SolarPACES NEWS

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update on solar power and chemical energy systems

Concentrating solar power (CSP) is arguably the renewable energy technology with the biggest potential to contribute to the world's future energy demand. So why has CSP not taken up its position as the leading application of renewable energy technologies ? The answer is cost, specifically high up-front capital costs.

The first commercial CSP plant started operation in 1985, but no CSP plants have been constructed since 1991. As such CSP can consider itself as a new market entrant in the electricity supply sector. The market is concentrated, stable and highly competitive. According to management guru, Michael Porter, three generic strategies can be applied to achieving market success: that of cost leadership, differentiation and scope - these are very much applicable to assessing CSP.

The difficulty lies with the fact that product differentiation is not easily achieved. Inherent product attributes are price and reliability. However, climate change sensitivities have introduced another attribute: environmental impact. The question is, however, whether this characteristic provides sufficient differentiation to account for the additional cost. This is unfortunately not the case. How then should the industry direct its efforts towards succeeding in this competitive market ?

Current efforts are focussed not on the strategies mentioned above, but on getting the next plant built - to show the world that CSP is alive. These efforts are driven by the ability to obtain grant funding, favourable financing packages or subsidies. These enabling mechanisms and their results should not be cast aside without further thought. Implementing the next project could contribute to revitalising the industry and if properly co-ordinated, some incremental learning. The impact on long-term costs is, however, doubtful.

If the CSP industry is considered it is clear that suppliers wield significant power. There are few competitors and the technical expertise resides with a select few. Further, the geographic scope still resides with the areas of initial research and development. This needs to change in order for CSP to move forward. In order for economy of scale advantages to be realised, manufacturing processes should become simplified and the level of technology required reduced, allowing for manufacturing in areas where advantages linked to low cost of labour and materials could impact on the capital expenditure.

In conclusion, innovation and research should be focussed on simplifying components and reducing costs. A geographically diverse strategy regarding manufacturing and sourcing of components will be the key in driving CSP costs down.

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Germany's new CSP program

Thanks to new funding friom the German research program, the capacity of the Eurotrough (above) will be demonstrated at the Kramer Junction Power Station in California

In the drive to make concentrating solar power (CSP) a reality around the world Germany has played a significant part in the past two decades. The German government continues to invest, with 10.5 million Euros allocated to CSP research and development for the period 2002-2003. Dr. Manfred Becker, Adviser to KfW which manages the new programme (see below), emphasizes the European perspective: *"Both sponsors and participants see the development of CSP as a significant objective for Europe as a whole, rather than as a local or national problem"* he remarks.

After the withdrawal of the German Ministry of Economy from further CSP research and development, in 1999, the programme is warmly welcomed by the CSP research and business communities in Germany. The new funding brings administrative changes, reflecting CSP's place in the market. CSP is now the responsibility of the Federal Environment Ministry (BMU). Meanwhile the Kreditanstalt für Wiederaufbau (KfW), known for its engagement in financing power station projects worldwide and renewable energy projects in developing countries, has been contracted to perform technical and administrative support.

Germany, of course, is not exactly in the sun belt - so is not itself a candidate for a power station using CSP technology. However the existing potential of

R&D leading to efficiency improvement in the volumetric receiver (above) will be supported.

The EURODISH will be applied in various regional conditons. Front and back views, above, are at the PSA in Spain.

German industry and research will be maintained and furthermore promoted.

The new programme has a number of objectives covering the major CSP technologies. For parabolic trough systems, the focus is on making them competitive in future markets. The development of central receiver options is a further objective. Finally, for dish/Stirling units, the focus is on applications for remote and island situations. A number of grants have already been negotiated and contracted*. These include:

- Further development of the parabolic Eurotrough system and demonstration of its capacity by including a 800 m loop into the power station operation at Kramer Junction, California.
- Support for the advancement of the volumetric receiver system (tower) at higher temperatures with the promise of higher efficiencies and operation on gas turbines.
- Applications of the dish/Stirling technology at remote and net-independent electricity generation
- Studies on accelerating project realizaton

Going beyond 2003, a continuation of the program is planned for a three year phase up to 2006.

For further information contact Dr. Manfred Becker: e-mail: dr-manfred.becker@arcor.de

* The main industrial partners are: Bomin Solar Research, Lörrach; E.ON Energie, München; Flabeg Solar International, Köln; KAM, München; Solar Millennium, Erlangen; Schott Rohrglas, Mitterteich; Schlaich, Bergermann and Partner, Stuttgart; Siempelkamp, Krefeld Research is represented by: DLR in Almeria, Köln and Stuttgart; Wuppertal Institut, Wuppertal; Fraunhofergesellschaft, ISE, Freiburg

INDUSTRY *focus*

the ConSolar Consortium

The commercialization of concentrating solar power technology depends on a multi-disciplinary approach and an appreciation of the complexities of both the technology and its markets. Recognition of this in Israel in the mid-1990s led to the formation of the consortium known as ConSolar Ltd. Since 1996 ConSolar has linked seven Israeli organisations in a focus on the industrial development of concentrating solar power technologies. Four industries and three research bodies participate, and the consortium manages four programs covering:

- the Beam Down Reflective Tower - a 500 kW pilot facility being tested at the Weizmann Institute's Solar Tower (see last issue of SolarpACES News).
- under 100 kWe solar facilities aimed at off-grid applications, using concentrator photovoltaic technology -
- small Solar Tower and Dish Concentrator options, plus a solar driven Gas Turbine generator with a power capability up to 75kWe intended for off-grid applications
- a solar-pumped laser technological development for communications, energy transmission and industrial photochemical applications.

The industrial partners are the Israeli Aircraft Industries (MLM Division Electronics Group), Ormat Industries Ltd., Rotem Industries Ltd. and EDIG. Research partners include RAMOT of TelAviv University, YEDA Research and Development Ltd. at The Weizmann Institute of Science (working with the Institute's Solar Research Facility) and B.G. Negev Technologies, a subsidiary of Ben-Gurion University of the Negev. Each partner brings special expertise to one or more of the programs.

ConSolar Ltd.'s programs represent a development of research activities initiated at the Weizmann Institute of Science and supported by the Ministry of Energy & Infrastructure (now part of the Ministry of National Infrastructures). In its early days, ConSolar was supported by the special MAGNET Program of the Chief Scientist Office at the Ministry of Industry and Trade. This ended in 2000, but ConSolar partners continue their commercialization activities.

For further information contact contact Michael Epstein - jhlang@wis.weizmann.ac.il
or visit http://magnet.consortia.org.il/ConSolar

US troughs: from "has-beens" to "rising stars"

A strong focus on the needs of the market lies behind renewed interest in parabolic trough technology in the United States. For many years the US Department of Energy (DOE) considered that trough technology had become commercially viable but showed little potential for cost reduction. Consequently priority was given to power towers and dish/engine systems which were thought to offer greater opportunity for improved performance and lower cost. But when the technologies were re-appraised from a market perspective in the late 1990s, the benefits of trough technology became apparent.

Firstly it was recognised that in the rapidly changing world-wide power industry a key feature in investment decisions is *risk*. The low-to-moderate risk offered by commercially available troughs means that they are likely to be the only CSP technology available in the near-term for the competitive power market.

Secondly, studies carried out in the US and internationally identified significant cost reduction opportunities for current and future parabolic plants.

As a result of this re-evaluation, the USA Trough Initiative was launched, and the first R&D contracts were awarded in 1999. These included:

- optimization of ISCS plant configurations and assessment of thermal storage technologies by *Bechtel/Nexant* and *Flabeg Solar International*
- analysis of 10 MWe trough ORC power plant concept by *Reflective Energies*
- analysis of several advanced trough concentrator design concepts by *Duke Solar*
- analysis of the SEECOT trough combined cycle inte gration concept by *IST*
- assessment of failure mechanisms of trough mirrors and receiver tubes by *MWE & Associates*

Six further USA Trough Contracts awarded during 2000 included:

- follow-on efforts by *Duke Sola*r on the development of a new trough concentrator structure, receiver with secondary re-flector and trough/ORC plant design
- follow-on effort by *Reflective Energies* to develop an optimized engineering design of a 5-10 MWe trough ORC plant
- evaluation by *Kearney & Associates* of the use of molten-salt as the heat transfer fluid in a trough collector field
- modification by *IST* of their trough concentrator to reduce cost and improve the high temperature performance
- development by *Augustyn & Associates* of an improved low-cost DNI measurement system
- development by *SUNI Albany* of their high resolution satellite DNI mapping technique for the Southwestern U.S.

The US Trough Initiative is intended to expand US industry involvement and competitiveness in worldwide trough development activities and to help advance the state of parabolic trough technologies from a US knowledge base. Meanwhile the initiative plays a further international role as part of the collaborative activities managed within the IEA SolarPACES program (see box above).

For further information on the US Trough Initiative contact: henry_price@nrel.gov
or see http://www.eren.doe.gov/troughnet/

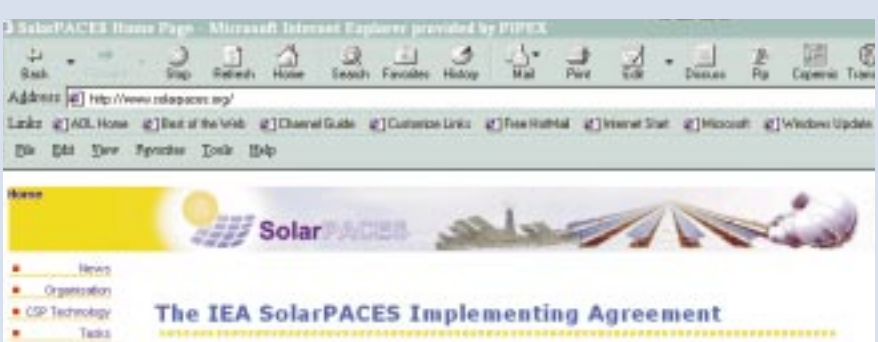
Task I.1 Central Generation Systems

Above: The new Solel UVAC trough receiver tubes under test at SEGS VI in California by KJC Oerating Co. and NREL.

The "USATrough" project is one of nine Central Generation Systems Projects within Task I of the IEA SolarPACES Program. Further projects involving troughs and other CSP technologies are underway in Australia, Europe and Israel.
For information on these projects contact: manuel.romero@ciemat.es
For further information on SolarPACES Tasks, see www.solarpaces.org

www.solarpaces.org

For the latest information on concentrating solar power projects around the world, check out the IEA SolarPACES website. The newly re-launched site also includes detailed information on CSP technologies and on SolarPACES Task activities. Annual Reports and Technology documents are available to be downloaded.



Bulletin *board*

US Congress looks at CSP potential
The US Congress have requested a report on the potential of CSP, reports US ExCo member Craig Tyner. The specific request is to present the options for putting 1000 MW on line by 2006. A draft has been completed and is currently under review at DOE. Meanwhile, in early 2001 the US CSP program finally got a formal budget for the fiscal year that started last October, down slightly from last year.

Proposal for solar hybrid plant in Jordan
The German solar thermal developer Solar Millennium AG has submitted a proposal to the government of Jordan to build a solar hybrid plant in the Quwairah area in the southern of the country. The $200 million project is scheduled to generate between 100-150 megawatts of electricity and will be implemented on a Build, Own and Operate (BOO) basis. Solar energy sources will be assisted by gas or heavy fuel to generate electricity at the plant.

Mexican power plant may include solar
Plans for a new power plant in Mexico have attracted interest from industries active in CSP. The "Request for Proposal" for the Mexicali II Power Plant includes the option of including a solar field in a bid to construct the plant. Availability of World Bank funding for the solar field is highlighted to bidders.

AndaSol Project includes 9h Storage
Milenio Solar S.A. and Solucar S.A. (Abengoa-group) are promoting the 50MW AndaSol project in Southern Spain. The project will utilize for the first time the EuroTrough technology in commercial scale and integrate a 9 hour thermal storage system, based on molten salts.

Solar Tres on its way
The experience gained from designing Solar Two, the advanced molten salt Solar Power Tower tested in the US from 1996 until 1999, is to be applied to the design of a new Solar Power Tower near .Seville, Spain. Thanks to the cooperation of US and Spanish experts, the 15 MWe "Solar Tres" will be a commercial plant with design features which reflect lessons learnt from its predecessor. Thermal storage will raise the annual plant capacity factor from 20-22% for Solar Two to over 60% for Solar Tres. Meanwhile further design modifications will result in efficiency improvements, as well as in the reduction of capital and operating costs. The new plant will also have improved system reliability, while technical risks will be lowered by addressing technical problems which surfaced during Solar Two operations.
For further information contact José Benavente jbenavente@ghersa.com

PS10 planned for Seville
Spanish company Abengoa is the promoter of "Planta Solar 10" (PS10) to be located in Sanlúcar la Mayor, just 15 km from Seville in Southern Spain. The plant, to be developed by the newly registered IPP (independent power producer) "Sanlúcar Solar", will be the first commercial 10 MW solar Central Receiver System plant to be constructed using volumetric air technology. The plant will use 981 heliostats developed by Spanish firm INABENSA, a 90 m high tower, a 33 MWh_{th} heat storage system and an integrated volumetirc air receiver design of 173 m^2 developed by the German company Steinmüller. PS10 should validate a first solar tower plant installed with a cost below $2800/kW.
For further information contact: rosuna@inabensa.abengoa.com

Changes in the ExCo
Dr.Craig Tyner from Sandia National Laboratory has been elected as the new SolarPACES Chairman. The ExCo thanks former Chairman Gary Burch for his long and dedicated engagement for the SolarPACES implementing Agreement. Meanwhile Dr. Manuel Romero, the new Director of the Plataforma Solar de Almeria was elected as the new Task I Operating Agent. By this election the Spanish research agency CIEMAT takes over the institutional responsibility for Task I.

SolarPACES Symposium 2002
The biennial SolarPACES Symposium will take place in Zurich, Switzerland from 4-5 September 2002. This international conference provides the largest and most comprehensive forum for the latest technological advances in the field of solar thermal electricity production as well as on solar chemical conversion.
For further information contact Aldo Steinfeld at solarpaces2002@psi.ch or visit www.solarpaces2002.ch

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Australia, Brazil, Egypt, European Commission, France, Germany, Israel, Mexico, Russia, South Africa, Spain, Switzerland, United Kingdom, United States.
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