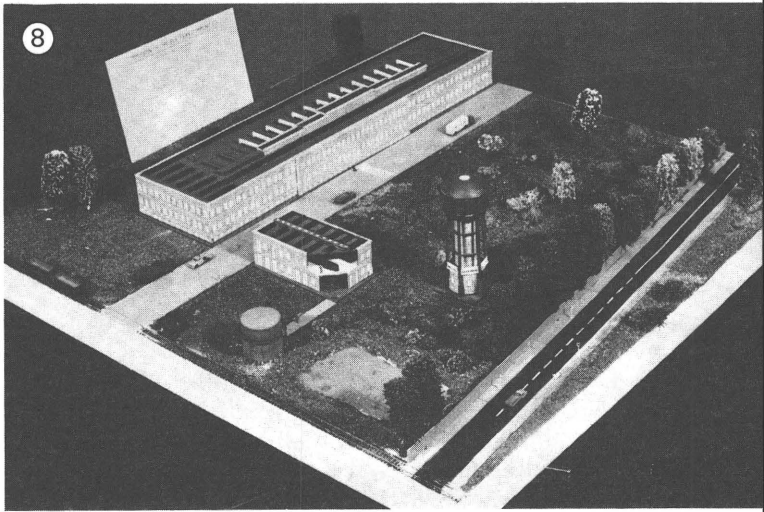
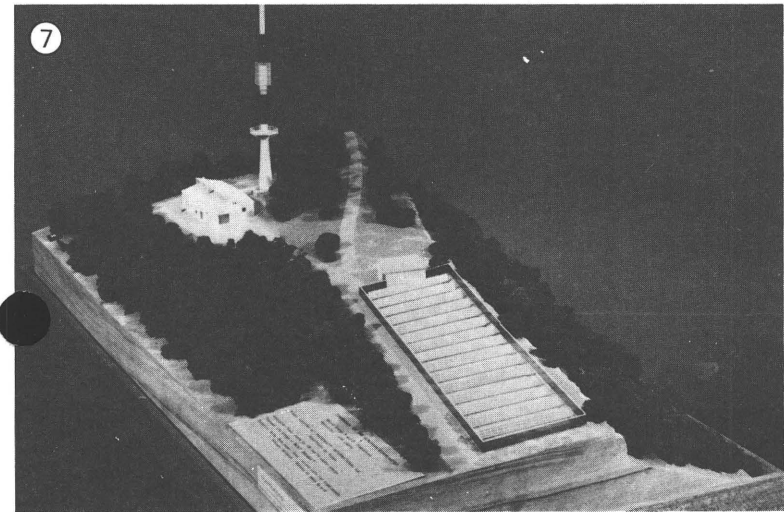
- 7 Montpellier (F)

8 Olen (B)

9 Fota Island (EI)
- 10 Alicudi Island(I)

11 Adrano, Sicily (I)

12 Denmark



Energy from biomass

Call for tenders

The Commission would like to receive proposals from undertakings in the Community interested in concluding shared-cost development contracts for biomass pilot projects. The following outline is given for information only, and the full text published in the Official Journal of the European Communities on 27 January 1981 should be studied before submitting proposals.

Project E, Energy from Biomass Synthetic fuel from wood

Aim. Development of pilot plants for the production of methanol from wood.

Objective. Technical development of a range of innovative systems rather than demonstration.

Goals. Once completed, systems should offer prospects for competitive fuel production costs, be reliable and have a reasonable life-expectancy. Pilot projects should be in-field projects; they should include a full-route from growing to conversion and utilization.

Size of projects. The size should be in the order of 20 tonnes of wood per day or more. Projects below 10 tonnes per day will not be considered. The proposed projects should have a high production potential for later on.

Technology. The production of methanol should involve 2 steps: (1) the production of a gas suitable for synthesis into methanol and (2) the synthesis process.

Industrial set-up. It is recommended that projects be submitted by industrial consortia composed of companies and/or institutions from different member states.

Financial set-up. The Commission's contribution will not be higher than 50% of the overall cost of a pilot project (maximum 600,000 ECU per project).

Completion time. All projects should be completed within 2 years. This does not include an experimental phase.

Other subjects. Proposals may also be considered on biomass pilot projects other than methanol plants. Production and use of algae is a possible area of consideration.

Proposals forms are available from the Commission of the European Communities, Directorate-General XII, Energy R & D Programme (Solar Energy), Rue de la Loi, B-1040 Brussels. Applicants should submit a first draft of their proposal to the above address not later than 1 May 1981.

Vatican meeting on "Mankind and Energy"

EEC project leaders for Project C, Photovoltaics (Prof. van Overstraeten, Belgium) and Project D, Photochemistry and Photobiology (Prof. Hall, UK) were amongst the 25 invited participants of a Study Week entitled "Mankind and Energy — Needs, Resources and Hopes" organised by the Pontifical Academy of Sciences at the Vatican in November 1980. Leaders in the energy fields from Latin America, USA, Africa and Europe studied the scientific, technical, social, political and ethical problems associated with the energy issues facing mankind. The participants were honoured by an audience with Pope John Paul II who in his short address recognized the importance of solar energy: "...it seems obvious that the sun, our chief and richest source of energy, should figure largely in the search for new energy resources. This should become one of the main objects of research."

There was general agreement at the meeting that energy policies are urgently needed, involving concerted action by the responsible bodies. Moreover, a joint effort by the industrialized countries and oil exporting countries is required to provide means to help the poorest countries to develop their own energy resources.

The participants considered that only coal and nuclear power — together with a strong energy conservation policy and continued gas and oil exploitation and exploration — can allow us to effectively meet the additional needs of the next two decades.

A strong research effort should be made to develop renewable energy sources which, among other things, can encourage decentralisation of human settlements. Solar energy has demonstrated good potential, especially for non-centralized energy supply.

Wood fuel is used by half the world's population for cooking and heating. This biomass resource is threatened by deforestation and soil erosion. It is recommended that increased attention be paid to tropical forest management, and to use of modern agricultural techniques for energy farming.

Since carbon dioxide effects on climate are not completely understood, researches should be pursued.

As regards the possible links between nuclear energy and the proliferation of nuclear weapons, it was recognized that, with adequate precautions, there is no reason to bar the development of nuclear energy for civil uses.

Research and development can make it possible to satisfy the longterm energy needs of mankind using the vast reserves of coal, non-conventional oil and gas, uranium in breeders, and renewable energies. However, some participants stressed that the rapid growth of the world population makes more difficult the long-term solution of many problems, including energy.

It is necessary for the industrialized countries to evolve new, less energy-consuming ways of life, which will promote new patterns of development. The developing countries should also evolve courses of action, with the co-operation of the industrialized countries, to promote technology transfer, education and training.

The Pope greeting Professor Hall, EEC Project leader for Photochemistry and Photobiology.



Passive solar architecture competition

The First European Passive Solar Competition, funded by the CEC, was aimed at spreading the principles of passive solar design to the architectural and engineering professions in Europe. It was supported by the Union Internationale des Architectes, Paris, and organised by Ralph Lebens Associates in London. This was the first of a series of such competitions planned by the Commission.

Three categories were defined: A, multi-storey housing; B, clustered housing; C, single houses. Either new or rehabilitated work was eligible.

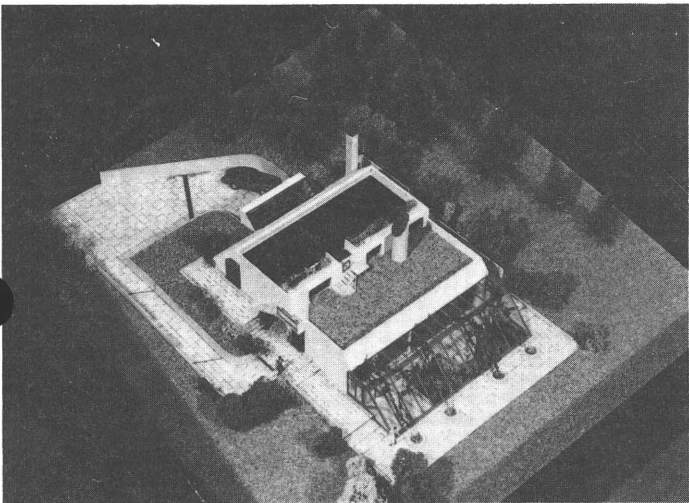
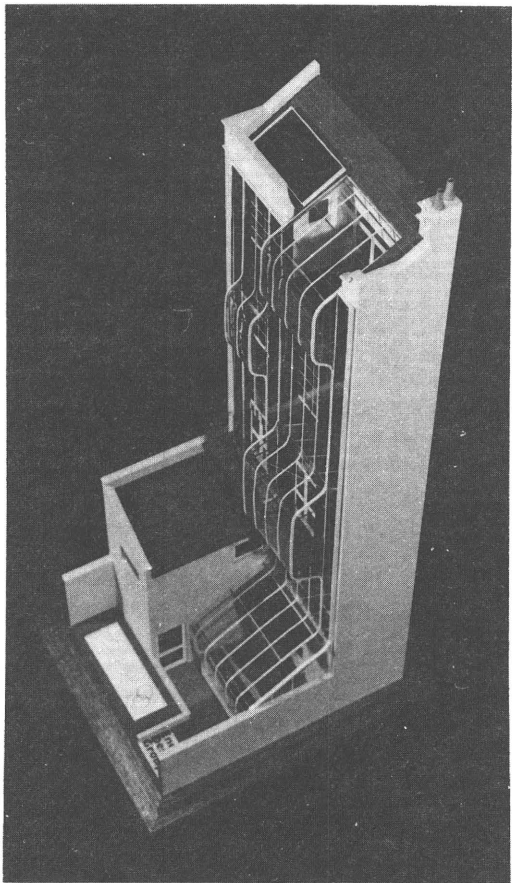
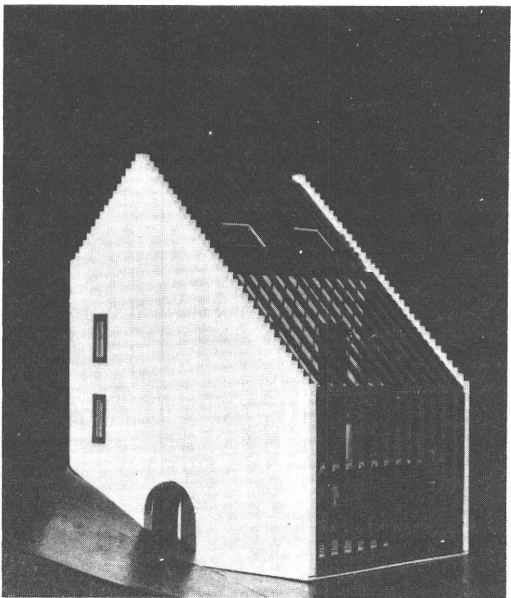
The standard of entries was very good at both technical and creative levels. Of the 223 entries there were 50 or more which would make eminently workable and attractive solutions to individual and grouped housing and of these about twelve schemes demonstrated that the passive solar design approach is developing an "architecture" all of its own.

The judges agreed that the best entries were in the individual house category. The first prize went to M. Gilles Perraudin from France who, besides designing an original and beautifully worked out house design, make a presentation which eloquently explained all the basic principles of passive solar design. The second prize went to Mr. Reinhold Raack from Germany for a sensitive and carefully thought preservation and retrofit of a traditional timber framed and thatched house. Other winners include a shuttered house from England, a hillside house from Italy and a formal vernacular revival of a fortified house from Scotland. Commendations were given to five other entries including a very carefully detailed house from Belgium.

The grouped housing entries were of a high standard. The winning entry was by Mr. Boje Lundgaard, Mr Georg Rotne and Mr Peter Sorensen from Denmark with a single storey courtyard house which can link and cluster together with its neighbours. Second prize went jointly to another courtyard house by Mr. Cedric Green from England and a cleverly planned terraced house by Mr. James Barrett from Ireland. Third prize was awarded to a rehabilitated stone village in France and commendations to five other entries including railway embankment housing in England, and a very stylised conservatory fronted terraced housing scheme from Italy.

The entries in the multi-storey section were of a lower standard. For this reason no first prize was awarded and second prize went to a retrofit solar skin applied to the rear of a stone terraced building in Bath, England.

The photos on this page show a few examples of price winning projects.



Reports issued by the CEC

Solar energy programme of the Commission of the European Communities

Abstracts of final reports of projects funded during the first phase 1976-77 in the fields of solar energy applications for dwellings, 1 MW(el) solar power plant of the EEC, photovoltaic power generation and energy from biomass. A special report prepared by the CEC Directorate-General for Research, Science and Education. Issued in 1980, available free of charge. Re. EUR 6959 EN.

The evaluation of the Communities' energy conservation and solar energy R & D subprogrammes.

U. Farinelli (CNEN-Rome), Gelus (Université de Compiègne), Muus (Aarhus University), Rorsch (TNO), Stöcker (Jülich Research Centre). Issued in 1980. Ref. EUR 6902 DA, DE, EN, FR, IT, NL.

Sonnenkonzentrationsysteme für photoelektrische Energiewandlung

H. Kleinwäcter, Entwicklungs- und Forschungslabor — Lörrach-Haagen. Contract No. 104-76 ESD. Issued in 1980. Ref. EUR 6953 DE.

GaAs-(GaAl) As solar cells to be used under concentrated solar light conditions.

Centro Informazione Studi ed Esperienze (CISE), Milan. Contract No. 194-76 ESI. Final Report. Issued in 1980. Ref. EUR 6934 EN.

Eurelios: The 1 MW experimental solar thermal electric power plant of the European Economic Community.

Summary of the final report on Phase B, 15 November 1977 to 15 November 1978. Issued in 1980. Ref. EUR 6747 EN.

Entwicklung einer Kadmiumselenid-Dünnschichtsolarzelle

Battelle-Institut e.V., Frankfurt Contract No. 189-77 ESD. Issued in 1980. Ref. EUR 6954 DE.

Study of the morphology, fabrication and methods of increasing the efficiency of gallium arsenide Schottky-Barrier solar cells

University College, Cork, Ireland. Contract No. 163-76 ESI. Final report. Issued in 1980. Ref. EUR 6933 EN.

Étude et réalisation d'un capteur solaire plan sous vide à hautes performances.

Bertin et Cie, Plaisir. Contract No. 529-78-7 ESF. Final report. Issued in 1980. Ref. EUR 6956 FR.

Energiegewinnung aus Stroh

Bayerische Landesanstalt für Landtechnik, München. Contract No. 052-76 ESD. Issued in 1980. Ref. EUR 6955 DE.

The utilization of straw for heating and other purposes.

Institute of Agricultural Engineering, Copenhagen, Denmark. Contract No. 051-76 ESDK. Final report. Issued in 1980. Ref. EUR 6935 EN.

These reports may be ordered from:
Office for Official Publications of the
European Communities, BP1003, Luxembourg.

New books

Solar houses in Europe: how they have worked

Edited by W. Palz and T.C. Steemers, CEC.

Presents for the first time a comprehensive analysis of European solar houses. Includes monitored data from over 30 solar houses in various EEC countries and climates: and this information serves to highlight some of the problems encountered and benefits to be gained from solar heating. The study concludes that with efficient insulation and improved control of ventilation and heating equipment, over two-thirds of a year's fuel requirements for a family dwelling may be replaced by solar energy. This concise guide will provide a better understanding of the domestic applications of solar energy, and in particular a more realistic assessment of its considerable benefits.

Published by Pergamon Press.

150 illus.
026743 2 (H)
026744 0 (F)

320pp
£17.00 \$40.00 US\$46.00
£ 8.50 \$20.00 US\$23.00

Non-Technical Obstacles to the Use of Solar Energy

Edited by A. Strub and T.C. Steemers, CEC.

Proceedings of the International Symposium held in Brussels, 20-22 May 1980, convened jointly by the CEC and the US Department of Energy. A key question for policy makers throughout the industrialized world is how to accelerate the introduction of non-conventional source of energy, particularly solar energy. This publication identifies non-technical obstacles to the wider use and exploitation of solar energy in industrialized countries; identifies and evaluates measures to minimize or overcome the impacts of the identified obstacles; and finally makes recommendations.

Published in 1980 by Harwood Academic Publishers (Chur, London, New York)

465 pages 95 Dfl/\$50.00 ISBN 3-7186-0050-1

Energie from Biomass in Europe

Edited by W. Palz and P. Chartier, CEC

This study arises from requirement by the CEC Solar Energy Programme, Project E, Energy from Biomass, to assess the prospects for the use of biomass as a source of energy in the countries of the community.

The study examines prospects for biomass for direct supply of energy and conversion to other fuels. It reviews energy-from-biomass methods and programmes of research in these, concluding with recommendations regarding future research strategies.

The study deals with all sources of grown biomass, including natural vegetation, agricultural and forest waste and surpluses, and specially grown energy crops of all types. Some urban and industrial wastes are considered as potential sources of nutrient for biomass production schemes.

Published by Applied Science Publishers Ltd, Ripple Road, Barking, Essex IG11 0SA, England.

OIP 662 6 TP 360
£16.50 plus £1.00 post/packing

ISBN 85334 934

This newsletter was prepared by W. Palz and L. Crossby.