

Conference Executive Summary

"Expanding the Market for Concentrating Solar Power (CSP) - Moving Opportunities into Projects"

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Introduction

An International Executive Conference on "Expanding the Market for Concentrating Solar Power (CSP) - Moving Opportunities into Projects" was held in Berlin, Germany, on 19-20 June 2002. The Conference was sponsored by the Kreditanstalt für Wiederaufbau (KfW), the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the UNEP-GEF Technology Transfer Networks and was organised by Energetic Consulting. The participants included more than 60 senior executives from 16 countries representing governments, the financial community, donor organizations, the CSP industry, independent power project developers and potential CSP plant owners. The objective of this conference was to identify urgent actions needed to overcome barriers to the current project opportunities and through this to turn CSP opportunities into projects.

Therefore, the participants of the Conference declared their commitment to collaborate in the formation of a structured approach to develop and expand the global CSP market. The participants agreed to form three working groups. These groups will contribute to the formulation of an integrated long-term-market introduction strategy. First concrete solutions will be provided at the follow-up conference in California at the beginning of 2003.

The CSP Conference was opened by **Wolfgang Kroh**, Member of the Board of KfW, **Simone Probst**, the Parliamentary State Secretary of BMU and by **Per Bakken**, Director of Cross-Cutting Programmes at the United Nations Environment Programme's Division of Technology, Industry and Economics. They highlighted the important role CSP can play in global climate protection and sustainable energy supply and appealed to all participants to use this platform to exchange experience and to consider a long-term-market introduction strategy.

Key Presentations

Georg Brakmann, Managing Director of Fichtner Solar GmbH and President of the European Solar Thermal Power Generation Industry Association (ESTIA) and **David Kearney**, President of Kearney & Associates gave an overview of status and prospects of CSP technologies. The parabolic trough and the solar tower technology can be applied for grid connected power plants of 30 MW_{el} to 200 MW_{el} unit size. The dish/stirling technology is suitable for smaller grid independent application of 10 kW_{el} to 1 MW_{el}. The generation cost of solar thermal power plants is much less than the one of photovoltaic installations. The development of parabolic trough collectors continues and aims towards improved performance at lower cost. The European concept (Eurotrough) reaches this goal by reducing weight and increasing the stiffness of the structure and by improving the values of reflectivity, absorptivity and emissivity.

In a solar rankine cycle power plant (SEGS type) the annual solar share is typically above 70 % up to 100 %, whereas in an integrated solar combined cycle (ISCC) power plant the annual solar share is typically around 10 %. The specific investment cost of solar thermal power plants decrease with size and volume of implemented plants. The CSP industry anticipates reducing solar power generation costs by 20%, once 400 MW_{el} of new solar capacity have been implemented. Upon reaching 5000 MW_{el} of new solar capacity, solar electricity generation cost will be fully competitive with fossil-based bulk power generation costs.

Rainer Aringhoff, General Manager of Solar Millennium and Secretary General of ESTIA and **William Gould**, Program Manager of Nexant, Inc. reported on challenges and expectations facing CSP. Innovative financing is definitely the key to successful CSP market introduction. In California in the late 1980s there was such a framework with favourable regulation, tax credits and attractive time-of-use tariffs (up to 36 US cent/kWh for summer on-peak). Thus, 9 plants with a total capacity of 354 MW_{el} were built in the Mojave Desert in only 7 years. After the deterioration of the favourable Californian framework conditions in the early 1990s, and the decrease in conventional energy costs, the utility companies no longer had any interest in the now less competitive CSP. The CSP industry and developers, who survived 10 years without new projects, have further developed their knowledge base. As most are small companies, the warranties and guarantees for components and services exceeds their financial strength. Consequently the CSP industry is teaming-up to be able to develop the next power plants.

Although various governments believe that CSP could play an important role in a sustainable energy scenario, regulations for CSP tend to be inconsistent, national legislation is lacking and unfavourable technical solutions are often enforced. The GEF-supported projects are delayed for the same reasons. New market-oriented financing instruments like the Clean Development Mechanism (CDM) might be able to reward the environmental benefits of CSP. The industry is looking for long-term power purchase agreements with decreasing prices in relation to the installed solar capacity (e.g. 13 US cent/kWh for the initial 200 MW_{el}, 10 cents for the next 200 MW_{el}, decreasing to 6 cents when the installed capacity reaches 5.000 MW_{el}).

Panel No. 1

Status of Major Project Opportunities

In the first panel **Dr. Michael Geyer**, of Flabeg Solar International GmbH and Executive Secretary of IEA SolarPACES, presented the status of major project opportunities world-wide. He was accompanied by representatives from nine countries informing about the status of CSP in their respective countries.

Beginning with Iran, **Mohammad Ali Tahani**, Deputy Managing Director of IPDC gave an over-view of the planned Yazd CSP plant in Iran. **Ziad Jibril Sabra**, Manager of the Non-Conventional Power Generation Section of the Jordanian Ministry of Energy and Mineral Resources followed describing the plans for the Al Quweyra CSP Plant in Jordan. **Abdeselam Boudlal**, Directeur Technique et Ingénierie at the Moroccan Office National d'Electricité (ONE) informed about the Ain Beni Mathar ISCCS project in Morocco. **Rafael Osuna González-Aguilar**, President of Solucar S.A. reported about the Spanish activities in the field of CSP. **Shyam S. Agarwal**, Managing Director of the

Rajasthan State Power Corporation Ltd. briefed the conference about the status of the ISCCS Mathania plant in India. **Eli Ronen**, Senior Deputy Director General of the Israeli Ministry of National Infrastructures and **Avi Brenmiller**, President of Solel Solar Systems followed with an over-view of the Israeli activities on CSP. In a noteworthy announcement Eli Ronen declared, that the Israeli government is ready to share with the neighbouring countries all the know-how and knowledge that Israel achieved for the last 30 years, in the area of CSP. **Roberto Cadenas Tovar**, Manager of the Renewable Energy Unit of the Mexican Comision Federal de Electricidad (CFE) informed about the bidding process for a CSP plant in Mexico. **Ehud Matya**, Executive Director of the Generation Group of ESKOM in South Africa described the CSP activities in South Africa. Finally, **David Slawson**, CEO of Stirling Energy Systems (SES) reported the on-going and future CSP activities in the USA.

The Panel 1 countries represented 2.7 GW, 10 Million square meter existing or future CSP fields. 380 MW ISCCS and 240 MW Solar Only are in the pipeline, namely in India, Mexico, Spain and Israel. Further GEF grants are committed for 200-300 MW ISCCS CSP in Morocco. Excellent conditions and dedication for further CSP plants can be found in Iran, Jordan and South Africa.

The following table gives an overview on the current situation.

Country	Project Characteristics	Investment, Grants	Schedule	Barriers (B), Assets (A)
Egypt	140 MW ISCCS 25 MW solar 2.400 kWh/m ² a	90 MUS\$ for CC 50 MUS\$ solar	1996 START mission 2000 investor conference	B: GEF unclear, RfP delayed A: CSP is in national energy programme
Iran	430 MW ISCCS 67 MW solar 2.500 kWh/m ² a	237 MUSD for CC 85 MUS\$ solar	1993 first expert mission 2000 feasibility study	B: Financing Restrictions A: 67 MW CSP for 50 MUS\$
Jordan	135 MW SEGS 135 MW solar 2.600 kWh/m ² a	90 MUS\$ for SC 140 MUS\$ solar	1997 START mission 2001 RfP 2002 offer submittal	B: developer must cover incremental cost A: RfP out, open for IPP
Morocco	200 MW ISCCS 30-40 MW solar 2.300 kWh/m ² a	50 MUS\$ GEF grant	1994 EU Study 2000 GEF grant 2002 RfP consultant	B: liberalization going on, no PPA A: 50 MUS\$ GEF grant
Spain	10 MW PS10 15 MW Solar Tres 15 MW EuroSEGS 50 MW AndaSol 25 kW Dish-Stirling 1.600-2.200 kWh/m ² a	2.500-4.000 €/kW 15 M€ EU grants	1979 SSPS project 1981 CESA-1 2002 construction start 10 MW PS10 (July: civil work, Sep.: main components)	A: new RD2818: premium of around 12,02 € cent/kWh A: 15 M€ EU grants
India	140 MW ISCCS 25 MW solar 2.250 kWh/m ² a	200 MUS\$ 49 MUS\$ GEF grant	1986 first study 1999 GEF grant 2000 RfP Consultant 2002 RfP	B: Further cost reduction A: RfP out, EPC financing
Israel	100 MW SEGS 100 MW solar	200 MUS\$	2002 Ministry decision	B: Further cost reduction A: needs summer peakers
Mexico	200-240 MW CC 25 MW solar optional 2.600 kWh/m ² a	49 MUS\$ GEF grant	1997 feasibility study 2000 GEF grant 2002 RfP	B: solar field optional A: RfP out, 49 MUS\$ GEF grant
South Africa	100 MW CSP 2.900 kWh/m ² a		2002 feasibility study	B: further cost reduction A: best radiation in world
United States	80-100 MW SEGS projects 1-42 MW Dish-Stirling projects		2002 1.000MW study	B: low bulk power cost A: 354 MW operating

Panel No. 2

Policies to Level the Playing Field

Marwan Masri, Renewable Energy Program Manager of the California Energy Commission gave an over-view of the California Renewable Energy Program. The program began operation in January 1998 and was planned for four years. In September 2000 legislation passed to extend program funding for another 10 years. On-site generation (photovoltaics, CSP) is subsidised up to 4.50 US \$/W or 50 % of capital cost. Central CSP stations qualify for an incentive depending on whether they are an existing or new facility, and on California's market price for energy. The existing plants currently get an average energy payment of 5.37 US cent/kWh. In times of low market prices, they can get up to an additional 1.0 US cent/kWh for existing CSP plants and up to an additional 1.5 US cent/kWh for new CSP plants.

Francisco Barroso Palomino, Technical Expert of the Ministry of Economy, Spain explained the Spanish policy of incentives to promote CSP. At the end of 1998, a Spanish Royal Decree (2818/1998) established tariffs for the production of electricity from facilities powered by renewable energy sources. The Decree ruled, that the installed power must be lower than or equal to 50 MW and the primary source must be 100% solar to apply for the bonus of 3 € cent/kWh in addition to the free market pool price. A modification of this Decree was signed on 2 August 2002, introducing a premium of around 12,02 € cent/kWh in addition to the free market pool price which usually is in the range of 3 € cents/kWh. A plan for promotion of renewable energies for the period 2000-2010 proposes a number of measures and incentives to foster the introduction of these technologies on the market, such as: public support for investment, tax allowance on the investment (10% reduction in corporation tax).

William Gillett, Manager in the Directorate-General Energy and Transport (DG TREN) of the European Commission spoke about legislative and regulatory policies in the EU. The EU White Paper on Renewable Energies (COM(97)599, 26.11.97) sets out a Community Strategy and an Action Plan to double the share of renewables from 6 % to 12 % by 2010. The campaign for take-off includes co-operation with third countries and partnerships with stakeholders. The SAVE-ALTENER Programme (1998-2002) supports bridging the gap between demonstration and commercialisation, actions to overcome non-technical barriers, market and sector studies, promotion and monitoring new legislation. An intelligent energy programme (2003-2006) is under preparation. A transitional support is needed to compete in today's electricity markets such as a long-term feed-in law and grants to reduce initial capital costs.

Christoph Sutter, Project Manager of Factor Consulting + Management AG, gave an over-view of potential contributions of carbon credits to CSP projects. For projects on the brink of profitability the contribution of carbon credits can be decisive. CSP projects in developing countries can make use of one of the Flexible Mechanisms of the Kyoto Protocol, the Clean Development Mechanism (CDM). Under the CDM, an investor from an industrialised country invests in a project in a developing country and obtains, in return, the credit for achieved emission reductions in the form of certificates. These certificates can be sold on the international market.

The market for tradable carbon certificates is emerging and several projects in the field of renewable energy are already selling their carbon offsets. This market is projected to reach a volume of 1 to 5 billion US \$ by 2010. A price of around 5 US \$ per ton of CO₂

reductions is expected for the next years with an increase up to 10 US \$ by 2010. Calculations for CSP projects showed that selling the carbon emission reductions can increase the project's financial returns by 10-20%.

Panel No. 3

Financing Requirements to Realise CSP Projects

Bruno Wenn, Senior Vice President of KfW, pointed out that up to 2.5 billion US \$ support is needed to realise the goal of 5000 MW installed solar capacity. Therefore, besides an adequate framework of regulations, the bundling of different financing instruments is important.

Dr. Manfred Konukiewicz, Head of Division at the German Federal Ministry for Economic Co-Operation and Development (BMZ), discussed the sources of preferential financing. The energy demand is increasing in developing countries yet many people still have no access to the electricity grid. The expansion of energy supply is an important step to combat poverty. CSP could cover some of this additional energy demand because these countries usually enjoy a high level of solar radiation. Decentralised applications of renewable energies are often competitive, but financing of the high investment costs are challenging. In order to use the solar resource, it is necessary to advise the governments to create an enabling environment. Financial support can be provided by bilateral and multilateral financial institutions possibly in connection with financial institutions and environmental facilities.

Peter Hilliges, Program Manager at the Global Environment Facility (GEF), gave an over-view on the strategic options for global market introduction of CSP. The GEF is committed to finance the incremental costs (IC) for four ISCC plants (Mexico, India, Egypt, Morocco) and thereby to contribute to a long-term cost reduction. As none of these projects have been realised, there has been no impact on CSP costs. It is important that these projects be implemented and to see a decrease in the IC. The GEF does not plan to finance additional CSP projects unless the four current projects are successful and other projects are also built in industrialised countries. The GEF offers to facilitate a partnership of OECD countries and CSP industry and link it to developing countries. Industry has to deliver cost reduction and governments have to deliver public support (e.g. incentives and/or subsidies) to create a mutually beneficial and trusted CSP program for OECD countries.

Günter Westermann, Head of the Energy, Telecom and Waste Management Department at the European Investment Bank (EIB), talked about the conditions required to attract financing for CSP. Traditional evaluation criteria have to be applied by the financing community in order to compare CSP projects with alternative projects. The contact with possible financing agencies should start at an early stage to formulate bankable investment proposals. To optimise the financing plan, different sources of financing are necessary in combination with tailor-made programmes by the government.

Panel No. 4

Declaration of Berlin

The participants of the CSP Conference declared their commitment to collaborate in the formation of a structured approach to develop and expand the global CSP market for the benefit of all involved partners. The participants agreed to form three working groups: "Financing community", "Government" and "CSP industry/project developers". These groups will contribute to the formulation of an integrated long-term-market introduction strategy to remove investment obstacles and to achieve required cost reductions. The strategy may include innovative financing schemes, aggregated bidding, risk sharing and overall performance guarantees. First concrete solutions for a CSP Global Market Initiative will be provided and further substantiated at the follow-up conference in California at the beginning of next year.

Further information on the Berlin CSP-Conference is available on the Web at:

http://www.solarpaces.org/berlin_conference.htm

<http://www.en-consulting.com>

Attachment:

DECLARATION OF BERLIN
**Expanding the Market for
Concentrating Solar Power**

An International Executive Conference on Concentrating Solar Power (CSP) was held in Berlin, Germany, on June 19-20, 2002. The participants included senior executives from 16 countries representing governments, the financial community, donor organizations, the CSP industry, independent power project developers and potential CSP plant owners. The presentations and discussions resulted in the following common understanding:

- CSP provides sustainable, clean, affordable and reliable energy supply over a range of unit sizes from 10 kilowatts to 200 megawatts.
- CSP plants have proven in more than 100 accumulated operating plant years to be the most efficient technology for direct use of the inexhaustible solar energy
- CSP plants can provide dispatchable power with back-up via thermal storage and/or the hybrid mode.
- CSP helps to reduce green-house gas emissions.
- CSP is an appropriate technology for supporting independence from fossil resources in sun-belt countries.
- A promising base of potential new projects has already been established.
- Realizing these projects will allow reduction in unit cost.
- The participants called for a collective effort and strategy to promote the use of CSP by removing existing investment obstacles and by facilitating the market penetration.

THEREFORE,

The participants of the International Executive Conference on Concentrating Solar Power declare their commitment to collaborate in the formulation of a structured approach to develop and expand the global CSP market for the benefit of all involved partners and agree to the following next steps:

1. Three trans-national working groups will be formed by interested stakeholders from solar system and service suppliers and developers, potential project owners, interested governments and regulators and the financial community.

2. These groups will contribute to the formulation of an integrated long-term market introduction strategy, including innovative financing schemes (like Kyoto Mechanisms, etc.), identification of necessary energy-economic frameworks and consistent regulations, as well as potential mechanisms for aggregated bidding, risk sharing and comprehensive performance guarantees. The GEF and UNEP SANet will provide administrative support and overall assistance.
3. The groups will cooperate and join efforts in promoting CSP with existing institutions like ESTIA, SEIA and IEA SOLAR Paces
4. The CSP industry anticipates reducing solar power generation costs by 20%, once 400 MW_{el} of new solar capacity has been implemented. Upon reaching 5 000 MW_{el} of new solar capacity, solar electricity generation cost will be fully competitive with fossil-based grid-connected power generation costs.
5. Therefore all participating Stakeholder Groups in this Berlin Conference support the launching of a CSP Global Market Initiative which will be further substantiated at the follow-up conference in California.

Berlin, 20 June 2002