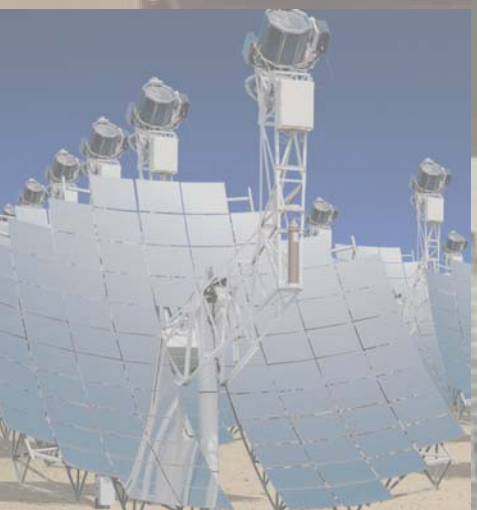
CSP
Global Market Initiative

International Executive Conference on Expanding the Market for Concentrating Solar Power: Launching the 5000 MW CSP Global Market Initiative

October 21 through 23, 2003
Palm Springs, California USA



International Executive Conference on Expanding the Market for Concentrating Solar Power

Sponsor Oganizations

Department of Energy United States of America

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International Executive Conference on Expanding the Market for Concentrating Solar Power: Launching the 5000 MW CSP Global Market Initiative

21-23 October 2003
Palm Springs, California

FINAL PROGRAM

MONDAY, 20 OCTOBER

16:00–18:00 Organizing Committee Meeting with Discussion Group Leaders & Reporters – *Desert Suite 3*

18:30–20:00 Opening Reception – *Sunrise Terrace*

TUESDAY, 21 OCTOBER

Integrating National Programs into the CSP Global Market Initiative

7:30–8:45 Continental Breakfast – *Fiesta Patio*

8:00–8:45 Speakers/Facilitators Breakfast Meeting – *Desert Suite 3 (Breakfast served in meeting room)*

9:00–10:00 SESSION ONE – OPENING OF THE CONFERENCE AND THE STATUS AND FUTURE OF CSP – *Las Palmas Salon E*

After welcoming remarks and a statement about the conference objectives, the status and outlook for CSP will be presented.

Moderator – Fred Morse, Chairman, Solar Thermal Power Division, Solar Energy Industries Association, United States

Conference Objectives
Uwe Ohls, Director, The German Development Bank (KfW), Germany

Overview of Concentrating Solar Power
Michael Geyer, Executive Secretary, International Energy Agency SolarPACES Program

The Future of Concentrating Solar Power
David Kearney, President, Kearney and Associates, United States

Conference Process
Fred Morse, Chairman, Solar Thermal Power Division, Solar Energy Industries Association, United States

10:00–10:30 Coffee Break

10:30–12:15 SESSION TWO – WORLDWIDE CSP ACTIVITIES *– Las Palmas Salon E*

The many CSP projects, activities, opportunities and programs around the world will be highlighted in this session.

Moderator – Rainer Aringhoff, General Manager, Solar Millennium AG & General Secretary of ESTIA, Germany

California
Tim Tutt, Technical Director, Renewable Energy Program, California Energy Commission

Nevada
Dick Burdette, Manager, Resource and Market Analysis, Public Utilities Commission of Nevada

Southwest 1000 MW CSP Initiative
Kevin Moran, Director, Washington, DC Office, Western Governors' Association

Egypt
Hosni Elkholy, Executive Chairman, New and Renewable Energy Authority

India
Chandra Shekhar Rajan, Secretary of Energy, Government of Rajasthan

South Africa
Kevin Nassiep, Chief Director of Energy Planning, Department of Minerals & Energy

Algeria
Tewfik Hasni, President and Director General, New Energy Algeria

Israel
David Assous, Chair Person, Public Utilities Authority

Germany
Klaus-Peter Pischke, Division Chief, The German Development Bank (KfW)

Spain
Manuel Lopez Casero, General Secretary for Industry and Technological Development, Andalucia

12:15–13:00 SESSION THREE – PROPOSED CSP GLOBAL MARKET INITIATIVE – *Las Palmas Salon E*

The process followed to produce the draft CSP Global Market Initiative will be summarized. The strategy, approach, key elements and structure of the proposed GMI will be described and the benefits of participation will be presented.

Proposed CSP Global Market Initiative
Fred Morse, Chairman, Solar Thermal Power Division, Solar Energy Industries Association, United States & Georg Brakmann, Managing Director, Fichtner Solar GmbH, Germany, and President of ESTIA

Guidance to Discussion Groups
Fred Morse, Facilitator

13:15–14:15 Lunch – *Starlight Terrace*

14:15–18:00 DISCUSSION GROUPS – *Las Flores Breakout Rooms*

Participants will be assigned to a discussion group. Groups will discuss the CSP Global Market Initiative strategy for their region and clarify the approach.

Group	Room	Group Leaders
Group A	*Gardenia*	Uwe Ohls, Director, The German Development Bank (KfW), Germany
Group B	*Hibiscus*	Alain Dahan, Vice President, Solel Solar Systems, Israel
Group C	*Jasmine*	David Slawson, Chairman and CEO, Stirling Energy Systems, United States
Group D	*Lantana*	Randy Manion, Western Area Power Administration, United States
Group E	*Larkspur*	John Myles, President, Solargenix Energy, United States
Group F	*Lavender*	Ramon Carlos Torres Flores, Economist, Semarnat, Mexico
Group G	*Plumeria*	Kevin Nassiep, Department of Minerals & Energy, South Africa

18:00 Conclude first day

WEDNESDAY, 22 OCTOBER

The Proposed CSP Global Market Initiative

7:15–8:15 Continental Breakfast – *Starlight Terrace*

7:30–8:15 Speakers/Facilitators Breakfast Meeting – *Desert Suite 3 (Breakfast served in meeting room)*

8:30–10:30 SESSION FOUR – DISCUSSION GROUP REPORTS – *Las Palmas Salon E*

The reporters from the Discussion Groups will present the findings and recommendations of their first discussions.

Moderator – Frederick Morse, Chairman, Solar Thermal Power Division, Solar Energy Industries Association, United States

Group	Group Reporters
Group A	Bob Liden, Chief Financial Officer, Stirling Energy Systems, United States
Group B	Kevin Moran, Director, Washington, DC Office, Western Governors' Association, United States
Group C	Klaus-Peter Pischke, Division Chief, The German Development Bank (KfW)
Group D	Avi Brenmiller, President & CEO, Solel Solar Systems, Israel
Group E	Arnold Leitner, United States
Group F	Tewfik Hasni, President and Director General, New Energy Algeria
Group G	Georg Brakmann, Managing Director, Fichtner Solar GmbH, Germany, and President of ESTIA

10:30–11:00 Coffee Break – *Outside Las Palmas Salon E*

11:00–12:30 SESSION FIVE – STAKEHOLDER PANEL *– Las Palmas Salon E*

The success of the GMI requires access to project finance, supportive regulatory polices, the involvement of the construction industry and willing utilities to purchase the power or CSP plants. This session will present the perspectives and recommendations of those stakeholders.

Moderator – Rolf Seifried, Senior Economist, The German Development Bank (KfW)

Regulatory Issues from Israel Perspective
David Assous, Chairman, Public Utilities Authority, Israel

Regulatory Issues from a German Perspective
Ludger Lorych, Environ & Renew Energ, German Ministry of the Environment (BMU)

European Union Perspective
Philippe Schild, New and Renewable Energy Sources Unit, European Commission

Financing Requirements from United States Perspective
Michael Ware, Managing General Partner, Black Emerald, Washington, DC, US

Perspective on Construction of CSP Power Plants
Jose Alfonso Nebrera Garcia, Director General, Cobra S.A., Spain

Utility Issues from United States Perspective
Bud Beebe, Sacramento Municipal Utility District, US

Guidance to Discussion Groups
Fred Morse, Facilitator

12:30–13:30 Lunch – *Starlight Terrace*

13:30–15:30 DISCUSSION GROUPS *– Las Flores Breakout Rooms*

Participants will return to their discussion group. Groups will discuss specific aspects of the Global CSP Market Initiative and identify the next steps.

15:30–16:00 Coffee Break – *Outside Las Palmas Salon E*

16:00–17:45 SESSION SIX – DISCUSSION GROUP REPORTS *– Las Palmas Salon E*

The reporters from the Discussion Groups will present the findings and recommendations of their second discussions.

Moderator – Gilbert Cohen, Vice President, Solargenix Energy, United States

17:45 Conclude second day

18:30 Formal Reception – *Sunrise Terrace*

20:00 Formal Conference Dinner – *Las Palmas Salon D*

THURSDAY, 23 OCTOBER

Launch of the CSP Global Market Initiative

7:15–8:15 Continental Breakfast – *Starlight Terrace*

7:30–8:15 Speakers/Facilitators Breakfast Meeting – *Desert Suite 3 (Breakfast served in meeting room)*

8:30–10:00 SESSION SEVEN – CSP GLOBAL MARKET INITIATIVE *– Las Palmas Salon E*

The performance of the 354 MW CSP plants operating in the California Mojave Desert for the past 15 years will be highlighted and the outlook for improvements in the cost and performance will be presented. With this background, the CSP Global Market Initiative, as revised during the preceding days of the conference, will be presented and endorsed by the Global Environment Facility. The benefits of CSP will be highlighted from a political perspective.

Moderator – Alan Miller, Global Environment Facility Coordinator, International Finance Corporation, Washington, DC

The SEGS Story: Fifteen Years of Improved Performance
Scott Frier, Chief Operating Officer, KJC Operating Company, United States

The Outlook for CSP
Avi Brenmiller, President and CEO, Solel Solar Systems, Israel

Launch of the CSP Global Market Initiative
John Myles, President, Solargenix Energy, United States & Rainer Aringhoff, General Manager, Solar Millennium, Germany, and General Secretary of ESTIA

Global Environment Facility Endorsement and Announcement of Advisory Board
Alan Miller, Global Environment Facility Coordinator, International Finance Corporation, Washington, DC

10:00–10:30 Coffee Break

10:30–12:00 SESSION EIGHT – ENDORSEMENT OF THE CSP GLOBAL MARKET INITIATIVE *– Las Palmas Salon E*

In this closing session, the participating countries and states will offer their endorsements, recommendations or requirements for the CSP Global Market Initiative.

Moderator – Woodrow Clark, Deputy Director and Senior Policy Advisor, Office of the Governor, State of California

Egypt
Hosni Elkholy, Executive Chairman, New and Renewable Energy Authority

India
Chandra Shekhar Rajan, Secretary of Energy, Government of Rajasthan

South Africa
Kevin Nassiep, Chief Director of Energy and Planning, Department of Minerals and Energy

Algeria
Hamid Dahmani, Counselor, Ministry of Energy & Mining

Mexico
Ramon Carlos Torres Flores, Economist, Semarnat,Government of Mexico

Morocco
Ahmed Nakkouch, General Manager, National Office of Electricity (ONE)

Israel
Avi Brenmiller, President and CEO, Solel Solar Systems Ltd.

Germany
Ludger Lorych, Federal Ministry for the Environment (BMU)

Electric Power Research Institute
Terry Peterson, Manager, Solar Power & Green Power Marketing, United States

New Mexico
Craig O'Hare, Special Assistant for Renewable Energy, New Mexico Energy Department

Western Governors' Association
Kevin Moran, Director, Washington, DC Office

12:00–14:00 CLOSING LUNCH AND AWARDS CEREMONY – *Las Palmas Salon D*

FRIDAY, 24 OCTOBER

8:30 VISIT TO THE SEGS PLANT AT KRAMER JUNCTION

Tuesday Oct, 21
9:00 to 9:30 AM

SESSION 1: OPENING PLENARY

Preparatory Meeting Objectives
Uwe Ohls, First Vice President – South and Central Asia, KfW, Germany

Distinguished guests, ladies and gentlemen,

It is a pleasure and honour for me to (co)-inaugurate this second international conference on Concentrating Solar Power (CSP). A warm welcome to all of you in this beautiful city of Palm Springs. My name is Uwe Ohls. I represent the German Development Bank KfW.

Before I come to the subject-matter of this conference, please allow me to introduce KfW to you in a few sentences. I assume that in particular our colleagues from the U.S. are not fully aware of who we are and of our role as Development Bank.

KfW was established already in 1948, one year in advance of the official foundation of the Federal Republic of Germany. It was KfW's contribution to reconstruction financing in Germany from Marshall Plan funds provided by the U.S that gave the bank its place in the history of the Federal Republic of Germany. Meanwhile KfW is among the ten largest banks in Germany with a balance sheet total of more than 260 billion EUR at the end of 2002.

Basically we have three key business activities: promotion of the German economy, export and project finance and the promotion of developing and transition countries by extending concessional investment financing on behalf of the German Government.

On a world-wide scale, the KfW group is one of the major lenders for investments in renewable energies. Within the scope of Financial Co-operation with developing countries we provided finance of some 650 million € over the last five years for renewables. In the domestic market in Germany, KfW is running a broad range of credit programmes for the promotion of renewables, among them the so-called 100.000 solar roofs programme. Last year, the KfW group provided loans of some 1.3 billion € for renewables and energy efficiency.

One major objective in the support of renewables is to contribute to the goal of climate protection. The Kyoto Protocol gives the signatory states, among them Germany, the flexibility in the implementation of the reduction objectives. The basic principle behind all three flexible mechanisms [Emission trading (ET), Joint Implementation (JI), and Clean Development Mechanism (CDM)] is to allow the industrialized countries to choose the most cost-efficient ways to meet their reduction obligations through the trade in carbon credits.

In this context, KfW – in cooperation with the German Government – is presently developing a new financial tool of carbon finance: the **KfW Carbon Fund**. The main purpose of the Fund is that of purchasing certificates from projects that utilize renewable energies or enhance energy efficiency.

With regard to solar thermal power, KfW, on behalf of the German Government and together with the Global Environment Facility contributes to the financing of the first

CSP project in India, the Mathania solar thermal power plant. We are also managing a Research and Development Project on Concentrating Solar Power sponsored by the German Ministry for the Environment.

Why is KfW supporting solar thermal power generation? We consider Concentrating Solar Power to be a technology with promising future. Among all solar energy technologies utilising solar radiation, the Concentrating Solar Power high-temperature technology is the most advanced in terms of technical efficiency and the one presently with the most favourable power generation costs. We trust that it can play a major role to replace limited and inevitably more and more costly fossil resources. This process will gain more and more momentum if and when the costs of fossil fuel will increase. Moreover, as I mentioned before, the use of the flexible Kyoto mechanisms will enhance the chances for solar thermal power plants by exploiting their great potential for avoiding the emission of green house gas emissions. The developing countries situated within the earth's sunbelt can benefit from CSP and play a major role in the market initiative.

In June last year we had the pleasure to host the International Executive Conference on Concentrating Solar Power (CSP) at KfW's Berlin Branch to discuss how to expand the market for Concentrating Solar Power and how to move opportunities into projects.

Participants included besides industry researchers and the general public, the Global Environmental Facility (GEF), the German Federal Ministry for the Environment (BMU), the European (ESTIA) and the American Solar Thermal Power Industry Association (SEIA) and, of course, KfW itself. All those participating agreed that a GIobal Market Initiative for CSP is needed and strategies towards the rapid and large-scale market introduction of CSP are necessary. This common understanding was published as the DECLARATION OF BERLIN. The stakeholder groups of the DECLARATION OF BERLIN supported the launching of this Initiative in order to introduce Solar Power into the market. The Solar Power Industry anticipated that the solar electricity generation cost will be fully competitive with fossil-based grid connected power generation cost, once an initial 5,000 MWe of new solar capacity will have been installed. As a consequence, the Stakeholder Groups participating in the Berlin Conference supported the launching of a CSP Global Market Initiative, which was subsequently formally registered as Type-II Market Facilitation Partnership for Concentrating Solar Power Technologies at the World summit on Sustainable Development in Johannesburg the same year under the leadership of UNEP and GEF.

During the following two days we will discuss how to achieve the goals of the BERLIN DECLARATION and how to bring life to the Global Market Initiative. In order to do so, we will have to start the process by discussing by which means the participating countries and other stakeholders could contribute to let the Global Market Initiative fly. In my opinion, beyond the question of technological advancement, the most crucial issues to be solved are in the field of the regulatory framework, and in providing the necessary finance for the launch and expansion of the market for the large-scale utilisation of solar thermal energy. To provide financing for economically sound projects with an acceptable risk structure is not a problem. The problem arises when the projects are not economically viable: who then bears the incremental costs?

Although solar thermal has a proven record of experience here in California it lacks a major break-through. We will learn during the conference that there are good reasons to believe that CSP will be able to match draw even economically with conventional power plants within a reasonable period of time, provided we start building solar thermal plants in large quantities now.

Nevertheless, for the time being, we must realise that solar thermal plants are not competitive with conventional fossil fuel based bulk producers. As a consequence we will need massive subsidies to cover the cost gap over the time path, until this technology can compete on its own.

One of the key questions is then, how much subsidies will be needed over the course of time to realise the necessary investments in solar capacity needed to drive costs down. This will depend of course on several parameters such as technology development, prices of fossil fuels and the like. Irrespective of these side conditions, I would expect a ball park figure that we will have to mobilise finance to the tune of several billions of dollars to cover the incremental costs over the course of time. This incremental costs will come on top of financing requirements for the "baseline" investments, i.e. investments that would have accrued in conventional power capacity expansion of, say, some 3 to 4 billion USD (for 5000 MW capacity to be installed).

The other key question consists in which **form** the subsidies should be granted and who has to pay for them – taxpayer or rate-payer. There are several options, how subsidies can be granted. In essence, there are two possibilities: either subsidies could be used to decrease the cost of supply, or they could be provided from an increase of revenues from electricity generation.

Winning the public support for introducing these schemes and to raise the necessary funding is the task of the political leaders in the countries participating in any renewable market initiative. We could support them with our initiative to fulfil their task.

Given that the use of subsidies will be limited, the final break-through of CSP technologies will depend on the realisation of cost reductions. One way to achieve this goal is a market aggregation approach which relies on the "economies of scale" to reach cost reduction. Technological improvement can also contribute to this goal. This is the task of the industry. We have to remind them on their obligations.

On a larger scale, encompassing all available renewable technologies but also energy efficiency improvements, this is also the topic of the International Conference for Renewable Energies, which Germany will host from June 1 to 4, 2004, as announced by the German Chancellor Gerhard Schröder at the World Summit on Sustainable Development in September 2002 in Johannesburg. The goal of this conference is to bundle and streamline the world-wide efforts to support a clean energy future. The expectations on the results are high. In my opinion, it provides an excellent opportunity to raise the awareness of political decision makers and the interest of a bigger public for the promising CSP technology, with the aim to discuss further ways and means to promote it and to attract the necessary funds.

I hope that here in Palm Springs, answers to the many open questions mentioned in my statement can be found. After an extensive exchange of views I expect that we will succeed to sketch out solutions to overcome the present stagnation and I do hope that this present conference, developing further the ideas of the Berlin Declaration, will be a major step forward to launch the Global Market Initiative (GMI) in such a way as to streamline the efforts of all stakeholders to promote this abundant, sustainable, clean and environmentally friendly form of energy. In line with the policy of the German Government, KfW will continue its engagement for the CSP technology.

Ladies and gentlemen, let us start working on the launch of the Global Market Initiative. I wish us all an exciting conference.

Thank you very much for your attention.

Overview of Concentrating Solar Power

for the International Executive Conference on
Expanding the Market for Concentrating Solar Power

21-23 October, Palm Springs, California

Dr. Michael Geyer
Executive Secretary of the
IEA SolarPACES Implementing Agreement

SolarPACES

Solar Power And Chemical Energy Systems

IEA SolarPACES Member Countries

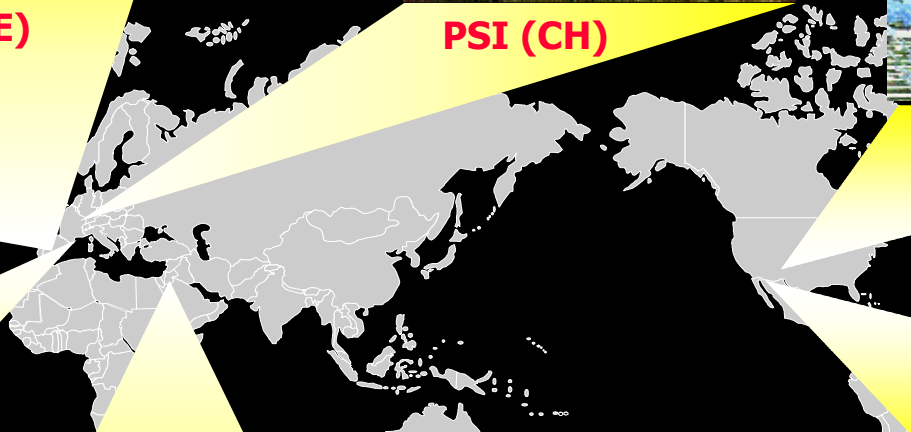
ALGERIA AUSTRALIA BRAZIL EGYPT EU FRANCE GERMANY ISRAEL MEXICO SOUTH AFRICA SPAIN SWITZER-LAND UNITED STATES

Solar Thermal Power Facilities Worldwide

PSA (E)

PSI (CH)

Solar One (US)



CNRS (F)

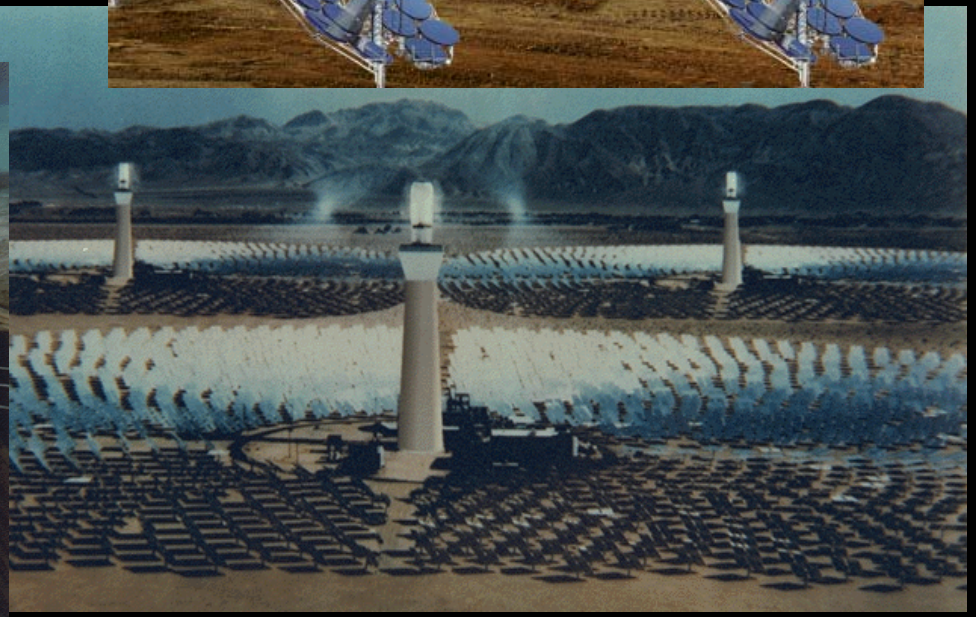
WIS (IL)

ANU (AUS)

SEGS (US)

The SolarPACES Vision

…by 2010, a significant contribution to the delivery of clean, sustainable energy services in the world's sunbelt



Key Advantages of CSP?

- Solar energy is the most abundant sustainable resource on Earth
- The inherent advantage of STP technologies is their **unique integrability into conventional thermal plants**: All of them can be integrated as "a solar burner" in parallel to a fossil burner into conventional thermal cycles
- With thermal storage or fossil fuel backup solar thermal plants can **provide firm capacity** without the need of separate backup power plants and without stochastic perturbations of the grid.
- Solar thermal can supply peak power in summerly heat periods when hydro and wind are scarce
- Solar thermal creates jobs in local Small and Medium Enterprises

SOLAR TOWERS

- PROVED FEASIBILITY
- PROVED STORAGE
- CURRENT PROJECTS
  - PS10 of Abengoa in Spain
  - Solar Tres of Ghersa/Boeing
  - 100MW Towers in SA by ESKOM
  - Receivers for GT and CC at PSA

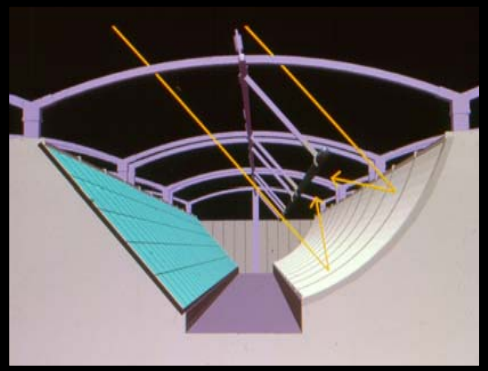
PARABOLIC DISHES

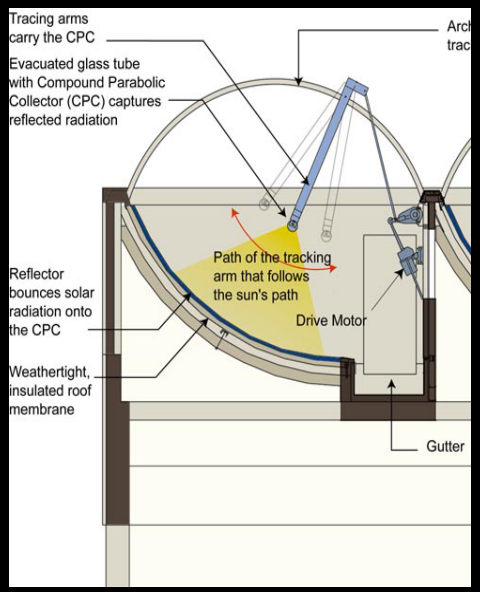
- PROVED HIGH EFFICIENCY
- MODULAR DESIGN
- REMOTE APPLICATIONS
- R&D OBJECTIVES
  - INCREASE AVAILABILITY
  - HYBRIDIZATION & STORAGE

PARABOLIC TROUGHS

- PROVED MATURITY
- MODULAR DESIGN
- OVER 10TWH GENERATED
- CHOICE OF MOST DEVELOPERS
- 354MW OPERATING

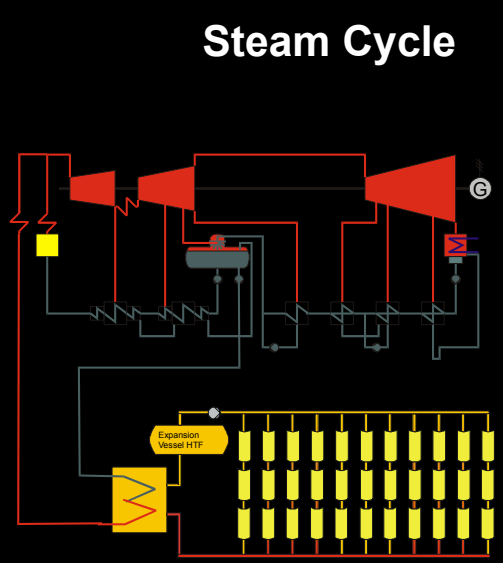
Integration into Buildings: Solar Roofs by Duke Solar



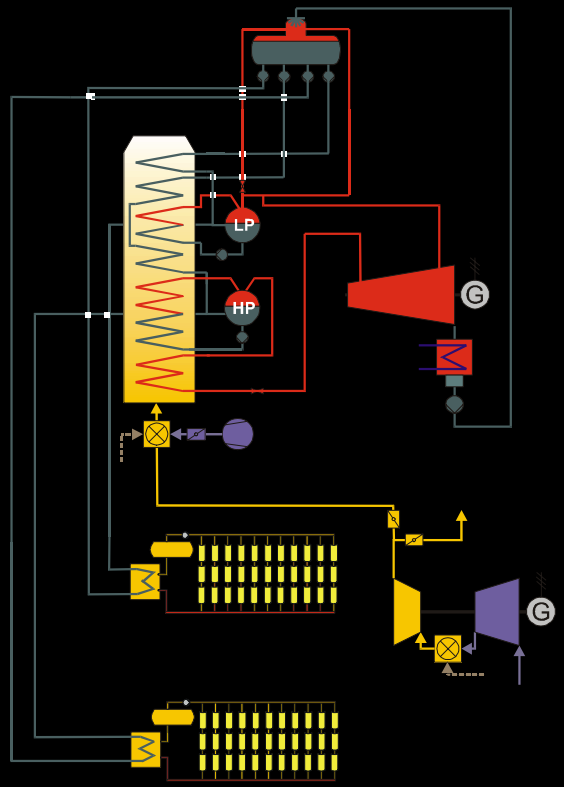


Industrial Process Heat Collectors by Solel

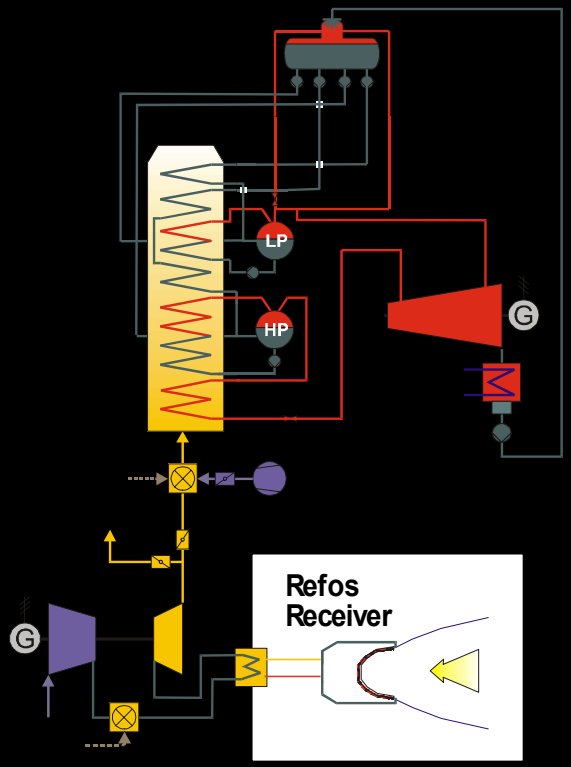
Steam Cycle



Combined Cycle

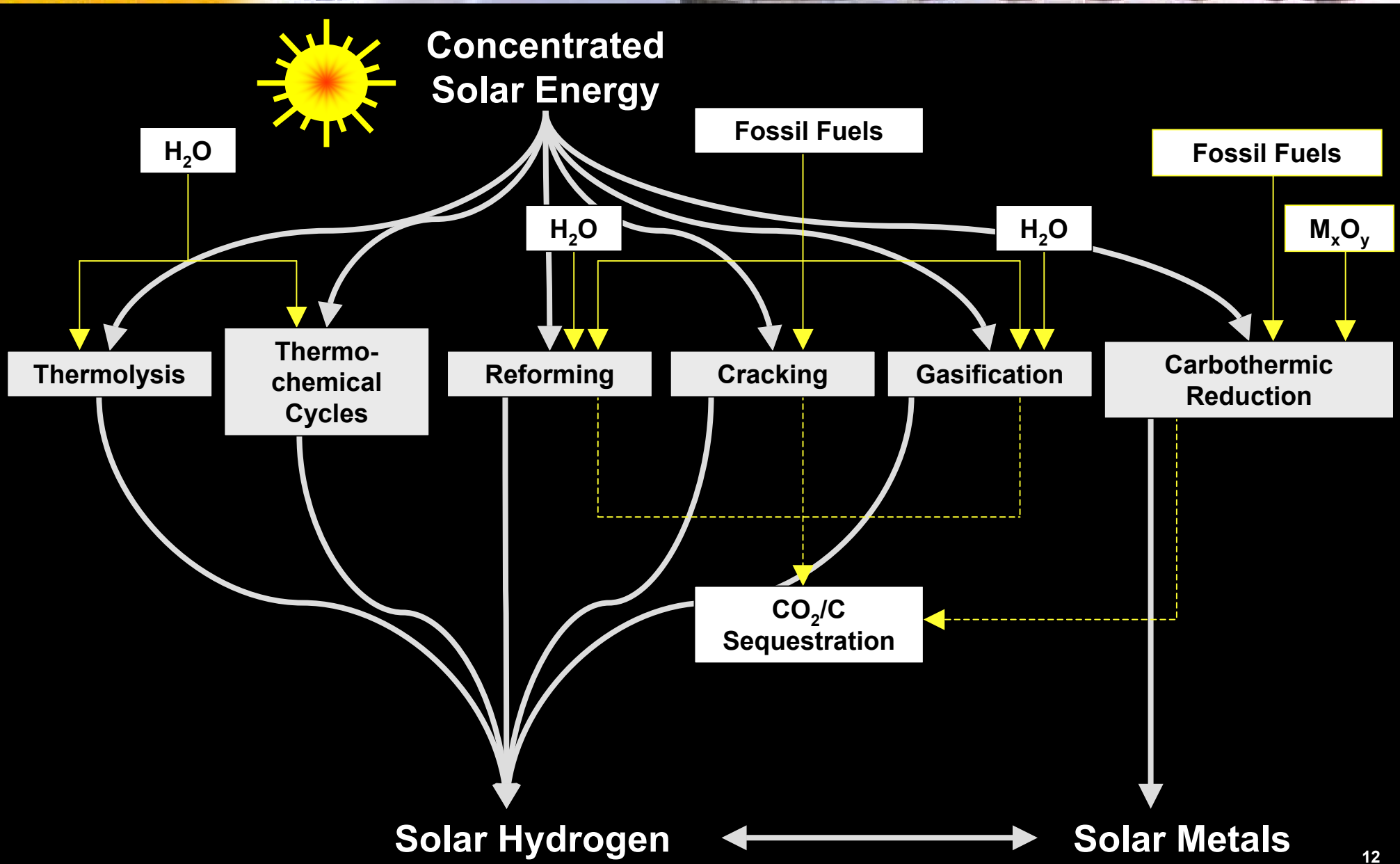


Combined Cycle



Today:
Solar Input into Steam Cycles

Tomorrow:
Solar Input into Combined Cycles


Concentrated Solar Energy
H_2O
Fossil Fuels
Fossil Fuels
H_2O
H_2O
M_xO_y
Thermolysis
Thermo-chemical Cycles
Reforming
Cracking
Gasification
Carbothermic Reduction
CO_2/C Sequestration
Solar Hydrogen
Solar Metals

100MW CSP:

50-100 O&M Jobs

500-1000
ction Jobs

400
uring
Jobs

0.000t Steel

0t Concrete

.000t Glass

IEA SolarPACES may give a Framework to the GMI:

- Established Multilateral Legal Framework for Cooperation under IEA umbrella, ratified by governments
- Established Organization, Management and Funding Procedures
- Established Intellectual Property Protection and Information Sharing Procedured
- DON‘T NEED TO INVENT THE WHEEL AGAIN

Parabolic Troughs

Power Towers

Key Factors Affecting the Future of Concentrating Solar Thermal Power Plants

Dr. David W. Kearney, K&A
in collaboration with
Prof. Jefferson W. Tester, MIT

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Why Should a Large Market Develop for CSP?

Technical Factors

- Peak solar power production matches high demand periods
- Can be dispatchable using natural gas augmentation or thermal storage
- Cost reduction scenarios becoming more clear
- Trough systems are commercialized, demon-strating proven, reliable solar power, with 150 MWe in development for 2005 deployment

Market Factors

- Provides more secure, distributed and centralized energy that offers
  - reduced dependence on fossil fuels,
  - price instability,
  - dispatchability, and
  - reduced greenhouse gas emissions
- Very strong interest internationally and in SW U.S. in sun-belt regions
- Offers significant growth in jobs and manufacturing where situated
- Several solar plant developers active in the marketplace

Electricity Cost Reductions a Crucial Factor to Reach Cost Competitiveness

- Technology Cost Reductions
  - Technology improvements identified leading to significant reductions in LEC in mid-term
  - Independent projections done by Testor Panel in 2001, Sargent & Lundy in 2002. Focus on towers and troughs.
  - Concluded that opportunities exist to lower costs albeit with appropriate risks and uncertainties
  - CSP systems need to be deployed at a faster rate in multiple units and/or larger capacity to achieve the cost reductions that will logically follow with n-generation plants.
  - Considerably more investment is needed now in research and development and component testing to ensure that size scaleup, technology needs and overall reliability goals will be met.
- Other Major Determinants
  - Government policies/incentives
  - Market deployment/competition

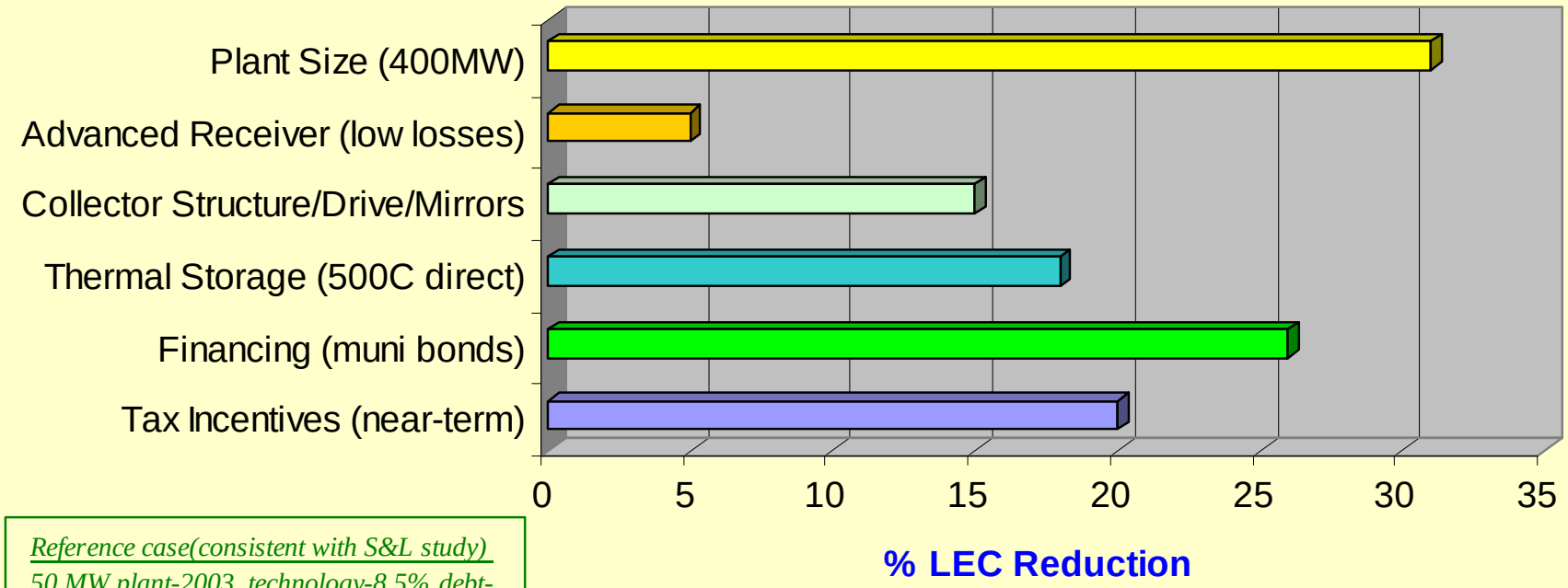
Impact of CSP Cost Reduction Opportunities

Example: Parabolic Trough Technology

- **Plant Size**
- **Advanced Receiver Technology**
- **Concentrator Design**
- **Thermal Energy Storage**
- O&M
- Design Optimization
- Power Park
- Competition
- **Financial**

Cost Reductions in Trough CSP Power Systems

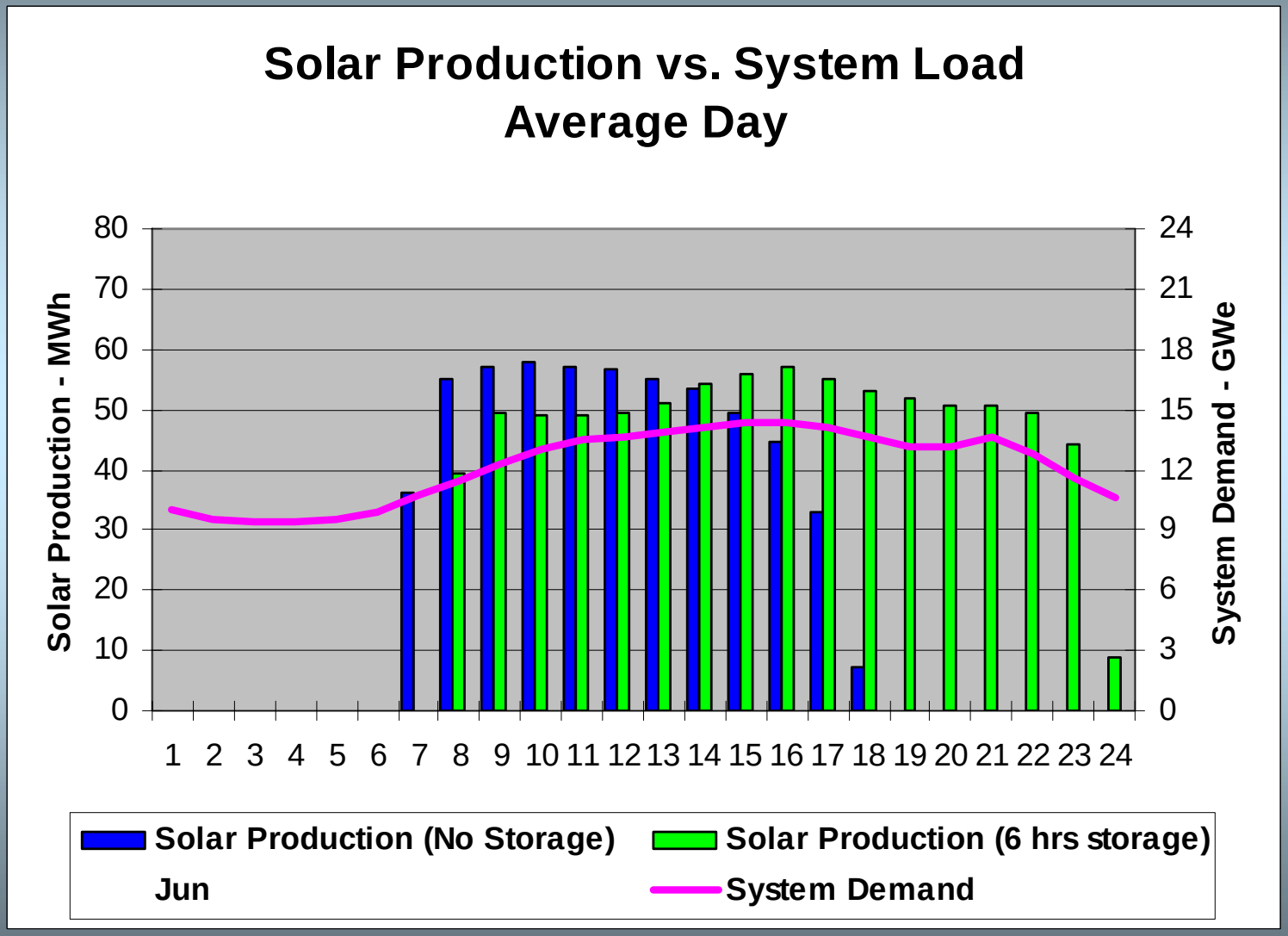
Potential Reductions in Levelized Electricity Cost



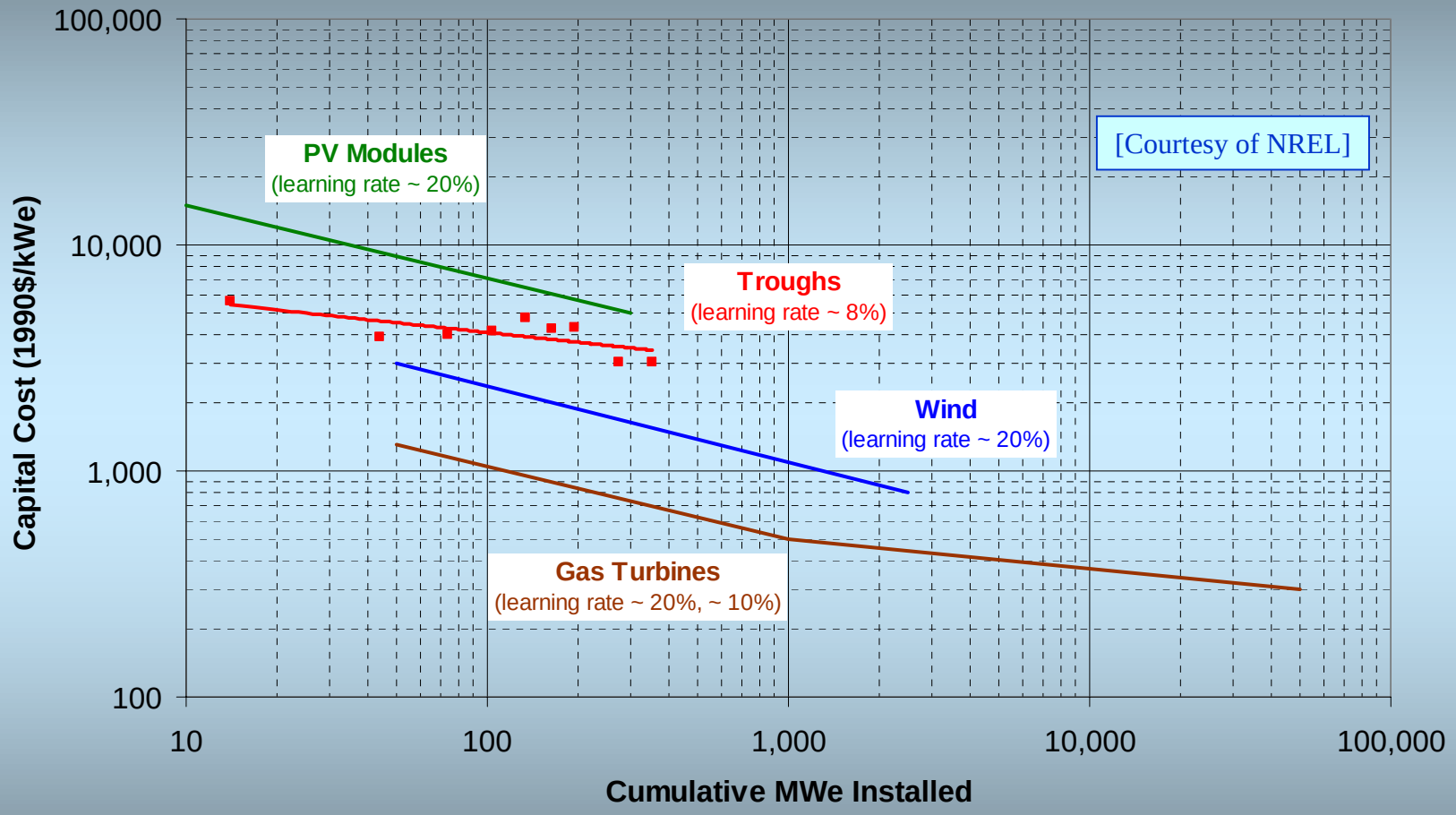
Reference case(consistent with S&L study)
50 MW plant-2003 technology-8.5% debt-40% equity-14% IRR

CSP Dispatchability with Thermal Storage

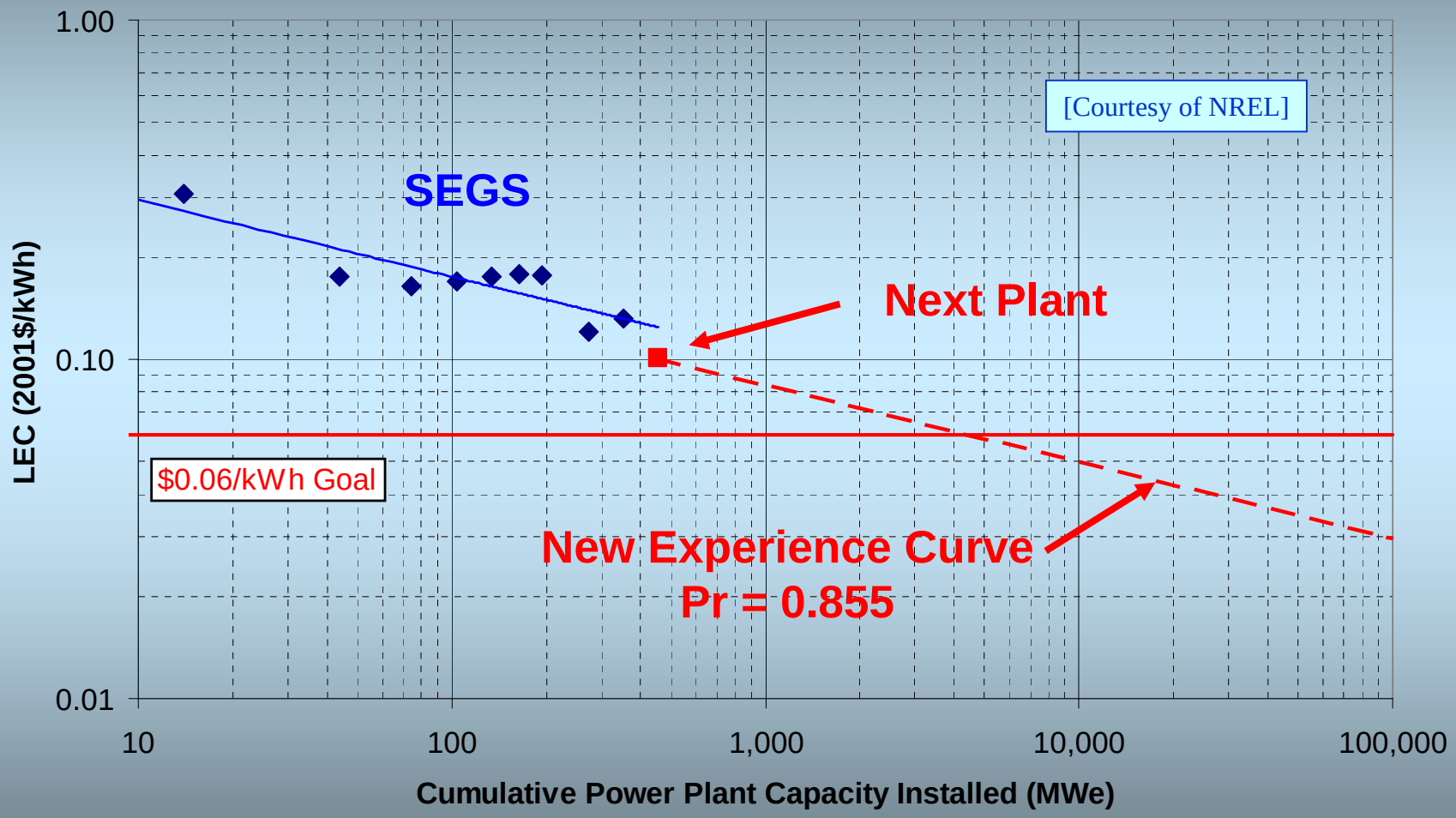
Daily Solar Generation vs Demand at So. California Site
Average Day – June 2002



Capital Cost Learning Curves (Troughs)

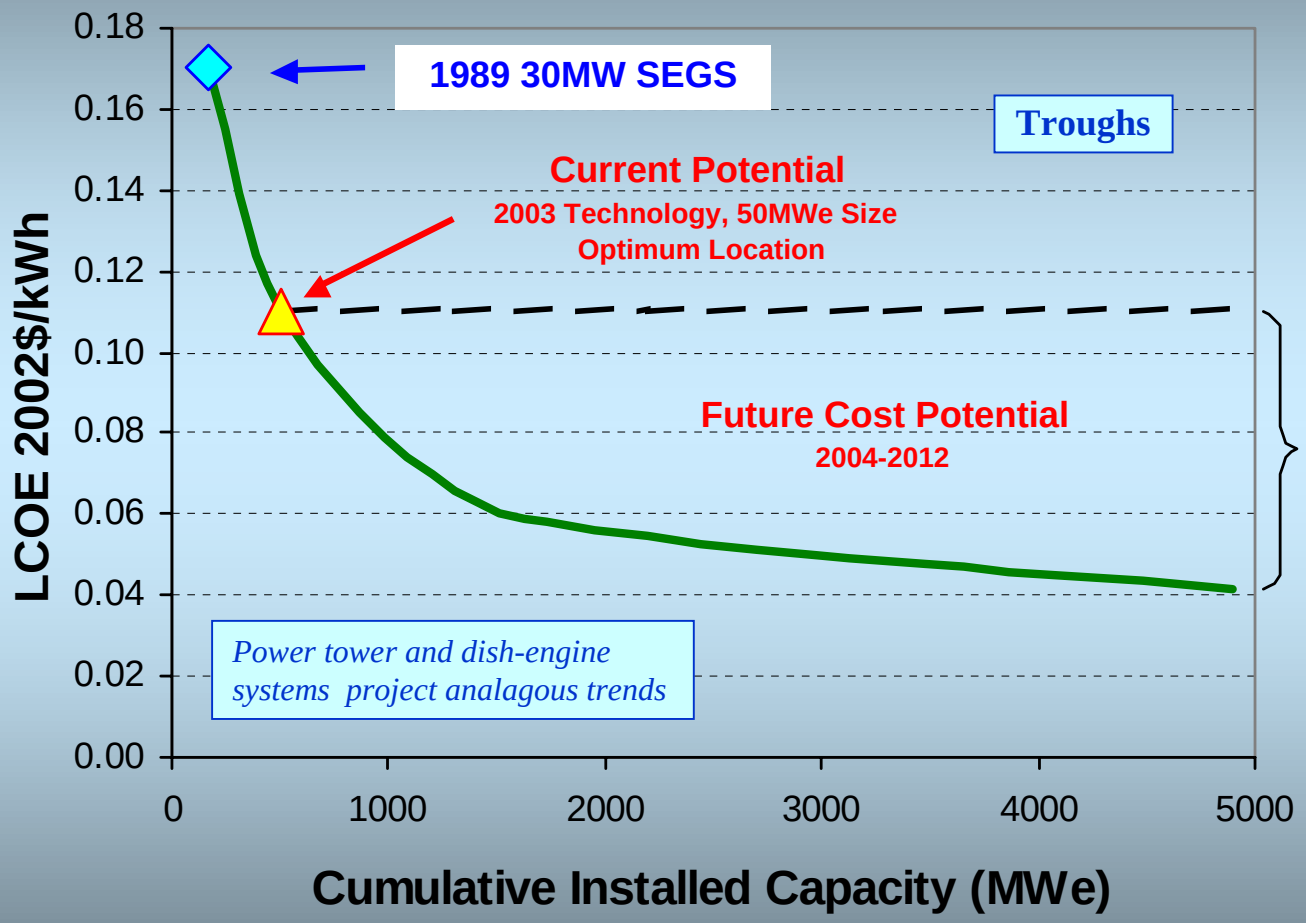


Capital Cost Learning Curves (Troughs)



CSP Development Scenario

{Cost reduction scenario based on 2002 Sargent & Lundy assessment}

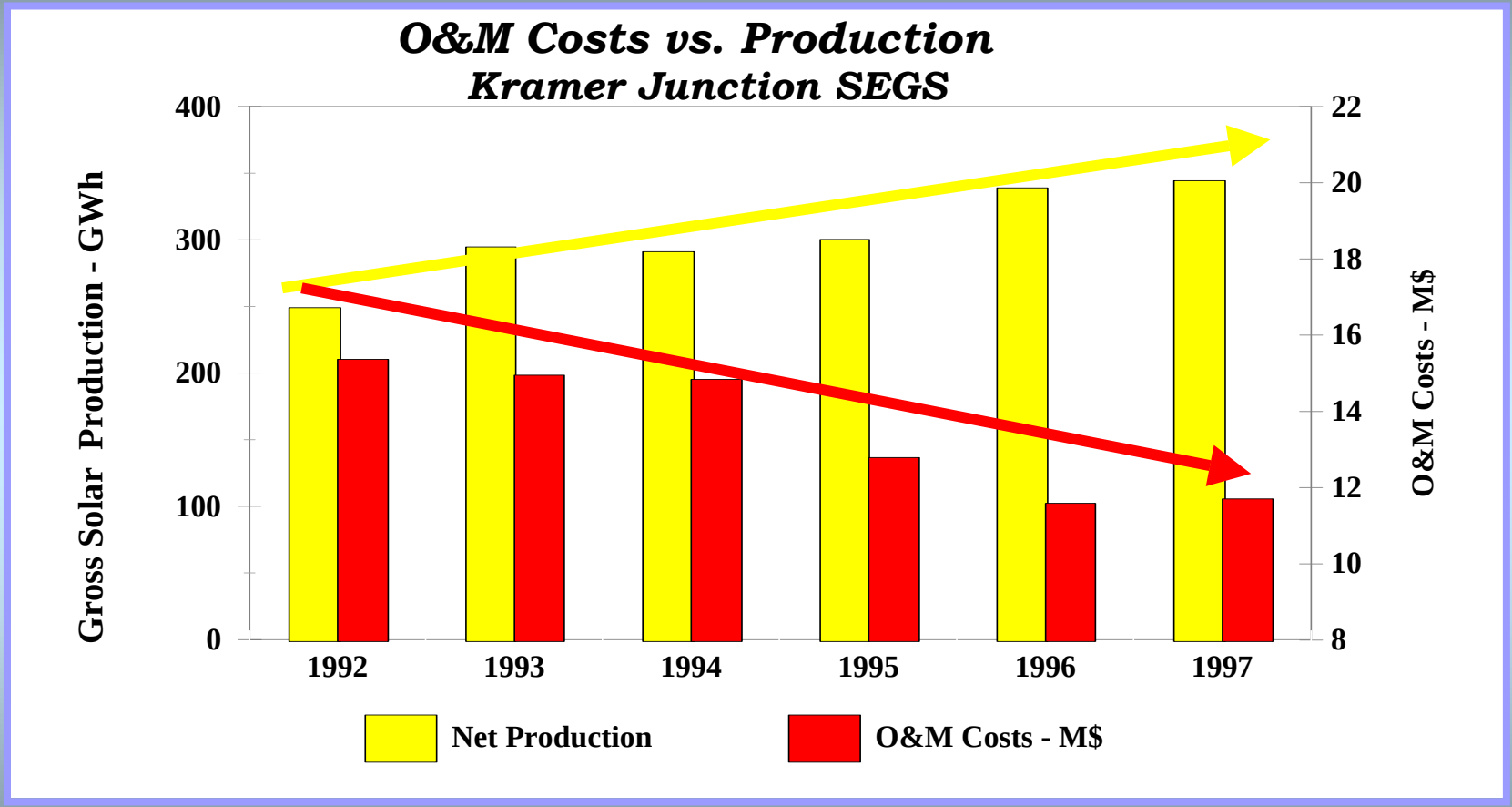


[Courtesy of H Price, NREL]

Factors Contributing to Cost Reduction

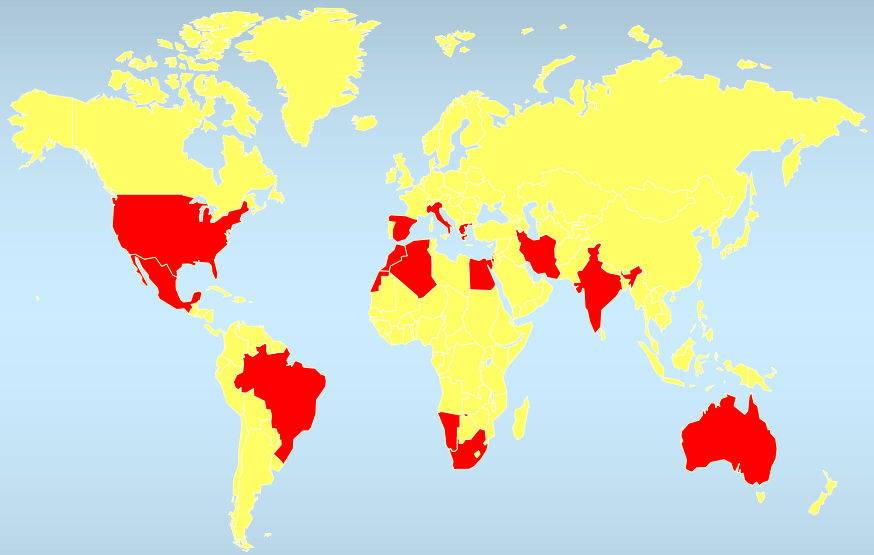
- Scale-up 37%
- Volume Production 27%
- R&D 42%

Example of O&M Cost Reduction



[Courtesy of KJC Operating Co. and Solargenix Energy]

CSP Market Areas



Courtesy of SolarPACES: Current international projects

- Widespread world-wide areas of high radiation
- Electrical transmission from high to low radiation areas possible
- Development activity intensifying in key areas

Market Factors Important for Success

- Market aggregation
- Incentives
- Favorable financing
- Policy changes
- Electricity production must be high to seriously impact reduction of green house gases
- Ultimate price goals tied to GW-scale deployment in 10-100 GW range

Summary

- Huge international resource potential
- CSP technology has significant opportunities for cost reduction
- CSP technologies targeted to directly compete with fossil power technologies in the long-term
- High quality renewable power resource for utility power need
- Market or financial incentives needed for early plants

Conference Structure

Frederick H. Morse
Conference Organizer

Organizational Sponsors

- United States Department of Energy
- Global Environment Facility
- United Nations Environment Program
- California Energy Commission
- IEA SolarPACES Executive Committee
- German Development Bank
- German Ministry for the Environment

Industry Hosts

- Solargenix Energy
- Stirling Energy Systems
- Solar Millennium
- Solel Solar Systems
- Schott-Rohrglas
- Fichtner Solar
- Morse Associates

Participants

90 participants, 12 countries, 5 international organizations

- Algeria
- Australia
- Egypt
- Germany
- Hong Kong
- India
- Israel
- Mexico
- Morocco
- Spain
- South Africa
- Switzerland
- Turkey
- United States
- GEF, IFC, IEA, UNEP and EU

Conference Objective

- To define and launch a coordinated Global Market Initiative to build 5,000 MW of CSP in prime areas around the world in the next ten years.
- A draft CSP Global Market Initiative was included with the meeting materials.

Structure

- Three days of plenary sessions with Discussion Groups on the first two days
- Day 1 – Overview of CSP technologies and activities around the world, followed by first group discussions.
- Day 2 – Discussion Group reports, stakeholder panel, second group discussions and reports.
- At the end of the second day, necessary revisions to the draft Global Market Initiative will have been identified, agreed-upon and made.

Structure (continued)

- A formal reception and dinner will close the preparatory part of the conference and open the launching of the CSP GMI.
- The CSP GMI will be launched on Day 3.
- The revised draft will be presented and endorsed, perhaps with conditions, by the GEF and representatives of interested countries and states.
- The conference will close with an awards lunch.
- A visit to the SEGS plants will take place on Friday.

Discussion Groups

- Organized according to the three regions described in the draft CSP GMI
  - “Ready-to-go” countries and states
  - “Well-connected” countries and states
  - “Individual” developing countries
- Typically 12 people, including a leader and a reporter.
- The leaders and reporters know what topics to discuss and what is expected in their reports.
- If not on list – see revised list at registration desk.

First Group Discussions

- Discuss the proposed CSP GMI from the perspective of each region.
- Recommend clarifications to the regional strategy and approach.
- Define the conditions necessary for the success of the CSP GMI.

Second Group Discussions

- The proposed elements (requirements) of the CSP GMI.
- The proposed structure and management of the CSP GMI.
- The steps required for the successful implementation of the CSP GMI.

Arrangements

- Breakfast offered each morning moved to upstairs on the Starlight Terrace
- Coffee breaks each morning and afternoon in front of this room
- Lunches each day – today and tomorrow on the Starlight Terrace and on Thursday in Salon D

Arrangements

- Open evening Tuesday
- Reception and dinner Wednesday
- The breaks, lunches reception and dinner hosted by six industry companies
- Friday's visit to the SEGS plant hosted by Solar Millennium
- Schedule at a glance behind name badge

Presentations

- Invited presentations will be made available on the web site of one of the sponsoring organizations, to be determined.
- Copies of the Discussion Group reports will be made available, if possible, prior to their presentation on Wednesday.
- Copies of the revised CSP GMI will be made available on Thursday morning.

Transportation

If you have a car and would be willing to provide a ride to Los Angeles or Ontario airports on Thursday or Friday, please write your name, room number, when you are leaving and to which airport on a sheet of paper and give it to Cindy at the registration desk. She will compile and post that list at the registration desk. This would be a great favor for those having difficulty with their departure arrangements.

Tuesday Oct, 21
9:00 to 9:30 AM

SESSION 2: WORLWIDE CSP ACTIVITIES

Expanding the Market for Concentrating Solar Power: The California Experience

October 21, 2003

Tim Tutt

Technical Director

Renewable Energy Program

California Energy Commission

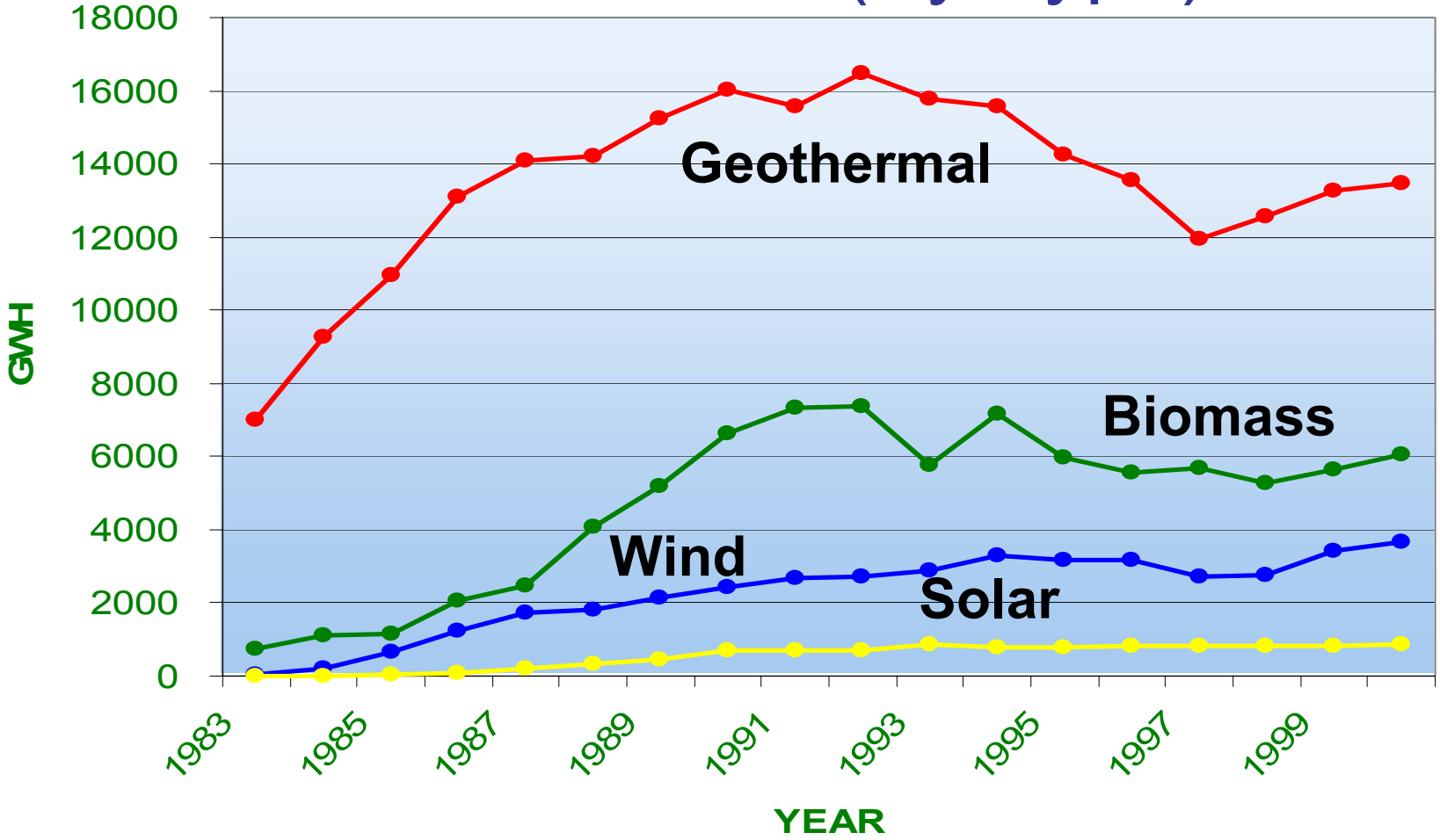
RENEWABLE ENERGY PROGRAM

CALIFORNIA ENERGY COMMISSION

Presentation Overview

- Overview of Renewable Energy In California
- History of Concentrating Solar Power in California
- California's Renewable Portfolio Standard and Concentrating Solar Power

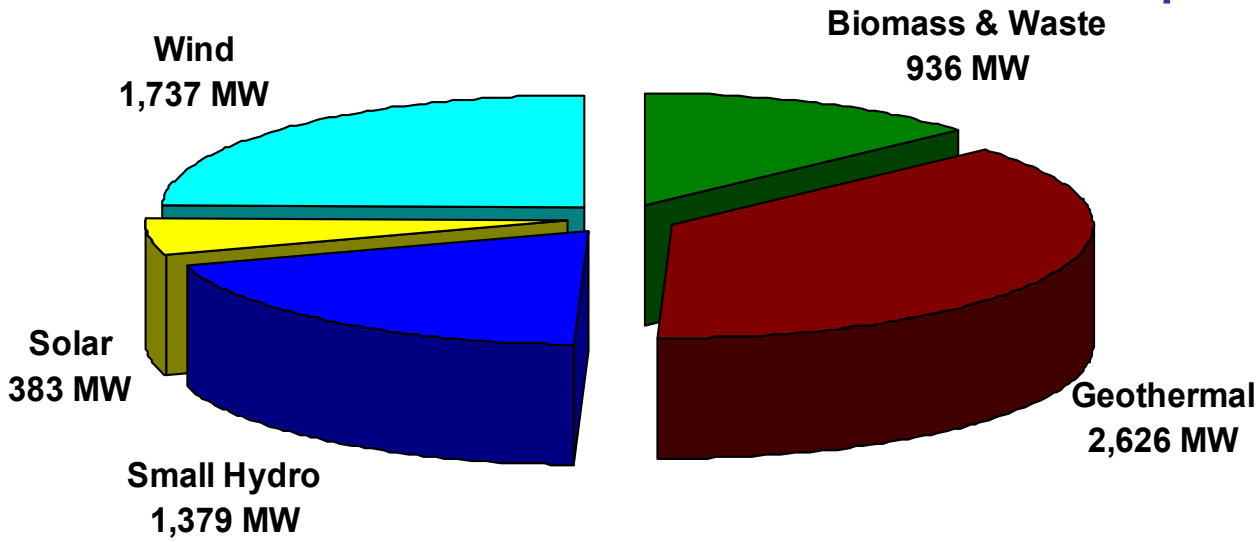
California's Renewable Generation (By Type)



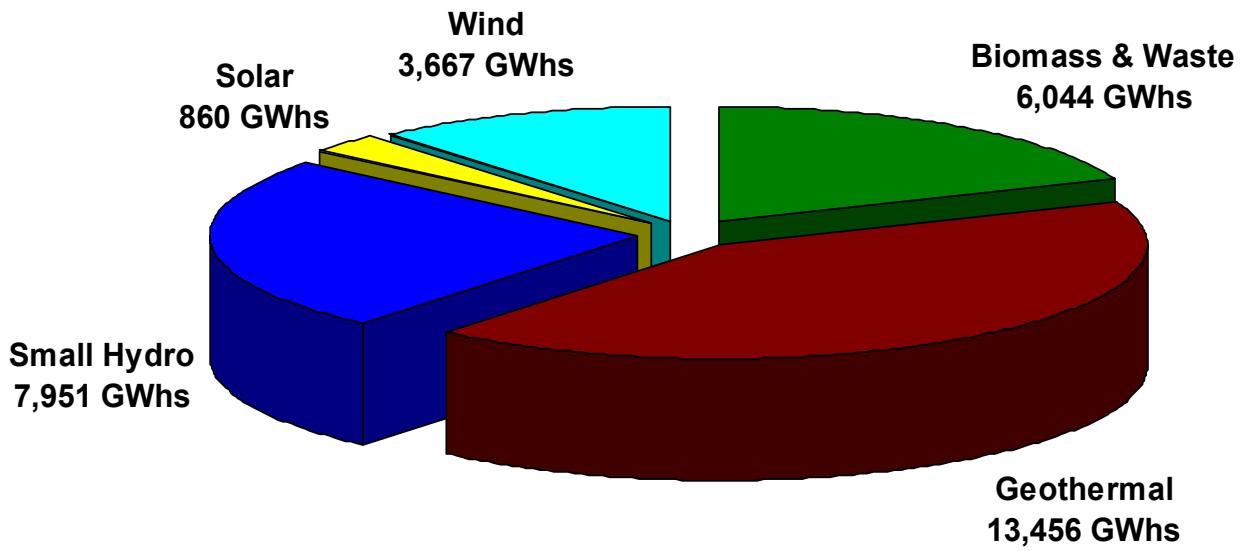
RENEWABLE ENERGY PROGRAM

CALIFORNIA ENERGY COMMISSION

California's In-State Renewable Capacity (2000)



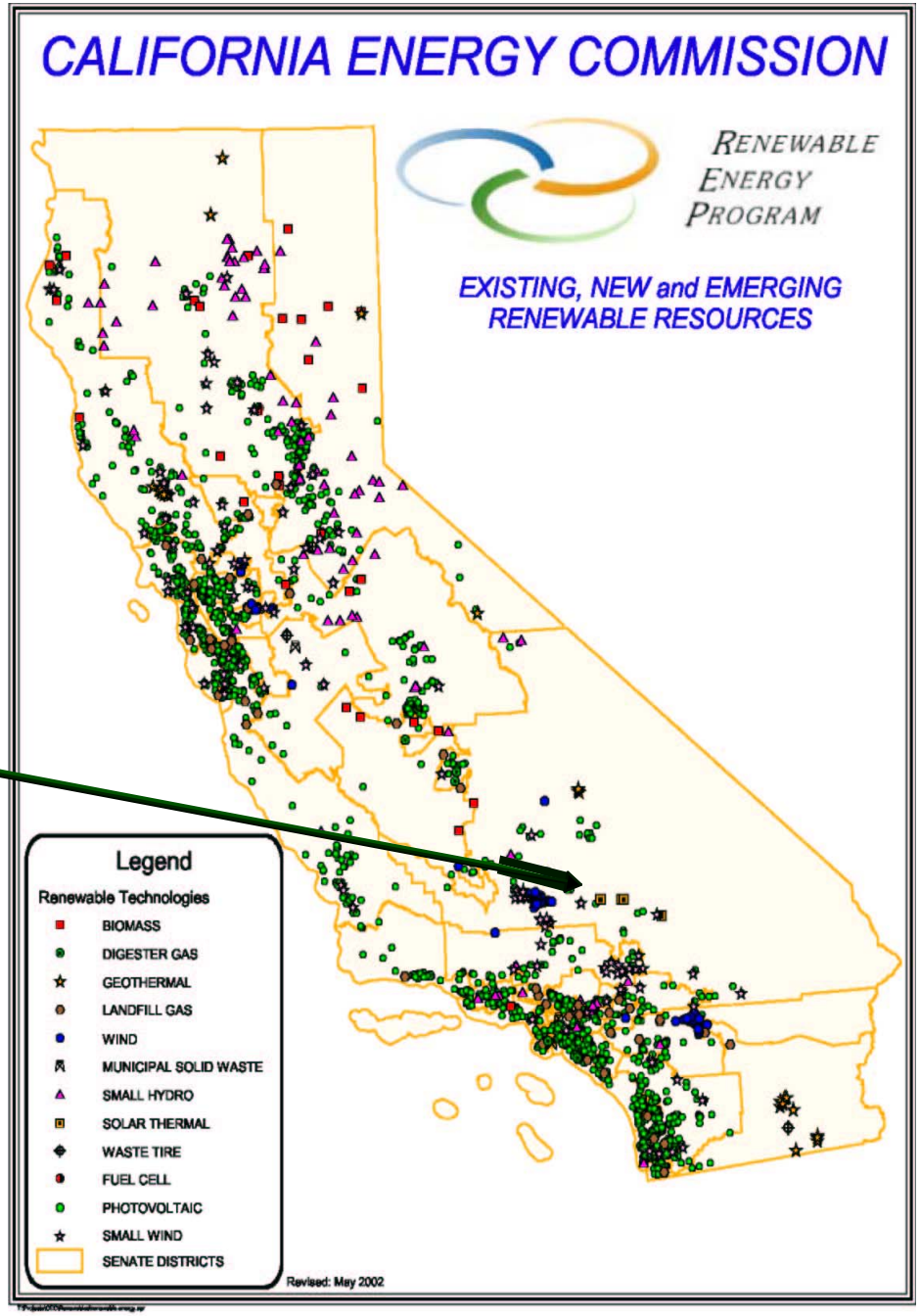
California's In-State Renewable Generation (2000)



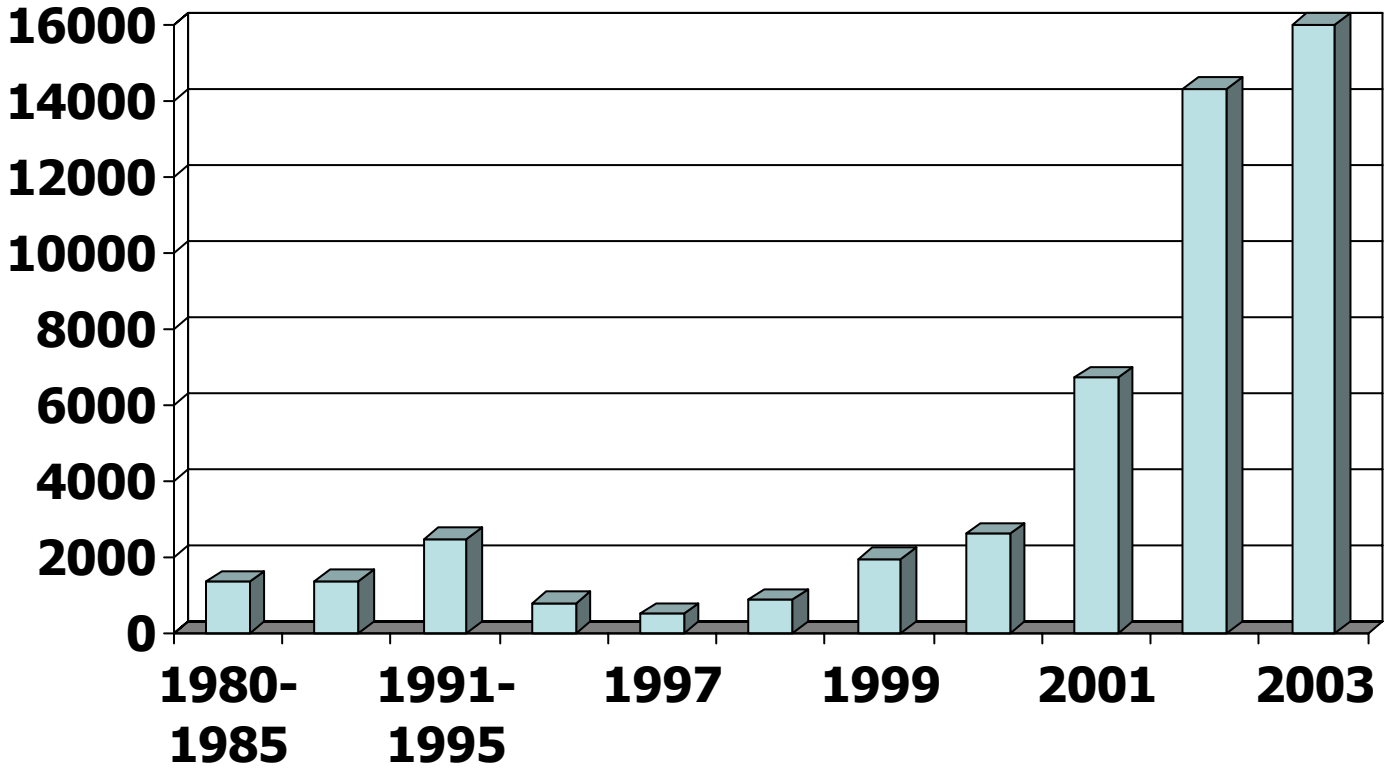
RENEWABLE ENERGY PROGRAM

CALIFORNIA ENERGY COMMISSION

Concentrating Solar Power Facilities



Number of Grid-Connected PV MW Installed

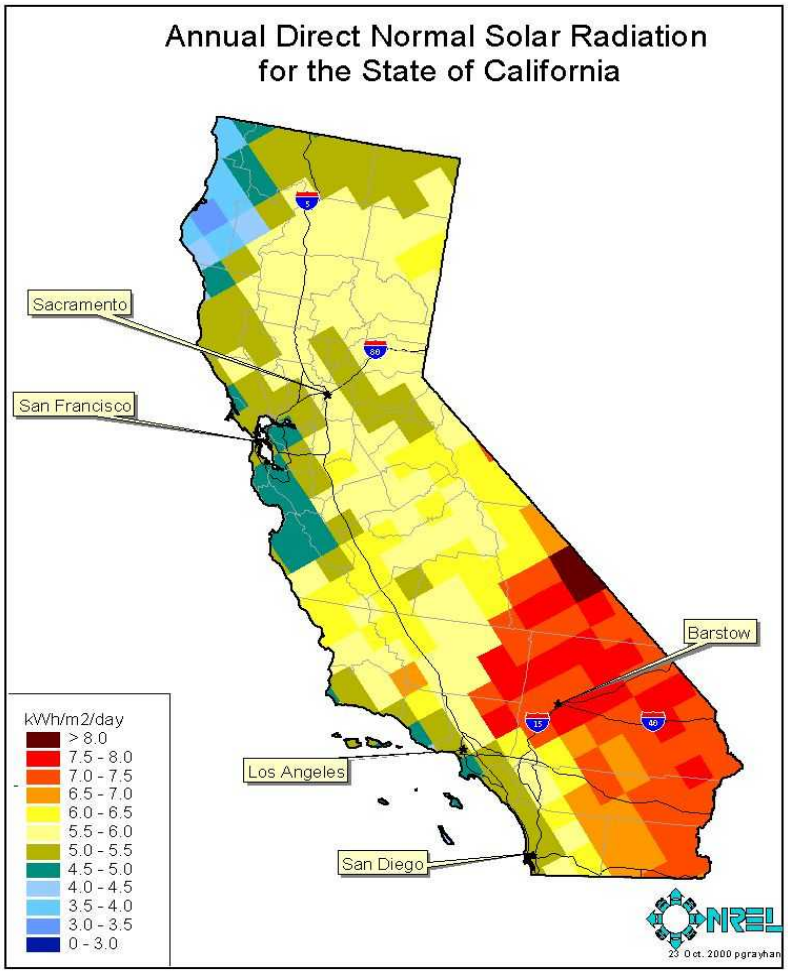


RENEWABLE ENERGY PROGRAM

CALIFORNIA ENERGY COMMISSION

California's Solar Resources

- California Has Some of the Best Solar Resources in the World
- Potential estimated at over 66,000 MW, using only 2% of land area in high resource counties



RENEWABLE ENERGY PROGRAM
CALIFORNIA ENERGY COMMISSION

Concentrating Solar in California: History

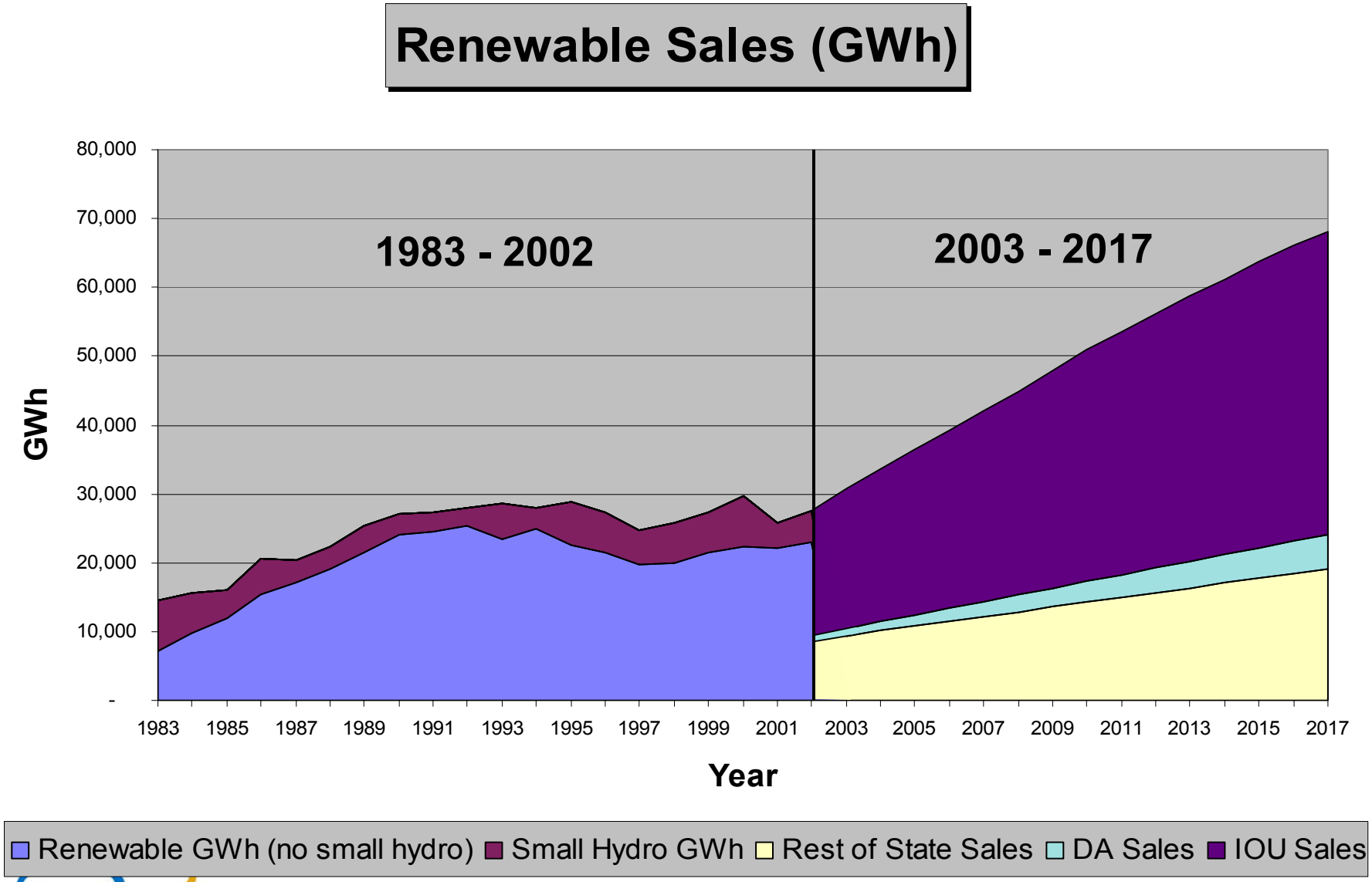
- Solar One: A 10 MW Power Tower that operated from 1982-1988
- Solar Two: A 10 MW Power Tower Demonstration Project that operated from 1996-1999

  LUZ/SEGS: 9 Parabolic Trough Facilities in Southern California Desert
  - Constructed in late 1980s – early 1990s
  - Continue to Operate today
  - Over $17 million in production incentive payments since 1998

Overview of California's RPS

- Target of 20 percent renewable energy for the state by 2017
  - Accelerated to 2010 in the Energy Action Plan
- Baseline is 2001: percent renewable = 11%
- Each Retail Seller shall increase its procurement of eligible renewables by at least 1% of retail sales per year
  - Municipal Utilities To Increase Similarly

Effect of California's RPS



ENERGY PROGRAM
CALIFORNIA ENERGY COMMISSION

Key RPS Factors For Concentrating Solar Power

- **Least Cost/Best Fit (LCBF) –** Solicit Renewables that best fit utility needs at lowest cost, including:
  - Transmission costs
  - Integration costs
  - Remarketing costs
- **Market Price Referent (MPR) –** A long-term, market price estimate for the product purchased:
  - Baseload
  - Peaking
- **Supplemental Energy Payments (SEP) –** Incentives for up to ten years of production to cover costs above MPR

Least-Cost Best-Fit

- Develop Long-term Procurement Plan Identifying Resource Needs
- Solicit Renewable Bids to Meet Needs At Lowest Cost
- Rank bids by bid price - to be compared to MPR for baseload and peaking products
- Rank Again including system costs:
  - Transmission costs
  - Integration costs
  - Remarketing costs

Market Price Referent

- CPUC and CEC to develop for each solicitation based on:
  - Long-term fixed-price costs of conventional baseload or peaking power plant
  - Long-term fixed-price contracts for baseload or peaking power
- CEC's Cost of Generation Report:
  - Combined Cycle: 5.18 cents/kWh
  - Simple Cycle: 15.71 cents/kWh

Supplemental Energy Payments

- Collecting more than $75 million a year through 2011 to fund costs above MPRs
- CEC may establish caps on SEPs allocated to:
  - Solicitation
  - Entity
  - kWh Generation – previous caps of 1.5 cents per kWh or less

Conclusions

- California has Significant Potential for CSP Development
- California has Need for Peaking Power Products
- California's RPS Provides the Policy Push for Renewables Development
- Concentrating Solar Power may be Entering a New Era of Growth In California

Conclusions

- Barriers
  - Technology Costs
  - Transmission Costs

- For More Information:
  - ttutt@energy.state.ca.us
  - (916) 654-4590
  - www.energy.ca.gov

Dick Burdette's presentation is not available.

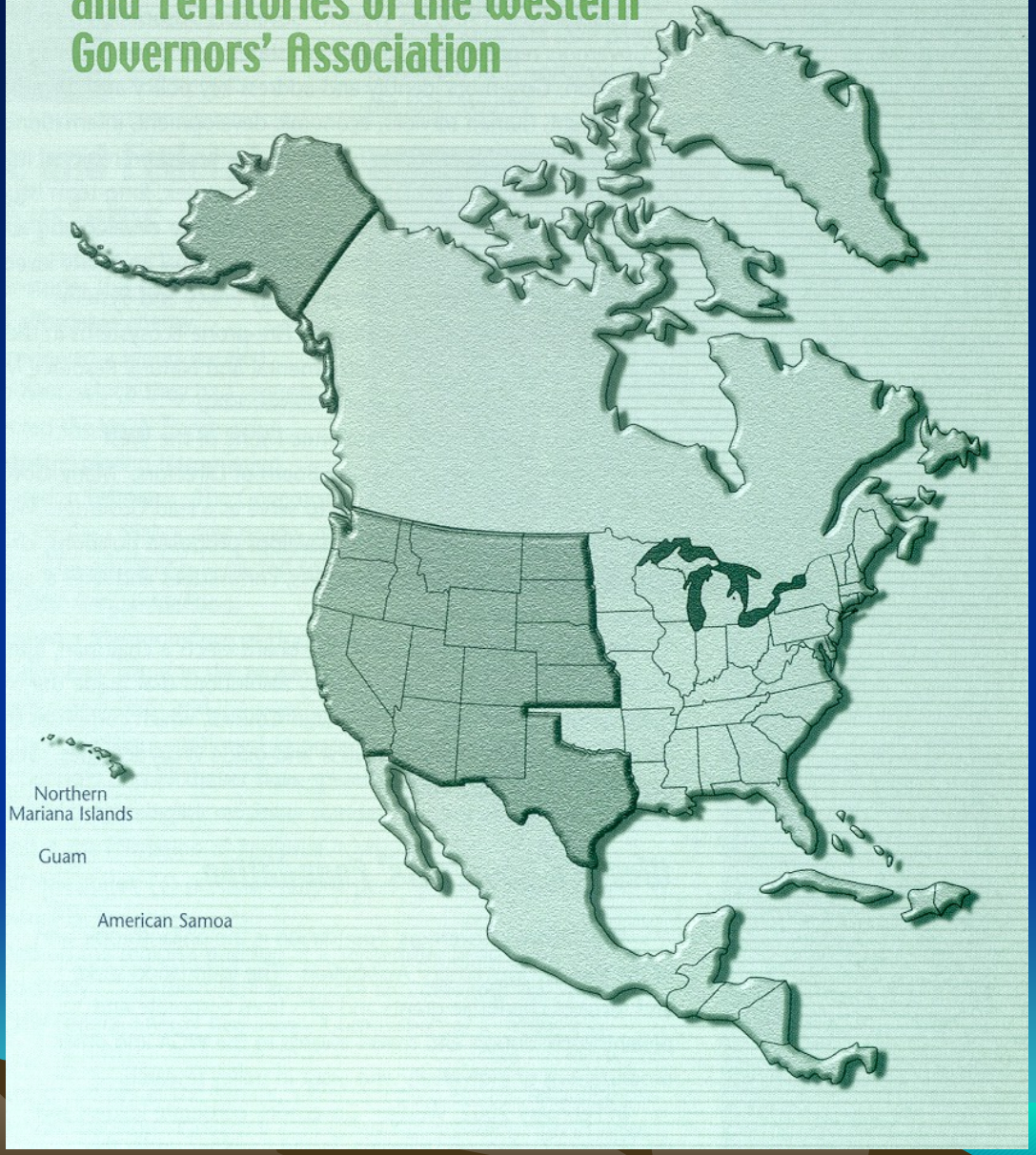
Western Governors' Association

Kevin M. Moran

Director, WGA Washington Office

www.westgov.org

Member States, Commonwealth, and Territories of the Western Governors' Association



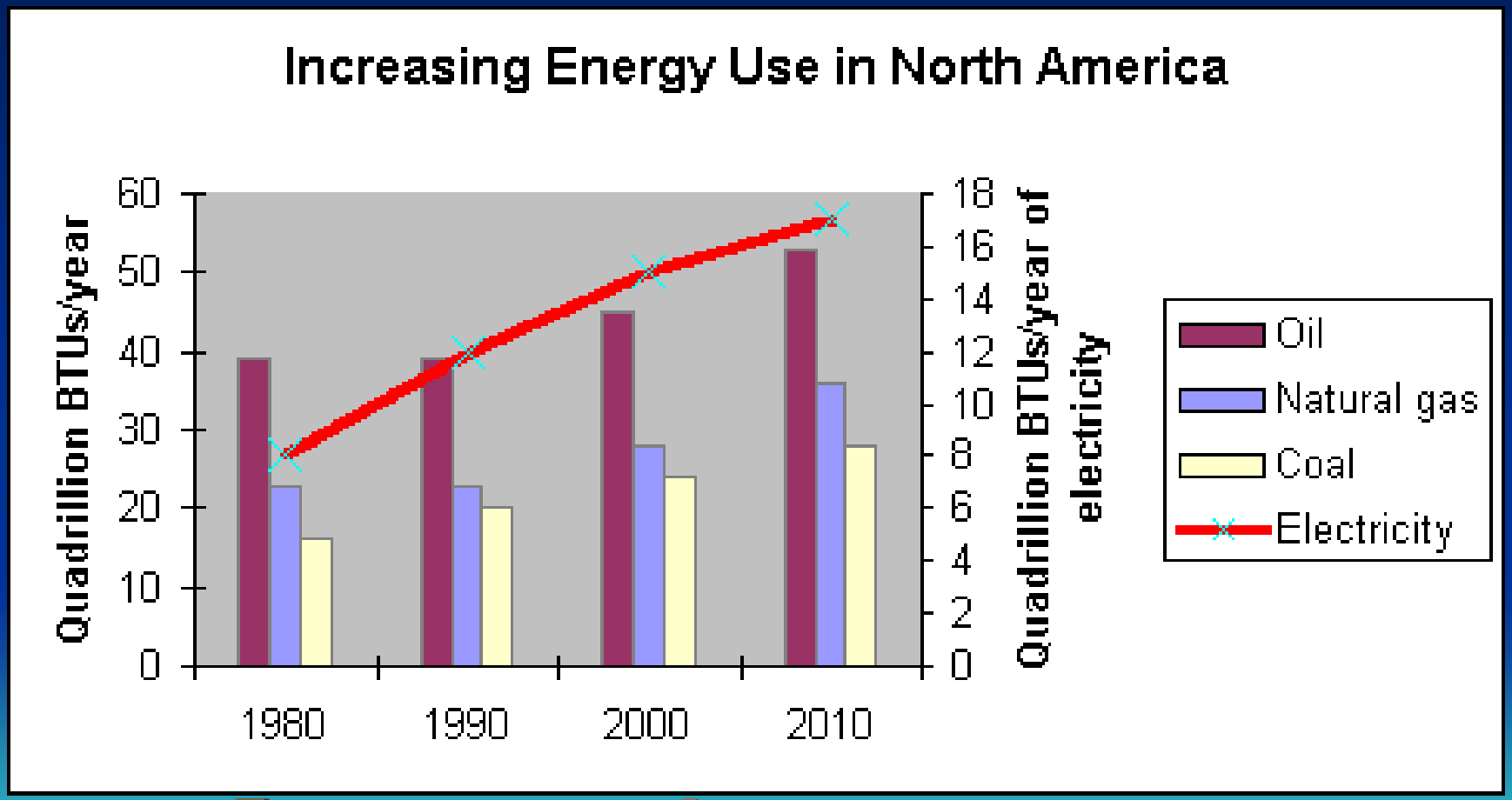
WGA Mission

"The mission of the Western Governor's Association (WGA) is to identify and address key policy and governance issues in the West; advance the the role of the western states in the federal system; and strengthen the social and economic fabric of the region."

STRATEGIES

- Develop and Communicate Regional Policy
- Serve as A Leadership Forum
- Build Regional Capacity
- Conduct and Disseminate Research
- Form Coalitions and Partnerships
- Build Public Understanding and Support

Keeping up with Demand



Background

- In 2001 Congress asked DOE to determine what would be required to deploy 1000 MW of Concentrating Solar Power in the Southwest U. S.
- DOE issued a report in August 2002 concluding that fulfillment of the initiative is technically and economically feasible if sufficient financial incentives are put in place to allow the industry to effectively compete in the marketplace.
- DOE & CSP industry approached the Western Governors' Association through the Western Interstate Energy Board to explore implementation.

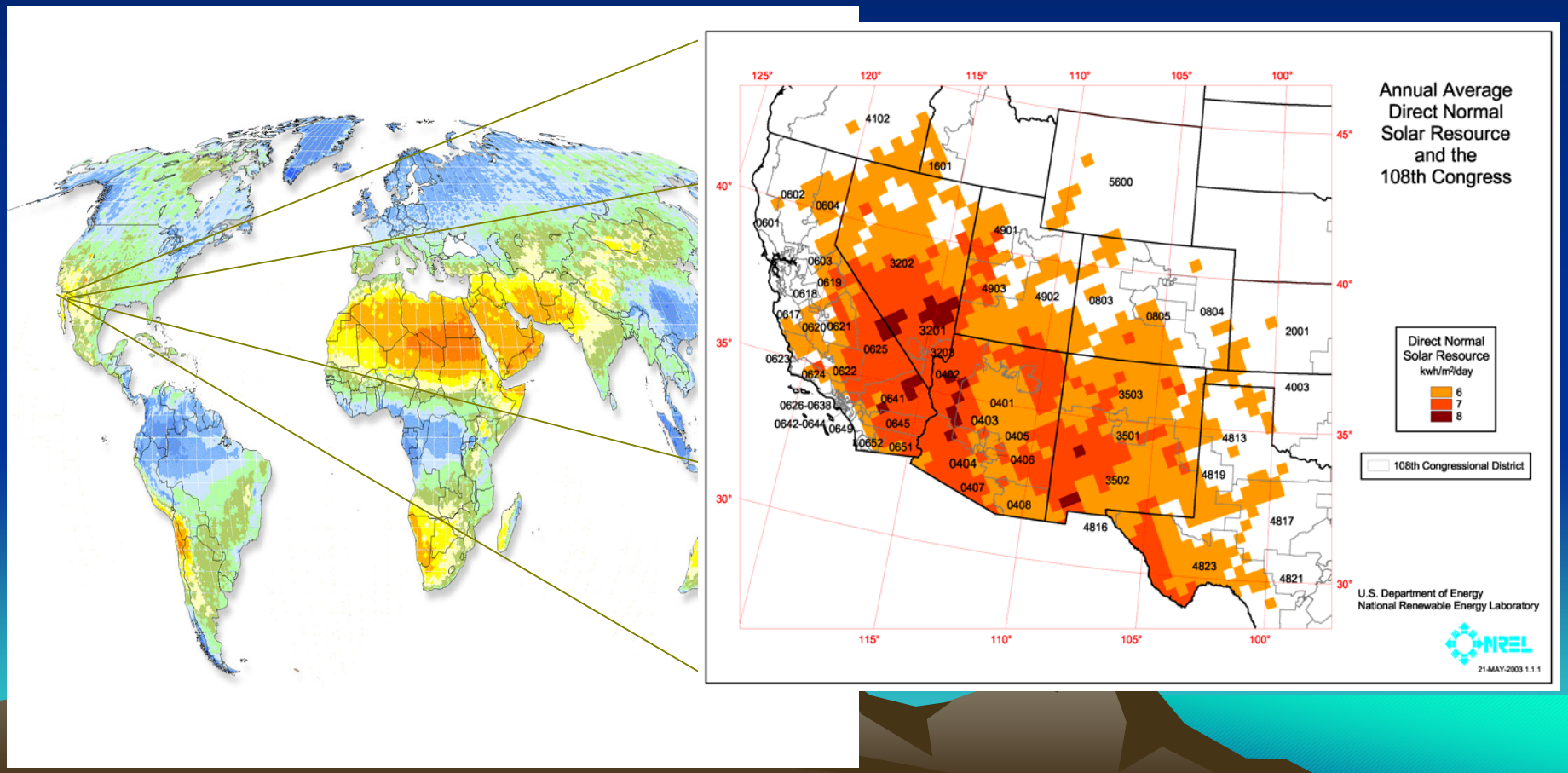
1,000 MW Initiative

The Governors recognize:

- The solar energy resource in the Southwest U. S. is enormous and largely untapped.
- The Southwest can add another engine for economic development by exploiting its CSP resource.
- The economic and environmental benefits can exceed the added cost to develop this clean, renewable energy resource.

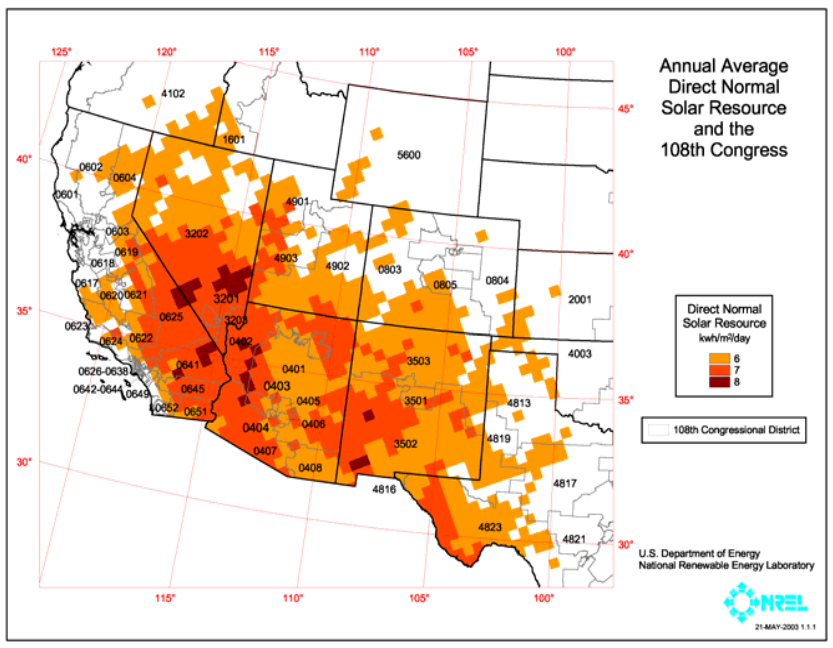
Southwest Solar Resource

Solar energy resources in the Southwest U.S. are among the finest in the world



SW Solar Energy Potential

State	Solar Capacity (MW)	Land Area (Sq Mi)
AZ	1,652,000	12,790
CA	742,305	5,750
NV	619,410	4,790
NM	1,119,000	9,157
Total	4,132,715	32,487



The table and map represent land that has no primary use today, exclude land with slope > 1%, and do not count sensitive lands.

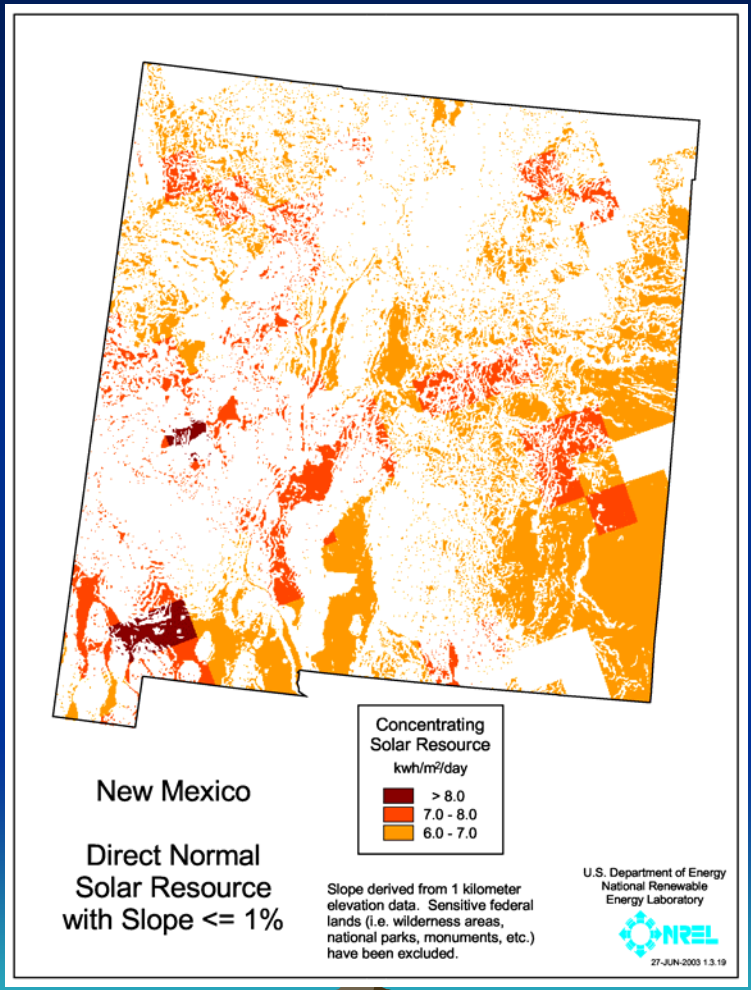
Solar Energy Resource ≥ 7.0 kWhr/m^2/day (includes only excellent and premium resource)

Current total generation in the four states is 83,500 MW.

Planned additions in four states over the next 3 – 5 years are 37,099 MW of which 87.6% is natural gas.

1000 MW of CSP requires 7.7 mi^2.

NM's Solar Energy Potential



The table and map represent land that is currently underutilized, excluding land with slope > 1% and environmentally sensitive lands.

Solar Resource kWh/m^2/day

	> 8.0	7.0 – 8.0	6.0 – 7.0	Total
Available Area* (mi	923	8,234	25,060	34,217
Capacity (MW)	119,000	1,000,000	2,550,000	3,669,000
Generation (MWh/year)	282,020,000	2,367,297,000	6,036,258,000	8,685,575,000

Benefits from Development

Economy

- **Create new** jobs **in rural areas**
- **Reduce** cash outflow **for energy**
- **Increase** capital investment **in the state**
- **Increase** state **GSP**

Energy

- Produce **clean power** in the state
- Hedge **against** NG price increases **and volatility**
- Hedge against **hydropower fluctuations**
- Reduce or mitigate **transmission** problems

Environment

- **Reduce air pollutants**
- **Reduce greenhouse gas emissions**

Create New Jobs in Rural Areas

- At its peak, installation of 1000 MW of CSP power plants would create nearly 7,000 new jobs.
- New jobs will be created to build, assemble and operate the CSP plants.
- These jobs can readily be created in rural areas.
- With the location of CSP plants in SW, manufacturing and assembly plants can be expected to locate in the region.

Environmental Benefits

Displacement (millions of lbs)

CSP Capacity (MW)	CO_2	SO_2	NO_x
250	1,100	1.0	0.9
1000	4,600	3.8	3.6
6000	27,400	23.0	21.6

Photo Source: Western Regional Air Partnership

Renewables can contribute to the WRAP goals of cleaner air, reduced air pollution, and haze reduction.

Other Benefits

- Produce clean power in the region.
- Energy price stability, a hedge against natural gas price volatility.
- Offset hydropower reductions during times of drought.
- Build/deploy to offset local transmission constraints.
- Potential for export power to other states in the region.

Next Steps

- S.W. Governors working together to develop this common resource.
- A stakeholder group is currently reviewing each State's solar resources, available transmission capacity, and other factors.
- Review State regulations and incentives and recommend how best to support the deployment of CSP technology.
- Support Federal incentives to reduce the burden on States' ratepayers.

- Encourage continued congressional support for the DOE CSP R&D program.
- WGA working to create an REC trading system.
- Explore ways to use federal and tribal lands to site CSP plants.
- Present status report at WGA's North American Energy Summit in Spring 2004.

Summary

The solar energy resource in the Southwest U. S. is enormous and largely untapped.

The Southwest can add another engine for economic development by exploiting its CSP resource.

The economic benefits can exceed the cost to develop this clean, renewable energy resource.

Western Governors are at the forefront of this effort.

Egyptian Vision on Solar Thermal Power Generation

Eng. Hosni H. El Kholy
Executive Chairman
Of the New and Renewable Energy Authority (NREA)
Ministry of Electricity and Energy
Egypt

Oct., 2003

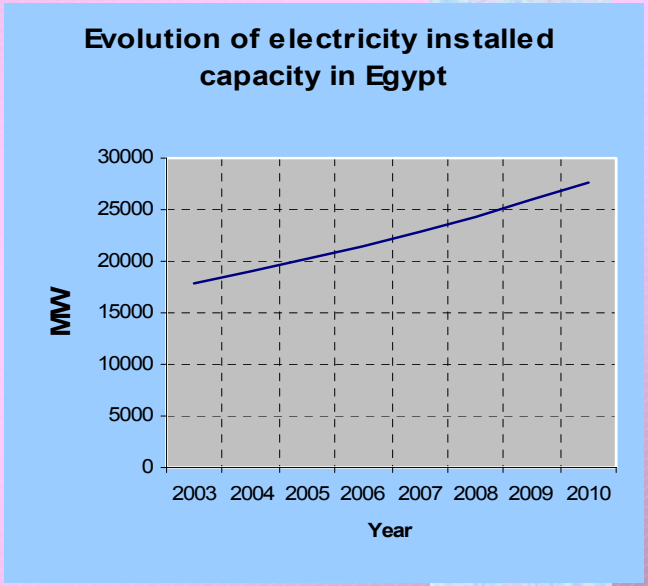
Egyptian Vision On Solar Thermal Power Generation

- Power Sector Directives
- Potential of RE in Egypt
- Targets
- Favoring Factors
- Main Requirements
- Current status of the 1st CSP Project
- Long Term Objectives
- Needed Efforts
- On the National Level
- On the International Level
- Why Concentrating Solar Power
- Prospects

Power Sector Directives

- Currently, the growing demand rate for electric energy to satisfy the socio/economic plans amounts to about 6.5 % annually during this decade.

- These plans necessitate in turn a concurrent generation expansion plan to increase the installed capacity from 17800 MW in 2003 to about 27500 MW by the year 2010.



- The sector Policy depends on 3 main Pillars:
  - Diversifying energy resources.
  - Improving Energy efficiency and energy conservation programs.
  - Enhancing the role of renewable energy (RE) in the energy mix.

- **Such expansion plan gives a room enough for a considerable share of electricity generation from RE sources.**

- **Presently, the Nile offers considerable amount of hydro energy, representing 16% of electricity generation.**

- **Meanwhile, wind energy will contribute by about 1% of electricity generation by mid 2004.**

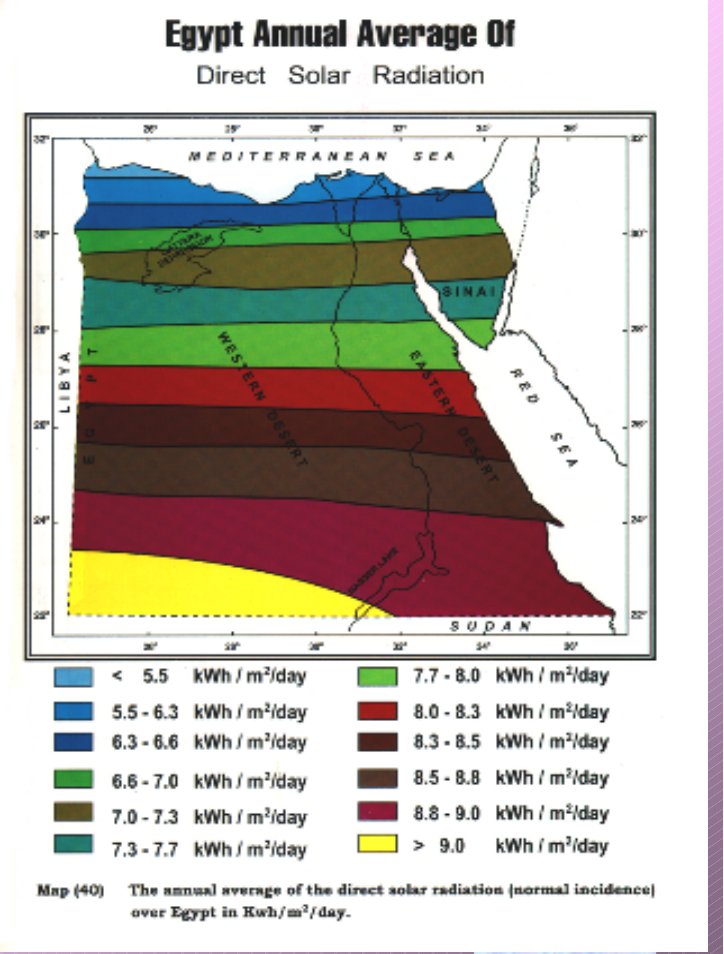
- **The Ministry of Electricity and Energy has formulated a Renewable Energy strategy to utilize abundant renewable energy resources, mainly wind and solar, targeting to cover 3 - 4% of the demand by 2010.**

Potential of RE in Egypt

- Egypt is one of the sun belt countries.

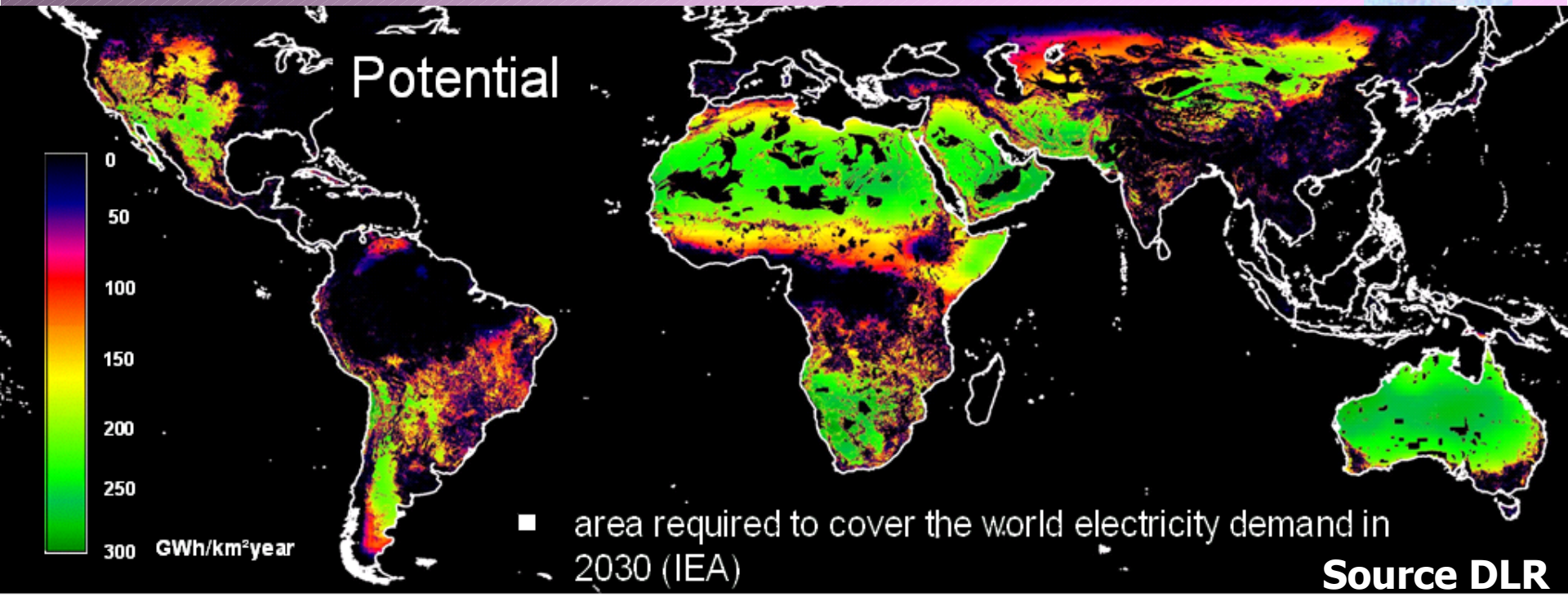
- In 1991, A solar Atlas for Egypt was issued, concluding that:
  - The direct solar radiation intensity ranges between 1900 KWh/m^2/y in the North and 2800 KWh/m^2/y in the South
  - The sun shine duration ranges between 9-11 h/day from North to South, with very few cloudy days.

- Also, Egypt is endowed with excellent wind regime at the Gulf of Suez reaching about10.5 m/s



Map (40) The annual average of the direct solar radiation (normal incidence) over Egypt in Kwh/m²/day.

Potential of Solar Energy in Egypt



1 km² of desert land can accommodate up to 200 GWh_e/year, which is equivalent to 50 MW coal or gas plant, saving about 500,000 bbl of oil/year and avoiding about 150,000 tons CO_2/year

Targets

- Due to the conclusions of several resources assessment studies indicating that Egypt posses remarkable potential of RE resources;

- A program has been developed for large scale grid connected RE power generation, mainly utilizing wind and solar thermal technologies that are currently matured.

- Our ambitious program aims to:-

1. Implement 150 ~ 180 MW and 300 MW installed capacity of hybrid solar / fossil fuel thermal power plants by 2007 and 2010 respectively.
   - Realizing that ambitious program depends upon:-
     - The evaluation of the 1st CSP project performance.
     - Securing finance to cover the incremental cost.
2. Implement 600 MW of wind farms by the year 2010.
3. Export green electricity

Favoring Factors

- Encouraged by:-
  - High intensity of solar irradiation
  - Uninhabited large flat desert available at no cost.
  - Extended national power grid and regional interconnection.
  - Expanding gas pipeline network
  - Cheap labor and intensive skills
  - Local industrial capabilities.

- The Egyptian Cabinet agreed to start the implementation of the 1st hybrid solar/fossil fuel thermal power plant, in 1996, with capacity of 150 MW including solar field of 30-40 MWe capacity.

- The project is the first of series of hybrid solar fossil plants to be implemented to fulfill the long term objectives.

Main Requirements

- The Governmental decision was based upon:-
  - Selecting a proven technology.
  - Reliable plant configuration
  - Financial support to cover the incremental cost
- GEF and the WB support the project through covering the incremental cost.
- The project will be owned by NREA and implemented with private sector participation through EPC, O&M contract.

The Current Status of the 1st CSP Project

- In 2000, the 1st phase Of consultancy services was granted by GEF and performed by the German company "Lahmayer".
- On the 2nd of Oct.,2003 NREA signed a contract with Fichtner Solar to perform the 2nd phase of consultancy services which will end by awarding the project contract.
- WB has agreed upon the following:-
  - NREA is the recipient of GEF' grant as the owner of the project.
  - The private sector will participate in the EPC and O&M through long term contracts agreed upon between parties.
  - The size of the plant ranges between 150-180 MW.
- It is planned to issue the tender document by Aug., 2004.
- It is anticipated to operate the project by late 2007.

Hybrid Solar/ Fossil Thermal Project at Kuraymat

Solar Industrial Processes Heat

- In addition to the 1st CSP project, NREA has given due consideration to utilize solar industrial process heat using parabolic trough technology that has the added benefit of capacity building in that technology

- A pilot project located at one of the pharmaceutical companies in cooperation with the "African Development Fund" is being commissioned.

- The purpose of the project is to generate 1.3 ton/hour of saturated steam at 175°C & 8 bar by utilizing solar parabolic trough collectors with an area of 1900 m^2.

- The local manufacture of the project' components amounts to 70% including thermal component for the first time in Egypt (supports, Aluminum frames, metallic connections, assembling and installing solar concentrator components at site, mechanical driver, piping work, civil & electrical works, instrumentation and controls).

Long Term Objectives

- The long term objectives of the RE grid connected power generation program are:-

  - Enhancing the local industrial capabilities through technology transfer.
  - Creating new job opportunities.
  - Creating national and regional market for RE equipment.
  - Exporting clean energy generated from RE & hydro to Europe via regional interconnection links, where as Egypt is considered as the nodal point for the regional interconnection via 3 links:

    a- Interconnection with Turkey via Jordan, Syria, Lebanon.

    b- Interconnection with Spain via Libya, Tunisia, Algeria, Morocco.

    c- Interconnection with the African Nile Basin countries (planned).

Needed Efforts

- To realize such program, it is necessary to secure the financial support from the International and other institutions (GEF, UNDP, UNEP, EIB, KfW, DANIDA, JBIC, ……etc.) to cover the incremental cost of the RE projects, which would in turn enable bridging the cost / market gaps.

- There is no doubt that CSP projects especially in the developing countries need a lot of efforts to do on both the national and international levels.

On the National Level

- Governmental commitment to achieve the planned program
- Availing free land for RE projects and access to the national electrical network as well.
- Establishment of electricity utility and consumer protection agency to, interallia, review PPA's tariff of RE projects .
- Establishing RE-Fund to finance RE projects from revenues of saved hence exported fossil fuel.
- Setting up a national strategy for Clean Development Mechanism.
- Preferential tariff for RE electricity

These are only the Beginnings

On the International Level

- The role of the international institutions is essential to exert more efforts to create the global market and to over-come the hurdles of finance and technology transfer.
- Programs to promote RE proven technologies generally and solar thermal power generation particularly, to reduce the cost.
- Kyoto protocol mechanism can and should play an important role.
- Encourage green electricity sales

Why Concentrating Solar Power?

Sustainable Development

Clean Energy

Creating new Jobs

Easy integration

CSP

Product for export

Local value

Local resources

Protection of the Climate

Egypt is very much concerned about the effects of climate change on its coasts lying on the Mediterranean Sea and the Nile Delta as well.

Prospects

- The dissemination of new clean technologies and applications on a wide scale is the governing factor to achieve the goal of cost reduction and hence gradually diminishing the incremental cost until the break-even point is reached.
- The CSP technologies should become able to compete with the conventional as a result of maximizing CSP penetration in the energy mix and hence reduce the cost.
- Egypt's economy would benefit through increasing hydrocarbon surplus available for export as one of the most important income sources.
- Therefore, Global Market Initiative meets Egypt's interest.

Thank you

RREC

Presentation on the

Integrated Solar Combined Cycle Power Plant,

Mathania, India

for the

International Executive Conference on

Concentrating Solar Power

at Palm Springs, California

21-23 October, 2003

Presented by

C.S. Rajan

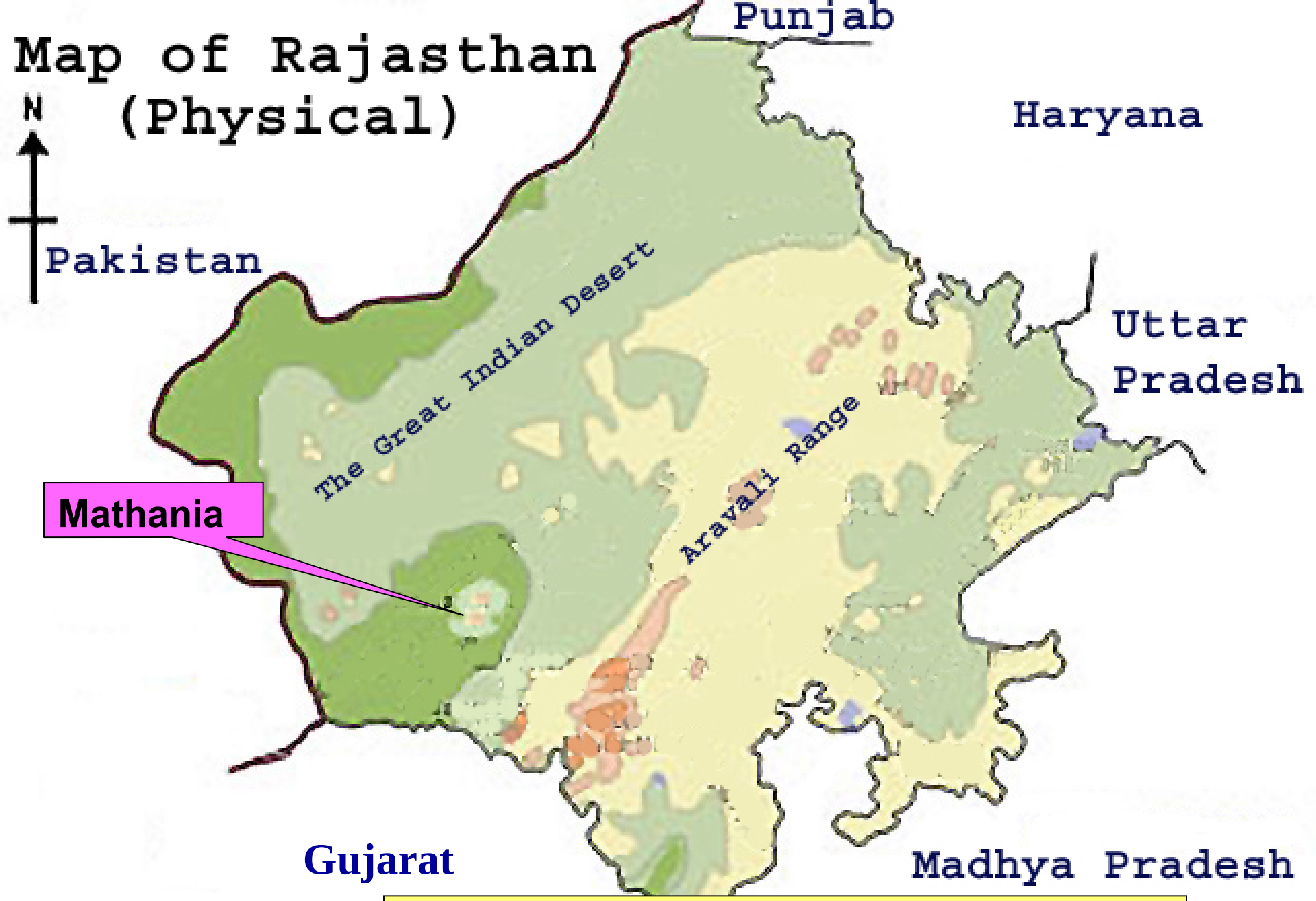
Secretary, Energy, Government of Rajasthan, India

and

Chairman, Rajasthan Renewable Energy Corporation

Jaipur, India

LOCATION OF RAJASTHAN
IN INDIA
N
JAMMU & KASHMIR
CHINA
PAKISTAN
DELHI
NEPAL
BHUTAN
RAJASTHAN
Jaipur
Kolkata
(Calcutta)
Mumbai
(Bombay)
ARABIAN SEA
BAY OF BENGAL
Chennai
(Madras)

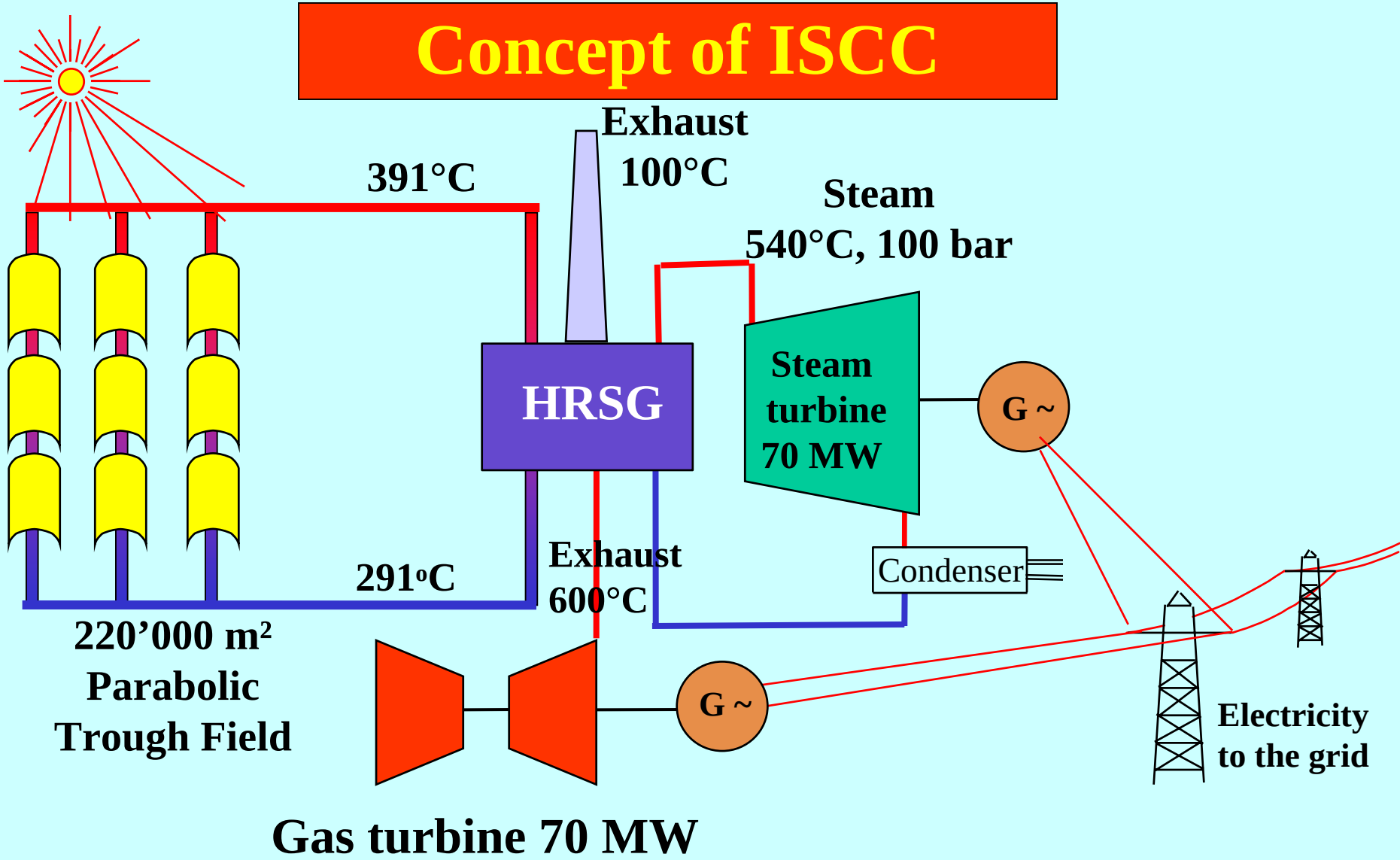


Best solar radiation in India
(Annual sum of direct normal irradiance = 2243 kWh/m²)

Key Technical Parameters

Technology	Integrated Solar Combined Cycle Parabolic Trough Collectors
Capacity	
a) CC Block	140 MW
b) Solar Block	35 MW
Site Location	Mathania, India
Solar Radiation	2243 kWh/m^2 p.a. (direct normal)
Collector Area	220,000 m^2
Electricity to Grid	800 GWh$_e$/a
Share from Solar	50 GWh$_e$/a
Fuel	Natural Gas (RLNG)

Concept of ISCC



Importance of CSP to Rajasthan and to India

- Limited fossil fuel resources in India, particularly in Rajasthan.
- Reserves depleting rapidly.
- High price volatility of conventional fuels.
- Abundant solar potential available with high insolation in Western Rajasthan.
- Sustainable environment management – Clean, Green Fuel.

Support to CSP in Rajasthan and India

- **Special thrust to promote CSP in Rajasthan**
  - RREC created as SPV for project execution.
  - CSP can share within 10% of the State power generation capacity reserved for renewables.
  - Exemption from merit order despatch regulation.
  - Long term tariff protection for renewables.
- **Special thrust to promote CSP in India**
  - GEF grant of US$ 45 million under appraisal.
  - MNES grant of US$ 11.12 million budgeted.
  - KfW loan of Euro 127.82 million sanctioned.
  - GOR equity of US$ 11.12 million approved.

Status of Mathania Project

- All clearances obtained.
- Power evacuation facilities in place.
- Principles of Power Purchase Agreement between Purchaser and RREC agreed upon.
- Terms and Conditions for long term Gas supply between Gas supplier and RREC finalized.
- Pre-qualification process for selection of EPC cum O&M Contractor completed.
- RfP document to pre-qualified bidders issued.
- RfP bids awaited.

Future Opportunities for CSP

- Availability of large area at low cost with high solar insolation provides sufficient scope for setting up CSP projects.
- Policy framework in place to support CSP projects.
- Huge scope for off-grid rural electrification employing CSP technologies.
- Tax incentives under prevailing guidelines.

Barriers in promoting CSP

- High tariffs biggest barrier.
  - Affordable cost of power in long term needs to be ensured.
- Monopolistic and limited number of suppliers of CSP technology.
- Lack of infrastructure facilities like Roads, Rail, Water, non-availability of conventional fuel for integration, absence of evacuation facility in CSP potential areas.
  - Large investment required for Infrastructure development
- Lacks R&D support.

Thoughts on GMI initiative

- Nature and extent of support by industrial countries to region III countries to be spelt out both for short and long term.
- Additional incentives / benefits required to offset the relatively higher cost of CSP power for attracting investment.
- Given the higher risks inherent in CSP projects, financing mechanisms on par with conventional project financing need to be evolved.
- Global monitoring and review of ongoing CSP projects essential for overcoming bottlenecks in time.
- Need for standardisation of technical parameters, efficiency benchmarks, bidding procedures, selection of equipment.

THANK YOU

Minerals and Energy for Development and Prosperity

DEPARTMENT OF MINERALS AND ENERGY
SOUTH AFRICA

South African CSP Experience

Tuesday, 21st October 2003

PRESENTATION BY:
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Chief Director (Energy Planning)
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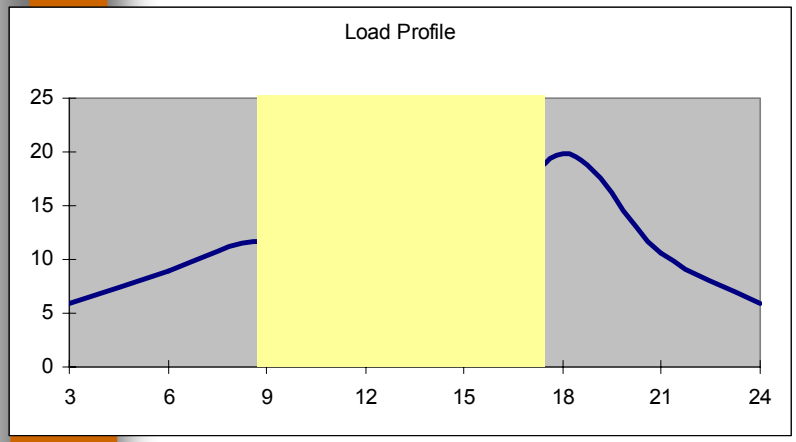
Drivers

- Diversification of Resources, as per Energy White Paper.
- Commercial Opportunities

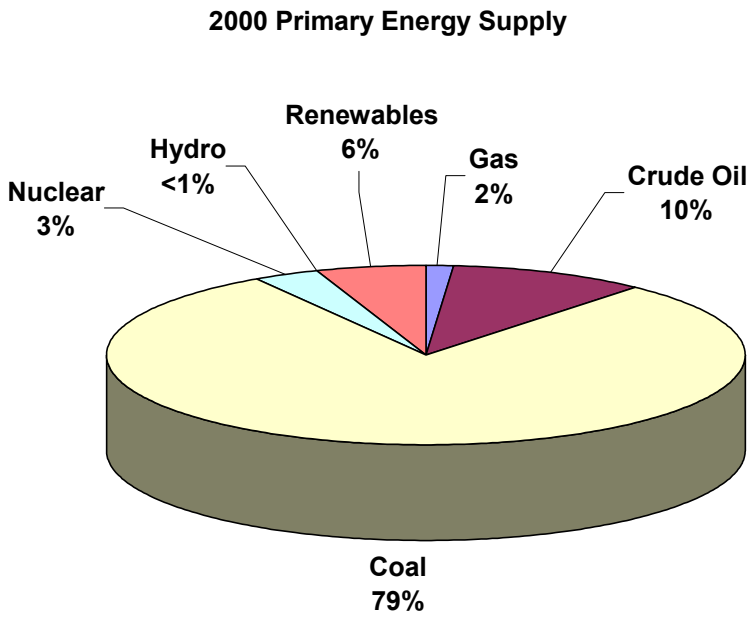
  Provision of future Peak power, green certificates (CDM) etc.
- Distributed Generation solutions.
- National strategies & targets

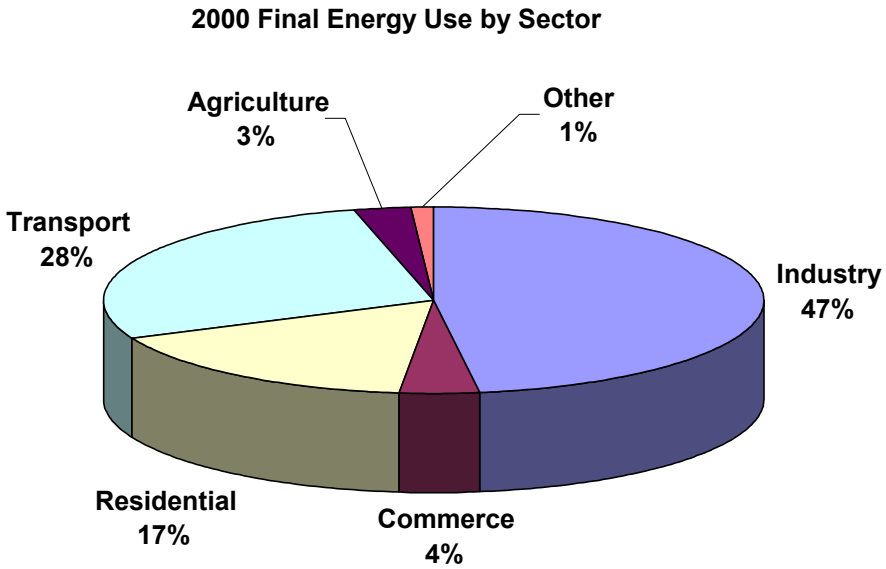
  Draft White paper on Renewables - 10,000GWh by 2013.
- Innovation-related benefits

South African Energy Environment



Type	No.	Net Max Capacity
Coal (C)	10	32 071 MW
Gas Turbine (G)	2	342 MW
Hydroelectric (H)	2	600 MW
Pumped Storage (P)	2	1 400 MW
Nuclear (N)	1	1 800 MW
Total	17	36 213 MW
Mothballed coal	3	3 541 MW
Non- grid Hydro (M)	4	61 MW
Non-grid PV		





Why CSP?

- CSP is the only large-scale renewable technology with a proven energy storage, and can provide peak power.

- A 100MW plant will offset 458,276 ton CO_2 or displace 257,458 ton coal per annum.

- It is possible that cost reductions in subsequent plant can in the future make CSP competitive with conventional options. Or more appropriate risk related discount rates are used to compare project costs.

- Pursuing CSP options with a large local content will result in job creation and new innovations can be further exploited.

Current Initiatives

Basic Research

- Trough-related studies at the University of Stellenbosch,
- Distributed power tower applications utilising small engines at the Council for Scientific and Industrial Research (CSIR)

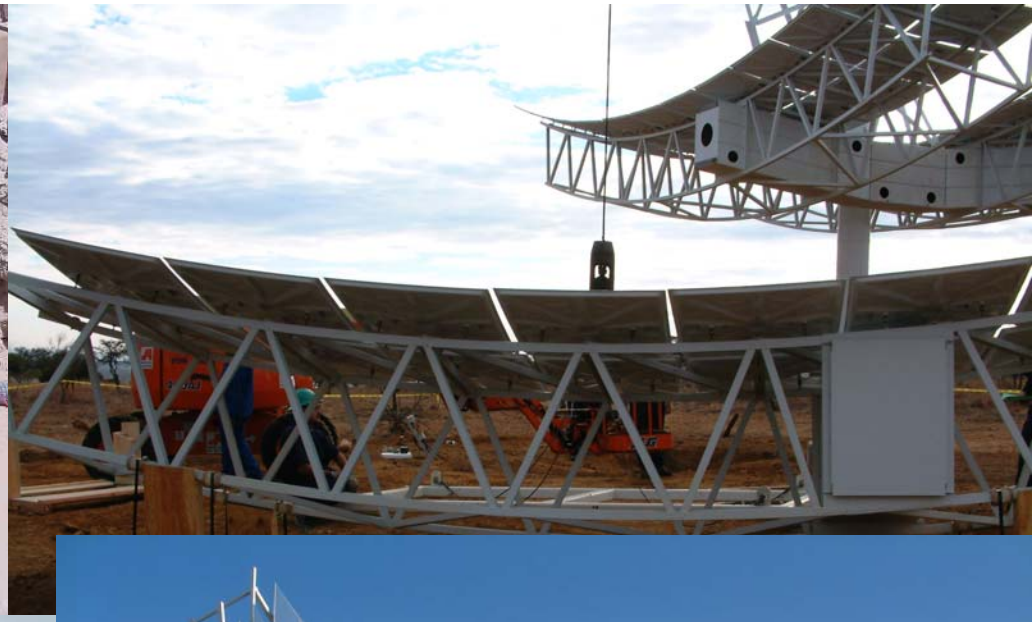
Demonstration Project

- Demonstration and assessment of the Dish/Stirling technology as a future Distributed Generation option by Eskom.

Feasibility Assessment

- Viability of the Molten Salt Central Receiver technology for large scale, grid-connected supply.

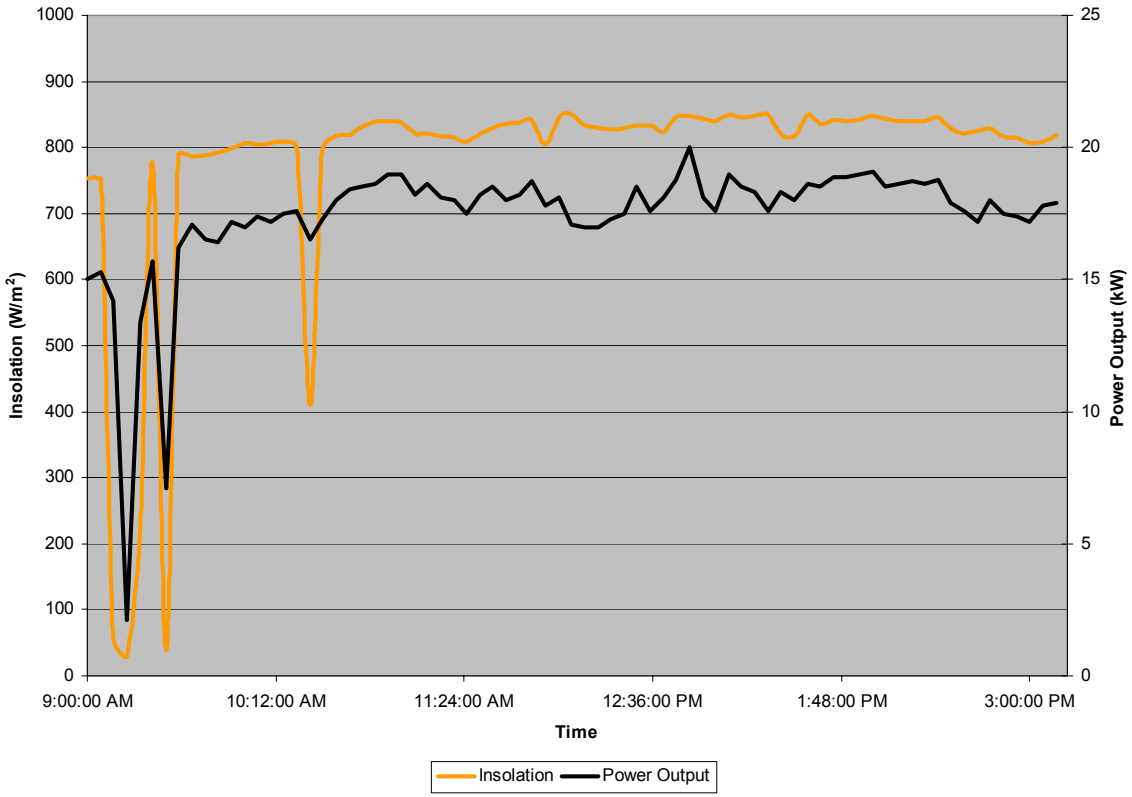
Dish/Stirling Demonstration



Project Information

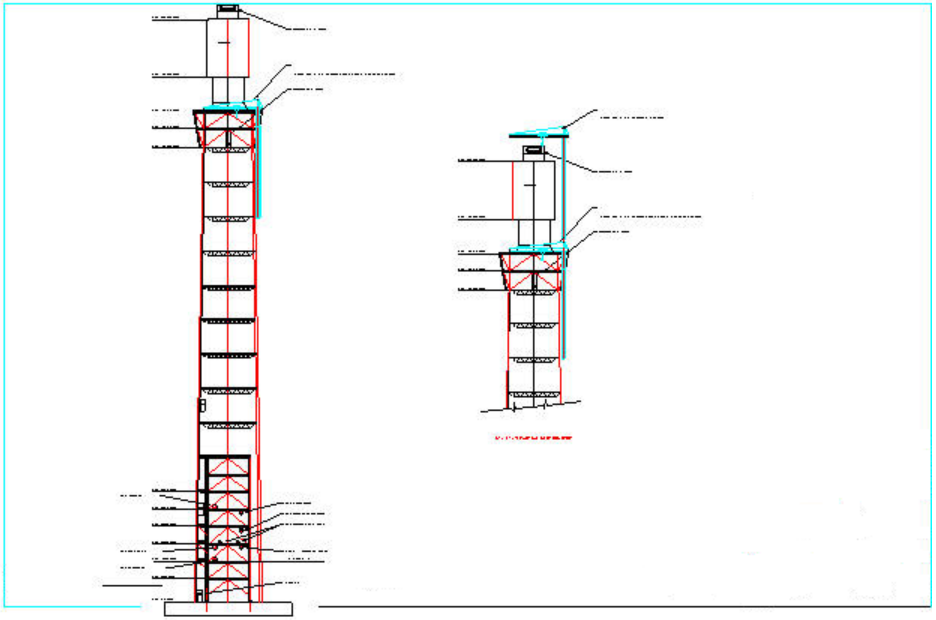
Official commissioning on the 28th of August during the WSSD.

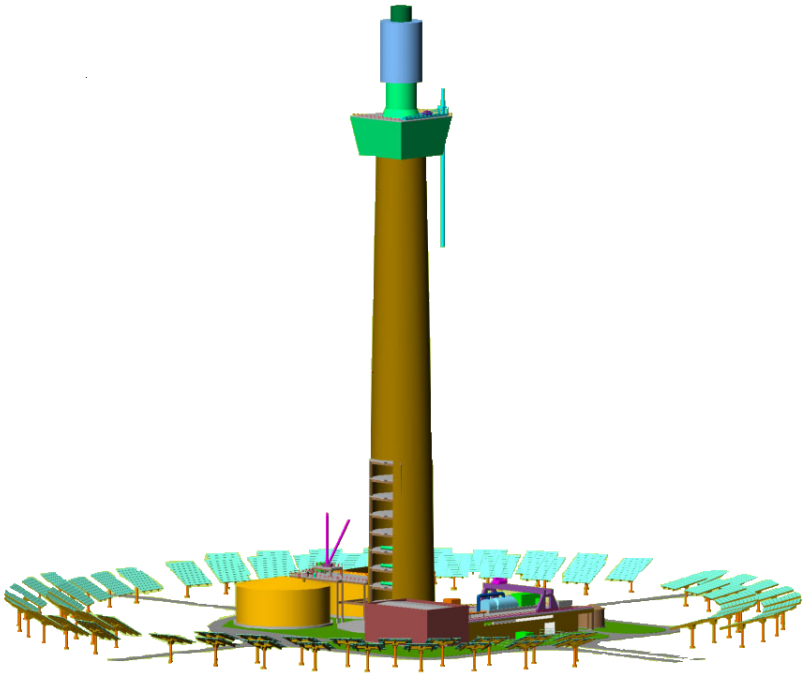
To date the system has been operated in a "non-commercial" fashion to enable various tests and assessments to be carried out.



- Maximum efficiency obtained to-date = 28.5%
- Average total efficiency to-date = 24%

Feasibility Assessment





Project Information

Technical Specifications

- Electrical rating: 100MW, 460MW thermal,
- Annual CF: 47.6%, producing 417GWh/annum and
- Hours of storage: 8, to provide peak power.

Current SA Demonstration Process

- Feasibility study results under review.
- Approval of scope of work for the next phase ongoing.
- Next phase - final design, construction and verification of key technology components.

Barriers to Implementation of CSP

- High, up-front capital cost, compared to conventional technologies.
- Non-competitive supply of key components.
- Technical expertise concentrated within a small number of institutions.
- Perceived technical risk - limited operational verification (towers: scale-up, troughs: storage).
- Perceived technical risk - operational and performance guarantees.
- Standard plant designs (based on user requirements) do not exist, which results in reducing incremental learning and hampering potential cost reductions.

Enabling Mechanisms Required

- Financial support (grants, equity buy-in, soft loans) is required to reduce up-front Capital expenditure in markets where green premiums don't exist.
- A phased subsidy approach is favoured - financing schemes should be aimed at continued technology support, with the degree of financing decreasing as economy-of-scale cost reductions are realised with subsequent plants.
- Supplier competition should be encouraged, aimed at component cost reductions.
- The technical expertise base should be expanded insofar as the design, optimisation and O&M of CSP technologies are concerned.

Enabling Mechanisms Required (continued)

- A geographically diverse scope should be encouraged when component sourcing is considered.
- Preferential CO_2 reduction credits for CSP should be considered to stimulate industry growth.

HYBRID SOLAR GAS PROJECT

Project definition

The project is analysed with the following options:

- Size 150 MW

Combine cycle 107,1 MW net.

Solar Field 43,56 MW net.

- Size 306 MW

Combine Cycle 258,8 MW net.

Solar Field 54,1 MW net.

-**Size 400MW**

Combine Cycle 363,4 MW net.

Solar Field 71 MW net.

In both choices we will add a desalting plant with a volume that will be determined by the thermic flux available at the steam turbine extraction.

This possibility has been added when GEF declared to us that in case of an asset's lack within the solar thermic programm, he will be able to give assistance to cover the incremental cost of the investment with the help of another water programm.

- **I) The Site Localisation**
- The Start Mission of Solar Paces has resulted in the discovery of several potential sites offering advantages such as :
- The access to the natural gas
- The recovery of salted water presently rejected
- An easy access to the electrical transport grid
- The disposal of transport infrastructures
- (Road, Railway – Airport)
- **Environment facilitating the project**
- All the factors for the project success are gathered.
- **Political will**
- It has been recorded by the president himself, being an ardent adherent of the sustainable development.
- It represents the basis of a support schedule to the renewable energies development plan in Algeria.
- It came to reality by the electricity law on account of the energy Ministery efforts. The application text project for renewable energies is under examination . It forecasts incentives with a sufficient out put to make possible the economical viability of the project .
- It was also demonstrated by the Governor of the state where will be located the plant who took all the local assistance measures to the project : land, gas feeding etc……

- **Investment Sight**
- The investment code otherwise very attractive forecasts more important incentive measures to renewable energies.
- **The Potential of Development**
- We think that the Start Mission conclusions underlying the relevant potentialities that exist in Algeria compared to other countries should encourage many electricity producers to invest in this particular field in Algeria.
- However, a number of difficulties regarding the access to the energy European market have to be overcome, but this does not concern our first project addressed to the Algerian market.

- **II) Structure of the project taking up**
- The project will be an IPP type, where the financial taking up will be a project finance one
- the existing securities are :
- a gas sale contract
- a purchase electricity contract
- a water purchase contract

From the first step up to the start up :

- NEAL will hold : 20 to 30% of the equity
- EPC constructor : 10 to 20%
- SONATRACH : 20 to 30%
- SONELGAZ : 30 to 40%

As to the second step :

- NEAL : 20 to 30% of the equity
- EPC constructor : 10 to 20 %
- Foreign Developer 10 to 20%
- Funds + BANKS 20 to 30%
- SONATRACH : 7%
- SONELGAZ : 10 to 33%;
- The equity will represent nearly 25% of the global investment

- **III) <u>The financing</u>**
- Apart from the expected help from GEF or GMI :
- the project can be financed locally utterly as far as the law on electricity allows the payment of the overcost and that it reaches an IRR of 15% on the basis of granted bonus.
- The local banks have enough provisions to totally support on project. Whithout having the GEF help, the project can be financed thorougly or partly by BEI with a concessional credit type + Shareholding credit + Commercial credit.
- The Project can be financed upon the GMI initiative with the German Government help and if needed the rest can be provided by the other already cited means.

- **Draft Feasability Results**
- **Project : 150 MW**
- 107 MW net Combined cycle
- 43,56 MW net Solar field
- Ratio : Solar out put (kwh) / Total out put (Kwh) = 11%
- **Agregate investment**
- - EPC 143 866 000 $
- - Intercalary interests 12 064 500 $
- - Preliminary costs 500 000 $
- - Contingency 4 315 980 $
- - Customs taxes 5 296 111 $
- **TOTAL 176 833 290 $**
- - IRR : 15%
- Production's premium (by law) : 140% onthe conventional price
- Estimated power conventional price : 2,2 cts $/kw/h
- Pay-back / 7 years

- **Draft Feasability Results**
- **Project : 300 MW**
- 251,8 MW net Combined cycle
- 54,1 MW net Solar field
- Ratio : Solar out put (kwh) = 6%
- Total out put (Kwh)
- **Agregate investment**
- - EPC 190 983 000 $
- - Intercalary interests 16 378 000 $
- - Preliminary costs 500 000 $
- - Contingency 5 729 490 $
- - Customs taxes 7 015 880 $
- **TOTAL 263 397 070 $**
- - IRR : 15%
- Production's premium (by law) : 50% onthe conventional price
- Estimated power conventional price : 2,2 cts $/kw/h
- Pay-back / 7 years

- **Draft Feasability Results**
- **Project : 400 MW**
- 363,4 MW net Combined cycle
- 71 MW net Solar field
- Ratio : Solar out put (kwh) = 5,4%
- Total out put (Kwh)
- **Agregate investment**
- - EPC 235 044 640 $
- - Intercalary interests 19 911 000 $
- - Preliminary costs 500 000 $
- - Contingency 7 051 340 $
- - Customs taxes 8 008 920 $
-
- **TOTAL 286 015 900 $**
- - IRR : 15%
- Production's premium (by law) : 30% onthe conventional price
- Estimated power conventional price : 2,2 cts $/kw/h
- Pay-back / 7 years

TOTAL INVESTMENT COST

PROJECT SIZE	INVESTMENT COST
150 MW	176 833 000
300 MW	236 397 000
400 MW	285 218 000

SOLAR ANNUAL OVERCOST

PROJECT SIZE	OVER COST USD	% ON TOTAL SALE
150 MW	28 815 690	58%
300 MW	22 733 170	33%
400 MW	19 785 610	23%

- Conclusion
- The 400 MW project appears to have the best irnternal return than the other options.
- The feasibility study should allow us to confirm this.
- The adding of a desalting plant will not only make the water resources available to the plant and the whole area but also it allows the access to a relatively important local and international financing.
- It is true that pollution by salted water and lack of water generally speaking in this zone are major preoccupations that can be solved by our project.
- The economical development resulting from this project will be reflected either directly by job creations or by the agricultural development in a zone pedicted to be the equivalent of California state if the water problem was solved.
- One should not forget the health problem of "population consuming a hard, hot water (60°).
- Our project would contribute to this.
- The existing Algerian thermic solar potential has raised a remark from the experts of solar paces who declared that 1/10 of sahara will be suffiscient to provide the electrical needs of the whole Europe.
- Therefore, the volumes of gas which could be saved would be available for other markets.
- All the evaluation is based on US equipments

Public Utilities Authority
Electricity

Solar electricity - national energy policy

State of Israel

On the behalf of Mr. Joseph Paritzky Israel Minister for infrastructure

Solar electricity - national energy policy

Presented by

David Assous, Head of Israel PUA,

Tzvi (Steve) Rozenman, Ph.D., Consultant

Public Utilities Authority
Electricity

From the Old Testament

State of Israel

Prophet Malahi says

Chapter three section 20

But to you who fear my name the SUN of RIGHTEOUNESS shall arise with HEALING in its wings……

Public Utilities Authority
Electricity

Solar electricity - national energy policy

State of Israel

- 90% of Israeli homes are equipped with solar water heating providing 50% of the demand
- Israeli government energy policy mandates that 2% of electricity production in Israel be generated from renewable by 2007
- Solar and Wind are the largest renewable sources in Israel. The 2% policy directive results in more than 200MW for solar electricity in 2007

Public Utilities Authority
Electricity

Five step program to implement government directives for Solar electricity

State of Israel

Step one

Evaluate the cost of Building a 100MW CSP solar electricity plant!!! Under the following terms:

- ✓ Lowest Cost Bidding of the plant
- ✓ Quality assurance of the solar system
- ✓ Performance guarantees
- ✓ Predictable, Low O&M
- ✓ Limited Usage of fuel for increased efficiency

Five step program to implement government directives for Solar electricity

Step two

- Analyze the economy of the solar plant within the Israeli electricity market under the following terms:
  - Non Dispatch – (Always feeding electricity to Grid)
  - Reduces peak Demand from Fossil Plants
  - minimize usage of fossil fuel (near to zero MC)
  - Analyze cost relative to virtual spot market price

Five step program to implement government directives for Solar electricity

Step three

Evaluate exogenous Benefits

- ✓ Pollution Reduction
- ✓ Support for Local Labor Market
- ✓ Reduce fuel imports
- ✓ International Support for renewable technology

Step Four

Consider the way to contract the project

- ✓ By the local monopoly
- ✓ By a private company
- ✓ By a new, government- owned company established to promote Renewable technology

Five step program to implement government directives for Solar electricity

Step Five

Guarantee Investment with Electricity rates

- ✓ Long term agreement with the Grid, based on a price for KWh produced (no capacity)
- ✓ Monitor Performance guarantees
- ✓ Share the production cost and market price risks
  - Production cost risks by the company
  - Long term market price by the consumer

CSP Global Market Initiative

Klaus-Peter Pischke
Vice President
Energy Sector Team, KfW
Palm Springs, October 2003

- Why is Germany, a non-sunbelt state, with limited solar resources, interested in Solar Thermal Power?

  - Commitment to contribute to reduction of CO_2 world wide
  - Vision that CSP offers high potential for low cost CO_2 abatement
  - Commitment to establish an energy system compatible with sustainable development
  - German Industry world leader in mirrors
  - World leader in glass tubes
  - Highly qualified research institutes active in various fields of solar thermal research. Research funds available from German Government.
  - Partner to the Plataforma Solar Almería (PSA) research center in Spain

- Policies to Promote Renewable Energies

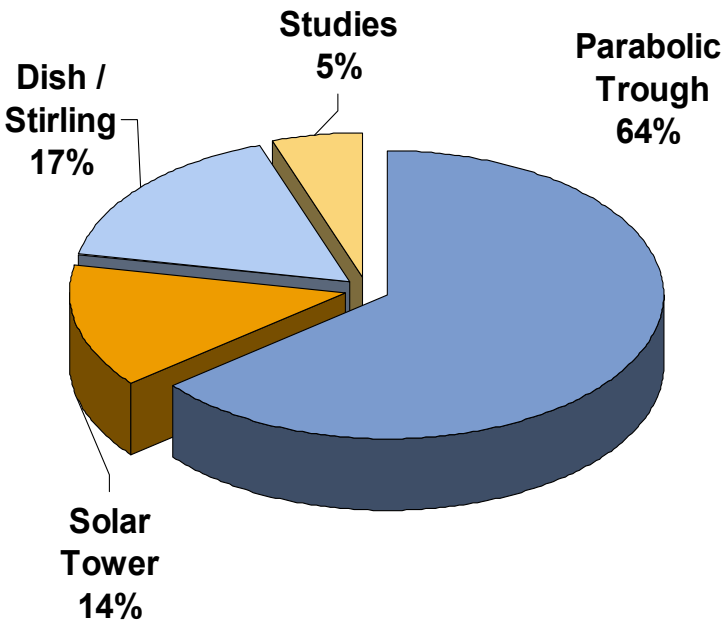
  - Preferential tariffs and dispatch for renewables (Renewable Energy Sources Act)
  - Soft loan financing facility available
  - Tax benefit for closed-end funds for financing renewables
    → World leader in wind energy > 12.800 MW installed
  - Domestic 100.000 roofs photovoltaic program
  - Preferential tariffs for co-generation facilities

- Still to be solved
  - Access and tariffs for imported energy from renewables
  - Internalisation of external costs
  - Support for energy for heat

R&D Programme on CSP

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

kfw BANKENGRUPPE



Research and Development of High Temperature Solar Thermal Electricity Generation

Volume 10 million EUR

Time Frame 2001 till 2003 (2004)

Contribution of the industry 7 million EUR

Funding of the Integrated Solar Combined Cycle Power Project in Rajasthan, India

- Investment funds of 128 million in EUR made available on concessional basis parallel to 45 million in USD GEF grant
- Preparatory activities supported through grant funding
- Long-term KfW-support for developing project concept

Present situation

- Bidding process unsuccessful
- New implementation concept sought

Participation in EM Power

- EM Power: GEF/UNEP Project to develop market for grid-connected solar energy technologies (PV & CSP)

- Germany asked to provide part-funding; KfW asked to manage the program

- Core aspects:
  - Coalition building among stakeholders
  - Capacity building for utilities, regulators, suppliers, etc.
  - Develop market aggregation techniques as well as innovative procurement and financing techniques

GMI - The Global Market Initiative

- Concentrating Solar Power is a well-advanced technology –
  But major break-throughs still have to be achieved
  → R & D
- Substantial cost reduction has been achieved;
  still relatively expensive
  → Market development; tariff policy
- Application restricted to sunbelt countries; technology
  development and manufacturing possible elsewhere
  → International co-operation

Thank you für your attention !

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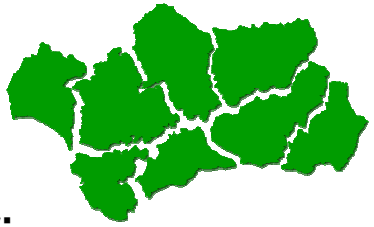


International Executive Conference on
Expanding the Market for Concentrating Solar Power:
Launching the 5000 MW Global CSP Market Initiative
21-23 October 2003
Palm Springs, California

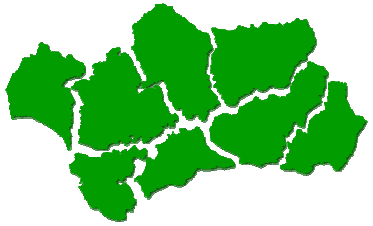
CSP activities, projects, opportunities and policies in Andalusia (Spain)

Manuel López Casero
General Secretary of Industry & Technological Development
Andalusian Regional Government (Spain)

Secretaria General de Industria y Desarrollo Tecnológico

JUNTA DE ANDALUCIA

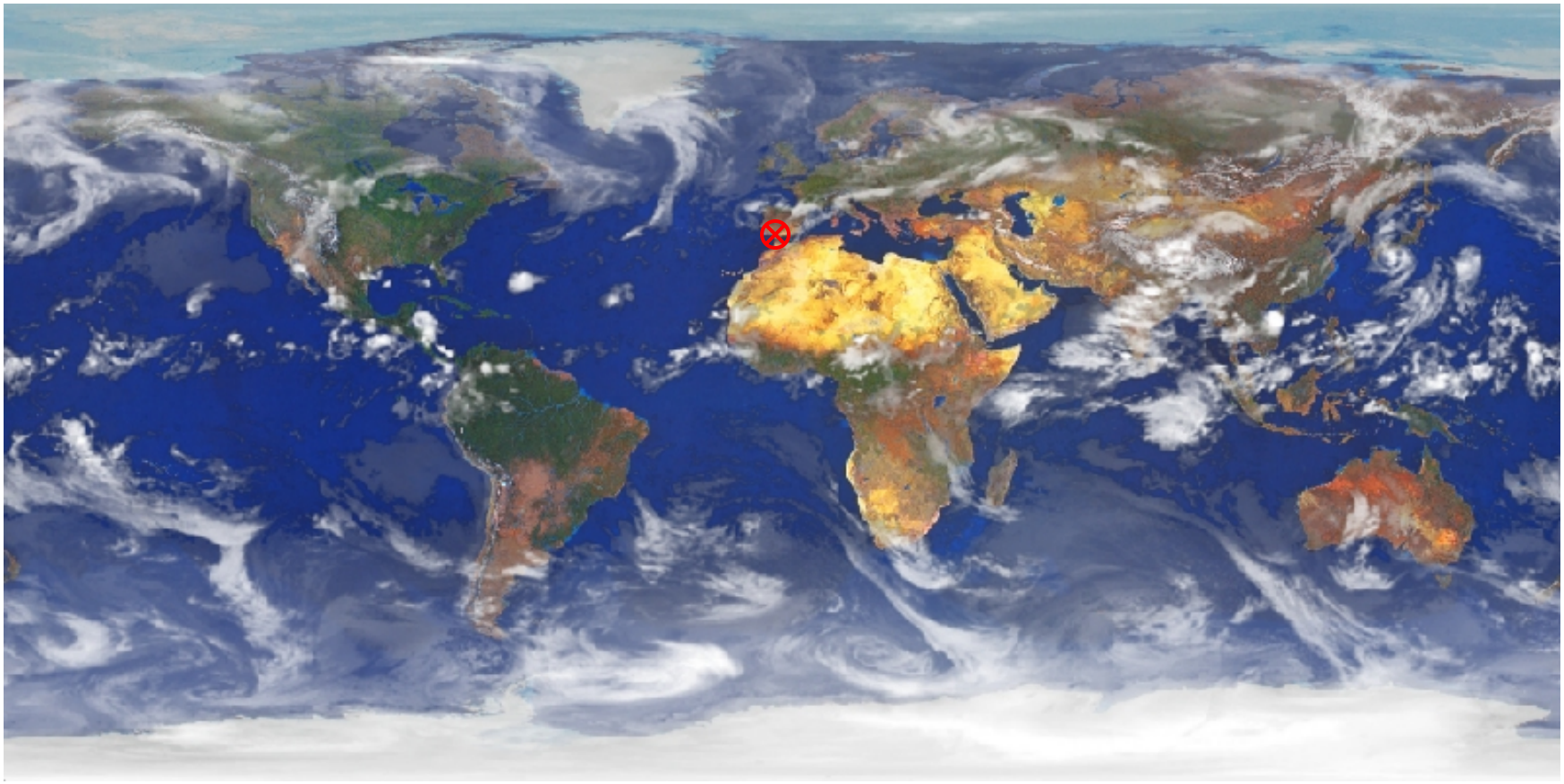
CSP activities, projects, opportunities and policies in Andalusia (Spain)



1. Basic figures about Andalusia
2. CSP in Andalusia
3. CSP in the Andalusian Energy Plan
4. Future Projects
5. Conclusions

JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)



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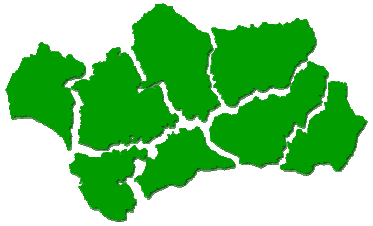
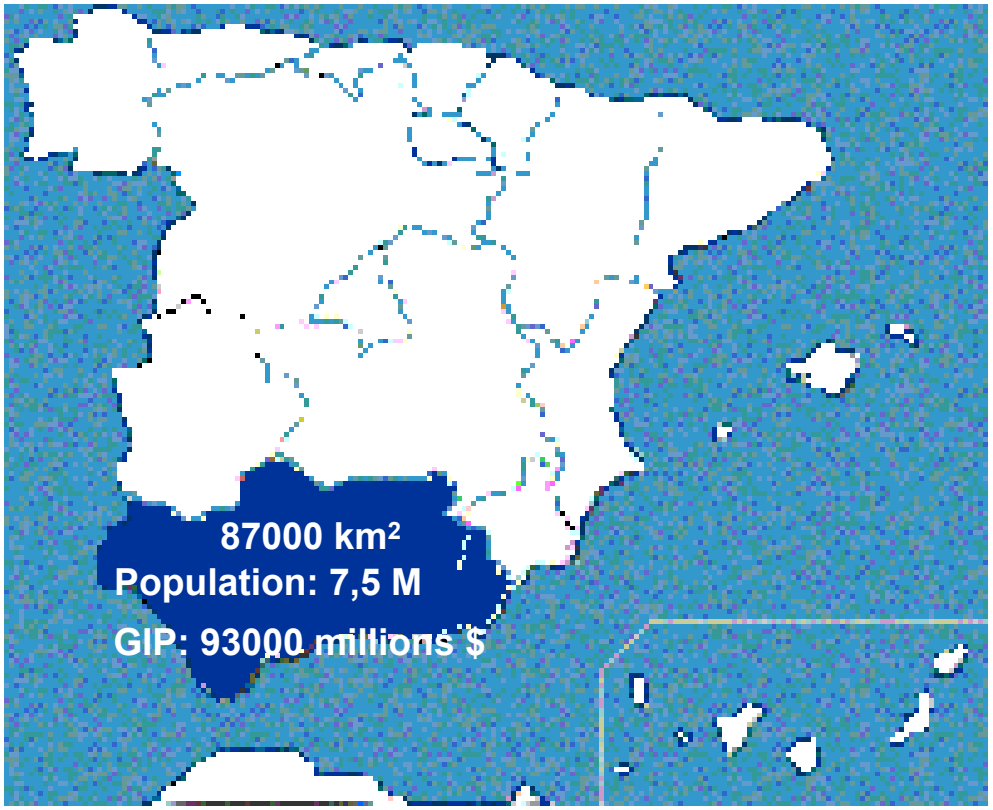
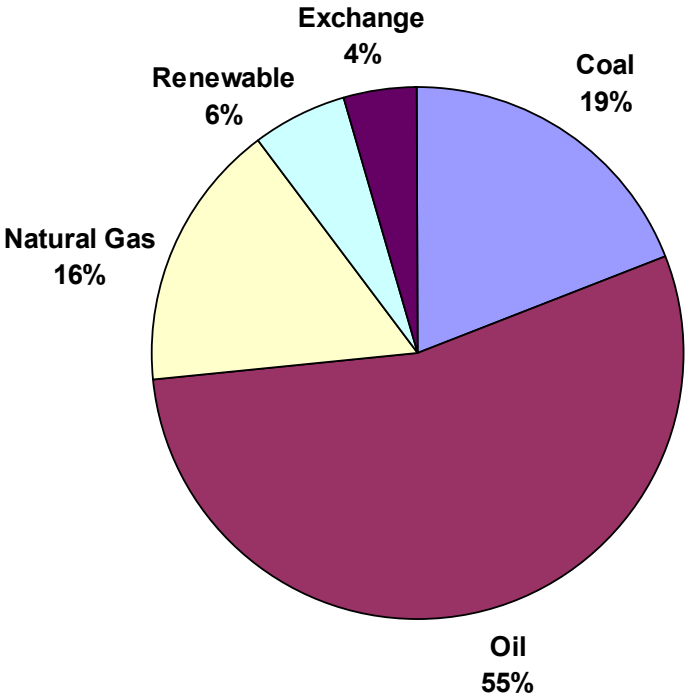
CSP activities, projects, opportunities and policies in Andalusia (Spain)



Basic figures about Andalusia





PE Consumption (2002): 16,7 Mtoe

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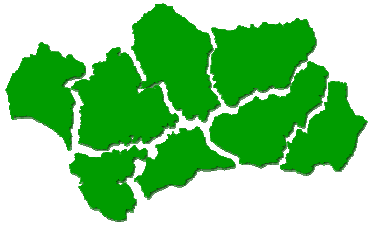
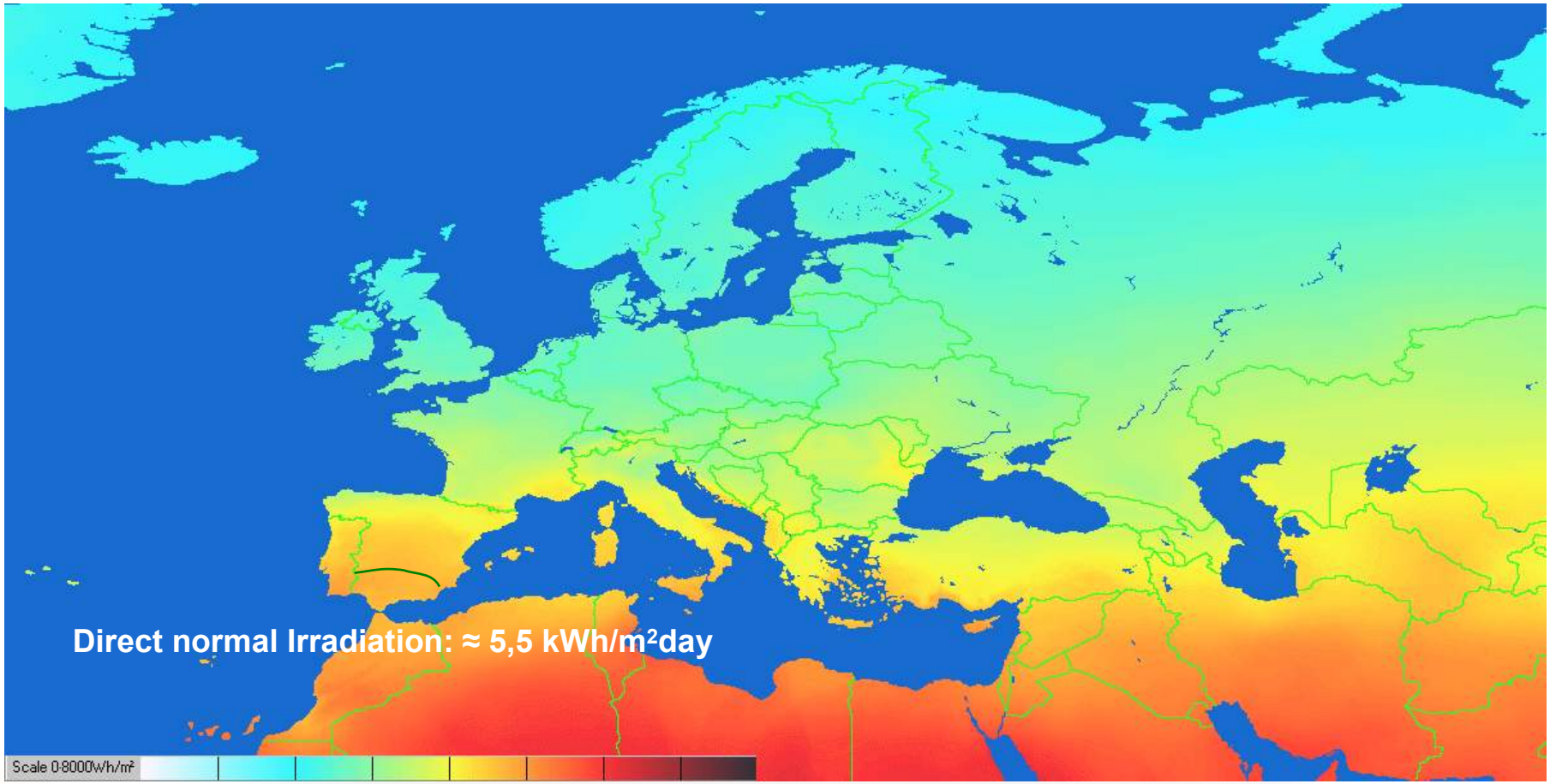


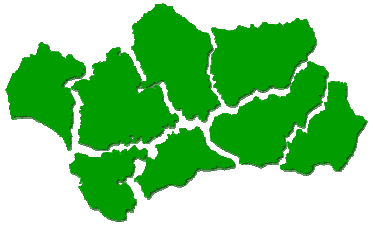
Basic figures about Andalusia



Secretaria General de Industria y Desarrollo Tecnológico

JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)



1. Basic figures about Andalusia
2. CSP in Andalusia
3. CSP in the Andalusian Energy Plan
4. Future Projects
5. Conclusions

JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)

CSP in Andalusia

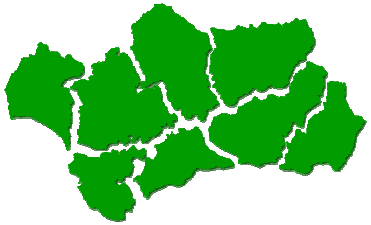
- **Plataforma Solar de Almería**

Secretaria General de Industria y Desarrollo Tecnológico

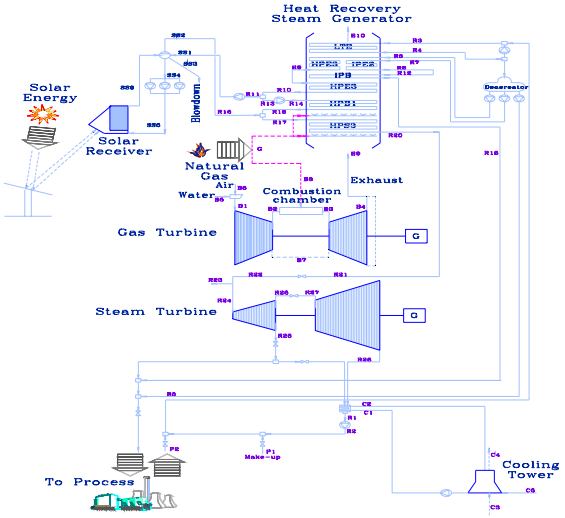
JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)

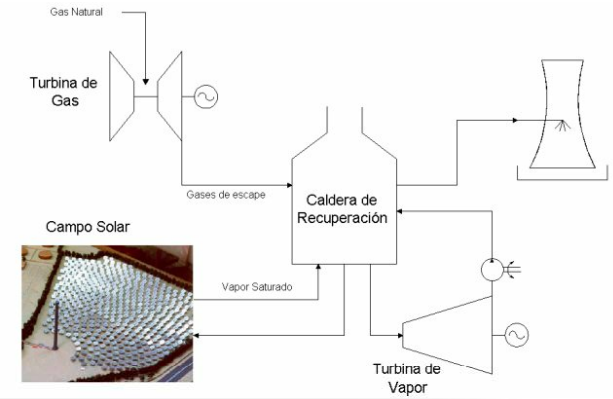
CSP in Andalusia



- **SOLGAS**
  - Feasibility Study for an Hybrid Solar-Gas Cogeneration Plant
  - EU project (SODEAN, Sevillana, EDP, INETI, CIEMAT (PSA), DLR, ZSW)



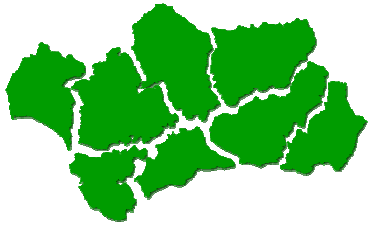
- **Colón Solar**
  - Integration of Solar Energy in an Existing Conventional Power Plant.
  - EU project (Sevillana-ENDESA, Ciemat-PSA, AICIA, Abengoa, DLR, EDP, PROET, BWE, ABB Stall)



Secretaria General de Industria y Desarrollo Tecnológico

CSP in Andalusia

- **SIREC**
  - Joint IAER-PSA Central Receiver Systems Technology Development Project
  - Results:
    - Heliostat Prototypes
    - Volumetric Receiver Absorbers
    - Hybrid components
    - Advanced Control Components and Concepts
    - Software Tools
    - Conceptual System Designs



CSP in Andalusia

Projects under Development

- Solucar

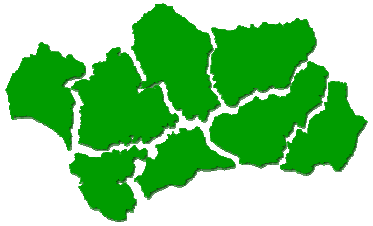
  PS10. 10 MW Central Receiver Solar Power Plant (Sanlúcar la Mayor, Sevilla)
- Solar Millenium

  Andasol. 2 x 50 MW Parabolic Trough Solar Power Plants (Guadix, Granada)
- GHERSA

  Solar 3. 10 MW, 24 h Storage, Central Receiver Solar Power Plant (Cordoba)

JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)



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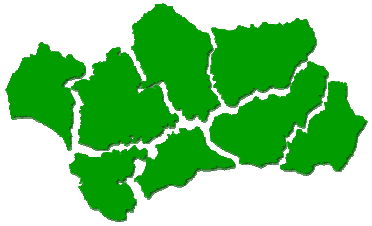


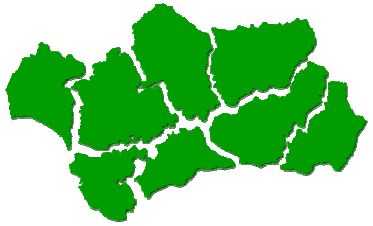
CSP in PLEAN

- **PLEAN: Andalusian Energy Plan**

- **CSP Goals:**
  - 100 MW by 2006
  - 230 MW by 2010

JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)



1. Background on Andalusia
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3. CSP in the Andalusian Energy Plan
4. Future Projects
5. Conclusions

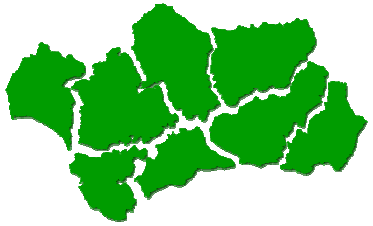
Future CSP Projects

- CESA 2

  - 2.5 MW Hybrid Solar-Biomass
  - 12,05 GWh
  - Energía primaria: 91,66 GWh
  - Rendimiento: 13,1 %
  - Fracción solar: 24,7 %

JUNTA DE ANDALUCIA

CSP activities, projects, opportunities and policies in Andalusia (Spain)



1. Background on Andalusia
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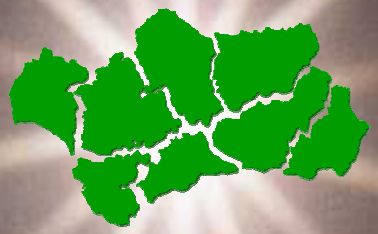
Secretaria General de Industria y Desarrollo Tecnológico



Conclusions

- **High Potential for CSP in Andalusia**
  - High Availability of Solar Resource
  - Significant Technological Background
  - Firm Institutional Support
  - Incentives: 30 % Inversion (limit, 1,2 M€)

Thank you for your attention

Tuesday Oct, 21
12:15 AM to 1:00 PM

SESSION 3: PROPOSED CSP GLOBAL MARKET INITIATIVE

International Executive Conference on Expanding the Market for Concentrating Solar Power Launching the 5 000 MW CSP Global Market Initiative

The proposed

CSP Global Market Initiative

Part I: Introduction and Regional Approach

Georg Brakmann
Managing Director, FICHTNER SOLAR GMBH
President of ESTIA

Palm Springs, California, 21-23 October 2003

From Berlin to California

- **June 2002: Berlin conference**
  * sponsored by BMU, KfW, UEP and GEF
- **Berlin Declaration**
- **CSP Global Market Initiative**
  * draft prepared by international working groups
  * to be launched at this Conference in California

Berlin Declaration

5 000 MWe of Concentrating Solar Power (CSP)

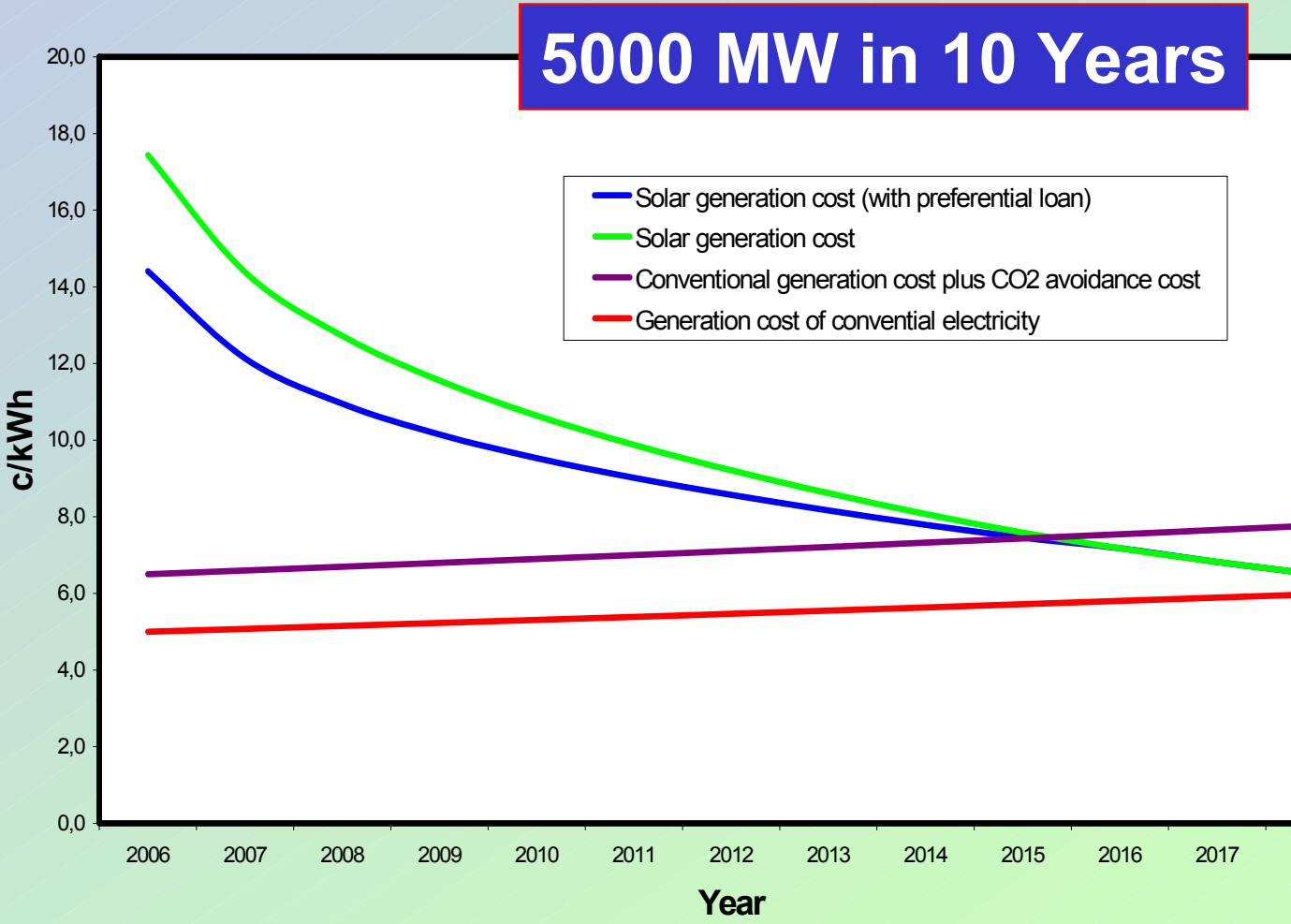
will make solar electricity generation generation fully competitive with fossil based grid connected power generation.

Cost Reduction

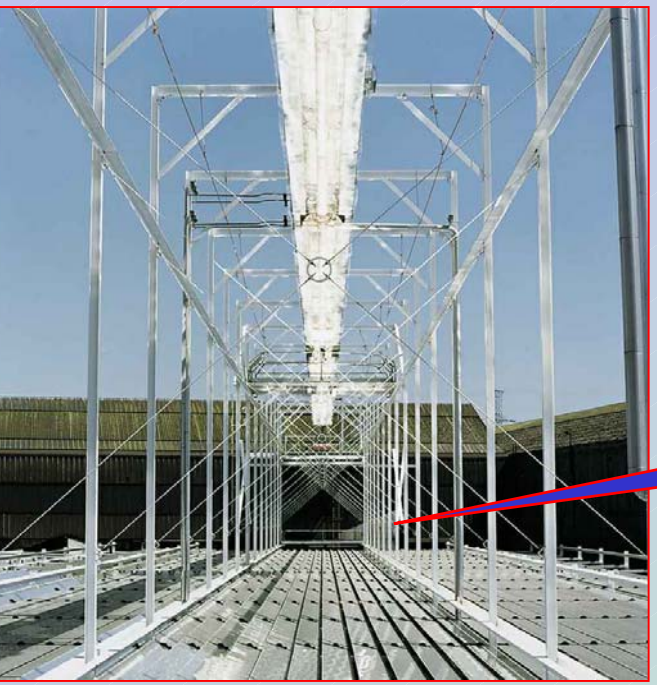
olume production

conomics of scale
arger plants)

echnology
nprovements



Technology: Fresnel, dishes, towe



Fresnel concentrators

- BMU sponsored development program
- lower material cost but lower efficiency

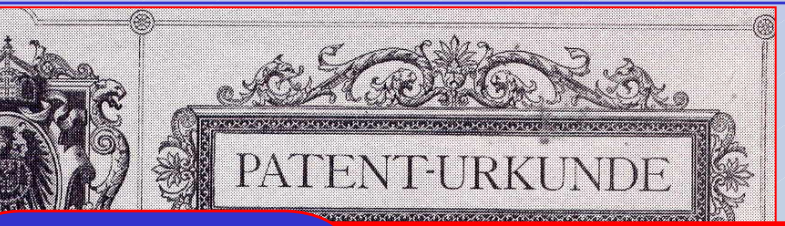
Parabolic dish with heat engine

- highest efficiencies (close to 30%)
- suitable for distributed power applications

Power tower

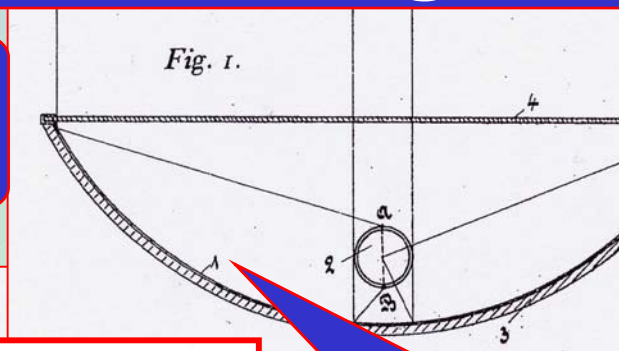
- interesting technology
- high efficiencies and st
- more R&D needed

Technology: Parabolic Troughs

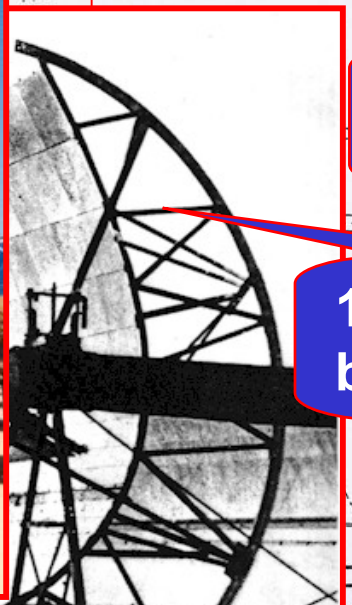


1998 - 2003: EuroTrough Development

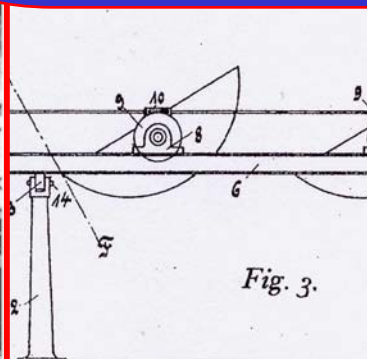
1984-1990: 354 MW by Luz in California



1907: Inven in Stuttgart



1912: 55 kW by Shuman in



Global Market Initiative

- Partnership to facilitate building of 5000 MW of CSP power worldwide over the next 10 years
- Network of CSP stakeholders
- Technical assistance made available
- Lessons learned workshops
- Assistance in securing subsidies and supportive policies

Policy

- **Political and technological targets**
  - Laws and regulations (e.g. feed-in tariffs, portfolio standards and targets, green tariff for electricity imports)
- **Regulatory Improvements**
  - avoid limitations on capacity or operating strategies
  - grid access at fair cost
- **Financing**
  - Long term, low interest credits
  - Kyoto instruments
  - Tax credits

Different Strategies for Different Regions (Region I)

Industrial Countries

* CSP -specific targets / Portfolio standards
* Feed-in law (ratepayer to cover the price gap)
* Tariff to reflect level of solar irradiation
* Conditions predictable and long term to facilitate commercial financing

Different Strategies for Different Regions (Region II)

Developing countries, grid connected to region I

* Region I countries to allow the feed-in tariffs for CSP electricity which is imported from region II countries
* Subsidies on fossil power production to be removed
* Emission trading and preferential financing (e.g. EU energy sector infrastructural support)

Different Strategies for Different Regions (Region III)

Developing countries, not grid connected to region I

* Subsidies to be provided by Region I countries (e.g. grants, soft loans, carbon credits, CDM)
* Example: The German Chancellor, Mr. Gerhard Schröder announced in Johannesburg 500 million Euro for renewable energy.
* Region II and III countries to contribute by providing free or low cost land, infrastructure and grid access, etc.

The Elements and Management of the Proposed CSP Global Market Initiative

Frederick H. Morse, Chairman

Solar Thermal Power Division

US Solar Energy Industries Association

ELEMENTS OF THE GMI

or

What is required for successful CSP projects

What is the CSP GMI?

- The CSP Global Market Initiative is a planning and implementation resource to be accessed by key stakeholders in those countries and states who decide to participate

What is required to participate?

- A desire to utilize your country's or state's solar energy resource to produce electricity and access the related economic benefits.
- Willing and able to meet six requirements which are essential for successful CSP projects.

Six Requirements

- **Target** – At least 100 MW in 5 years
- **Tariff** – Adequate to pay cost gap
- **Financing** – Long-term low-interest debt
- **Policies** – One or more essential policies
- **Contracts** – Long-term contracts with credit-worthy off-takers
- **Bidding** – Streamlined and best practice

Targets

- Required to provide project opportunities.
- Must be specifically for CSP capacity.
- Can be a percentage of new capacity or a number of MW over a certain number of years.
- 100 MW in first 5 years is required target for participation.

Tariffs

- CSP projects are commercially financed power projects that require a tariff adequate to service the debt, meet investors return and cover O&M.
- Without such a tariff, the project will not be financed and will not be built.
- Tariff must cover price gap.
- Preferred approach is a feed-in law or a public benefit change in which rate payers cover this gap.
- If not adequate, subsidies are required.
- Participating countries and states must offer a suitable tariff.

Policies

- A target and an adequate tariff are not enough for a CSP project to happen.
- Need favorable policy framework, including
  - Comparable tax credits
  - Grid access at fair cost
  - Streamlined permitting and licensing
- Participating countries and states must have or must agree to implement those policies that are required to support the development of the solar energy resource.

Contracts

- Debt and equity require long-term contracts with credit-worthy off-takers.
- Could be a power-purchase agreement.
- Could be a long-term feed-in law.
- Could be equity ownership by public organization(s).
- Participating countries and states must agree to support the use of such contracts.

Bidding

- If a PPA is not used, a bidding process is required.
- Bidding must be efficient and represent best practices for power plants.
- Participating countries and states must commit to follow those best practices.

STRUCTURE

Preliminary thoughts on how the CSP GMI might be organized and managed.

Still on open issue.

GMI Structure

- Advisory Board
- Executive Committee
- Ad Hoc Subcommittees
- Management Support

Advisory Board

- Advisory Board of 3-4 successful business people will provide overall direction, strategy and visibility.
- This Advisory Board will be formed by the GEF but will not report to the GEF.
- The Advisory Board will be accountable to the participating countries to implement the GMI expeditiously.

Executive Committee

- An Executive Committee will be formed with one representative nominated per participating country or state.
- Executive Committee will report to the Advisory Board and will therefore be guided by it.
- Executive Committee will review progress and identify actions to expedite progress.
- Time and travel paid by participating governments.

Ad Hoc Subcommittees

- Several ad hoc stakeholder subcommittees are envisioned.
- Will include Project developers, project financers, policy makers, utilities and others.
- Stakeholders will meet to address issues and recommend actions
- These subcommittees can bring matters and recommendations to the Executive Committee and thereby directly impact the GMI.

Management Support

- Management support for the GMI will be provided by a small management company.
- The CEO of the support company will report to the Chairman of the Executive Committee.
- This support will be paid by the annual contributions (50,000 Euro/year was proposed but open to discussion) by the participating countries and states and matched by GEF funds.
- The Chairman of the Executive Committee will control the funds and approve the annual work plan.
- The management company will use consultants as required.

Possible GMI Activities

- Expedite each CSP project in participating countries and states, from initial opportunity to project commissioning.
- Facilitate identifying and securing subsidies.
- Facilitate identifying and securing project finance.

Continued

- Facilitate the design of supportive policies.
- Facilitate the development of bid packages and model long-term contracts.
- Organize and conduct periodic lessons-learned meetings.
- Organize and support two ExCo meetings per year.
- Conduct regional meetings to encourage development of CSP and generate interest by utilities in CSP.

PARTICIPATION

Countries and States Should Consider Participating

- An appropriate government organization in an interested country or state.
- Participation gives key stakeholders in those countries access to the services of the GMI.
- Thereby project developers, CSP system providers, subsidy providers, policy makers and others can access the services of the GMI.

Why Participate in the CSP GMI?

- CSP Projects in your country or state will come online faster and be more commercially viable.
- Gives ready access to networks of project developers, project financers; subsidy providers; policy makers and a range of technology and project development assistance.
- Invitation to periodic lessons-learned workshops
- Projects in participating countries will be tracked, actively facilitated and monitored to remove obstacles and speed-up implementation.

SUMMARY

The Challenge

- **Solar resource is widely available around the world.**
- **Many benefits come from developing this resource.**
- **The technologies (CSP) to convert it into electricity exists today.**
- **But that electricity generally costs more than from competing resources, effectively stopping projects.**
- **The economic benefits far exceed the cost to develop the solar resource**
- **But barriers stand in the way – that's the problem**.

The Premise

- The cost of electricity from CSP technologies will be fully competitive with fossil-based power once 5,000 MW of new CSP capacity has been installed globally.
- The need is to facilitate the building of this capacity.
- That is the objective of the CSP GMI – to help CSP projects come online faster and be more commercially viable

Revisions to the GMI

- Starting draft is dated 1 October.
- Steering Committee will meet on Tuesday evening, Wednesday lunch and evening to consider all proposed revisions.
- Recommended changes received prior to conference were noted and will be considered in above process.

CSP GMI Steering Committee

- Alan Miller
- Rainer Aringhoff
- Michael Geyer
- Georg Brakmann
- John Myles
- Gilbert Cohen
- David Kearney
- Scott Sklar
- Fred Morse

Guidance for Discussion Groups

First Discussion

Tuesday afternoon

Assignments

- 12 people in each discussion group.
- 7 Discussion Groups organized by GMI region.
- Balanced by country and expertise.
- Leaders and reporters have been identified and briefed on their assignments.

Continued

- Meet in rooms noted on program and shown on hotel grounds map – Las Flores group
- Please accept our assignments and go to your assigned group.
- If not on list, please see revised list at registration desk.
- Coffee break will be outside those rooms at 4 pm.

Objectives

- Opportunity to consider the GMI strategy and different approach for the three regions
- Try to arrive at findings and recommendations that the majority of the group supports.
- Identify issues that will need to be addressed after the conference.

Specific Matters to Discuss

- Discuss the proposed CSP GMI from the perspective of each region.
- Recommend clarifications to the regional strategy and approach.
- Define the conditions necessary for the success of the CSP GMI.

Reporting

- Each DG has a reporter who will prepare a summary of findings and recommendations.
- Reporters will prepare a power point presentation.
- Reporters must have their presentations ready Tuesday evening.
- Copies will be provided to all participants Wednesday morning.
- Reports will be presented Wednesday morning and briefly discussed.

Revisions to the GMI

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- Steering Committee will hold open meetings Tuesday and Wednesday evenings to consider all proposed revisions.
- Recommended changes received prior to conference were noted and will be considered in above process.

CSP GMI Steering Committee

- Alan Miller
- Rainer Aringhoff
- Michael Geyer
- Georg Brakmann
- John Myles
- Gilbert Cohen
- David Kearney
- Scott Sklar
- Fred Morse

Wednesday Oct, 22
8:30 to 10:30 AM

SESSION 4: DISCUSSION GROUP REPORTS

Discussion Group Assignments

Las Flores Building

Group A - Gardenia Room

Uwe Ohls (Leader) – Germany
Bob Liden (Reporter) – United States
Bernhard Milow – Germany
Eli Mandelberg – Israel
Rainer Kistner – Spain
Bud Beebe – United States
Gilbert Cohen – United States
Herb Hayden – United States
Dave Kearney – United States
Michael McDowell – United States
Scott Sklar – United States
Robin Taylor – United States

Group B – Hibiscus Room

Alain Dahan (Leader) – Israel
Kevin Moran (Reporter) – United States
Winfried Ortmanns – Germany
Wolfgang Schiel – Germany
Jose Alfonso Nebrera Garcia – Spain
Debra Bowen – United States
Marcie Edwards – United States
Scott Frier – United States
Roland Hulstrom – United States
Scott Jones – United States
David Saul – United States
Claudine Schneider – United States

Group C – Jasmine Room

David Slawson (Leader) – United States
Klaus-Peter Pischke (Reporter) – Germany
Peter Le Lievre – Australia
Henner Gladen – Germany
Manuel Blanco Muriel – Spain
Manuel Lopez Casero – Spain
Andrew Beebe – United States
Robert Emery – United States
Glenn Hamer – United States
Marwan Masri – United States
Raymond Sutula – United States
Mark Skowronski – United States

Group D – Lantana Room

Randy Manion (Leader) – United States
Avi Brenmiller (Reporter) – Israel
Ludger Lorych – Germany
Rudolf de Millas – Germany
Valeriano Ruiz Hernandez – Spain
Barry Butler – United States
Dennis Erickson – United States
Hank Price – United States
Cynthia Torres – United States
Michael Ware – United States

Discussion Group Assignments

Group E – Larkspur Room

John Myles (Leader) – United States
Arnold Leitner (Reporter) – United States
Fritz-Dieter Doenitz – Germany
Rolf Seifried – Germany
David Assous – Israel
Kenneth Cory – United States
Len Daniels – United States
William Gould – United States
Dick Burdette – United States
Mark Mehos – United States
Craig O'Hare – United States
Terry Peterson – United States
Newton Becker – United States

Group F – Lavender Room

Ramon Carlos Torres Flores (Leader) – Mexico
Tewfik Hasni (Reporter) – Algeria
Rainer Aringhoff – Germany
Benoit Begault - Israel
Roberto Cadenas Tovar – Mexico
Ahmed Nakkouch – Morocco
Amina Lamrani – Morocco
Tom Mancini – United States
Tim Tutt – United States
Alan Miller – Global Environment Facility

Group G – Plumeria Room

Kevin Nassiep (Leader) – South Africa
Georg Brakmann (Reporter) – Germany
Hosni Elkholy – Egypt
Ballah Daw'Elbait – Hong Kong
Chandra Shekhar Rajan – India
Gopal Somani – India
Haldun Atif Danisman – Turkey
Hassan Mohammed – United States
Tod O'Connor – United States
Michael Geyer – International Environment Agency SolarPACES
Philippe Schild – European Commission
Tom Hamlin – United Nations Environment Programme

GROUP A REPORT

Group A Leader: Uwe Ohls
Group A Reporter: Bob Liden

Is the proposed GMI the right approach for Region 1?

- **Potential advantages of GMI include:**
  - Building on experiences of other similar projects
  - Education of financial community about CSP
- **Disadvantages or flaws to concept:**
  - Important differences between "Region 1" countries
  - Challenges of project financing are very project-specific -- May be made less complex in considering only Region 1
  - It's hard to envision how competitors are going to really help each other out

GROUP A REPORT

Region 1 was envisioned to be those countries with developed transmission, financing, infrastructure, etc.

GMI can provide a politically influential vehicle to facilitate the development of international projects (e.g., U.S. (Region 1) and Mexico (Region 2))

Does U.S. 1,000 MW Program Relate to GMI 5,000 MW Initiative? (A. Yes)

GROUP A REPORT

GMI may be way of “spreading the wealth” between technology providers, countries, etc.

GMI is intended to be a driver for commitments for large-scale CSP

GMI must be technology-neutral

Purpose of GMI is to develop a framework whereby CSP solar can be made economically and politically viable vs alternative energy sources

GROUP A REPORT

Key issues

- **Cost**
- **Specific interests of countries/states**
- **Management structure**
- **Getting political commitments a different kind of "chicken and egg" issue**
- **Risk mitigation**

GMI can attract large suppliers to the solar industry to come back and "play"

GMI will create momentum

GROUP A REPORT

GMI should be a vehicle to get support at Bonn

GMI document doesn't have enough public information or education of customers

GMI should include <u>process heat</u>

Dish engine systems should not just be described as "valuable for distributed power applications" but also state that dish engine systems can be used for centralized power plants -- i.e.,some editing is required to dish paragraph on pg 4.

GROUP A REPORT

Changes to paragraph on parabolic dish:

- Photo caption: “Parabolic dish focused on power conversion unit”
- Paragraph heading: “Parabolic Dish Solar Power Systems”
- Change “heat engine” to “power conversion unit” in sentence 1.
- Change sent. 4 to say “Dish power systems can be employed in both central power plants and distributed power applications, with unit outputs ranging from 10 kW to 100’s of MWs.
- Delete next sentence.
- Change “dish/engine” to “ dish power” in next sentence.

GROUP A REPORT

Concept of 3 Regions is o.k., but Australia should be added to Region 1, and last par. of Region III should be revised:

- **"Even though their financial resources are limited, Region II and III countries should make a significant financial and regulatory commitment to the success of CSP projects in their countries, including providing free or low-cost land…."**

GROUP A REPORT

An important element of this GMI should be that any "gap-narrowing" support is time-limited -- i.e., as the production of systems goes up, the cost goes down and the need for price gap filling is reduced … and finally eliminated altogether

Some members of group suggested that the cost curve on page 5 should be made "qualitative" and not quantitative, showing that as volumes go up costs go down, with a cross-over with baseload conventional power at some point. Then add a paragraph to describe some tentative end-points. Others disagreed.

GROUP A REPORT

Elements of success of GMI:

- **Targets:**
  - Change “in” to “by” in last sentence.
- **Tariffs:**
  - Eliminate the last sentence (and not let the Region II or III countries completely “off the hook”).
- **Financing:**
  - Eliminate first sentence (it’s not necessary and is misleading).

GROUP A REPORT

Policies:

- **Add a new first bullet point: "Availability of consistent laws and regulations."**

Bidding:

- **Add 1st sentence: "International open competitive bidding on CSP projects is encouraged." Eliminate next 2 sentences and keep the last sentence.**

GROUP B REPORT

Group B Leader: Alain Dahan

Group B Reporter: Kevin Moran

What is Needed?

Convince policymakers of the value of CSP Initiative

- **Good cost/benefit analysis (cost of not doing it).**
- **Recognition of external costs of conventional generation sources.**
- **Adds to the reliability of the grid.**
- **In-State Job creation.**

GROUP B REPORT

What is Needed? (2)

- New arguments for government action/subsidies (e.g., reliability of the grid, energy independence).
- Know your audience and target your arguments to them. Prepare proposals specific to each country/state/region.
- Need to highlight cost reduction advantages of participating in a global initiative.
- Need to engage allies outside of the CSP industry.
- Highlight value of assisting developing countries.

GROUP B REPORT

Recommended Changes to GMI

Clarification why GMI is needed – collaborative effort to share best practices and resources through networking in order to facilitate cost reductions.

Prepare an executive summary – no more than one page.

Should succinctly state why CSP is the best option.

Recommended Changes to GMI (2)

Add another argument for the globalization of the initiative the advantages of using CSP for the generation of hydrogen.

Add regulatory certainty that permits investment in capital intensive technology.

GROUP B REPORT

Conclusions/Recommendations

Need to create incentives for banks to invest in CSP technologies, and to share information on financing mechanisms.

Consider standardization of design to reduce due diligence requirements for financing purposes.

Prepare succinct case studies of successful projects.

Need to emphasis the need for long-term tax credits for 15 plus years.

GROUP C REPORT

Group C Leader: David Slawson

Group C Reporter: Klaus-Peter Pischke

GMI should refer to the value of CO2 offset (current market value approx. 5.00 USD per ton)

CSP sells capacity and energy

CSP being available during the day it should capture

peaking tariffs (applicable only in Region I countries)

Feed-in laws with attractive tariffs are the ultimate market

Drivers

GMI and industry should try to promote such tariffs

Governments to create positive environment for developer

GROUP C REPORT

GMI to start with open informal structure

GMI to build close working relationship with SolarPaces

GMI not clear which target group is addressed:

- developers
- politicians

(benefits on page 5/6 refer to both)

100 MW per country in 5 years will not bring us to 5000 MW within an reasonable period of time

GROUP D REPORT

Group D Leader: Randy Manion

Group D Reporter: Avi Brenmiller

The GMI is a positive approach

It needs sales edge

The GMI document should be the tool to persuade and to get the commitment – and not the commitment itself.

An opportunity to declare the commitment will be next spring in Germany – an event organized by the German prime minister

A country could be a member of region #1 by either importing power in preferential rates or by installing/ supporting SEGS in Sunbelt country.

GROUP D REPORT

We need to add :

Executive summery – (half page) which will put emphasis on the GMI benefits, including economy development , political and social impact.

We need to edit an rearrange the major elements of the GMI according to their importance.

GROUP E REPORT

Group E Leader: John Myles

Group E Reporter: Arnold Leitner

Topics Discussed:

Region Definitions

Clarifying Technical Issues of Electric Systems

Solar Technologies Included in the Initiative

Goals of the "Global Market Initiative"

Financial Incentives: Crutches","Incubation",…

How do you get 5,000 MW?

Economic Window?

GROUP E REPORT

Topics [Continued]

External Costs

Benefits

Modeling Capabilities

Baseload, Mid-merit, peaking, or what?

Lessons learned from LUZ

Region Definitions

Are we comfortable with the region definitions? Report needs review.

We found most of our discussion focusing on Region I.

Region II and III projects have:

- Growing population and power needs
- But difficulties on many ends: financial stability, developers, can't "recover" cost from rate payers

Benefits of solar may open up Regions II and III: transmission issues, limited access to other fuels

GEF are mandated to work in these countries… GIM has an ally

Regions II and III must not be neglected

GROUP E REPORT

Clarifying Technical Issues

Related to opportunities of Region II countries

Ad hoc overview of transmission in Europe

- **Noticed that NO significant transmission exists to move power north at this time**

Discussed transmission technologies including:

- **Superconductivity, HV DC transmission**

Transmission losses: 7% good figure-of-merit for well-maintained system, 3% HV transmission system, remaining losses occur in distribution network

GROUP E REPORT

Technologies included in the Initiative

What does the GMI include?

Trough, Towers, Dish Systems (Sterling and PV) … anything CONCENTRATING?

What about process heat

Do we differentiate on- and off-grid

Is this a definition valuable?

Agreed on "market" to be the focus of the initiative

Discussed taking "high-road", leaving door open to Flat Panel PV

GMI = "Global Solar Energy Market Initiative?

Discussed historical PV/CSP relations.

Including PV should be discussed.

GROUP E REPORT

Goals of the "Global Market Initiative"

- To get projects into the ground
- Cost reduction
- Becoming competitive
- 5,000 MW a technology driven-goals, that's what needed to get to become competitive
- Communicate the availability of the resource
- Establish an effective management team
- Getting the global warming "desaster insurance" industry on board
- Comprehensive economic model should be available to GMI team

GROUP E REPORT

Financial Incentives: “Crutches,” “Incubation”, “Subsidies”

How should we “spin” the need to close the cost gap

Question was, should GMI propose best-practice ideas or just list options?

Options and issues:

- Financing matters for power cost!!!
- Credit worthiness of buyer (Region I)
- Need Long-term buyers
- Can’t really ask rate payers to cover cost (Region II, III)
- Monetize/quantify CO2 off-sets
- How do you hedge a country default
- No economic literature on net present value of assets with no marginal cost after paid off. Nuclear power plants the first experience.

GROUP E REPORT

Financial Incentives…[Continued]

- Term initiative and its financial subsidies an "incubation" period, related to other technologies
- Various ideas to reduce the price of first project to buyer. Problems are: incentive for anyone to do so, not one entity (WorldBank) to provide hedge, too many divergent markets
- Default insurance for Regions I, II, but again who provides the guarantee?
- Allowing investor to take tax credits whenever it seems fit to them
- Agreement that financial incentives should be based on kWh, buyer should take not risk in project performance
- …and more.

GROUP E REPORT

How do you get 5,000 MW

Looks like 2,000 MW need to happen in the U.S.

But where do you find another 3,000 MW?

Also, this capacity is for a group of technologies, where each likely assumes that is takes the lions share of the 5,000 MW

Direct sale of project to utilities.

Simple and fast decision making and for new projects.

But this is not coordinated

Economic Window?

Is there really an "economic window of opportunity"?

- High oil-prices
- Low interest rates

Comment: Too US-centric point of view

Situation in Europe different and very different in Regions II and III

Also depends on how power price is structured.

Experience tells that power price should be tagged to inflation and fossil fuel (oil, then, natural gas, today, prices)

GMI needs clarification on macro-economic issues

The GMI Economic Model must play this role

GROUP E REPORT

External Costs

How should the initiative handle external cost?

Agreed that should be considered by decision makers

However, don't provide numbers…There was a very opinionated discussion on subsidies currently enjoyed by the fossil fuel and nuclear industry.

Issues

- Fossil fuel depletion allowances
- Clean-coal technology

Argue for "leveling the playing" field. Let others be the judge…

Provide nonetheless ideas and guides

- Must be universal…
- And useful for regional analysis

GROUP E REPORT

Benefits

- Let's look at CSP benefits rather than external cost of others
- Discussion started with a look at green retailing
- A query around the table showed that success of these programs <u>marginal</u>, 1%.

Keep looking at incremental benefits

Benefits [Continued]

Investment tax credit reflects benefit of long-term assets

Highlight tax payback of solar project

Job creation, local economy

Balance portfolio, hedging, cost of doing so…realm of PUCs and utilities

- Emissions savings
- Fuel cost hedgin

Easier to convince a dozen educated PUC members than millions uneducated power users

Modeling Capabilities

GMI needs advance modeling capabilities

Model must

- Accessible (including version on web)
- Can be done for whole world, enough commonalities
- Solar resource specific
- Room to include external cost
- Various financing schemes
- Value hidden costs of solar, such as hedging
- Detailed and comprehensive

GROUP E REPORT

Baseload, Mid-merit, peaking, or what?

When challenged that solar generates “peak” power, the following issues came up

Dispatch merit of plant depends on load/ region specific

Correleation between load peak and production, but not perfect

Definition of base load, mid-merit, and peaking somewhat elusive

GMI should clarify what it means

Quote: “We are peaking! We produce when the sun shines…right?” (Anonymous)

Issue clearly needs clarification for benefits discussion

GROUP E REPORT

Lessons learned from LUZ

Repeatedly the group revisited some of the lessons learned from the LUZ experience

- **Timing was key**
- **Always barely ahead of the money**
- **A two-month (deliberate?) delay in the passing of a bill and lower oil prices resulted in insolvency of company**

GROUP F REPORT

Group F Leader: Ramon Carlos Torres Flores

Group F Reporter: Tewfik Hasni

- **Our group addressed type 2 markets where both region 1 and region 2 have reasons and there is mutual value to collaboration**
- **Form a working group to develop Maghreb-Euro relationship -- economic and regulatory areas for collaboration in CSP electricity exchange because of emission targets more readily available in region 2**

GROUP F REPORT

- Develop mechanisms for exchange and dissemination of information relative to existing and/or developing projects
- Develop a GMI task force to work with developing projects and enable them to occur
- Develop outreach efforts to financial and project developers on CSP technologies

GROUP G REPORT

Group G Leader: Kevin Nassiep

Group G Reporter: Georg Brakmann

Substantive Issues

Risk mitigation mechanism

Technological risks of new technology (if this is to be taken by supplier, he will factor in his price)

Uncertainty over achievement of 5 000 MW target by 2013

How should the support mechanism be structured?

Feed in law, portfolio standards, time limit on support,

GROUP G REPORT

Substantive Issues (cont.)

Lack of political awareness

Lack of standardisation of technical parameters, efficiency benchmarks, bidding procedures, etc.

Procedure Issues:

Problem of Formation of Consortia between large large Power Block and small Solar Company

GROUP G REPORT

Procedural Issues (cont.)

Mode of implementation (Pubic / private)

Lack of Funds for Project Preparation

- **(e.g. feasibility studies)**

Limited number of suppliers

Lack of technology transfer and training

Intergroup communication

Absence of database for supplier of technology and services

GROUP G REPORT

Solutions and other suggestions:

Sharing of the technology risk amongst all stakeholders

Action plan for segregation of the total goal by time and by regions

Focussed R&D on the problems of the projects

Prospects of private participation to be assessed

Opportunity for training (technical, project management) to be provided

Identify match-making opportunity for industry

Establish database for of suppliers of technology and services

GROUP G REPORT

Solutions Suggestions (Cont.)

No discrimination between region II and region III

- **Region II countries cannot wait until feed-in laws are in place. They need subsidies now to cover the gap (the economic not the financial one.**

Subsidy for tariff is time limited.

- **Once the debt is repaid the solar production does not need further subsidies**

Sudan should be named in group III

Wednesday Oct, 22
11:00 AM to 12:30 PM

SESSION 5: STAKEHOLDER PANEL

Public Utilities Authority Electricity

The Israel PUA
Powers and Responsibility

State of Israel

1. Electricity Consumption rates
2. Quality of the Electricity supply
3. “Network service Usage” Rates
4. Demand side Managements programs
5. Incorporate Alternate Energy system into the Israel Electricity sector

New Model for Electricity rates

Functional Segmentation and **Analysis** of the IEC operational and financial data.

- Separate Rate Base and Tariff for electricity services along the electricity supply chain network:

1. Generation
2. Transmission
3. Distribution

Public Utilities Authority
Electricity

State of Israel

New rate making model

- Utilize Base Rate of each sector with different ROI's
- Set Electricity charges by Time-Of-Usage (TOU)
- Utilize Marginal cost of Producing and Transmitting of electricity as basis for TOU Tariff
- TOU Tariff incorporates Loss of Load Probability (LOLP) at peak usage

How to evaluate new plants

- ✓ Introducing New plants in an expanding electricity service, whether regulated or competitive, need be evaluated by its specific merit.

- ✓ The use of Marginal cost of Producing electricity incorporating Loss of Load Probability (LOLP), Creates the Framework which enables to evaluate the contribution of new technologies into the expanding national electricity service in ISRAEL

Public Utilities Authority Electricity

Incorporating Solar Trough plant into Israeli power mix

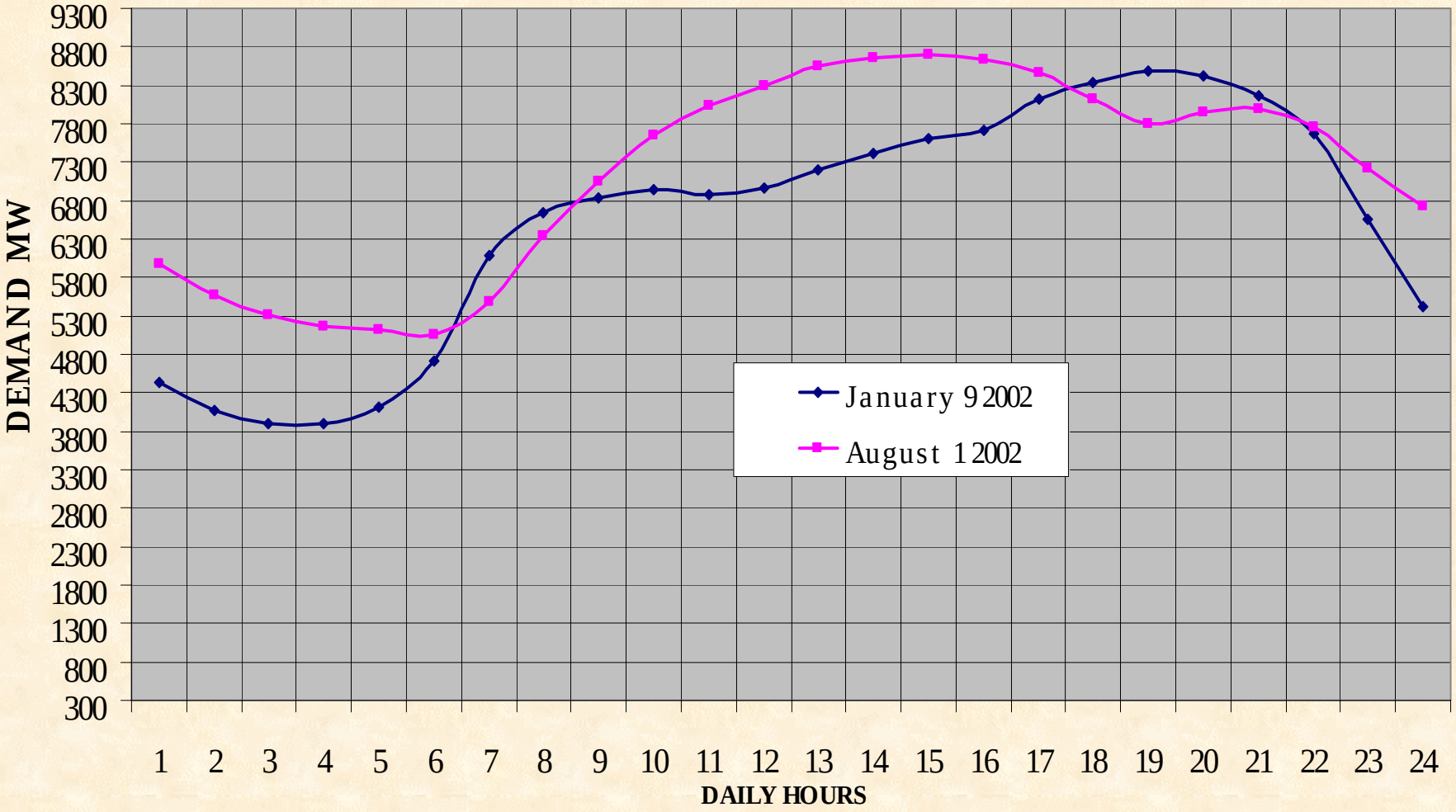
State of Israel

- Solar Power plants have Zero Marginal cost and are of fixed average cost.
- Trough Technology average cost of producing Electricity in Near term (2004) is 10.5 Cents/Kwhr.
- This cost has to be compared with the Marginal cost of the electricity production in Near term for corresponding hours

Public Utilities Authority
Electricity

Typical High Demand Profile in Israel

State of Israel



Public Utilities Authority Electricity

Incorporating Solar Trough plant into Israeli power mix

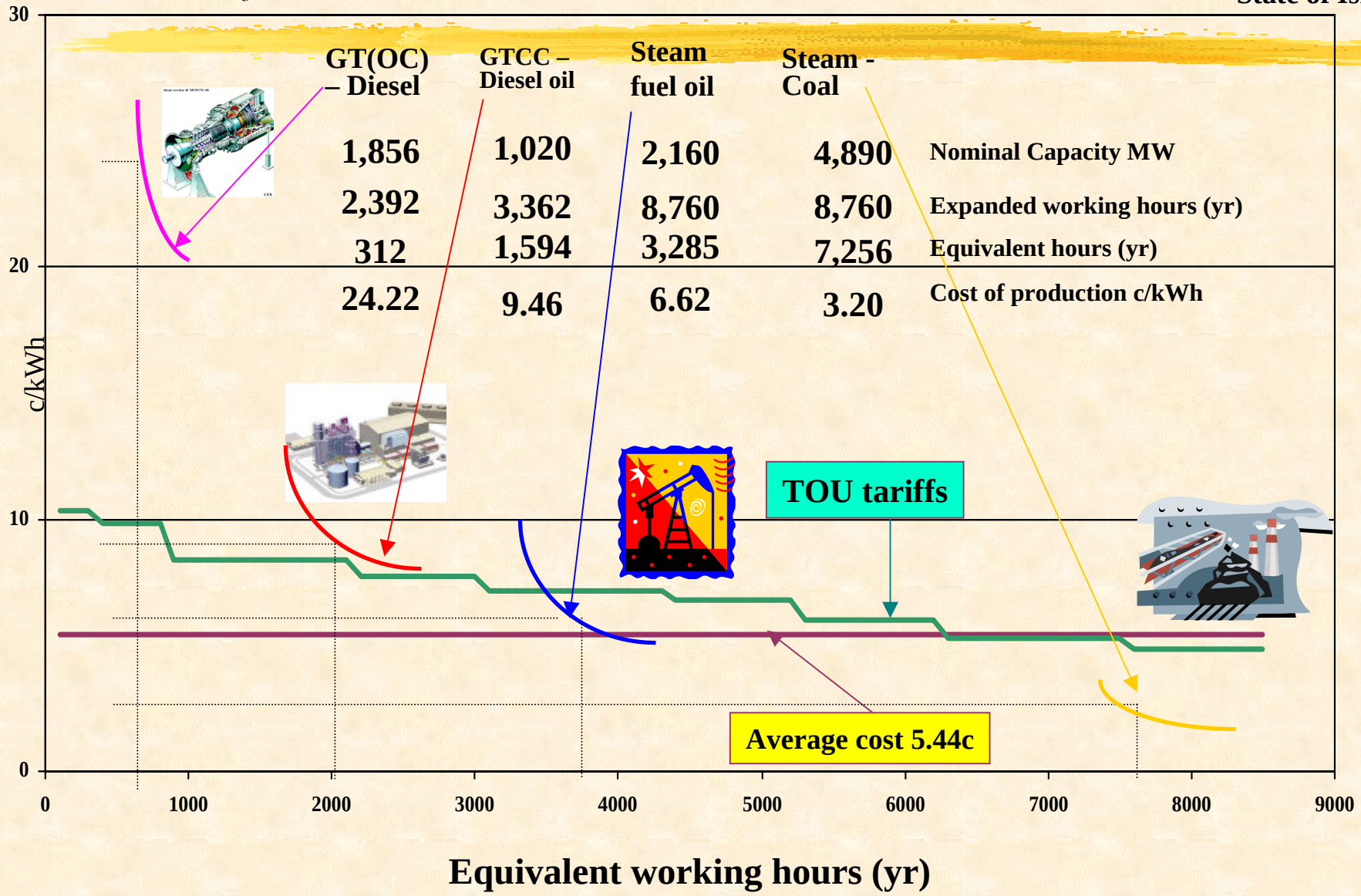
State of Israel

- Low demands are provided by Coal plants
- High demands are provided by Turbines that use high –priced Gas Oil (Diesel) liquid fuel
- The hourly marginal cost of the electricity production can change by a factor of five over the daily hours.
- If cost of the Loss Of Load Probability (LOLP) is added to the marginal fuel cost, the Near Term Solar Trough, Average Solar Cost is lower than the actual marginal in many hours of the summer.

Public Utilities Authority
Electricity

Hourly Cost of production by generating unit

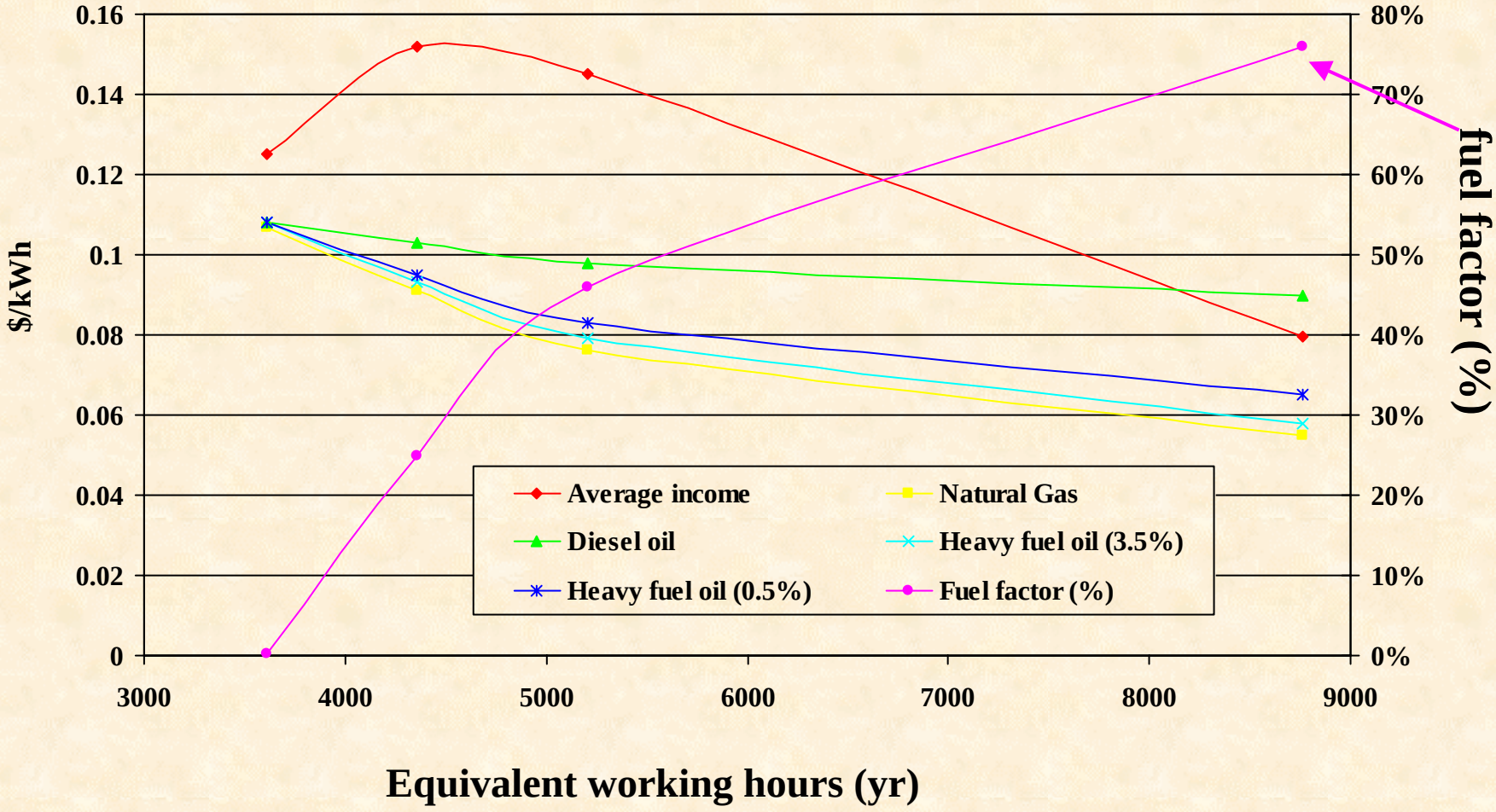
State of Israel



Public Utilities Authority Electricity

Production costs and income of a Solar power plant reinforced with various fuels

State of Israel



Public Utilities Authority
Electricity

Preliminary Observations

State of Israel

- Solar technology must be evaluated not as a Stand-Alone but as part of a mix of plants in an electricity service
- A national electricity system that exhibits increased demand at daily hours corresponding with high solar availability can Already , presently, benefit from Solar Trough plants
- The benefit of the solar plant need be evaluated by comparing its average cost with the hourly marginal cost that includes the cost of the Loss Of Load Probability (LOLP)

Bundesministerium
für Umwelt, Naturschutz
und Reaktorsicherheit

DAS HAT ZUKUNFT

CSP
Global Market Initiative

Regulatory Issues from a German Perspective

Ludger Lorych
Federal Ministry for the Environment, Germany

Palm Springs, October 2003

Instruments for Supporting Renewable Energies

overview

- targets
- research and development
- grants; tax- and custom-relieves
- internalisation of external costs
  - tax on environmental harmful technologies
  - feed-in law (Renewable Energy Act)

Targets

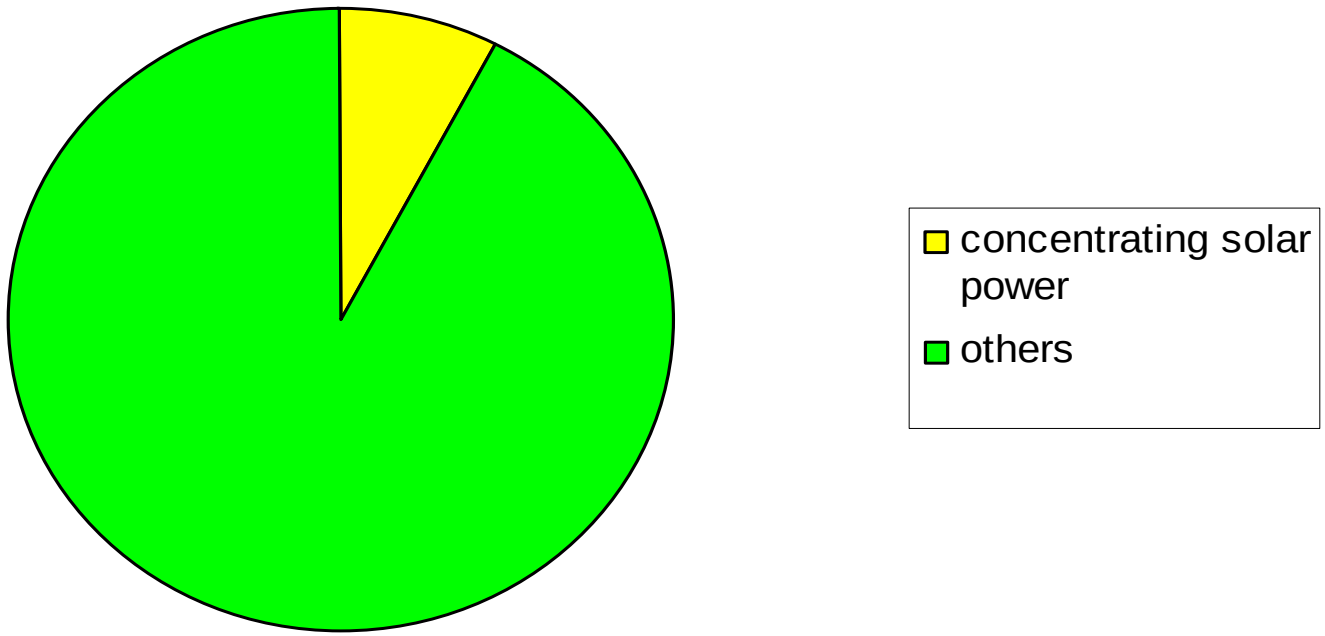
for the extension of renewable energies in Germany

- 2010: doubling the share of 2000
  (4.2 % of primary energy; 12.5 % of electricity,
  particularly according to EU Directive 2001/77/EC)
- 2020: 20 % of electricity demand
  (in preparation)
- 2050: 50 % of primary energy demand

source: BMU

Research and Development

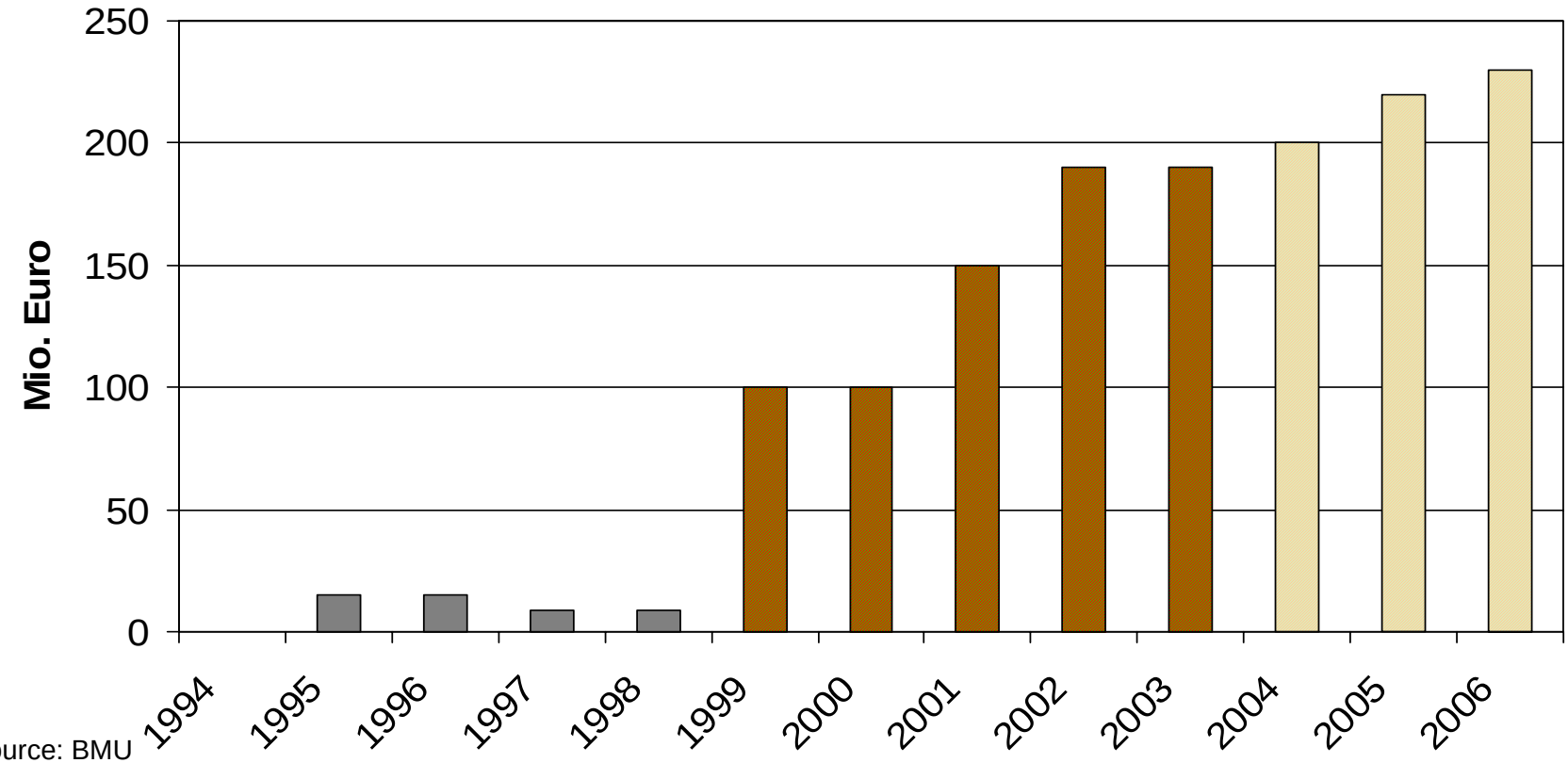
100 Mio. Euro/year public support for renewable energies in Germany



source: BMU

Grants (national)

for renewable energies in Germany (main program)



source: BMU

International Promotion

for Renewable Energies

in the field of economic cooperation with eveloping countries

- 500 Mio. Euro over a period of 5 years

source: Chancellor Schröder on the World Summit on Sustainable Development in Johannesburg 2002

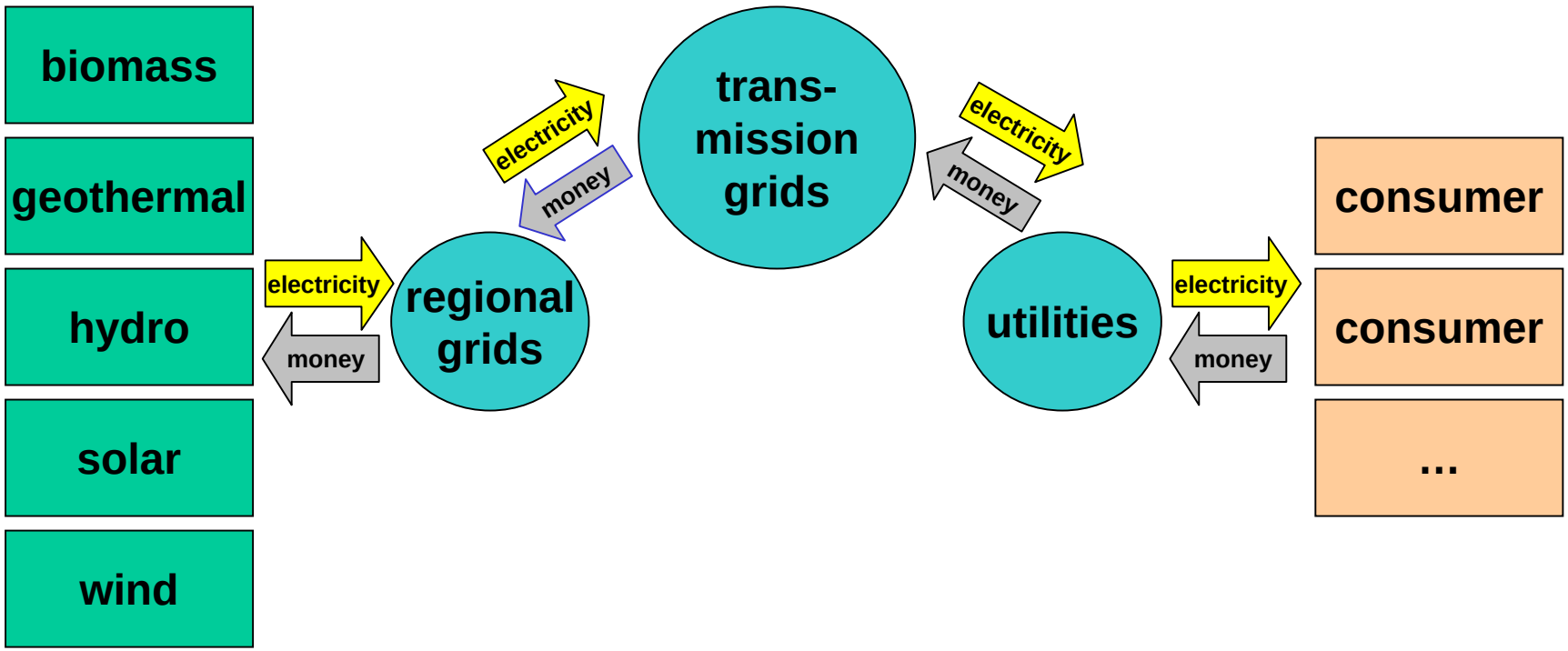
Feed-in Law (Renewable Energies Act)

principles

- anybody is allowed to produce electricity out of renewable energies
- the network operator has to connect the electricity generation facilities to his grid
- the network operator has to purchase all of the electricity with fixed rates for a period of 20 years

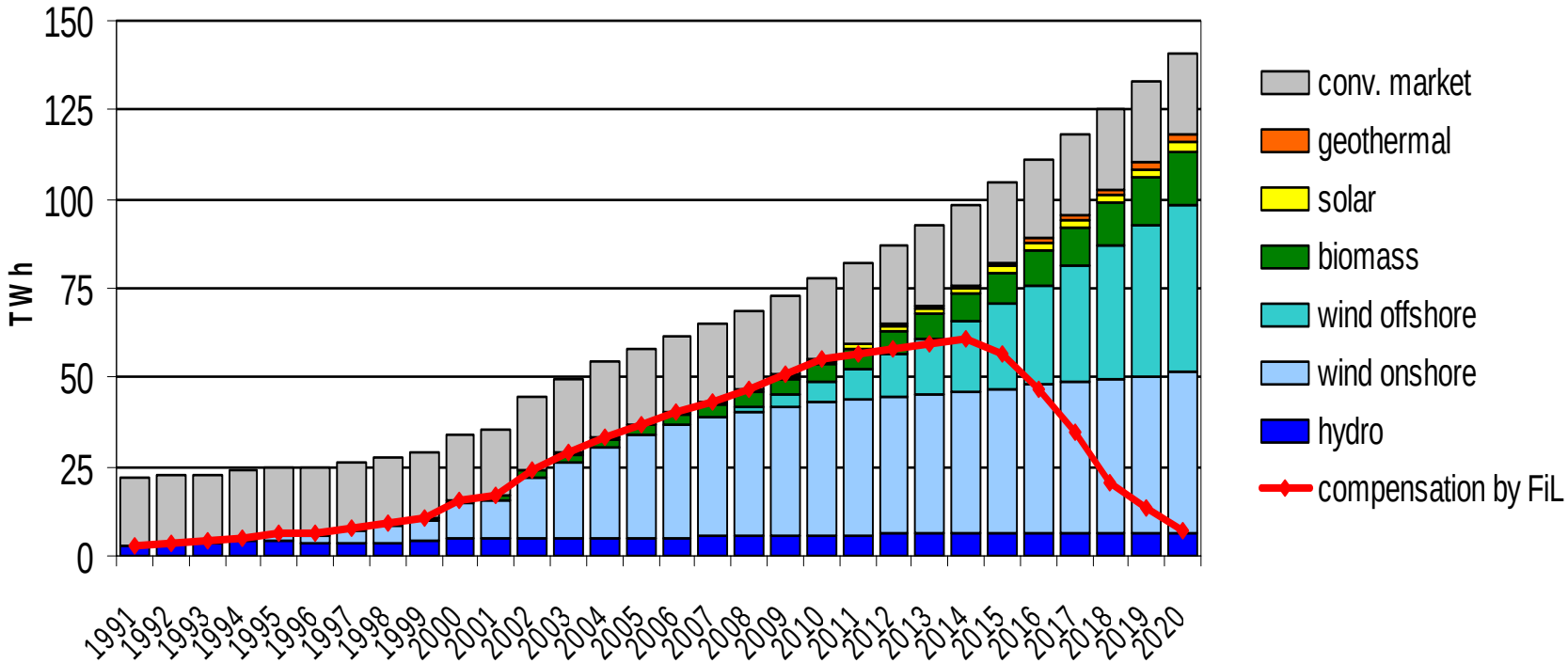
Feed – in Law

functioning



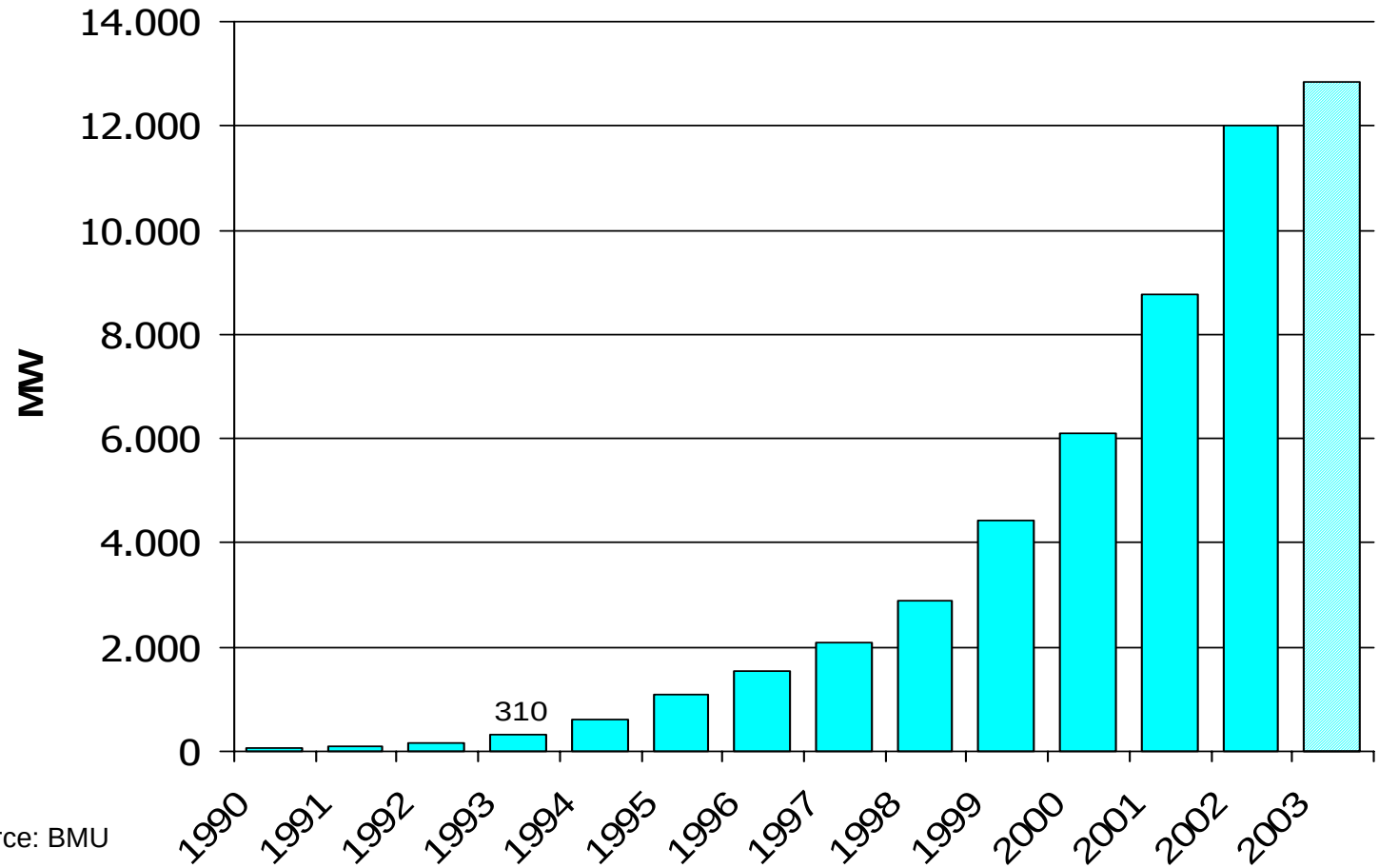
Feed - in Law

estimated progress of renewable energies in Germany



source: BMU, Z III 1

Wind Power in Germany



source: BMU

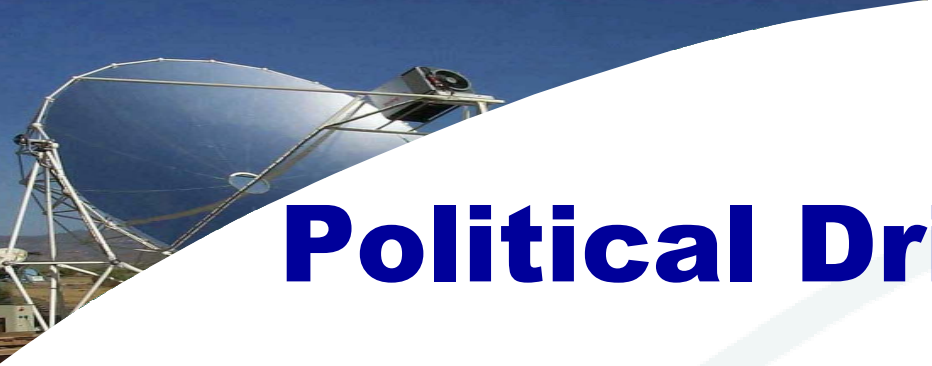
European Union Perspective

Philippe Schild

New and Renewable Energy Sources Unit

Directorate General Research

European Commission



Political Driving Forces

- Sustainable Development:
  - ✓ Gotenborg summit,
  - ✓ Kyoto protocols,
  - ✓ Joannesburg Summit
- New Research Policy:
  - ✓ European Research Area
  - ✓ Barcelona summit
- EU Energy Policy
- Enlargement

Energy Policies

- Papers and Communications
  - ✓ White paper on Renewable Energies and Action Plan (1997)
  - ✓ Green paper on Security of Energy Supply (2000)
  - ✓ White Paper "European Transport Policy for 2010: Time to decide" (2001)
  - ✓ Communication "Environment 2010: our future, our choice" (2001)
- EU Directives
  - ✓ RES-E Directive (from 14% to 22% for E-electricity by 2010)
  - ✓ Internal Market for Electricity (1996) and Gas (1998)
- EU Directives in preparation
  - ✓ CHP, Bio-fuels, Buildings, *Energy Efficiency*
  - ✓ Amended Directive on Internal Market for Electricity and Gas

European Union Funding

- European Investment Bank
  - ✓ Special interest in funding renewable energy projects on commercial footing
- European Development Fund
  - ✓ Development aid for developing countries
- 6th R&D Framework Programme (2002 – 2006)
  - ✓ Research projects
  - ✓ Demonstration projects

European Union Targets

- White paper on Renewable Energies and Action Plan (1997)
  - ✓ For Other Renewables (CSP, OES, EGS): 1 GWe by 2010

- 6th R&D Framework Programme
  - ✓ Long Term (> 2010): Electricity cost < 0,05€/kWh

European Union Actions

- Demonstration Projects (5th R&D Framework Programme) [15M€]
  - ✓ PS10: 10MWe, Sevilla, Spain
  - ✓ Andasol: 50MWe, Andalucia, Spain
  - ✓ SolarTRES: 15MWe, Spain
- Research Projects (5th R&D Framework Programme) [9,3M€]
  - ✓ Electricity Generation
    - EUROTROUGH, INDITEP (trough), SOLAIR (tower), SOLGATE (hybrid-tower)
  - ✓ Solar Chemistry
    - SOLZINC (metal), HYDROSOL (hydrogen)
- Research Projects (6th R&D Framework Programme) [under negotiation]
  - ✓ DISTOR (thermal storage), SOLREF (gas reforming)
  - ✓ ECOSTAR (network)

Web sites

- **CORDIS (for R&D Framework Programmes):**
  http://www.cordis.lu/susdev/energy/
- **EUROPA:**
  http://www.europa.eu.int/comm/dgs/research/index_en.html
- **DG Research, Energy web site:**
  http://europa.eu.int/comm/research/energy/index_en.html
- **DG Energy and Transport, Energy web site:**
  http://europa.eu.int/comm/energy/index_en.html

CSP Financing: US Perspective

By
Michael D. Ware
Advance Capital Markets;
Black Emerald Capital Advisors Ltd.
Conference on Concentrating Solar Power
October 22, 2003

Factors Influencing Project Finance Markets

- Overhang of Merchant Project Debt
- Depressed State of Electric Power Industry
- Where are the EPC Contractors?
- Insurance Industry Woes
- Will the technology work?
- RE is not Mainstream

Key Elements of Project Finance for CSP Projects

- Project Sponsor/Developer
    - Power Purchase Agreement
- Project Economics
    - Financial Structure
- Environmental Feasibility
    - Permits
- Technical Feasibility
    - Independent Engineer Report

Key Elements of Project Finance for CSP Projects (continued)

- Construction/Project Completion
    - EPC Contract
- Risk Mitigation
    - Technology
    - Construction
- Operation and Maintenance Contract

Key Elements of Project Finance for CSP Projects (continued)

- **Financial Package**
  - **Equity**
  - **Debt/Subdebt**
  - **Guarantees**
  - **Reserves**

What is needed for better access to Capital Markets?

- Better understanding of Technology Risk
- The Role of VC Equity in CSP
- Better Understanding of Project Financing by VC Equity Investors
- Alternative Financing Structures
- Loan Guarantees
- Working towards a New Project Finance Model

Increasing Success of GMI

- **Multilaterals Proceed with CSP Projects in Developing Companies**
- **Adoption of RPS in More States**
- **Compatibility of RPS with “Economic” PPA**
- **Blend of Public and Private Financing**
- **Get EPCs off the Bench**
- **Create “Project Teams” to Develop/Build Projects**

Outlook

- **CSP Plant Costs will Decrease**
- **CSP Power Addresses Need for Large Scale Grid Connected RE**
- **Private/Public Sector Cooperation Needed to Assure Financial Markets**
- **Equity and Debt Providors Need to Adapt**

PERSPECTIVE ON CONSTRUCTION OF CSP POWER PLANTS

October 2003

Introduction

The ACS-Group main figures after the Dragados merge

2002 revenues	9,962 M €
Human resources	100.000
Equity	1.738 M €
Countries of presence	50
Net profit	359 M €

ACS Group structure

WHAT CAN WE EXPECT FROM A CSP EXPANDED MARKET IN TERMS OF INVESTMENT COSTS REDUCTION?

WHAT CAN WE DO TO ACCELERATE THE REDUCTION?

ANDASOL Plants in Spain: main features

TECHNOLOGY: Parabolic-cylindrical collectors with HT System, with a steam cycle and gas support.

ELECTRICAL OUTPUT: 50 MW

SOLAR FIELD: 510.000 m2

STORAGE SYSTEM: 6 hours 90% production

INVESTMENT

CYLINDER PARABOLIC (EURO-TROUGH) ANDASOL THERMOSOLAR POWER PLANT

CURRENT STATUS OF ENGINEERING&ESTIMATION 15/10/2003

ITEM	SUBELEMENTS OF THE WBS	CONCEPT DESIGN	BASIC DESIGN	DETAIL DESIGN	VENDORS INQUIRIES	SUBCONTR. INQUIRIES	ESTIMAT. PROCED.	PERFORM. TEST	% OF TOTAL D.COST	COST ESTIMAT. CERTAINTY	COST AMOUNT
	COLUMN Nº	1	2	3	4	5	6	7	8	9	
a)	**ENGINEERING & Know How**	100%	90%	50%	N/A	90%	IE+PA	N/A	5,9%	80%	14,308
b)	**SOLAR FIELD** (SCE&HCE)	100%	100%	95%	100%	100%	IE	YES	46,1%	95%	111,793
c)	**HTF Syst.** (Pipeheaders&H.Exchangers)	100%	100%	80%	80%	100%	IE+PA	YES	12,1%	95%	29,343
d)	**HEAT STORAGE** (Storage&H.Exch.)	100%	100%	50%	50%	100%	IE+PA	KJ (1)	8,5%	80%	20,613
e)	**POWER BLOCK** (TG&BOP associated)	100%	100%	0%	50%	25%	PA	N/A	16,4%	90%	39,770
f)	**SUBSTATION & HV Transmission line**	100%	50%	0%	50%	100%	PA+IE	N/A	1,3%	90%	3,153
g)	**ANCILLARIES** (Aux.Buildgs.,Environm...)	100%	50%	0%	0%	50%	PA	N/A	0,5%	50%	1,213
h)	**FIRST FILL** (HTF,Salt,Lube&Additives)	100%	100%	N/A	100%	100%	IE	N/A	7,4%	80%	17,945
i)	**INSURANCES & Guaranty**		50%	0%	N/A	50%	PA	N/A	1,8%	80%	4,365
	T O T A L C O S T & Average (2)								100%	90%	242,500

NOTES.-

IE : Estimation procedure based on detail cost estimation of each element or subelement

PA : Estimation procedure based on historical costs from similar previous work and/or projects

NA : Non applicable

(1) : Saving the storage tank size, mostly based on the SEGS experience in KJ.

(2) : Not including Developer's Costs neither pre-operational financial costs

WHAT WOULD BE THESE COSTS IF THE NUMBER OF UNITS WERE 5, 10 OR 20, RATHER THAN 1 OR 2?

WHAT IS THE POTENTIAL FOR COST REDUCTION IN EACH AREA?

Assumptions used in the estimate:

- Site is appropriate for the project: green field, slopes, soil

- Standard design is used as much as feasible for plant, components and bulk material.

- Good transportation infrastructure

- Local availability of skilled manpower

- Optimized balance between shop-site activities

- Optimized construction procedures and equipment

Criteria to estimate:

- Curve of learning with different parameters depending on the nature of the cost considered:
  - -Existing experience in fabrication or construction
  - -Present content of raw material as a component of cost of the item
  - -Expected influence of the size of fabrication series
- Number of dependable manufacturers
- Reliability of present technological knowledge

Cost of investment of the last plant of a series, as compared to the cost of one Andasol Plant. Conservative estimate.

COST ESTIMATION FOR UNIT Xth, BASED ON LEARNING CURVE (million euros)

COST ELEMENTS	TOTAL COST	Nº DEPEND. SUPPL.	LEARNING CURVE S FACTOR	% COST REDUCTION 5TH UNIT	EXPECTED COST 5TH UNIT	% COST REDUCTION 10TH UNIT	EXPECTED COST 10TH UNIT	% COST REDUCTION 20TH UNIT	EXPECTED COST 20TH UNIT
ENGINEERING & KNOW HOW	14,31	1÷2	0,80	60%	8,52	48%	6,82	38%	5,45
SOLAR FIELD (SCE&HCE)	111,79	1÷3	0,83	65%	72,53	54%	60,20	45%	49,97
HTF Syst. (Pipeheaders&H.Exchangers)	29,34	1÷3	0,88	74%	21,81	65%	19,19	58%	16,89
HEAT STORAGE (Storage&H.Exch.)	20,61	>5	0,89	76%	15,73	68%	14,00	60%	12,46
POWER BLOCK (TG&BOP associated)	39,77	>3	0,95	89%	35,30	84%	33,54	80%	31,86
SUBSTATION & HV Transmission line	3,15	>5	1,00	100%	3,15	100%	3,15	100%	3,15
ANCILLARIES (Aux.Buildgs.,Environm...)	1,21	>10	0,90	78%	0,95	70%	0,85	63%	0,77
FIRST FILL (HTF,Salt,Lube&Additives)	17,95	>10	0,95	89%	15,93	84%	15,13	80%	14,38
INSURANCES & Guaranty	4,37	>3	1,00	100%	4,37	100%	4,37	100%	4,37
TOTAL COST	242,50			74%	178,29	65%	157,25	57%	139,29

Cost of investment of the last plant of a series, as compared to the cost of one Andasol Plant. Optimistic estimate.

COST ELEMENTS	TOTAL COST	Nº DEPEND. SUPPL.	LEARNING CURVE $ FACTOR	% COST REDUCTION 5TH UNIT	EXPECTED COST 5TH UNIT	% COST REDUCTION 10TH UNIT	EXPECTED COST 10TH UNIT	% COST REDUCTION 20TH UNIT	EXPECTED COST 20TH UNIT
ENGINEERING & KNOW HOW	14,31	1÷2	0,75	51%	7,34	38%	5,50	29%	4,13
SOLAR FIELD (SCE&HCE)	111,79	1÷3	0,78	56%	62,79	44%	48,97	34%	38,20
HTF Syst. (Pipeheaders&H.Exchangers)	29,34	1÷3	0,84	67%	19,57	56%	16,44	47%	13,81
HEAT STORAGE (Storage&H.Exch.)	20,61	>5	0,85	69%	14,13	58%	12,01	50%	10,21
POWER BLOCK (TG&BOP associated)	39,77	>3	0,95	89%	35,30	84%	33,54	80%	31,86
SUBSTATION & HV Transmission line	3,15	>5	1,00	100%	3,15	100%	3,15	100%	3,15
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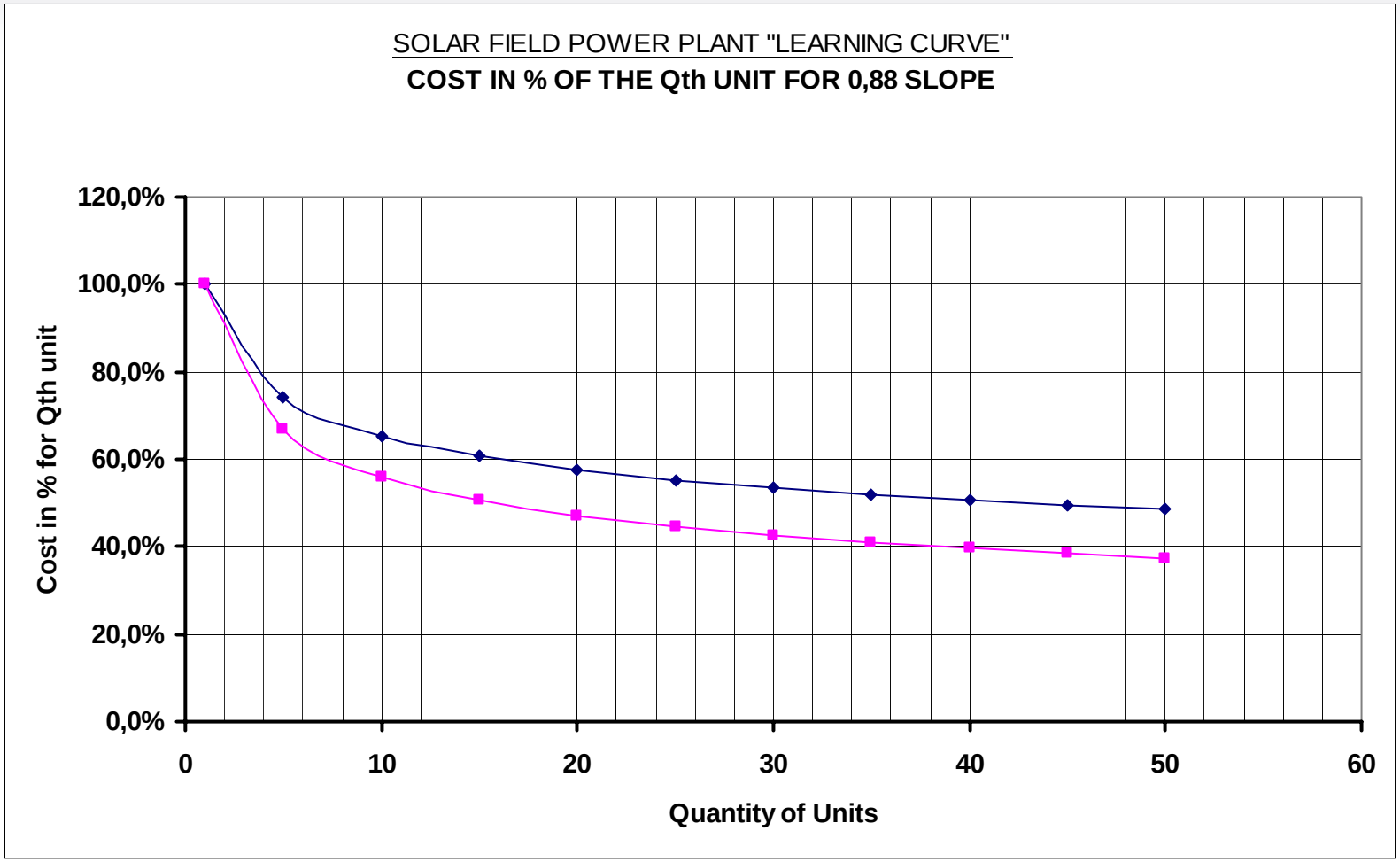
INSURANCES & Guaranty	4,37	>3	1,00	100%	4,37	100%	4,37	100%	4,37
TOTAL COST	242,50			67%	163,53	58%	139,98	50%	120,87

Cost of investment of the last plant of a series, as compared to the cost of one Andasol Plant.

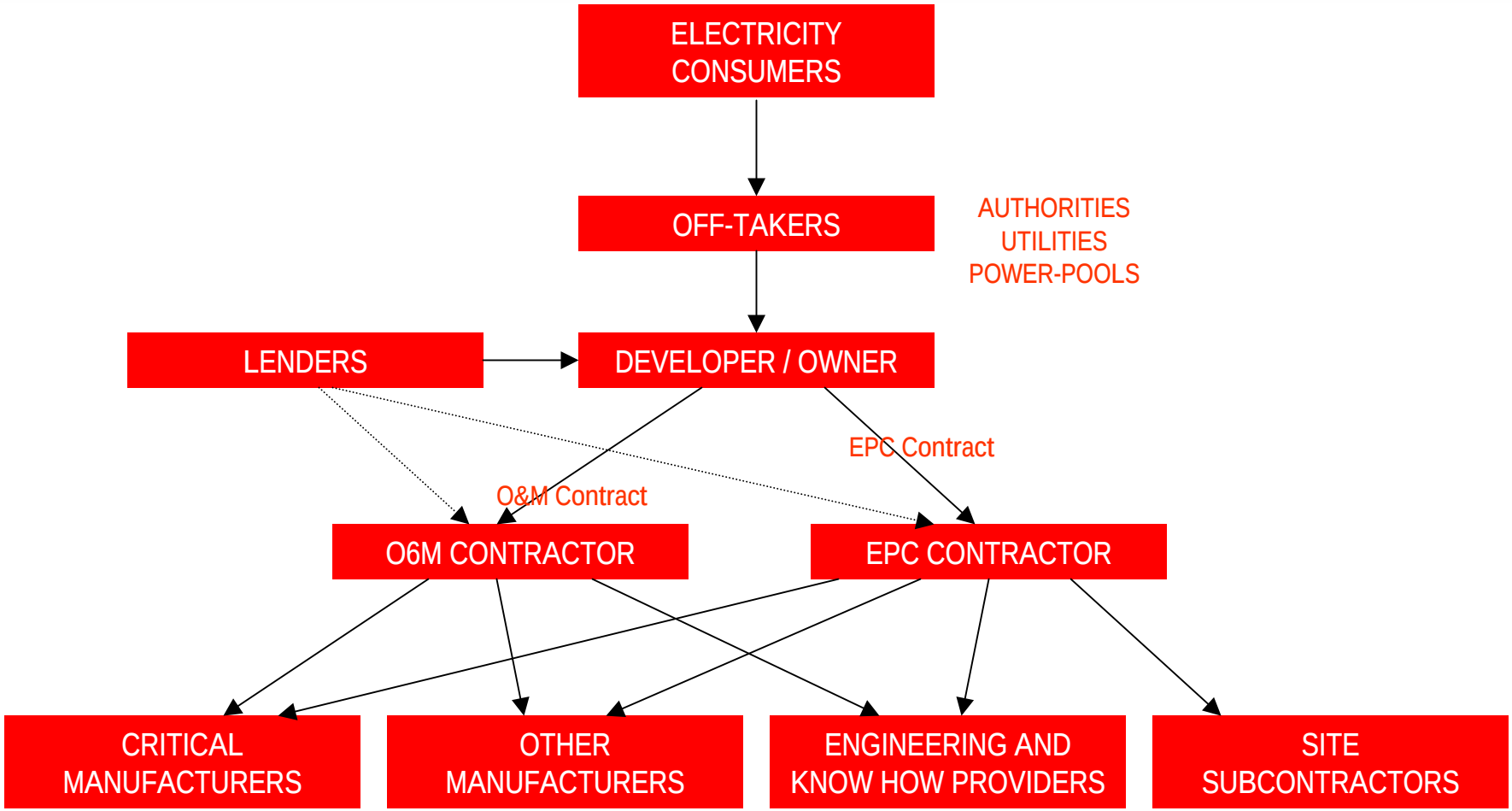


Investment Cost Reduction Key Factors

- Standard optimized design of plant and size of the fabrication series of:
  - mirrors
  - reflecting panels supporting structure
  - collecting tubes
  - heat exchangers
- Optimization of shop and site procedures and equipment
- Long term agreement with specific components manufacturers
- Strategic alliance among developers and contractors

WHAT CAN WE DO TO ACCELERATE THE REDUCTION?

TIPYCAL “PROJECT FINANCE” ORGANIZATION



SOME GENERAL GUIDELINES

- Win-win approach: cost reduction should benefit everybody, from consumers to subcontractors
- Market forces left alone will lead to delayed cost reduction: cooperative research may accelerate it
- Contracts and agreements must be more flexible, to accommodate the potential costs reductions while guaranteeing a minimum profit for private agents
- Subsidies in electricity prices may change with actual capex cost, but be stable during the debt repayment period
- For most power systems, the CSP success will be linked to its programmability

SOME GUIDELINES FROM THE CONTRACTOR PERSPECTIVE

- Potential for cost reduction is concentrated in a few items
- New designs and materials may lead to significant reductions
- Critical components providers must be positively involved in the cost reduction effort.
- EPC and O&M Contracts should contain provisions to incentive the cost reduction effort along the project, without increasing the risk exposure inherent to these contracts
- Size of the potential market would be an incentive to participate in cost reduction research initiatives

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

CSP Global Market Initiative

What will Utilities need to Consider

Bud Beebe

AR&DGT Department

Palm Springs, California **October 2003**

About SMUD

Sacramento's Electric Utility

- **1.5 Million Population**
- **2,900 MW Summer Peak**
- **1150 MW avg**
- **1200 MW Generation (net importer)**
  - **Hydro, Natural Gas, PV, Wind**

SMUD

SACRAMENTO M[illegible]IPA[illegible]TY DISTRICT

COST

Transmission

[illegible] be

w[illegible] buying a powe[illegible] p[illegible]

Permits & Environmental Impact

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

Before **you build the plant :**

COST = CAPITAL + O&M (Operations & Maintenance)

After **you build the plant :**

COST = CAPITAL + **O&M** (Operations & Maintenance)

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

Whatever you can do to decrease O&M will, if the project gets built, be a major factor for a second project

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

If capital is available and O&M looks good,

What's to stop the project ?

R I S K

The usual suspects

Fear of the Unknown

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

RISK

(In this case, justified (?) fear of the unknown)

?Q? - Will the Power Plant work 'as advertised' ?

- "Utilities" are mostly financing organizations

Answer 1 - Develop a Partnership; with enough other entities in the project, I won't look foolish !

Answer 2 - Have enough local benefit so that leaders have a reason to step beyond their cautionary limits. e.g., jobs, air quality, resource diversity, tax base; the build a factory syndrome

SMUD
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RISK

Schedule Risk

- Cost of non-productive capital
- Cost of replacement power
- Cost of “fixing” whatever is causing delay

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RISK

Liability for shutdown & site remediation if (when) project closes…disposing of the dead body

Lots of examples : Fuel Cells, PV, Geothermal, Nuclear, Wind Turbines, Transformers, Switches, etc.

Be prepared to address this concern.

Guidance for Discussion Groups

Second Discussions

Wednesday afternoon

Assignments

- Please return to same discussion group and room as yesterday.

Specific Discussions

- The proposed elements (requirements) of the CSP GMI.
- The proposed structure and management of the CSP GMI.
- The steps required for the successful implementation of the CSP GMI.

Additional Comments

- Only two hours available
- Please be in your discussion group room at 1:30 pm, right after lunch.
- Coffee break back here at Las Palmas Salon E at 3:30 pm
- Reporters must have their presentation ready for the session starting at 4 pm.

Wednesday Oct, 22
4:00 to 5:45 PM

SESSION 6: DISCUSSION GROUP REPORTS

Proposed Elements And Requirements of GMI

Our group basically concurs with the elements of the GMI

Suggest changing title of document to read:

- **Summary of A Global Market Initiative (GMI) for Concentrating Solar Power (CSP)**

Group A - 2

Add an introductory paragraph (lifted from the first 2 sentences of the Draft GMI):

- **Solar energy is the most evenly distributed and readily available renewable energy resource on the planet. Solar thermal power plants, which make use of this concentrating solar power (CSP) technology have the capability to meet a significant percentage of the future global electricity demand without technological, economic, or resource limitations.**

Group A - 3

Then in introduction:

- At the First International Executive Conference on CSP in June 2002 in Berlin, Germany, strategies towards the rapid and large-scale market introduction of the technology were defined and summarized in the *Declaration of Berlin*, which was registered as a UNEP Market Facilitation WSSD Type-II Partnership for CSP Technologies.
- At the Second International Executive Conference on CSP here in Palm Springs, California, a *Global Market Initiative* was developed and is outlined below.

Group A - 4

Change WHEREAS # 3 to:

- **Concentrating solar power (CSP) technologies exist today to convert this resource into electricity.**

Change WHEREAS # 4 to:

- **Electricity from CSP plants generally cost more than from conventional power plants today. Independent studies, however, predict that the cost of CSP power will be full competitive with fossil-based power once 5,000 MW of new CSP capacity has been installed.**

Group A Report

Group A - 5

Eliminate WHEREAS # 5.

Change new WHEREAS # 6 TO SAY:

- **This Global Market Initiative is needed to overcome the barriers of widespread adoption of CSP technologies.**

Change THEREFORE # 1 to add new sentence at end:

- **The total initiative calls for 5,000 MW of new CSP in ten years.**

Group A - 6

Change THEREFORE # 2 to say:

- This Initiative will be endorsed by the Global Environment Facility.

We concur with adding under THEREFORE # 3 of the one-page summary:

- Facilitate the process of bringing buyers of electricity and developers of CSP plants together

Eliminate 1st item of THEREFORE # 5 and #6 and #7 -- see next comments.

Group A - 7
Organization, Structure & Management

- We concur with concept of an unpaid Advisory Board of highly-respected, well-known business leaders. This Board should be comprised of, say, 3 from Region 1 and one each from Regions 2 and 3.
- We believe this Initiative should be a new separate task of SolarPACES, with additional support staff or experts hired by SolarPACES as needed. (SolarPACES has an existing organization and structure and is the logical body for this task.)

Group A - 8

A budget and revenue plan for this task will need to be developed by SolarPACES. Conceptually, we concur with the concept that participating countries and states should financially support this Initiative, with matching funds provided by the GEF.

We believe SolarPACES should determine how best to include states and industrial participants in this funding.

Group B Thoughts on GMI

Proposed Structure and Management

Implement the GMI under the umbrella of an existing organization like IEA or Solar PACES instead of creating a new management structure.

- **Legality structure already established**

Under SolarPACES or separate?

Group B Thoughts on GMI

GMI Under SolarPACES

Advantages

- **Faster**

Disadvantages

- **Slow moving**
- **Current ExCo dominated by R&D people**
- **Less clear role of industry**

Group B Thoughts on GMI

Changes to Executive Summary

Strengthen advantages and uniqueness

- CSP is solves solar intermittence
- CSP can provide both energy and capacity
- CSP can provide significant portion of electricity and hydrogen
- CSP expansion could be like wind

Group B Thoughts on GMI

Changes to Therefore Section

“All of those” or “members” rather than “countries and states”

Bullet 3 streamline wording

Additional benefit: establish best practices

Group B Thoughts on GMI

Questions?

Who belongs to the GMI organization?

- **Those developing solar resources (and sign the initiative)**
- **Industry who develop, build, operate the plants (and don't sign the initiative)**
- **Are there any analogous organizations?**

Group B Thoughts on GMI

Why a global initiative?

- **Must be better than local initiative**
- **Gets to end goal of CSP cost competitive**
  - Faster
  - Less expensively
  - Address tragedy of the commons (share burden)

Group C Report

The sun is the most vast energy resource in the world
The technologies, concentrating solar power (CSP) to convert
this resource into electricity exist today
2.- 6. Delete: instead
Many environmental benefits will come from
developing this resource, whereas
solar provides both renewable energy and capacity,
3 to 5 times more jobs will be created
the tax basis will be increased compared to
fossil alternatives,
generation cost is independent of fuel price instability,
CSP is cost competitive to peaking combustion turbines;
additional 5000 MW of CSP will result in CSP being
competitive to fossil base load generation.
7. Several obstacles have to be overcome for CSP plants to be built.

Group C Report

Therefore:

1. ...develop [their] solar energy resouces....CSP plants. [in their country or state]
2. ...Environment Facility and other interested parties.
3. ...

   Set targets for CSP plants of at least 100 MW in the first 5 years

   .....

   Establish policies and fair capacity and energy evaluations to facilitate CSP plants.

   Facilitate long-term low-interest debt financing

   Establish fair and open bidding procedures

   To facilitate guarantees for long-term contracts

Group C Report

4. Participation in the GMI will accelerate the economic and environmenal benefits along with technology cost reductions

5. Additional benefits include

- A seat on the Executive Committee.
- Access to technical assistance
- Assistance in securing project finance
- Assistance in securing incentives
- Assistance in crafting supporting policies based on existing successful models
- Assistance in developing bid packages and structuring long-term contracts
- Assistance in expediting CSP projects from industry experience

Group C Report

6. / 7. Delete these in the Executive Summary

Organization, Structure and Management

Group D’s Report is not available.

Group E Notes

Agenda

Opening Discussion

- US Today Article on Energy
- The Value of Lobbying
- Lobbying Needs Information

GMI Executive Summary

- Point-by-point discussion

Details of the GMI

- Members
- Funding
- Mission

Group E Notes

USA Today Article on Energy

Today, 22 October 2003, the "USA Today" ran a story on energy appropriations (not tax incentives) from 1973-2000

Group reviewed information…

…and agreed that there is value of communicating this information

- **However, how do you do that effectively?**

Please see article of detail.

Nevertheless, the conclusion is that

- **Historical subsidies to conventional energy sources ar substantial and ongoing**
- **Realizing the Initiative would only require** a small fraction **of these subsidies**

Example of proposed $20 billion Alaska pipeline was brought up, which led to discussion on the importance of lobbying

Group E Notes

The Value of Lobbying

Group heard a summary of recent lobbying efforts by Solargenix and agreed to the importance of such efforts

Solargenix experience was supported by the experience of LUZ during the development of the SEGS plants

Solargenix showed letter of support by half a dozen members of Congress

This led to a more general conclusion on the value of credible analysis of the technology and resources.

Group E Notes

Lobbying needs Information

Examples:

- **Seargent & Lundi CSP report**
- **"Why California should develop solar."**
- **The roads how of the 1,000 MW report**

Tremendously valuable tool for lobbying. Facts!

Proposal came up to provide a primer of developing solar projects in various states

Argument against it was that there are too many states and countries with too many rules.

Nonetheless, there may be clear value for case studies

Group E Notes

The GMI Executive Summary

Bullet-by-bullet review of the "Draft Executive Summary of the CSP GMI"

Group E Notes

Proposed Changes Summary

WHEREAS:

1. **Too generic. "*In x countries containing x% of the worlds population there are solar resources sufficient for the development of commercial solar power plants..*"**
2. **Delete.**
3. **No note.**
4. **Delete**
5. **Remove focus on 5,000 MW. "*Independent studies predict that the cost of solar power would approach competitiveness if new solar projects are built whose combined capacity would be roughly equivalent to…*"**

New. "*Solar power comprises technologies with up to twenty years of successful commercial operation…*"

Group E Notes

Changes [continued]

WHEREAS:

1. ***"Solar power requires only a fraction of the incentives and subsidies historically afforded to other generating technology to reach cost competitiveness, while producing reliable, displaceable power that meets the needs of modern societies without the environmental and societal cost of conventional technologies, including air pollution, price instability, decontamination, or energy dependence…"***

Group E Notes

GMI Executive Summary

What does the GMI include?

Trough, Towers, Dish Systems (Sterling and PV) … anything CONCENTRATING?

What about process heat

Do we differentiate on- and off-grid

Is this a definition valuable?

Agreed on "market" to be the focus of the initiative

Discussed taking "high-road", leaving door open to Flat Panel PV

GMI = "Global Solar Energy Market Initiative?

Discussed historical PV/CSP relations.

Including PV should be discussed.

Group E Notes

Goals of the "Global Market Initiative"

To get projects into the ground

Cost reduction

Becoming competitive

5,000 MW a technology driven-goals, that's what needed to get to become competitive

Communicate the availability of the resource

Establish an effective management team

Getting the global warming "desaster insurance" industry on board

Comprehensive economic model should be available to GMI team

Group E Notes

Financial Incentives: “Crutches”, “Incubation”, “Subsidies”

How should we “spin” the need to close the cost gap

Question was, should GMI propose best-practice ideas or just list options?

Options and issues:

- Financing matters for power cost!!!
- Credit worthiness of buyer (Region I)
- Need Long-term buyers
- Can’t really ask rate payers to cover cost (Region II, III)
- Monetize/quantify CO2 off-sets
- How do you hedge a country default
- No economic literature on net present value of assets with no marginal cost after paid off. Nuclear power plants the first experience.

Group E Notes

Financial Incentives…[Continued]

- Term initiative and its financial subsidies an "incubation" period, related to other technologies
- Various ideas to reduce the price of first project to buyer. Problems are: incentive for anyone to do so, not one entity (WorldBank) to provide hedge, too many divergent markets
- Default insurance for Regions I, II, but again who provides the guarantee?
- Allowing investor to take tax credits whenever it seems fit to them
- Agreement that financial incentives should be based on kWh, buyer should take not risk in project performance
- …and more.

Group E Notes

How do you get 5,000 MW

Looks like 2,000 MW need to happen in the U.S.

But where do you find another 3,000 MW?

Also, this capacity is for a group of technologies, where each likely assumes that is takes the lions share of the 5,000 MW

Direct sale of project to utilities.

Simple and fast decision making and for new projects.

But this is not coordinated

Group E Notes

Economic Window?

Is there really an "economic window of opportunity"?

- High oil-prices
- Low interest rates

Comment: Too US-centric point of view

Situation in Europe different and very different in Regions II and III

Also depends on how power price is structured.

Experience tells that power price should be tagged to inflation and fossil fuel (oil, then, natural gas, today, prices)

GMI needs clarification on macro-economic issues

The GMI Economic Model must play this role

Group E Notes

External Costs

How should the initiative handle external cost?

Agreed that should be considered by decision makers

However, don't provide numbers…There was a very opinionated discussion on subsidies currently enjoyed by the fossil fuel and nuclear industry.

Issues

- Fossil fuel depletion allowances
- Clean-coal technology

Argue for "leveling the playing" field. Let others be the judge…

Provide nonetheless ideas and guides

- Must be universal…
- And useful for regional analysis

Group E Notes

Benefits

Let's look at CSP benefits rather than external cost of others

Discussion started with a look at green retailing

A query around the table showed that success of these programs <u>marginal</u>, 1%.

Keep looking at incremental benefits

Group E Notes

Benefits [Continued]

Investment tax credit reflects benefit of long-term assets

Highlight tax payback of solar project

Job creation, local economy

Balance portfolio, hedging, cost of doing so…realm of PUCs and utilities

- Emissions savings
- Fuel cost hedgin

Easier to convince a dozen educated PUC members than millions uneducated power users

Group E Notes

Modeling Capabilities

GMI needs advance modeling capabilities

Model must

- Accessible (including version on web)
- Can be done for whole world, enough commonalities
- Solar resource specific
- Room to include external cost
- Various financing schemes
- Value hidden costs of solar, such as hedging
- Detailed and comprehensive

Group E Notes

Baseload, Mid-merit, peaking, or what?

When challenged that solar generates “peak” power, the following issues came up

Dispatch merit of plant depends on load/ region specific

Correleation between load peak and production, but not perfect

Definition of base load, mid-merit, and peaking somewhat elusive

GMI should clarify what it means

Quote: “We are peaking! We produce when the sun shines…right?” (Anonymous)

Issue clearly needs clarification for benefits discussion

Group E Notes

Lessons learned from LUZ

Repeatedly the group revisited some of the lessons learned from the LUZ experience

- **Timing was key**
- **Always barely ahead of the money**
- **A two-month (deliberate?) delay in the passing of a bill and lower oil prices resulted in insolvency of company**

Group F Report

REVIEW OF DRAFT GMI

Whereas:

2. **Many benefits will accrue from developing this resource including: diversification of generation, enhanced reliability, environmental externalities, etc.**
3. **CSP (Concentrating Solar Power) technologies to convert solar energy into electricity and heat exist today.**

Group F Report

5. With a modest investment, independent studies based on the expansion of the markets predict that the cost of CSP power can be competitive with fossil-based power.
6. Delete.
7. Delete.
6. A CSP industry that is equipped and prepared to respond to increasing demand is in place.

Group F Report

7. A number of parties have made commitments of resources and made efforts to remove policy barriers but without a coordinated approach this will not achieve the deployment of CSP plants. Therefore, a group of interested public and private parties met in Berlin and endorsed the establishment of a goal of 5,000 MW and defined strategies for achieving this goal.

Group F Report

Therefore:

Combine 1 and 2.

1. **We hereby form a collaborative effort of interested parties to be known as the CSP Global Market Initiative with the objective to deploy 5,000 MW of CSP power by 2013.**

Group F Report

3. Set targets for commercial-scale CSP Plants. We don't need to be so specific in defining amount? Adopt goals intended to achieve the 5,000 MW objective by 2013..

   All countries may not want or be able to agree to the content of this list? Maybe they will work toward incentives required to achieve the deployment, such as? Is this too specific in terms of requirements?

   Different requirements for Regions 1 and 2?

Group F Report

We need something suggesting the development of regulation and financing support.

How are we incorporating organizations such a KfW, GEF, World Bank, EIB, ……

4. Through 7. Are process not function of the GMI.

Group F Report

4. The GMI will aggregate markets, facilitate shared learning, leverage resources, reduced perceived risks, support developing countries, and provide high-level visibility to CSP power deployments.

Group G Report

Changes to WHEREAS section of GMI

Item 2:...many benefits, including energy diversity and social upliftment and rural electrification, will...

Item 3: remove the word technologies

Item 4: Change the word generally to initially

Item 6: add....economic and environmental benefits

Item 6: move up to item 3 and renumber

Changes to GMI - Exec ummary

Item 3, line 2: Establish adequate tariffs and / or support mechanism to allow

Item 3, line 3: delete ...essential...

Item 3, line 4: change provide to facilitate

Item 3, new line: promote cross border CSP power transmission

Item 5: change heading to GMI memberships includes

Item 6: delete the words 50,000 Euro .....to contribute to the cost share of this initiative.

Expectations of GMI

Additional to what is in Executive Summary

- CSP Project Fundraising
- Political lobbying
- Raise awareness
- Establishing appropriate support tools
  - economic models
  - databases
  - matchmaking
- Qualify CSP projects for CER credits

Participation into GMI

Participating countries (already highlighted)

Financial institutions / donors

Solar industry

Utilities (power purchasers)

Purchasers of carbon credits

Organisation of GMI

GMI will be a new task assigned to SolarPaces

Group G Report

Next steps

Seek endorsement from interested countries for Executive Summary

Work out full text of GMI

Expand coverage of crucial activities (e.g. Start missions to other interested countries)

Get agreement for full GMI text

Get endorsement for full GMI text during Bonn conference in June 2004

Substantive Issues

Risk mitigation mechanism

- **Technological risks of new technology (if this is to be taken by supplier, he will factor in his price)**

Uncertainty over achievement of 5 000 MW target by 2013

How should the support mechanism be structured?

- **Feed in law, portfolio standards, time limit on support,**

Lack of political awareness

Lack of standardisation of technical parameters, efficiency benchmarks, bidding procedures, etc.

Group G Report

Procedure Issue

Problem of Formation of Consortia

- **between large large Power Block and small Solar Company**

Mode of implementation (Pubic / private)

Lack of Funds for Project Preparation

- **(e.g. feasibility studies)**

Limited number of suppliers

Lack of technology transfer and training

Intergroup communication

Absence of database for supplier of technology and services

Solutions and other suggestions

- Sharing of the technology risk amongst all stakeholders
- Action plan for segregation of the total goal by time and by regions
- Focussed R&D on the problems of the projects
- Prospects of private participation to be assessed
- Opportunity for training (technical, project management) to be provided
- Identify match-making opportunity for industry
- Establish database for of suppliers of technology and services

Group G Report

No discrimination between region II and region III

- **Region II countries cannot wait until feed-in laws are in place. They need subsidies now to cover the gap (the economic not the financial one.**

Subsidy for tariff is time limited.

- **Once the debt is repaid the solar production does not need further subsidies**

Sudan should be named in group III

Issues concerning the Regions

Egypt:

- **Kuraymat project: IPP was changed to EPC cum O&M; Turnkey or lots?**

Sudan

- **should be own regional area**

Germany

- **3 Oct Draft should be considered. The organisation of GMI must make sure the interest of stakeholders**

EU

- **Interest on EU / Mediterranean Region**

Issues of Regions

India

- Mathania Project: Bidding process of Competition is needed; (Guarantee conditions were initially to stringent, but this issue was solved.)
- GMI: Cost of CSP is to high, There are few suppliers, because there is no market. Because of new technology the bidding procedure should not be to stringent.
- The total goal must be segregated by regions (how to distribute the 5 000 MW)

Group G Report

- What is particular for region 3? These are stand alone region
- Who will underwrite the capital cost
- In GMI text (first page: Policy) it says that this is new. For the consumer it is not new. We are making electricity. (That is not new.)

Issues of Regions

SolarPaces

- **Technology providers in Solar Thermal are small companies, but there are monopolies.**
- **For India small (Solar) companies had to make consortia with big (Combined cycle) company. This made the consortium negotiations extremely difficult. The big companies had other interest than Solar.**
- **GMI must have a method so that the technology giver can work independent of the CC**

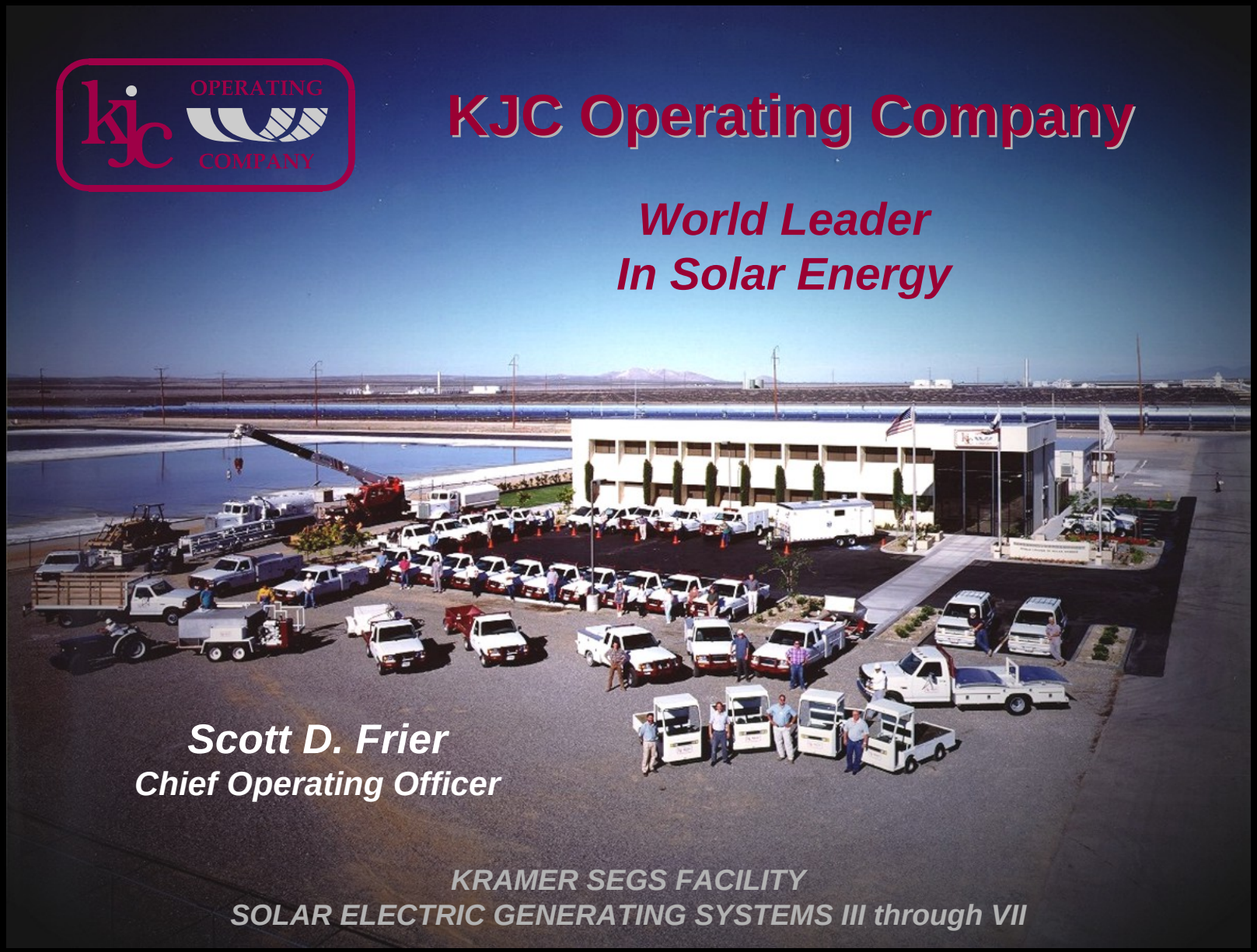
- **South Africa: Targets**

Thursday Oct. 23
8:30 to 10:00 AM

SESSION 7: CSP GLOBAL MARKET INITIATIVE

KJC Operating Company

World Leader In Solar Energy



Scott D. Frier

Chief Operating Officer

KRAMER SEGS FACILITY

SOLAR ELECTRIC GENERATING SYSTEMS III through VII

KRAMER JUNCTION SOLAR ELECTRIC GENERATING SYSTEM (SEGS) FACILITY III - VII

Five 30+ MW Hybrid Power Plants

- **SEGS III-V: Dual Inlet Rankine Steam Cycle**
- **SEGS VI-VII: Single Inlet Reheat Rankine Steam Cycle**

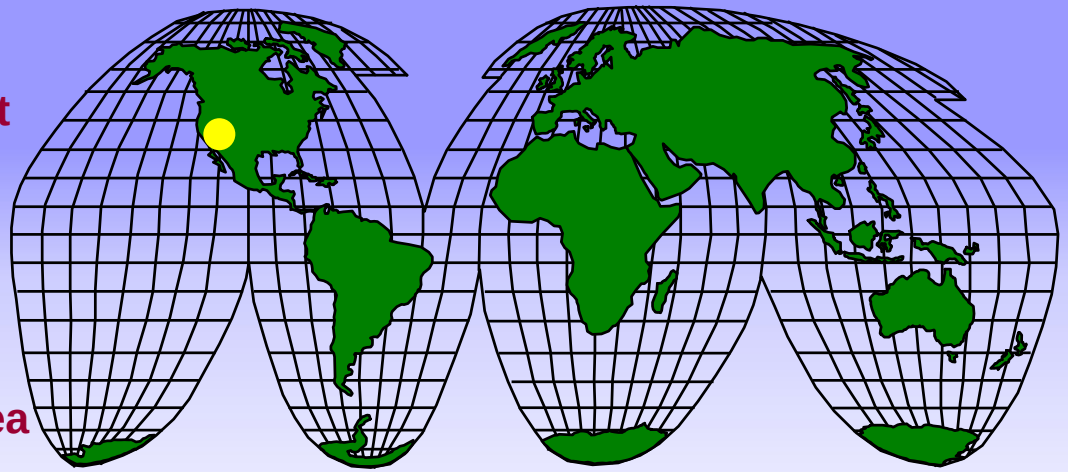
Annual Energy Input Entering Steam Turbine

- **75% Solar Energy**
- **25% Natural Gas Boilers**

Typical 30+ MW SEGS (VI) Characteristics

- **800 LS2 Solar Collector Assemblies (SCA)**
- **188,000 m^2 of Reflective Aperture Area**
- **96,000 Reflector Panels (RP)**
- **9,000 Heat Collection Elements (HCE)**

- Approx. 160 Kilometers Northeast of Los Angeles
- Latitude 35° 01’N
- 760 Meters Above Sea Level
- Annual Rainfall ~120mm
- Ambient Temperatures Range from –10°C to 46°C
- Average 340 Days of Sunshine
- Average Direct Normal Radiation (DNR) 7.65 kWh/m^2/day



LOCATION OF EXISTING SEGS

CALIFORNIA SEGS CHARACTERISTICS

VHJ V		L	LL	LLL	LY	Y	YL	YLL	YLLL	L[
OR FDWIRQ		GDJJHWW		NUDP HU MXQFWIRQ					KDUSHU GU\ ODNH	
\hdu Frqvwuxfwhg		4<;8	4<;9	4<;:	4<;:	4<;;	4<;<	4<;<	4<<3	4<<4
Rulj lqdoVdch Sulfh +'333 Qrp lqdoX1V1Grodu,		'94/7;<	'<8/554	'445/993	'446/358	'45</7:4	'449/373	'449/<97	'563/433	'5:;/;<3
Udwhg Krxuo\ Fdsdflw\ +Ph,		461;	63	6:	6:	6<	6818	6818	;3	;3
Jurvv Vrodu Rxwsxw +PZ k,-		56/85:	76/;95	:3/8<;	:4/986	:8/55<	:3/34<	9</4;9	469/743	46</9<:
Dshuwxuh Duhd +p ^{5},		;5/<93	4<3/66;	563/633	563/633	583/893	4;;/333	4<7/5;3	797/673	7;6/<93
Vrodu Ilhog Dvvhp eolhv	OV04 +45; p ^{5},	893	869	000	000	000	000	000	000	000
	OV05 +568 p ^{5},	7;	84;	<;3	<;3	<<5	;33	733	000	000
	OV06 +878 p ^{5},	000	000	000	000	65	000	4;7	;85	;;;

- Dqqxdorxwsxwgdwd vhdnfwhg iurp dfwxdoqrq0rxwdjh \hduv1

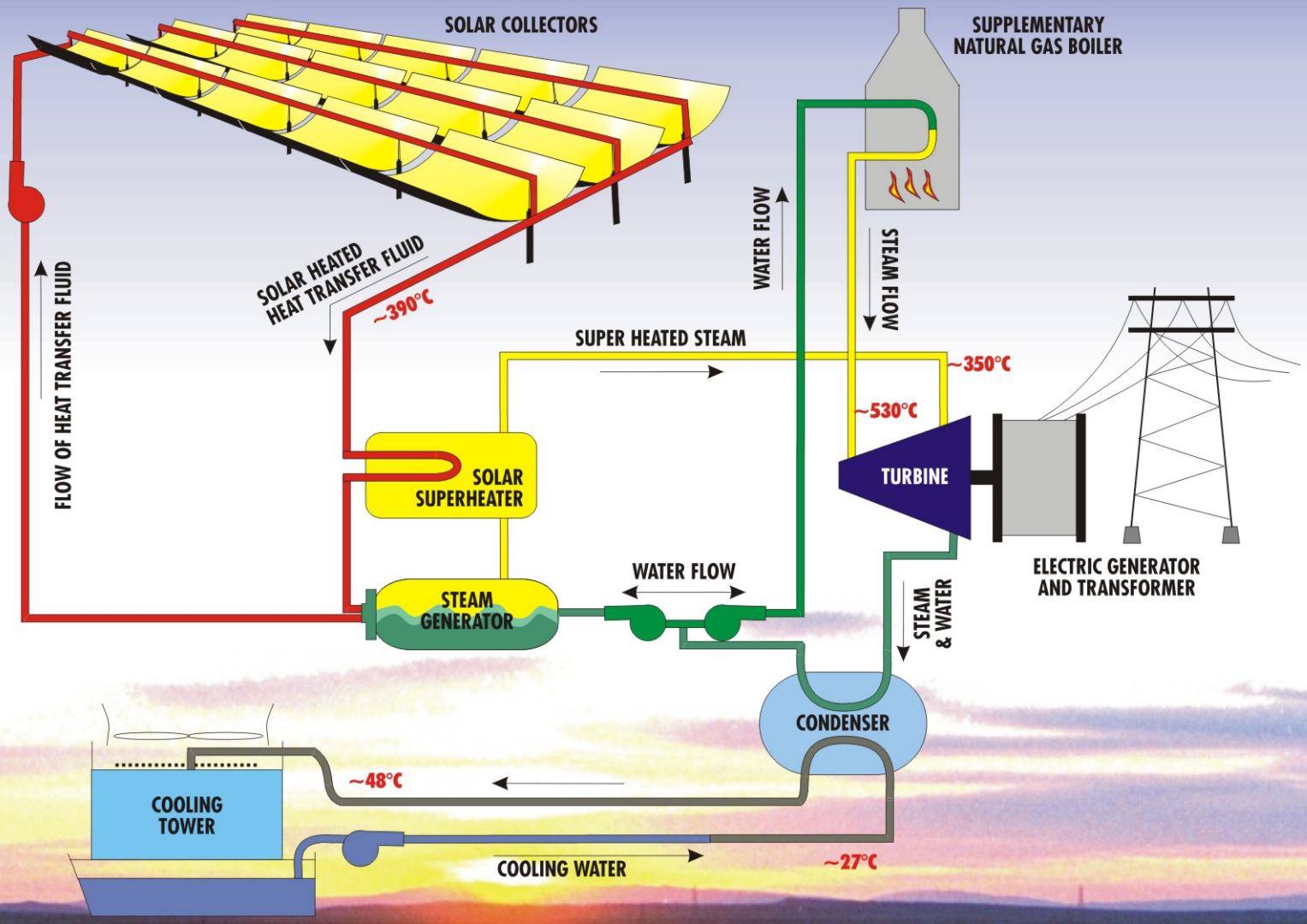
HISTORIC SEGS PRODUCTION

J urvv Vrodu Surgxfwlrq 0P Z k

	G djjhww I dflolw\		N udp hu I dflolw\					K dushu I dflolw\		
	VHJ V L	VHJ V LL	VHJ V LLL	VHJ V LY	VHJ V Y	VHJ V YL	VHJ V YLL	VHJ V YLLL	VHJ V L[	WR WDO
4<;8	4<594									4<594
4<;9	55843	583;8								7:8<8
4<;:	58388	56764	7<777	854;4						483444
4<;;	49<5:	6;<47	947:8	97:95	95;8;					577<6:
4<;<	5685:	76;95	963<9	:3885	985;3	7;378	6;;9;			686563
4<<3	547<4	6<489	9<743	:7994	:577<	959<3	8:994	447<<9	8<:7	84;7;:
4<<4	53585	6849;	93467	97933	8<33<	97488	8;6:6	435797	477;38	93;<93
4<<5	4:<6;	657;4	7;:35	8433:	886;6	7:3;:	79<73	43<694	45<88;	86;78;
4<<6	5369;	69;;5	8;57;	8;<68	9:9;8	88:57	87443	463<<<	463;7:	946:<;
4<<7	534<7	69899	89;<5	8::<8	99588	89<3;	86584	4678:;	46:<48	953687
4<<8	4<;33	68;86	89996	87<5<	96:8:	96983	94553	466;76	46;<8<	95;9:7
4<<9	4<;:<	68<<8	974:3	94<:3	:476<	:473<	:346;	46<4:7	474<49	9:93<4
4<<:	4<55;	67;4:	979::	97836	:8<69	:334<	9<4;9	469743	46<9<:	9:77:6
4<<;	4;9;9	66;69	:38<;	:4968	:855<	9:68;	9:984	46:<38	44<:65	995964
4<<<	44583	6673;	:39;<	:4475	:35<6	:4399	9958;	468566	43:846	969;84
5333	4:568	6453:	98<<7	9678:	:6;43	9;876	974<8	4733:<	45;648	985;68
5334	4:<7:	657<:	9<69<	97;75	:4;59	9:66<	97543	46::87	465384	98:;67
5335	4:735	64844	99458	:3646	:6568	977;6	95<59	46;<::	46:8:3	995875
Wrwdo	664883	87<48<	<<89;9	434:5;6	4357777	;:;7:9	;67<;9	49<4::6	48<7;85	;<9:456

Qrwh=Qxp ehuv vkrz q iru VHJ V Ldqg VHJ V LL lq lwdolfv duh hvwlp dwhv1

30+ MW SEGS CONFIGURATION AT KRAMER JUNCTION, CALIFORNIA, USA

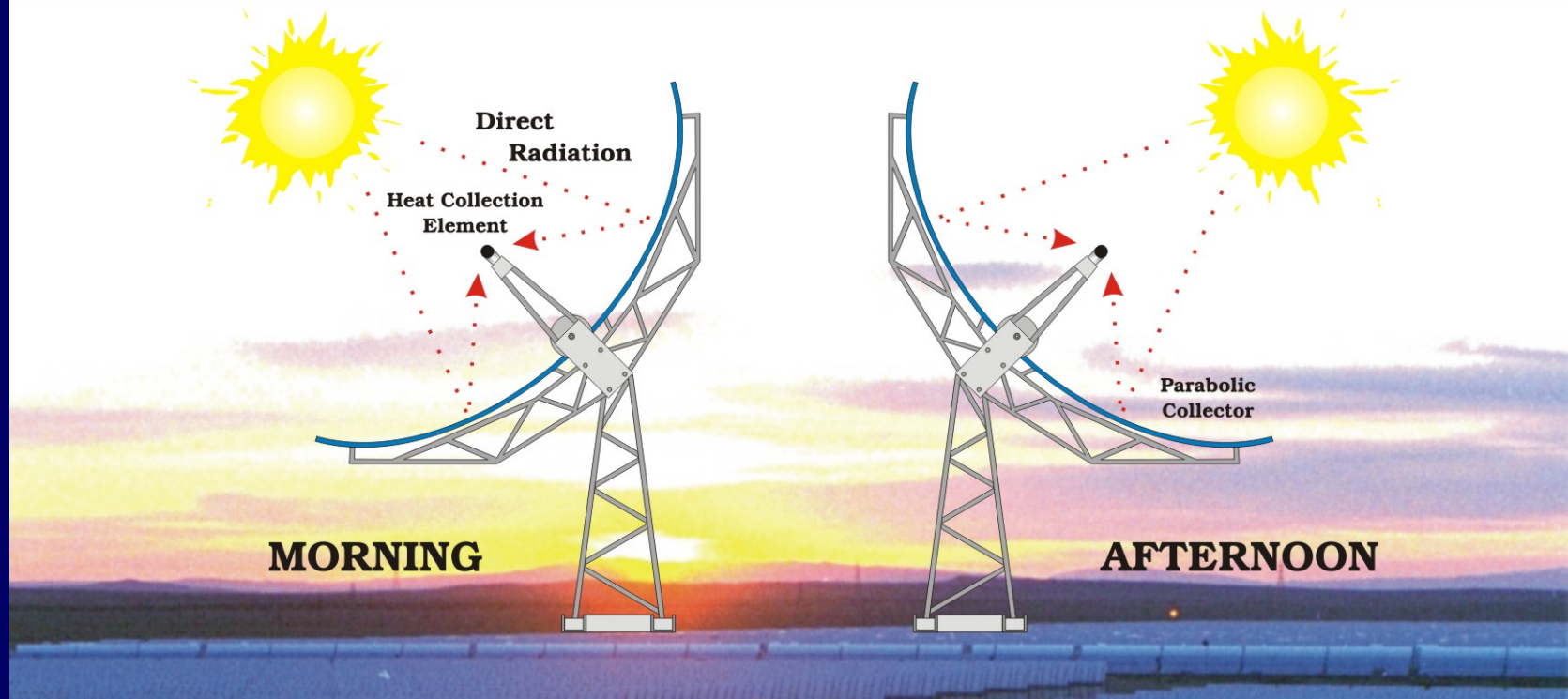


SIMPLE SCHEMATIC OF PARABOLIC TROUGH OPERATION
(North-South Axis)

- The SEGS utilize Parabolic Trough Collectors which is a Concentrating Solar Power (CSP) Technology

- CSP Technologies utilize Direct Normal Radiation (DNR) which is measured in terms of Watts per Square Meter (good sunlight yields ~1,000+ Watts/m^2)

Concentration Ratio		
LS-2	71:1	(71 Suns)
LS-3	80:1	(80 Suns)



LS-3 SOLAR COLLECTOR ASSEMBLIES (SCA)
(Typical Configuration)

A Loop of LS-3 SCAs has Two Rows of 4 SCAs (8 total), each ~100 Meters Long (800 Meters Total)

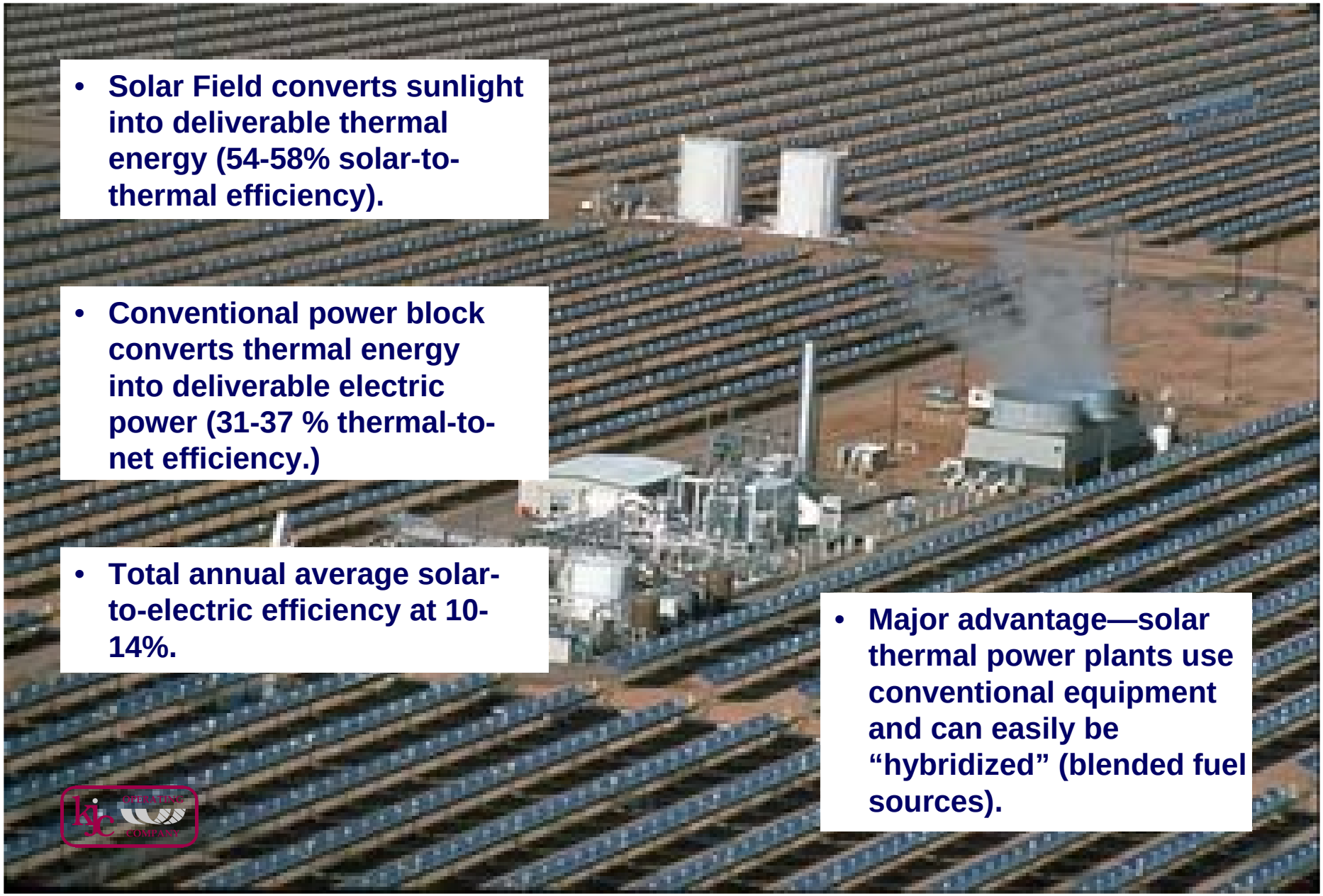
REFLECTOR PANELS (RPs)

- **Supplied by Flagsol GmbH**
- **Each SCA has 224 Reflector Panels and has an Aperture of 545 M^2**

HEAT COLLECTION ELEMENTS (HCEs)

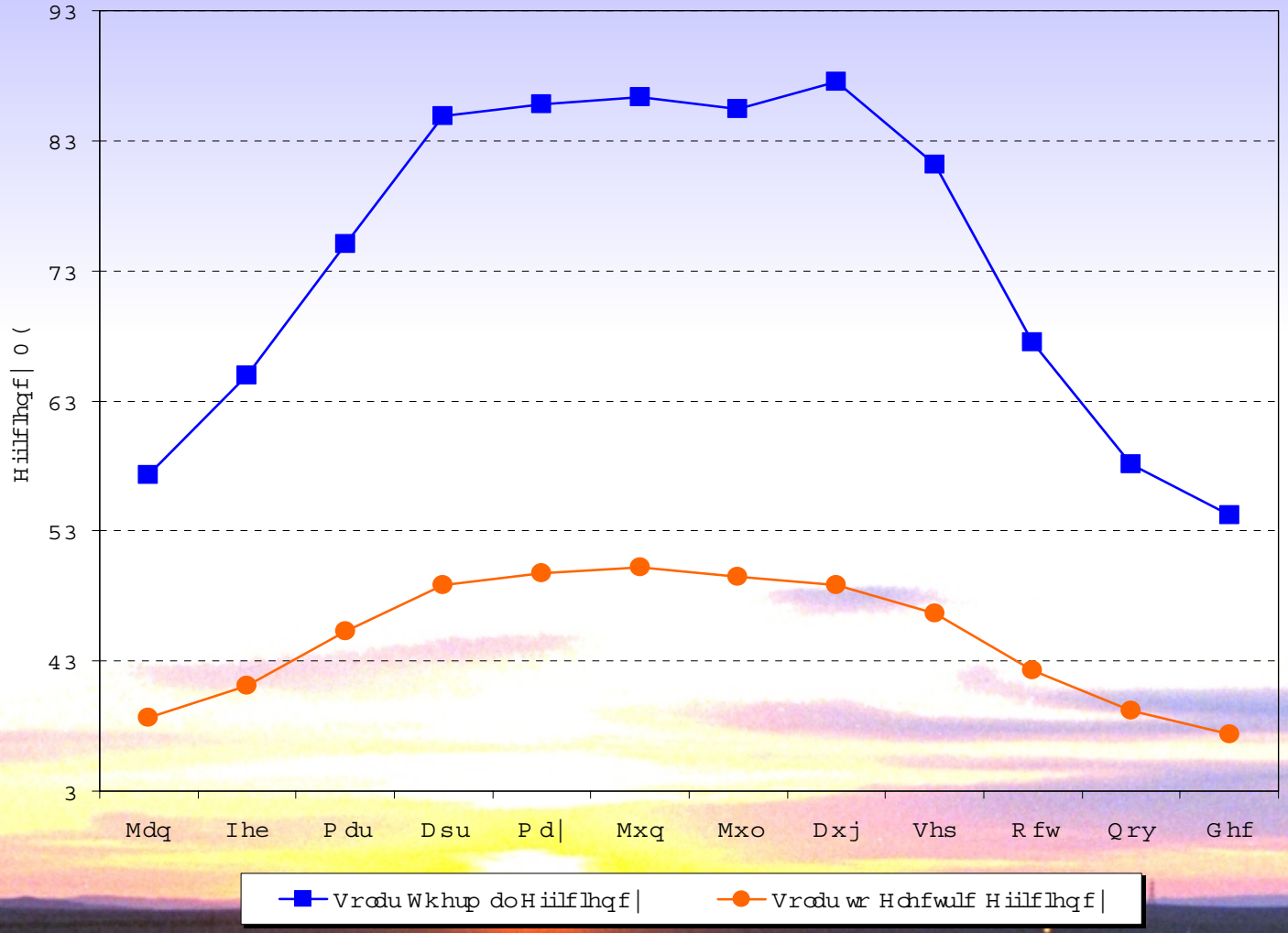
- **Supplied by Solel Solar Systems, Ltd.**
- **Each SCA has 24 HCEs, each 4.06 Meters long (at 37°C) and 70mm in Diameter**

The SEGS Are Solar Thermal Power Plants



- **Solar Field converts sunlight into deliverable thermal energy (54-58% solar-to-thermal efficiency).**
- **Conventional power block converts thermal energy into deliverable electric power (31-37 % thermal-to-net efficiency.)**
- **Total annual average solar-to-electric efficiency at 10-14%.**
- **Major advantage—solar thermal power plants use conventional equipment and can easily be "hybridized" (blended fuel sources).**

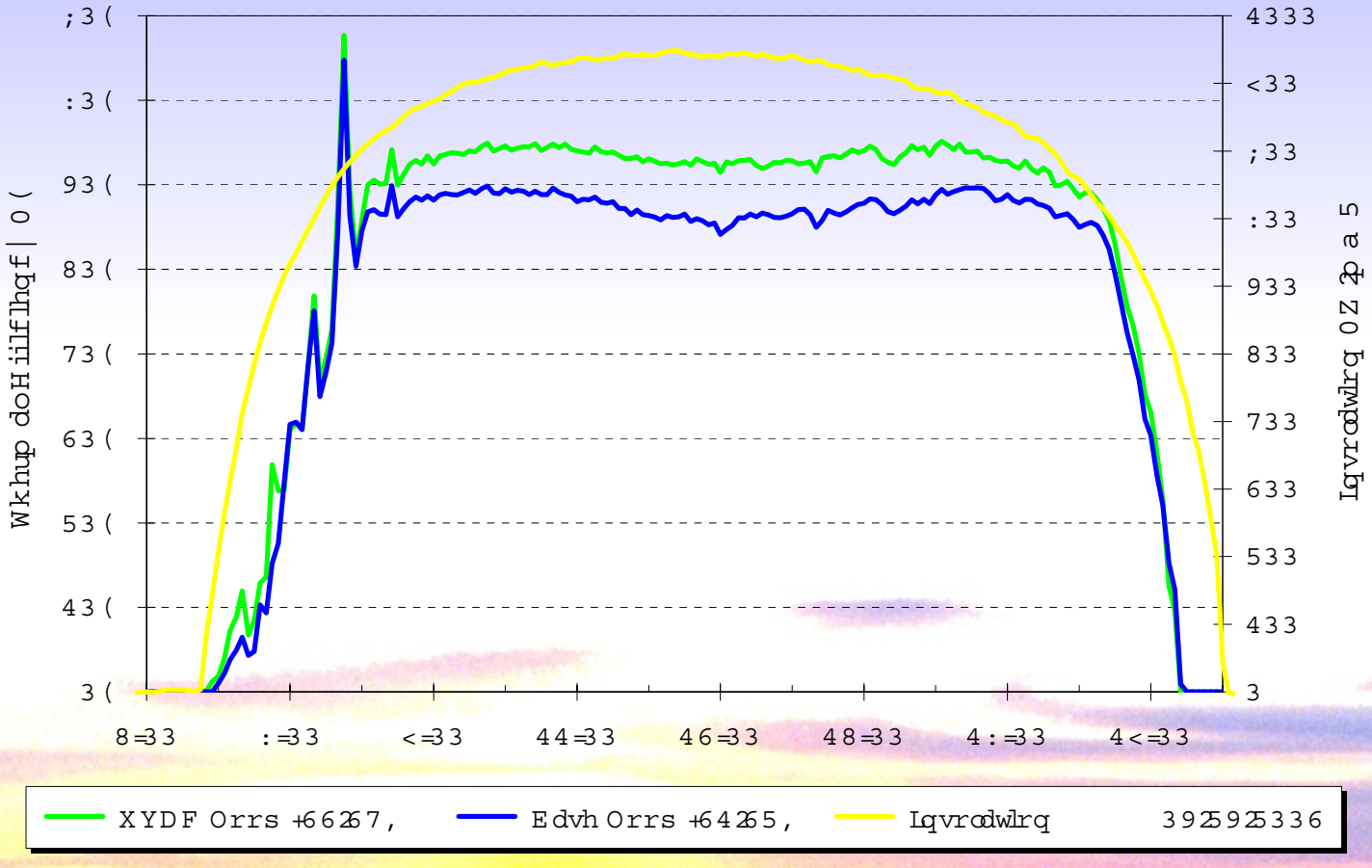
SEGS VI
ANNUAL SOLAR EFFICIENCY
(Actual 2001)



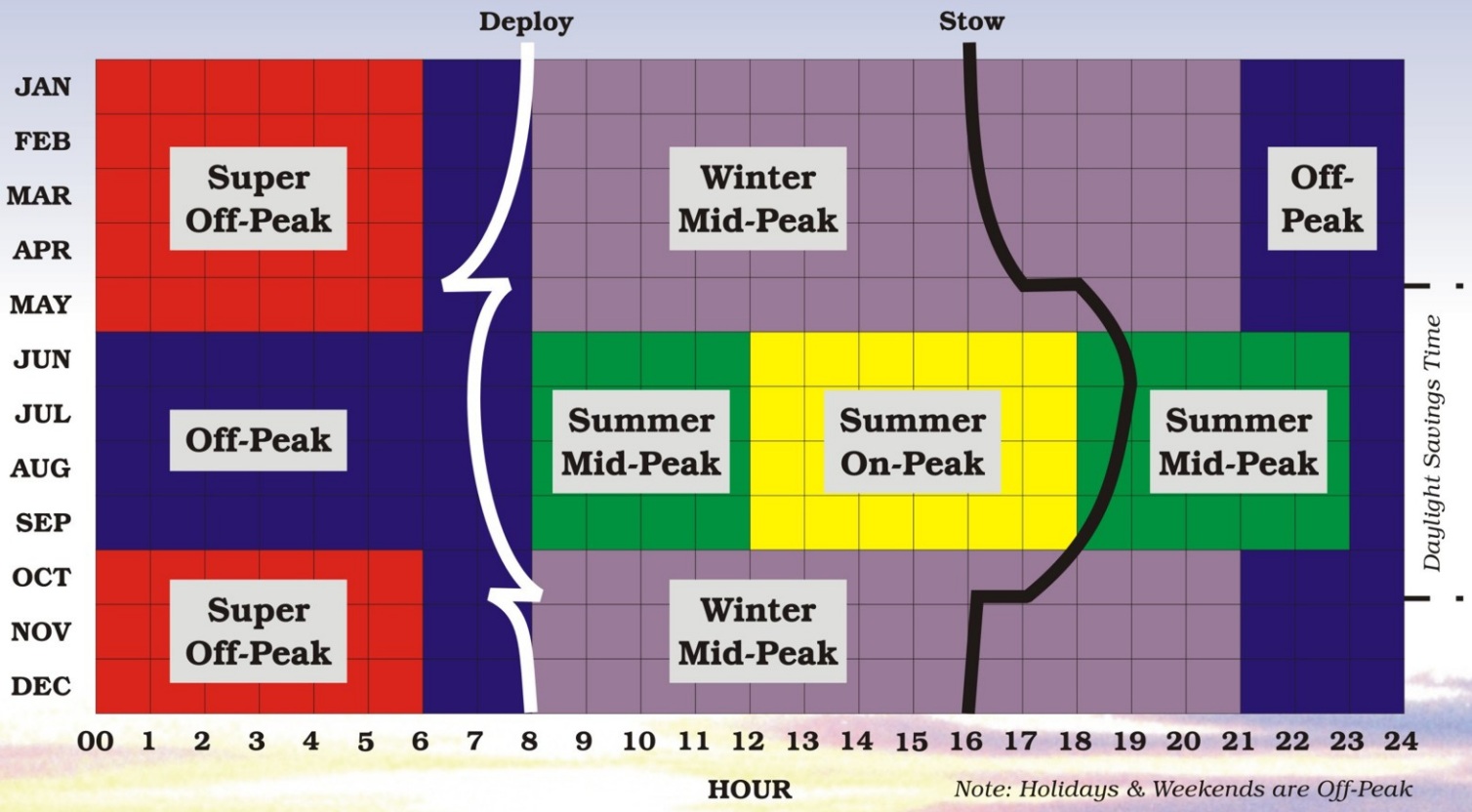
LS-3 UVAC TEST LOOP COMPARISON - SEGS VII

(Test Loop Commissioned 1/24/2002)

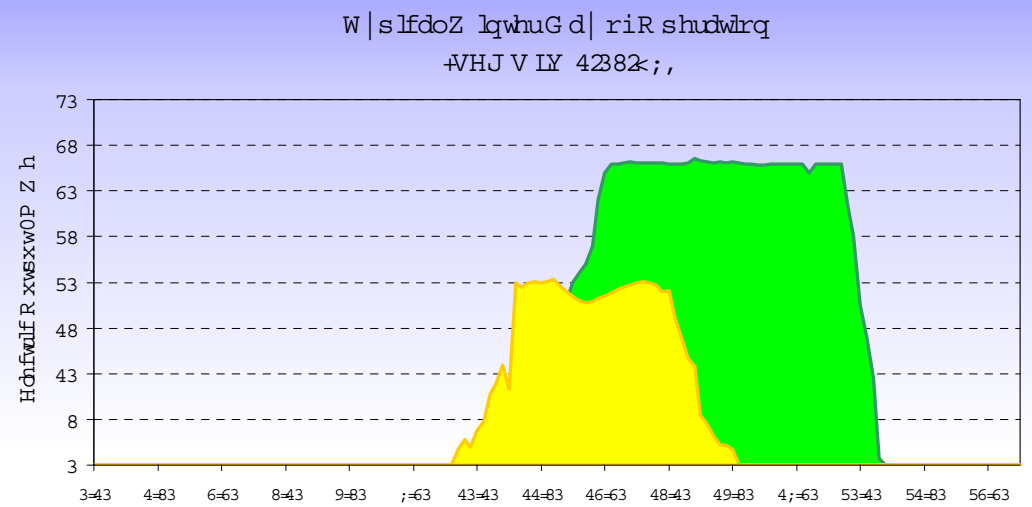
Single Day Solar Efficiency 6/26/2003

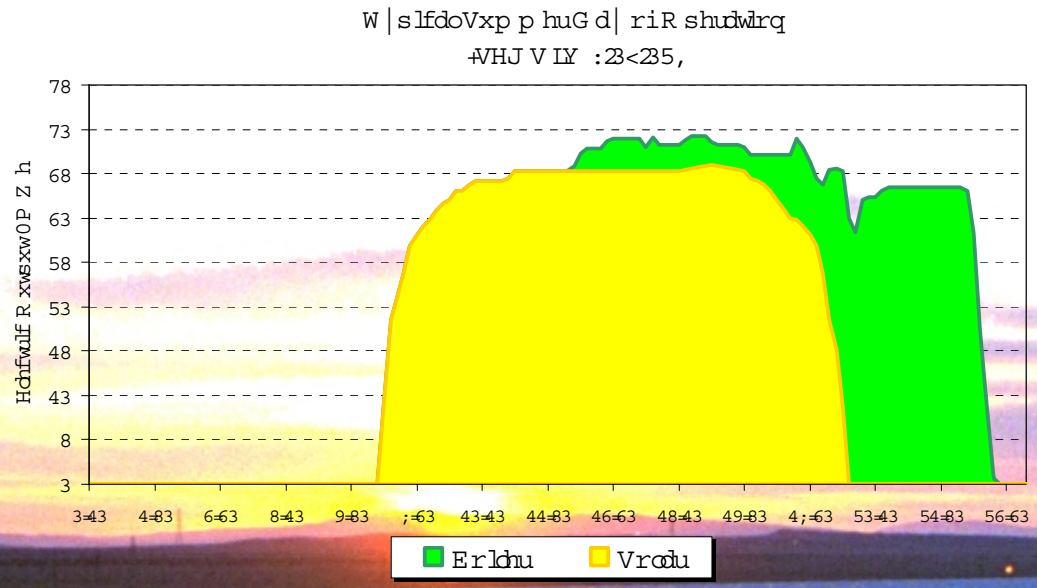


SOUTHERN CALIFORNIA TIME OF USE (TOU) RATE PERIODS SEGS III-VII

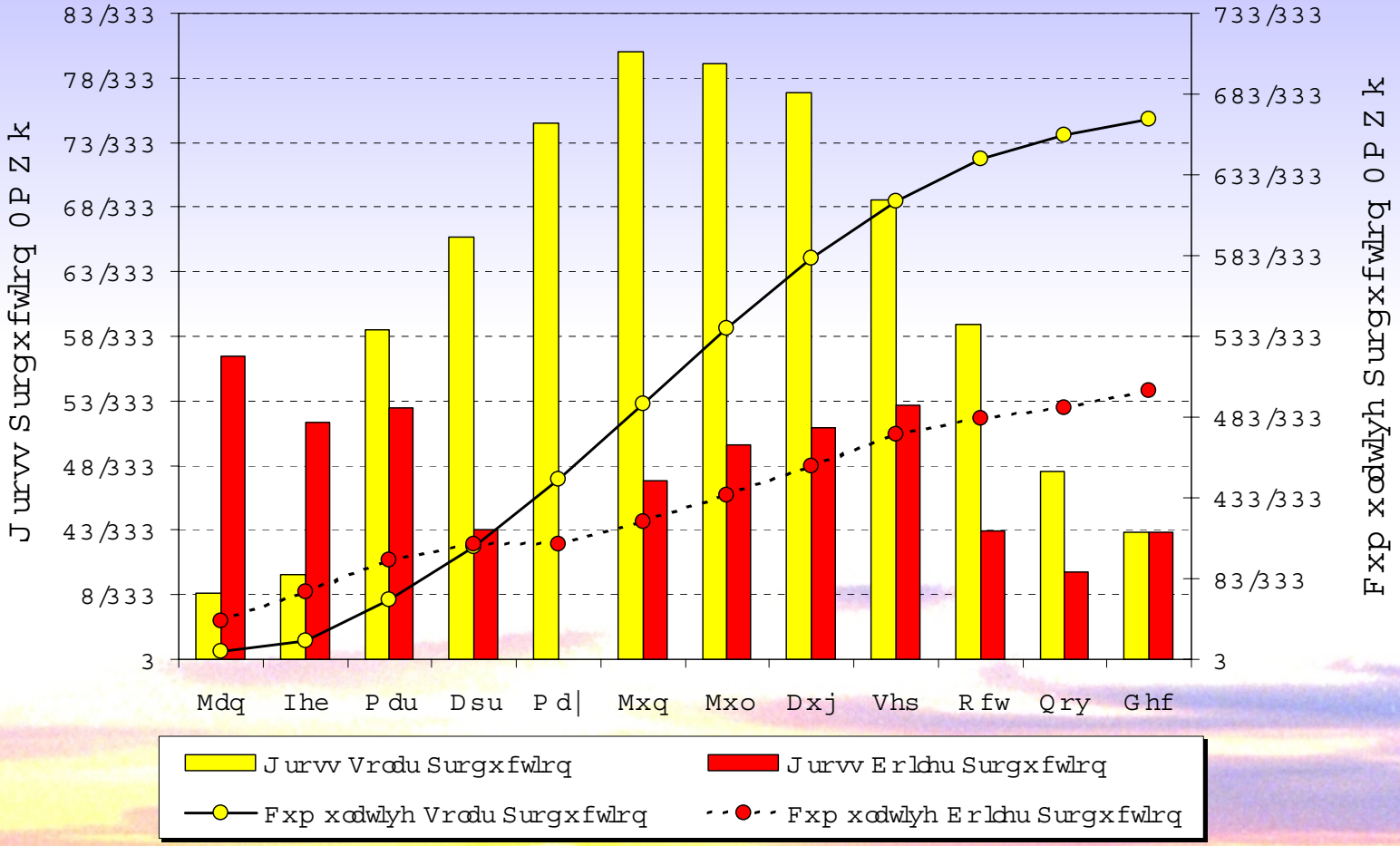


MODES OF OPERATION
Summer/Winter Hybrid Operation

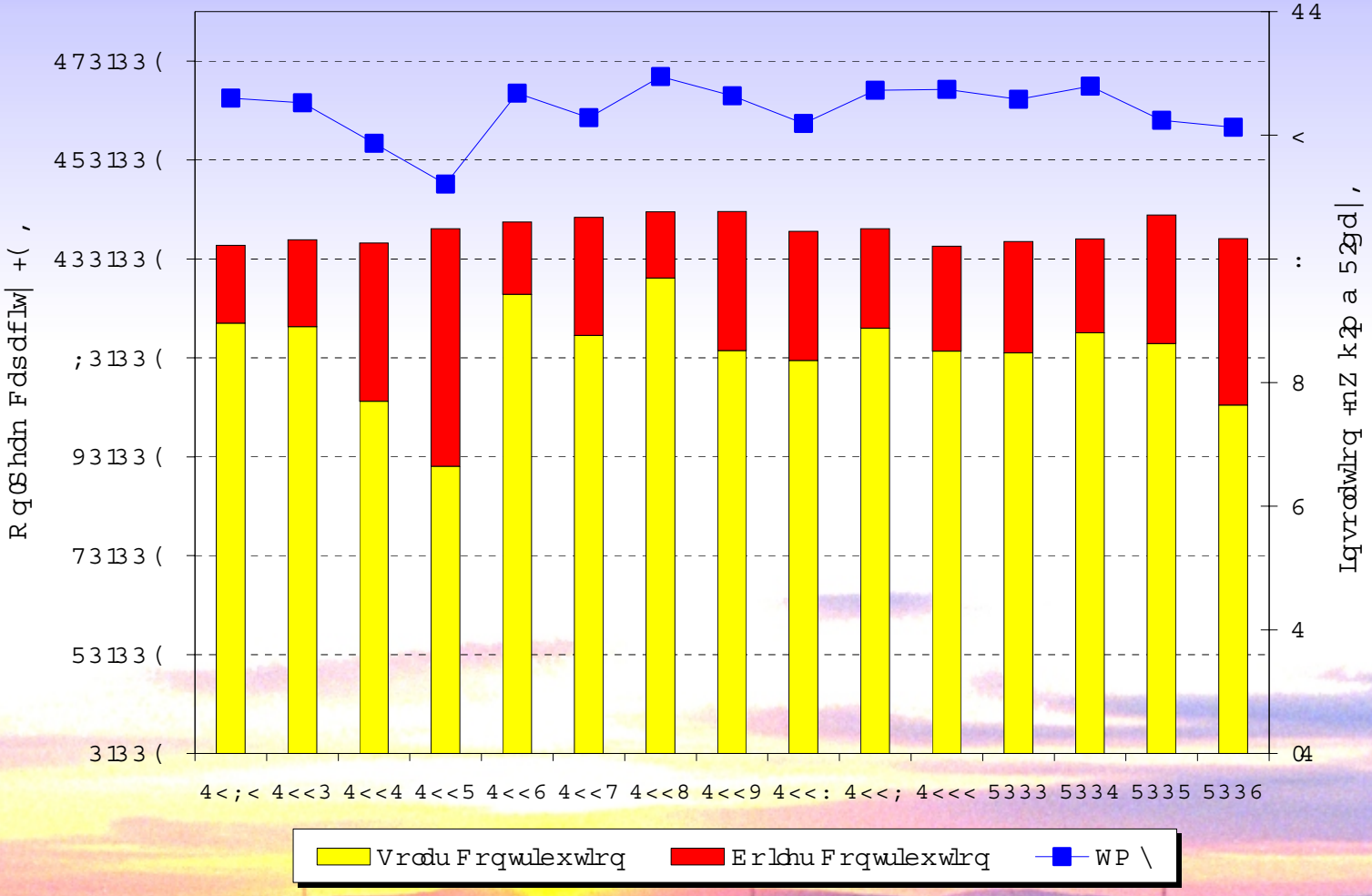




GROSS PRODUCTION
Solar & Boiler By Month
(2002 Actual)

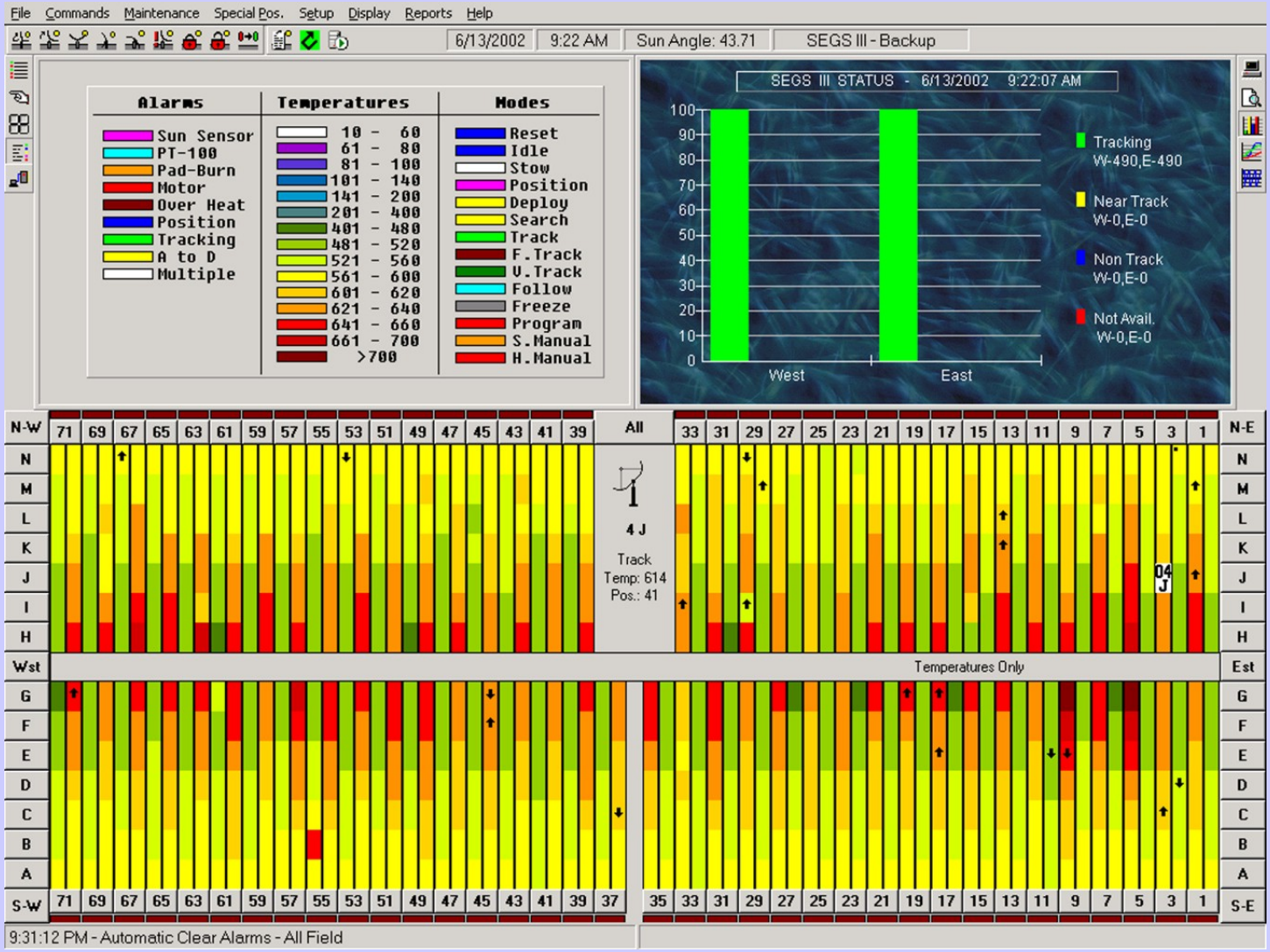


SUMMER ON-PEAK PRODUCTION CAPACITY



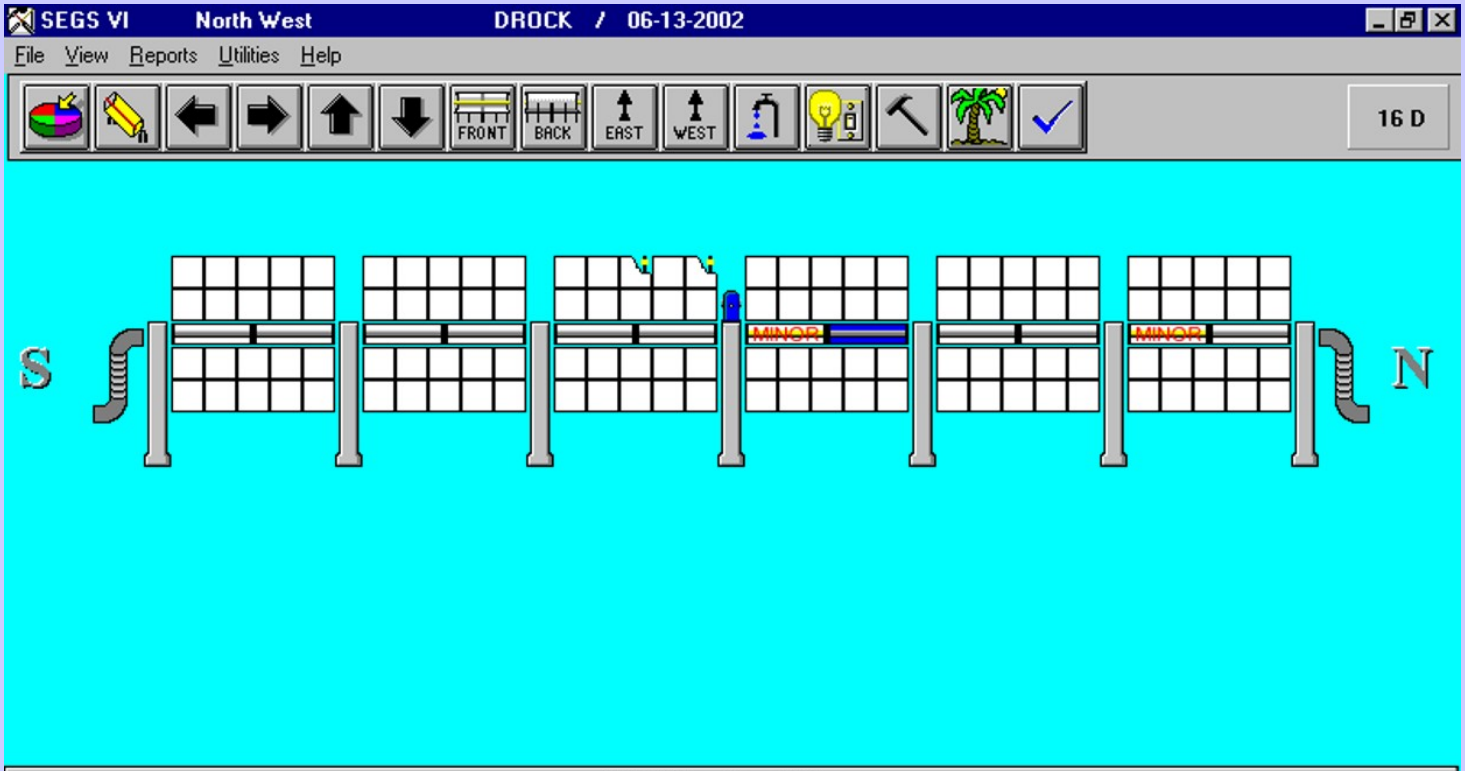
FIELD SUPERVISORY CONTROLLER (FSC)

KJC OC has continued to upgrade Solar Field Control Technology to assure that hardware and software platforms remain current and maintainable.



FIELD STATUS PROGRAM (FSP)

KJC OC has developed sophisticated Maintenance Management software uniquely suited to solar field operation, maintenance and performance analysis.

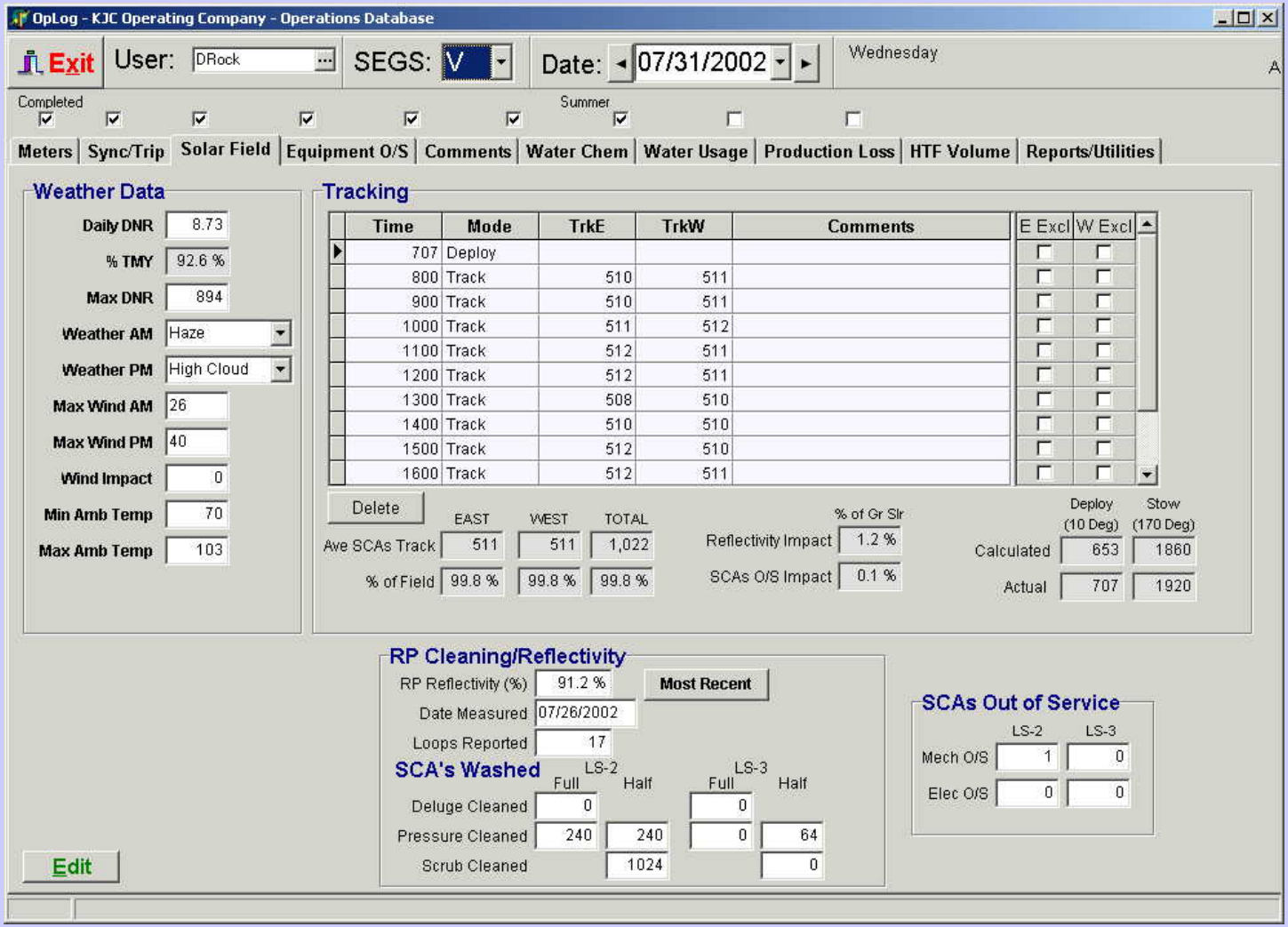


SCA 16 D - Current Failures

Part	Location	Failure	Cause	FailureDate	ReportedBy	NoTrack	Comments
RP - Ceramic Pad	1S1	Crack	Wind	8/5/96	CERVANTE	0	
RP - Ceramic Pad	3S1	Crack	Wind	5/18/96	CERVANTE	0	
Tube	1N	Fluorescent - Minor	Manufacture Defect	1/3/02	RCIPRIANI	0	
Tube	5N	Fluorescent - Minor	Manufacture Defect	1/3/02	RCIPRIANI	0	
Tube	2N	Loss of Vacuum	Glass/Metal Seal Fail	1/3/02	RCIPRIANI	0	

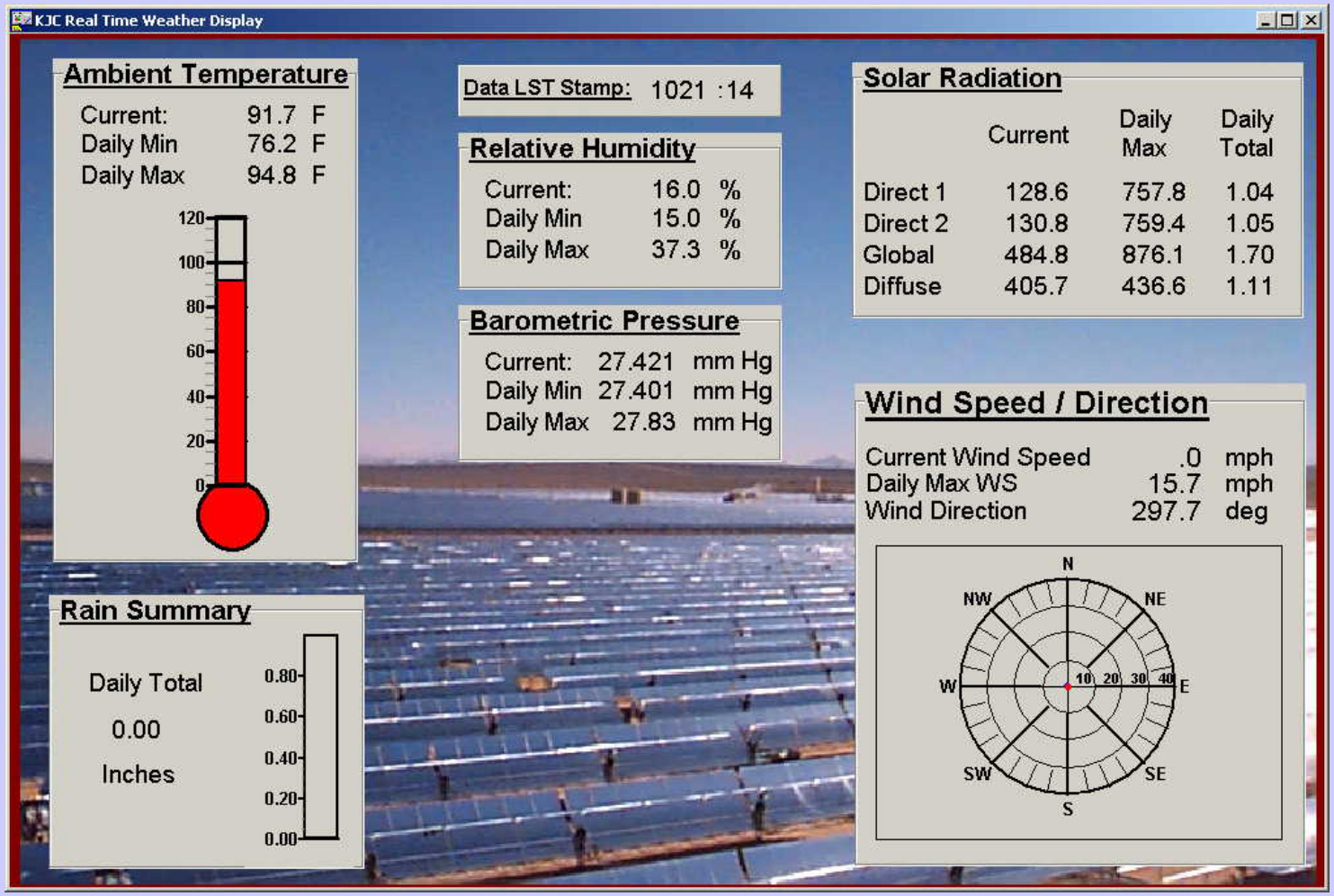
OPLOG

KJC OC has developed a comprehensive software program to log all elements of SEGS operation. Operational records may be accessed on-line and within hours of the logged operational events. This database contains information dating back to initial operations for each Kramer SEGS.



WEATHER STATION

In addition to small weather stations located at each SEGS that monitor temperature, wind conditions, and direct radiation, KJC OC has a full central weather station that may be monitored on-line through the Company network.



OPERATIONS & MAINTENANCE PROCEDURES

KJC OC has developed detailed procedures for Solar Field Operations and Maintenance.

KJC Operating Company
Solar Field Routine Maintenance
Pipeline Repairs — SFPR001

LS-2 and LS-3 Heat Collector Element Replacement
Rev. 002
Page 1.7

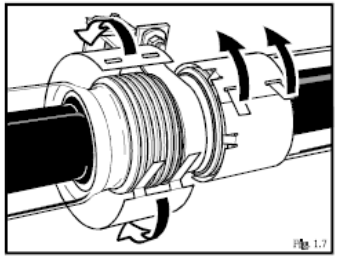


Fig 1.7

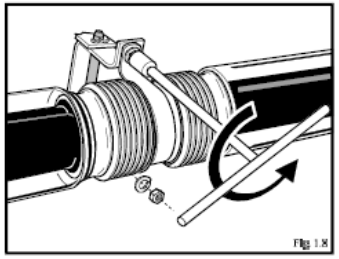
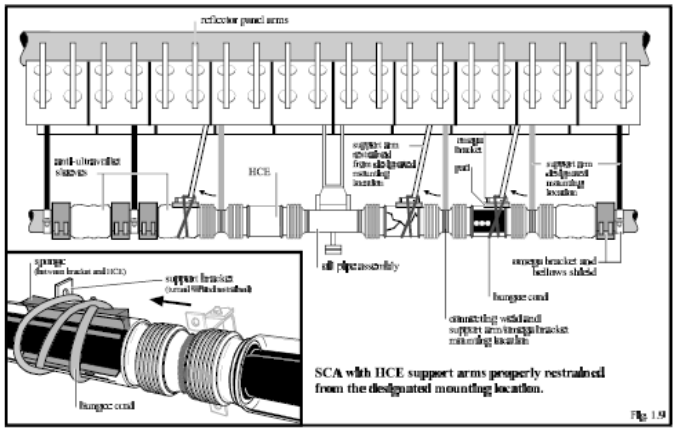


Fig 1.8



SCA with HCE support arms properly restrained from the designated mounting location.

Fig 1.9

7.2. Remove the bellows shields from the HCE(s) identified for replacement. (Figure 1.7)
7.3. Remove the bellows shields from HCE(s) adjoining HCE(s) identified for replacement.
7.4. Using a 7/16" T-handle wrench, remove the omega brackets securing the HCE(s) identified for replacement. (Figure 1.8).
7.5. As the omega brackets are removed, support and lower the HCEs away from the support arms. Turn the support bracket 90°, place a pad between the support bracket and HCE. Restrain the support arms away from the bellows with a bungee cord. (Figure 1.9)
7.6. To catch any HTF that may pour from loop as the fluid system is opened, position a 55 gal. barrel directly under the weld(s) to be cut and thermowells or direct immersion PT-100s to be removed.
7.7. When an HCE adjoining an oil pipe assembly is to be extracted, use a 3/4" wrench to remove the thermowell or direct immersion PT-100 unit. Damage to either of these units may occur as the HCE is cut from the oil pipe assembly. (Figure 1.10) Utilize spill protection.
7.7.1. Discard the used gasket.

LS-2 and LS-3 Heat Collector Element Replacement
Rev. 002
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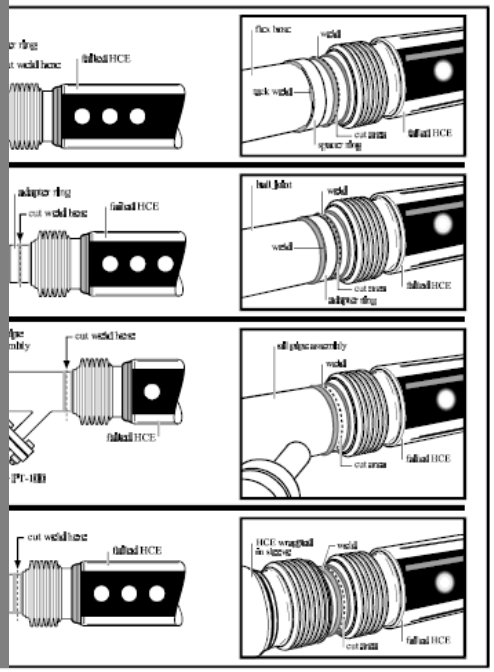
noved from the loop.

2 or 3 adjoining HCEs, remove them as one unit. Always cut off-center of the welds (s) identified for replacement.

extreme caution and maintain stable footing when operating the chop saw or pencil e around the HCE identified for replacement is broken, wear leather gloves to help ntaining HTF that was not removed during loop evacuation may pour from the HCE as e 55 gal. barrel(s) accordingly.

he welds to remove the HCE(s) from the loop. (Figure 1.11) Utilize spill and

isting craftsman, must support "each" HCE as it is removed from the loop.
to cut through welds between the HCEs and adjoining oil pipe assemblies.
nder to cut through welds between HCE(s) and ball joint adapter rings or flex hoses.
ver the end of the HCE(s) identified for replacement to direct any remaining
5 gal. barrel.



REFLECTIVITY MAINTENANCE

- KJC OC has developed an effective array of Reflectivity Maintenance methods
- Flabeg Solar designed RPs have a top reflectance of over 94%
- Field conditions are maintained at between 90 and 92+%

The DOUBLE "D"

- Uses medium-pressure, high-volume water spray with leading and lagging spray heads.

The ZOOM BROOM

- Utilizes direct contact brush head with low pressure, low volume water spray

The TWISTER

- Utilizes high-pressure directed water beams with spinning heads.

SOLAR-ONLY PRODUCTION RECORDS

Mdq	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	464	342572;;	4<5<	4<<3
VHJV IY	477	342632<4	5978	4<;<
VHJV Y	45:	342572<;	4<;:	4<<9
VHJV YL	45<	342642<4	4;96	4<<9
VHJV YIL	475	342632<:	4;37	4<<<
VHJV IIL0YIL			;9<;	4<<9

P d|	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	734	382642<3	<<:3	5335
VHJV IY	743	382572<3	<:7<	5335
VHJV Y	744	3825<235	4365;	5334
VHJV YL	733	382632<;	<938	4<<9
VHJV YIL	6;9	382632<;	<73;	4<<9
VHJV IIL0YIL			7:9<8	5334

Vhs	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	665	3<2352;<	:665	4<<<
VHJV IY	668	3<2362;<	;557	4<<3
VHJV Y	67:	3<2342<3	:;46	5333
VHJV YL	648	3<2382<<	::53	4<<3
VHJV YIL	5<7	3<2462<:	:7;9	4<<9
VHJV IIL0YIL			6:8:7	4<<3

Ihe	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	4<<	352552<3	665;	4<;;
VHJV IY	546	352552<3	67<3	5335
VHJV Y	4<:	352562<3	66:9	4<<4
VHJV YL	535	352552<:	6473	4<<4
VHJV YIL	533	352552<:	66;9	4<<4
VHJV IIL0YIL			47885	4<<4

Mxq	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	753	392492<35	43<8<	5335
VHJV IY	746	392492<35	43<9;	5335
VHJV Y	783	3924:2<;	44976	5335
VHJV YL	757	3924:2<;	436:7	4<<9
VHJV YIL	74<	3925<2<9	438;6	4<<9
VHJV IIL0YIL			8699;	5335

R fw	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	566	432352<<	8::7	4<<<
VHJV IY	57:	4323<2<3	9434	4<<3
VHJV Y	588	432372<:	8:77	4<<<
VHJV YL	57<	432342<8	89<5	4<<3
VHJV YIL	574	432352<8	856<	4<<:
VHJV IIL0YIL			5:77;	4<<<

P du	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	643	3625<2;:	9<74	4<;;
VHJV IY	65:	3625:2;<	9535	5336
VHJV Y	655	362642<4	9768	4<;;
VHJV YL	643	362632<;	9685	4<<:
VHJV YIL	644	362632<9	9478	4<<:
VHJV IIL0YIL			63386	4<<:

Mxo	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	759	3:23;236	44366	4<<;
VHJV IY	756	3:23;236	43<<4	4<<;
VHJV Y	77<	3:2452<;	449<;	4<<;
VHJV YL	764	3:2342<:	44396	4<<;
VHJV YIL	755	3:2342<:	437;<	4<<;
VHJV IIL0YIL			885:8	4<<;

Qry	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	48;	442342<:	5::4	4<<3
VHJV IY	48<	442372<3	66<6	4<<3
VHJV Y	495	442352<:	5<88	4<<3
VHJV YL	48<	442352<:	63;6	4<<3
VHJV YIL	47;	442342<:	5876	5333
VHJV IIL0YIL			47959	4<<3

Dsu	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	69:	372632<3	:;67	5333
VHJV IY	69:	372632<3	;347	4<;<
VHJV Y	6<5	372632<3	;5;4	5333
VHJV YL	6:<	372632<9	;54;	4<<9
VHJV YIL	6:;	372632<9	;436	4<<9
VHJV IIL0YIL			6;459	4<<9

Dxj	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	6<7	3;2342<;	<;5<	4<<<
VHJV IY	6<6	3;2342<;	<9:8	4<<;
VHJV Y	754	3;2342<;	437;;	4<<<
VHJV YL	6<8	3;2342<;	<845	4<<<
VHJV YIL	6:;	3;2342<;	;<;9	4<<;
VHJV IIL0YIL			7;658	4<<<

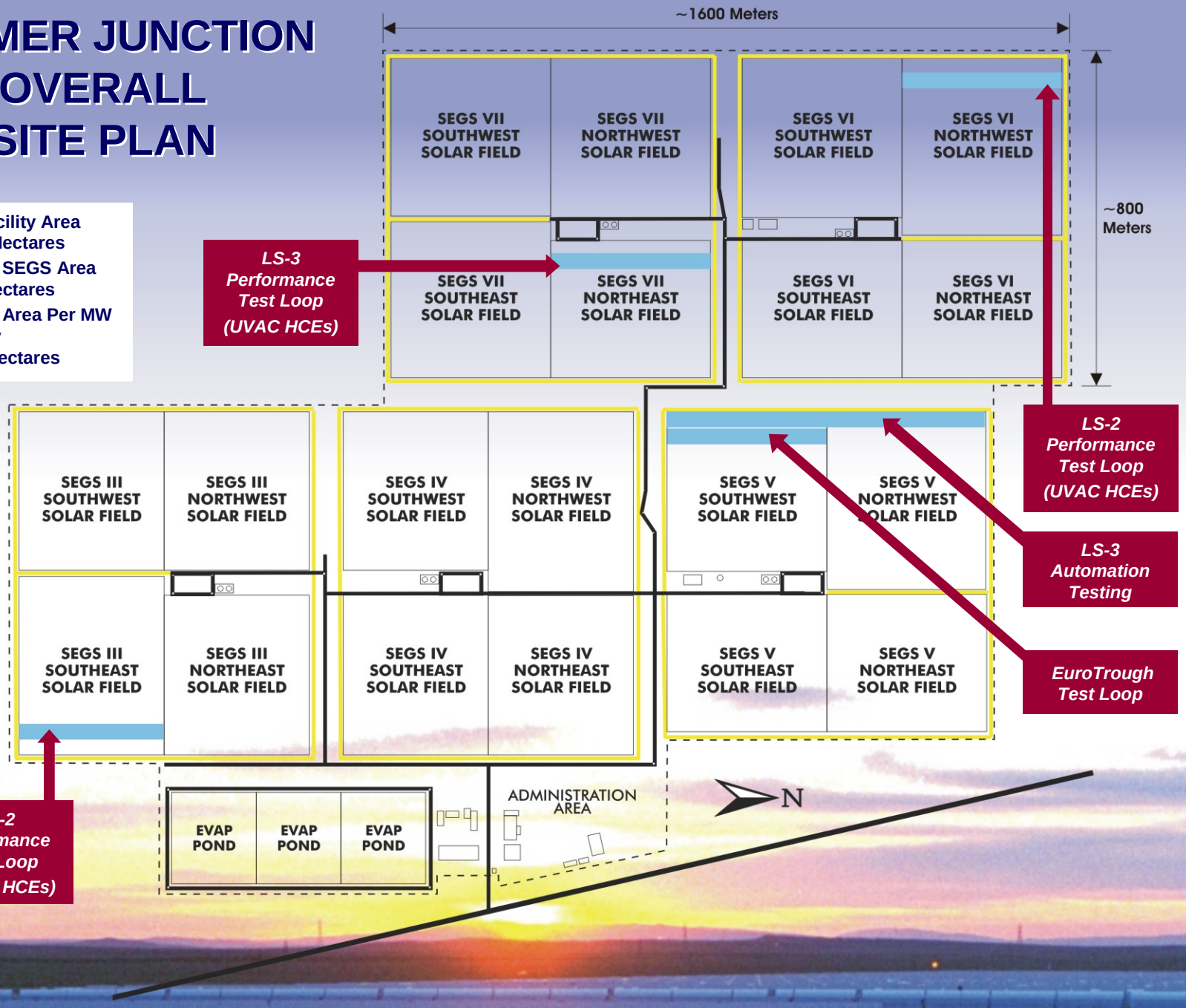
Ghf	Gdlo| Uhfrug		P rqwko| Uhfrug	
	P Z k	Gdwh	P Z k	\hdu
VHJV III	<3	452592<:	4<;9	4<<;
VHJV IY	436	452352;<	559;	4<;<
VHJV Y	<6	452342<3	4<84	4<<;
VHJV YL	<;	452342<8	5459	4<<;
VHJV YIL	<3	4523;2<3	4<33	4<<;
VHJV IIL0YIL			43357	4<<;

Dfklhyhg lq wkh suhylrxv 6 \|hduv1

Dfklhyhg lq wkh fxuuhqw \|hdu0wr0gdwh1

KRAMER JUNCTION OVERALL SITE PLAN

- Total Facility Area
  ~526 Hectares
- Average SEGS Area
  ~67 Hectares
- Average Area Per MW Capacity
  ~1.8 Hectares



Solar Electric Generating Systems

- Clean, Renewable Power
- Proven, Reliable Technology
- Technology & Experience Readily Available
- Energy Not Subject to Price Volatility
- Creates Employment Opportunities
- Experience & Technical Advances Gathered During the Last Decade Will Assure Greater Success for Future Solar Thermal Power Plants

- Yes, this is a picture of a sunrise (not a sunset)

kjc OPERATING COMPANY

CSP Industry outlook

CSP GMI CONFERENCE
Palm Springs – October 2003

Avi Brenmiller CEO

Solel Solar Systems.

Concentrated Solar Power Overview:

CSP definitions:

- ⇒ **Sun**
- ⇒ **Direct Solar Radiation**
- ⇒ **Reflect and Concentrate (Mirror & Structure)**
- ⇒ **Absorb and get useful heat (absorber)**
- ⇒ **Convert into Power (electricity)**

CSP Technologies

Tower

Large sun tracking mirrors focus sunlight on a receiver at the top of a tower

Demo projects Solar 1& 2 salt

TSA for air

Interesting storage capacity

Not yet commercial

Dish

The dish collects solar energy and concentrates it on a small area.

Concentrated in a small area so that it can be more efficiently used.

Valuable for distributed power generation

Demo projects in Spain, South Africa, Israel, USA, Australia, other

Not yet commercial

Trough

Linear parabolic trough shaped collector, concentrates solar radiation on tube shaped absorber.

Nine SEGS, operating more than 15 years

Commercially available

Outlook objectives

Finance and incentive programs

Scale up process

Technology Improvements

Finance & incentive programs:

Investment tax credit

Production tax credit

Giving the Solar power it “real value”

- Economic development
- Green power
- Peak Power
- Security, and hedging against rising prices

Scale up process

Projects size

Deployment rate

- new advanced tooling and larger production facilities

- creating a competitive environment

Technology Improvements application area :

Cost effectiveness of:

- Installation
- Operation and maintenance
- System lifetime

Technology Improvements

(cost effectiveness as per the mentioned application areas) :

Structure

Mirrors

Receiver

Power block

Storage

Industrialization (Project and O&M)

Evaluated LEC in an Integrated model

Tower Outlook (5-yr)

- 1st commercial salt tower
  - South Africa, Spain (Solar Tres), Southwest USA?
  - Incremental improvements from Solar Two
  - Rapid scale-up in size reduces LEC quickly
- Air tower
  - PS-10 (Spain) air + Rankine + pebble storage
- R&D on high-temperature options for gas turbine and hydrogen production

Trough technology outlook

Near term projects (~5 years)

- 100 MWe electric output modules in clusters of 500 MW.
- LS-2 based parabolic trough collectors concept. (structural - concentration and longitudinal stretching in development process)
- UVAC receiver. The new Solel receiver has been demonstrated at the SEGS plants and will be the receiver of choice for new projects – estimated LEC reduction of up to 25% due to performance and durability.
- Ball-joint assemblies in place of flex hoses. These have been extensively demonstrated at the SEGS plants
- O&M improvements to reduce failures and increase performance

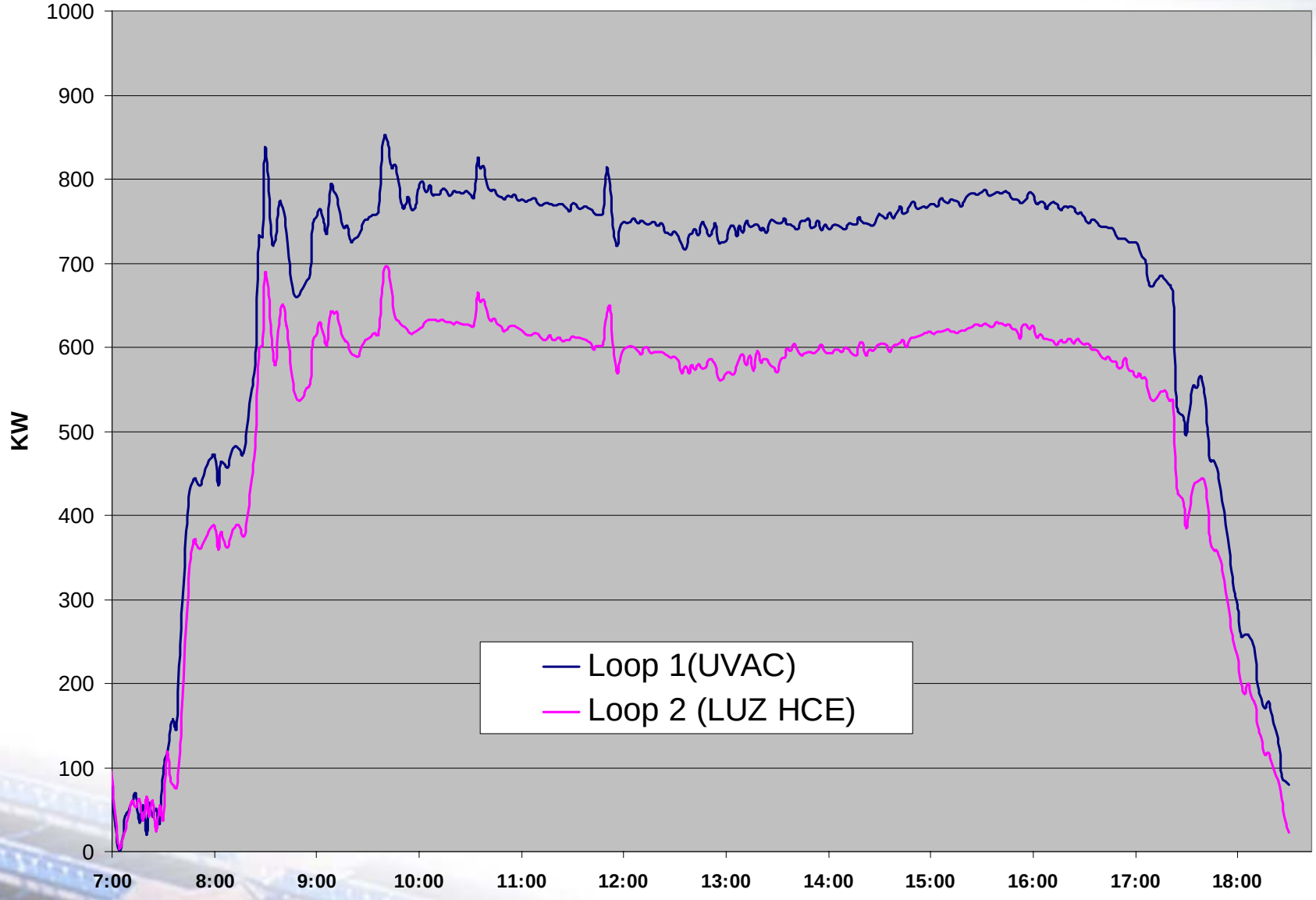
CSP Industry Goals:

Get Commitment –
Start now with minimal size and sustain installation rate

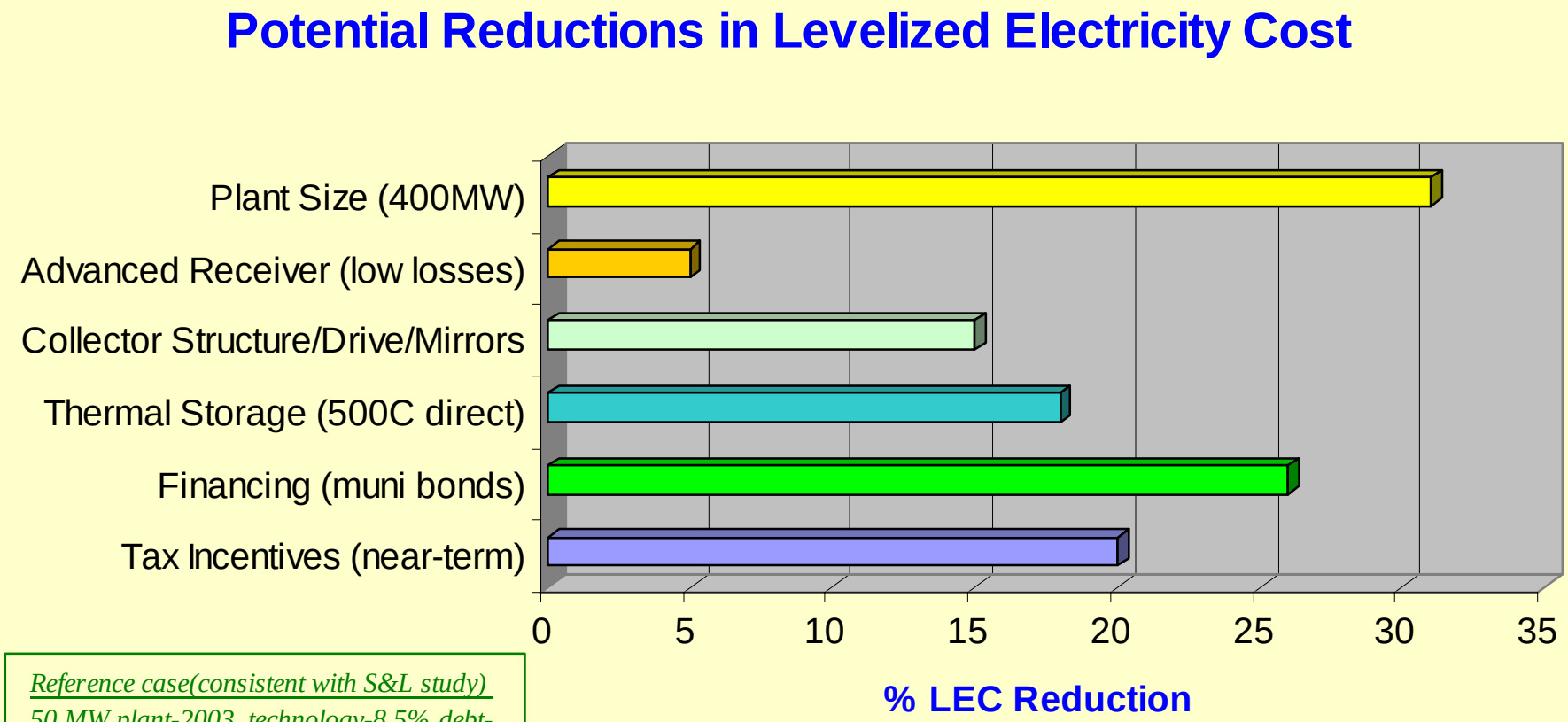
Push start a 10 years implementation program – Let the market and industry do the rest.

Thank You

Thermal output by time - 14 September 2003
Harper Lake site (output temperature 393 deg C)
Daily thermal output ratio - More than 1.25



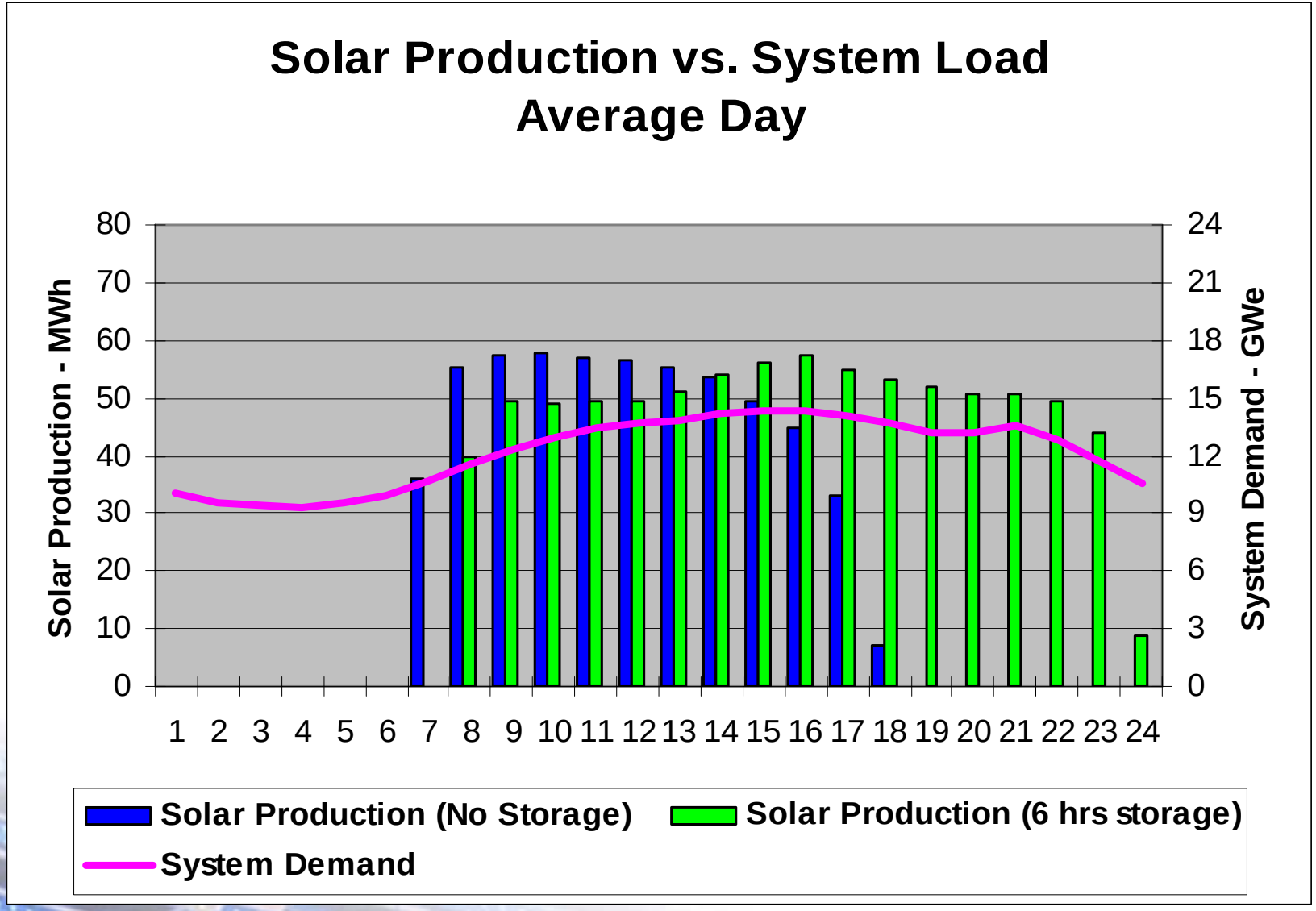
Cost Reductions in Trough CSP Power Systems



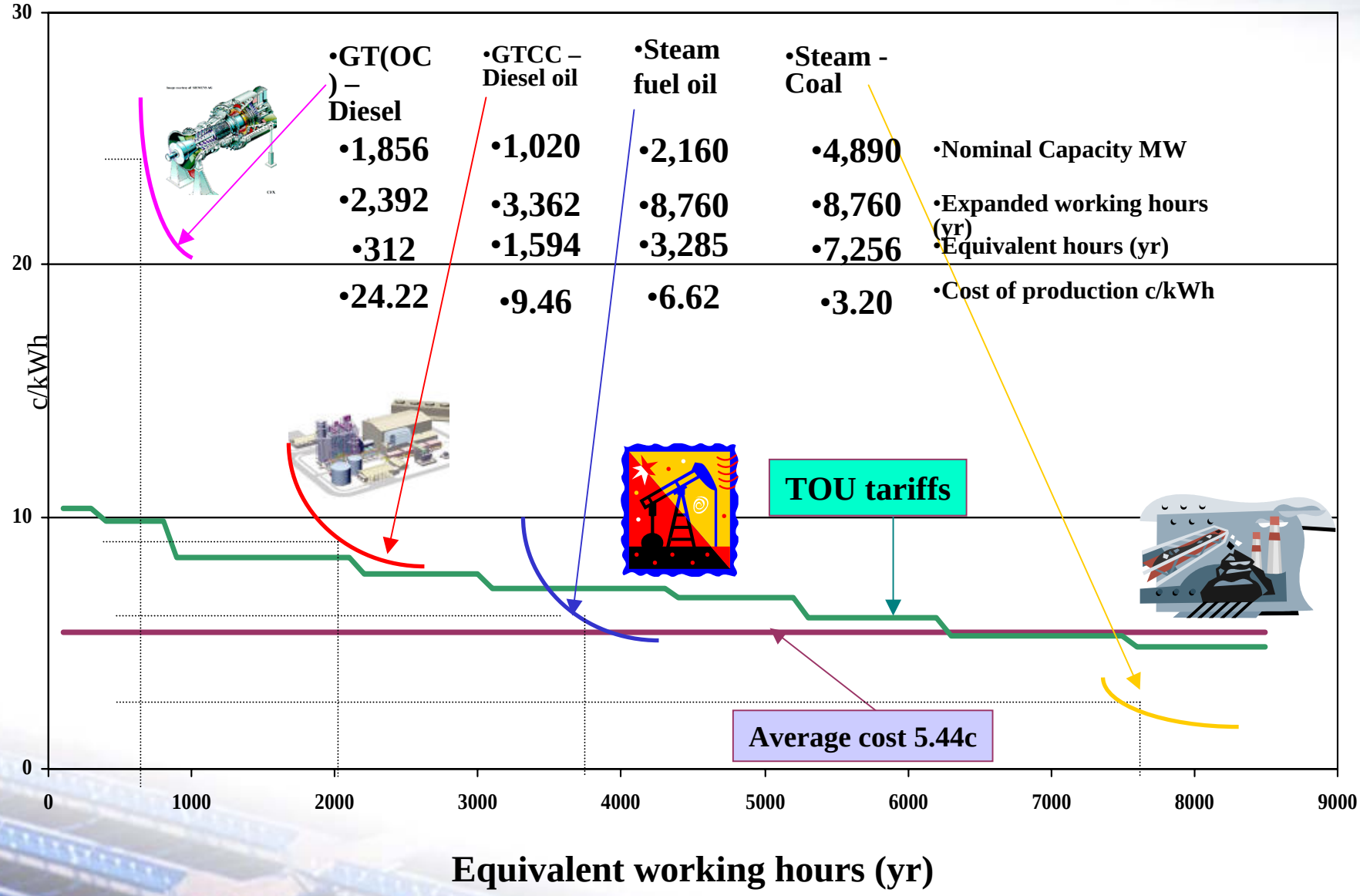
Reference case(consistent with S&L study)
50 MW plant-2003 technology-8.5% debt-40% equity-14% IRR

CSP Dispatchability with Thermal Storage

Daily Solar Generation vs. Demand at So. California Site Average Day – June 2002

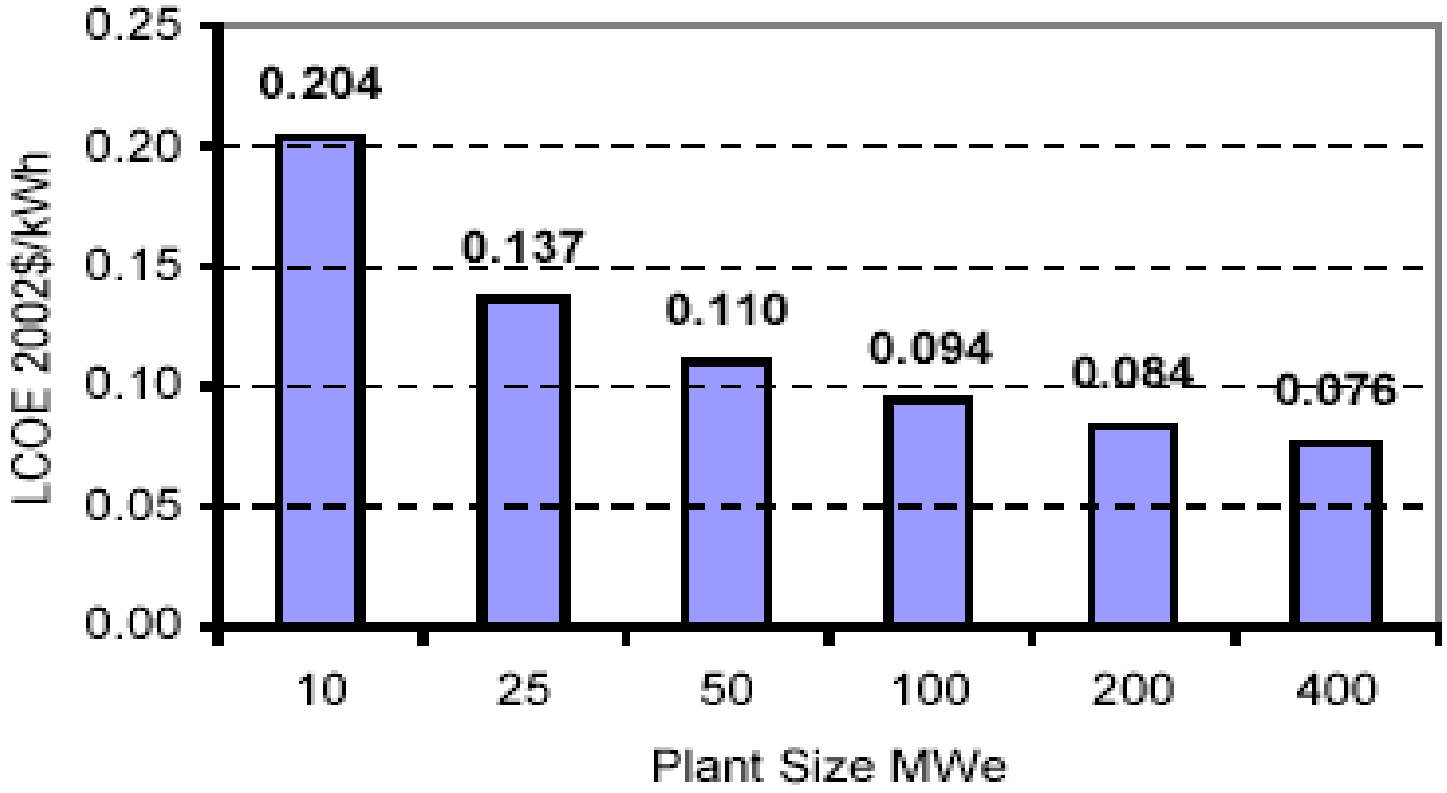


Hourly Cost of production by generating unit



Equivalent working hours (yr)

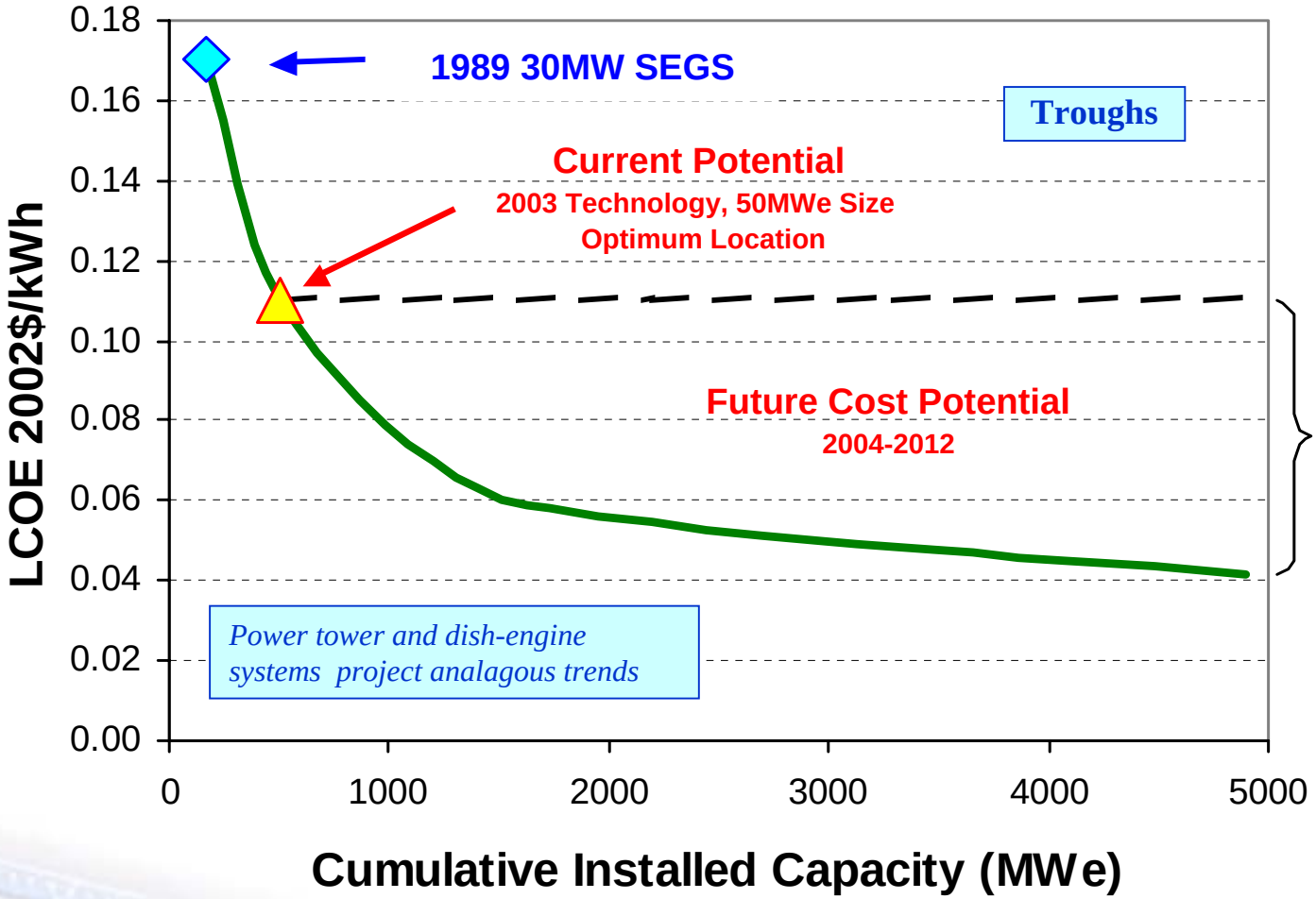
Impact of plant size on cost of energy



D. Kearny & H. Price January 2003 • NREL/CP-550-33208

CSP Development Scenario

{Cost reduction scenario based on 2002 Sargent & Lundy assessment}



[Courtesy of H Price, NREL]

Factors Contributing to Cost Reduction

- Scale-up 37%
- Volume Production 27%
- R&D 42%

CSP
Global Market Initiative

Summary of a Global Market Initiative for Concentrating Solar Power

The Palm Springs Protocol

At the First International Executive CSP Conference held in June 2002 in Berlin, Germany, strategies towards the rapid and large-scale market implementation of CSP were defined and summarized in the ***Declaration of Berlin***, which was registered as a UNEP Market Facilitation WSSD Type-II Partnership for CSP Technologies.

At the Second International Executive CSP Conference held in October 2003 in Palm Springs, California, a ***Global Market Initiative*** was developed .

The Palm Springs participants concluded as follows:

Whereas:

1. The solar resource necessary for CSP technologies is widely available around the world.

2. Many economic and environmental benefits will accrue from developing this resource.

3. Solar thermal power plants, which make use of the CSP technology, have the capability to meet a significant percentage of the future global electricity demand without technological, economic, or natural resource limitations.

CSP
Global Market Initiative

4. Due to the “fuel-saving” solar field investment the initial capital costs for CSP plants are higher than the initial cost of conventional power plants which purchase their fuel over time at uncertain prices.

   Reconciling this, independent studies predict that the cost of CSP power will be fully competitive with fossil-based power once 5,000 MW of new CSP capacity has been installed.

CSP
Global Market Initiative

5. This Global Market Initiative is needed to level the playing field of CSP technologies.

6. CSP addresses many of the world's most pressing issues, energy security, energy independence, climate change, air and water quality and long term price stability.

CSP Global Market Initiative

Therefore:

1. We, the participants in the Palm Springs Conference have agreed to form a collaborative effort to be known as the CSP Global Market Initiative ***with the objective to deploy 5,000 MW of CSP power by 2013.*** Countries and States that wish to develop solar energy resources are invited to participate in this initiative.

2. The endorsement by the Global Environment Facility,UNEP and other major multinational organization is anticipated.

CSP
Global Market Initiative

3. The following elements are considered to be essential to achieve the stated GMI goals:
   - Set targets for commercial, utility scaled CSP plants
   - Facilitate the process of bringing buyers of electricity and developers of CSP plants together
   - Establish adequate tariffs or equivalent mechanisms to allow CSP plants to be financed

CSP
Global Market Initiative

- Establish essential policies to facilitate CSP plants
- Facilitate long-term low-interest debt financing
- Establish open, fair and streamlined contract processes.
- Support long-term contracts with credit-worthy purchasers.

CSP Global Market Initiative

4. The purpose of this initiative is to expedite the deployment of new CSP power plants from identification of CSP project opportunities to project commissioning.

CSP Global Market Initiative

Organization, Structure & Management

- The current organizers pledge to develop a plan for the organization, structure and management, which will be submitted and adopted prior to the Renewable 2004 Conference in Bonn, Germany.
- The Palm Springs participants have agreed that GMI should have a qualified full-time management staff, which will initially be under the umbrella of the IEA or another acceptable international organization.

CSP
Global Market Initiative

Immediate Next Steps:

1. Finalize the full GMI text in accordance with this protocol by early December 2003 (designated editors for this task are Fred Morse, Rainer Aringhoff, John Myles, Tefwik Hasni and Kevin Nassiep.)
2. Secure the GMI endorsement by the interested States and Countries.
3. Cultivate ancillary support and raise awareness for GMI (Develop marketing strategies, media approach etc…)

.

CSP
Global Market Initiative

4 . The Target for success

The renewables 2004 Conference taking place in Bonn, Germany in June 1-4 2004 will include an emphatic mandate for the implementation of the GMI

Alan Miller’s presentation is not available.

Thursday Oct. 23
10:30 AM to 12:00 PM

SESSION 8: ENDORSEMENT OF THE CSP GLOBAL MARKET INITIATIVE

SESSION EIGHT – ENDORSEMENT OF THE CSP GLOBAL MARKET INITIATIVE*

Egypt
Hosny Elkholy, Executive Chairman, New and Renewable Energy Authority

I would like to comment on Egypt's position on the Global Market Initiative. In Egypt we have some barriers working against adding solar energy. These barriers include tariffs, cost limits set at 3 cents and the cost of the new technology which is about 10 cents. However, there is the opinion that solar projects are very attractive and offer sustainable development for the whole country, create more jobs, are easily integrated with other power sources, offer energy export opportunities and the added value of a clean environment and climate change protection.

Egypt is very concerned about climate c*hange, especially along the Mediterranean coast and the Nile delta. Moreover, CSP projects won't just benefit Egypt but the Mediterranean basin countries and the world as well. Cooperation between northern and southern Mediterranean countries would offer the necessary tools to put CSP and green power into the European grid. Egypt's target is to satisfy 4% of the electricity demand from renewable energies, mostly wind and solar, with CSP accounting for 1% by 2010.

Egypt views the GMI as an important, if not indispensable, tool for promoting CSP utilization and the course of achieving the target of as much as 100MW of CSP in the next 5 years. As for the major elements and requirements of the GMI, Egypt has devoted several efforts to meet these requirements by setting CSP program goals, promoting relevant policies and seeking adequate financing mechanisms. These activities will support, and are consistent with, the goals of the CSP GMI.

In this context I would like to state how Egypt envisions the role of the GMI. GMI represents a key element to realize the ambitious Egyptian program. If financial mechanisms and plans of action are required to activate the GMI on an international level, particular emphasis and concentration should be given to technology transfer and capacity building in developing countries. We suggest tying the GMI mission and functions with the solar basis activities. This will not add new financial burdens on GMI members.

In view of all of this, Egypt declares its positive support of the objectives of the CSP GMI.

India
Chandra Shekhar Rajan, Secretary of Energy, Government of Rajasthan

The GMI initiative is endorsed as it represented the broad consensus amongst participants representing developed and developing countries/states, solar industry including manufacturers, suppliers and consultants. The GMI is a potent instrument to enable the participants to use it as a lever to influence government policy formulation. The organization and structure envisaged to be created under the umbrella of the GMI would provide a forum for interaction amongst all stakeholders to exchange experiences.

The GMI also needed to address the crucial issue of rural electrification as the prospects of renewable energy through CSP technologies like the Stirling dish are immense.

India had already introduced a new legislation namely the Electricity Act, 2003.The Act already exempts distributed generation from licensing. The Act also provides for issue of National Policies for Rural Electrification including through renewables. Rajasthan already had such a

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* Frederick Morse and Cynthia Hunt Jaehne transcribed and/or edited these endorsements and accept responsibility, and apologize, for any errors herein.

policy which provides for preferential tariffs for power generation through renewables including a target of reaching 10% of the State generating capacity through renewables (including solar) by 2007.

The unfairness of comparing the relatively higher cost of CSP generation, which is a nascent technology, with the cost of 'fossilized' fossil fuel generation technology was brought out and a strong case for preferential tariffs for CSP technologies in the initial years was made. It was acknowledged that once the capital cost/debt of the CSP projects had been serviced (on reaching a certain minimum level of aggregate generation, say 5000 MW), the tariffs of CSP generation would be competitive with the tariff of fossil fuel generation.

Finally, the high level of preparedness of the Mathania project was highlighted. All clearances are secured. The principles of long term PPA have been negotiated and terms and conditions for long-term gas supply agreement finalized. Power transmission facilities are in place. Prequalification process for selection of the EPC O&M contractor has been completed. Pre-qualified bidders been issued RFP documents. However, we have been waiting 18 months for RFP bids. Most importantly, the financial closure of the project has been achieved with the KfW loan, GEF and Government of India grants and Government of Rajasthan equity already in place. Hence, it is of vital interest to the global solar community that this project takes off. Current difficulties must be resolved to the satisfaction of all concerned well before the Bonn conference in June 2004. This would set a mood of optimism for the Bonn conference.

South Africa
Kevin Nassiep, Chief Director of Energy and Planning, Department of Minerals and Energy

South Africa supports the initiative in terms of:

- The proposed process of global collaboration to expand the market
- The establishment of regional forums to establish regional goals and priorities
- The identification and implementation of suitable incentives to stimulate growth (Carbon credits, GEF grants, favorable financing options, etc)
- The establishment of an Advisory Board and Executive Committee to oversee strategic initiatives and ensure political awareness

Issues to be resolved for South Africa:

- The target is prescriptive – should be based on regional collaboration in SADC (Southern African Development Community)
- South African priorities aimed at electrification and job creation at present – major focus is on energizing remote customers at present
- Considers the proposed membership fee steep, in light of other international memberships already committed to
- Questions the intent of the Advisory Board and Executive committee – whose interests are served?
- Fundraising component needs to be highlighted

Next Steps:

- The issue of targets is best addressed through the regional forums – customer-driven process based on identified needs – rather than supplier-driven
- Challenge to suppliers is to demonstrate cost reduction opportunities – assist regions in planning their own targets
- Use process heat and other commodities to achieve further cost reduction
- Ring-fenced support mechanism for mid-term target

- Suppliers welcome to bid for projects in South Africa based on Renewable Energy target and subsidy program
- Supplier competition should be encouraged, aimed at component cost reductions – matchmaking program with industries in South Africa
- Appropriate capacity building programs should be initiated to promote awareness and stimulate local industry
- A geographically diverse scope should be encouraged when component sourcing is considered.
- Preferential CO_2 reduction credits for CSP should be considered to stimulate industry growth.

In short, South Africa wishes to accommodate GMI within the framework of existing priorities and policy.

Algeria
Hamid Dahmani, Counselor, Ministry of Energy and Mining

It is my pleasure to be here and be invited to speak in the closing session of this important gathering for the solar energy industry community.

My country, Algeria, with a territory of some 2.4 million Km2 with extremely high solar radiation rate, has a great potential for CSP.

Besides, the southern and most sunny part of the country, the Sahara desert, is also the location for the country's natural gas reserves, which are quite substantial by international standards. These reserves are already linked by a set of pipelines to other parts of the country and further to south European markets. Moreover, electricity transmission lines linking Algeria to Spain and Italy are under study. In fact the technical feasibility study has been finalized.

Above all, Algeria has set the adequate institutional and legal framework to develop its solar energy potential. An electricity law has been enacted last year. It includes dispositions aiming explicitly at promoting renewable energy sources.

We have an ambitious vision regarding the development of renewables and particularly solar energy in Algeria, with the target of achieving a share of 5% of our total power generation capacity by 2010. We are expecting foreign investment to contribute to achieve that objective, but also we expect to get the necessary support in financing and grants to put such plan on track.

Regarding the CSP GMI, we observe with interest that the stated objectives are to accelerate entry of CSP into markets. In particular, we note that its stated policy is to use appropriate strategies for each region, including the offer of price premium for imported CSP electricity from Region II, where Algeria is located, to other regions.

Algeria is willing to develop its CSP potential and understands that an initiative like the GMI will help the country achieve that objective. Algeria is interested in such initiative and will support it.

Our view is that the GMI will enhance the development of our solar energy potential within a sustainable development path.

Mexico
Ramon Carlos Torres Flores, Economist, Semarnat, Government of Mexico

Regarding the importance of CSP to the Government of Mexico:

- Great potential in Mexico. Three times of installed capacity.

- In the next weeks, the Congress will decide what and how the private and public sector are going to participate in the development of the electricity.
- This doesn't effect only CSP but, in a way, CSP is open for opportunities.

The following statements on the CSP GMI are offered:

- We must realize the division of the society including companies, financial institutions, developers, and so on, in favor of the message of CSP.
- We must stress that the environmental and health benefits of CSP compensates for the additional incremental costs of this energy in Mexico. This approach will work for the GMI and for the Government of Mexico.
- The GMI promotes work between Mexico and the United States with the support of the international financial community, and can take advantage of Mexico's facilities for the development of CSP.

Some ways for the Government of Mexico to implement the GMI:

- A CSP project in Mexico is in the process of bidding. We must solve the problems for implementation of this project. Solutions include
    1) To warranty to the leaders, the financial support from the GEF, and
    2) To ensure that good offers for the CSP project will be received.

  If we solve these two problems, the endorsement of the GMI will be easier.
- The goal of the Mexican Government to implement the GMI: As an important producer of hydrocarbons, Mexico must be in the future of energy and the way to do this is through renewable energy. The GMI is a part of this strategy and the Government knows this.
- Mexico endorsed the Kyoto protocol and participated totally in the UN efforts. We see the GMI could be a complement to these objectives but we need to find a way to address the financial obstacles.
- It is clear that we need to conduct studies for the GMI and realize public policies for this purpose. If we have support from the international financial community we will be successful in this objective.

Finally, the goals of the UN programs and lending, and specifically goals like GMI are the best sign that we moving in the right direction.

Morocco
Ahmed Nakkouch, General Manager, National Office of Electricity (ONE)

First, I would like to stress points related to the Moroccan power sector. With the exception of renewable energies, Morocco does not have good energy resources and therefore imports all fuels necessary for power generation.

Morocco faces important increases in electricity demand of more than 8% per year. Important investments are required to respond to these issues. For these reasons, one of Morocco's chief concerns is to mobilize renewable energies for power generation and rural electrification in a reliable, safe and competitive way.

In this context, Morocco has important projects underway including using solar power to supply electricity to 160,000 rural households. Two new wind power parks with a total capacity of 200MW are also underway along with a CSP power station granted by the GEF. This is a 200MW plant with 5-10% of solar output.

Morocco will contribute directly to the CSP GMI. The first action is to make the CSP project a success and a demonstration of all of the benefits of this technology including the creation of local jobs. Moreover ONE supports the GMI activities that enable or facilitate the implementation of more CSP projects.

Two sets of action may be considered. The first one will target the construction of adequate regulatory framework at both national and regional levels. The second one has to facilitate and accelerate the projects that are pending by giving a better understanding of CSP technologies, sharing experiences and developing standards.

Israel
Avi Brenmiller, President and CEO, Solel Solar Systems, Ltd.

Interest:

- Israeli government energy policy mandates that 2% of electricity production in Israel be generated from renewable energy by 2007.
- The only feasible application is CSP.

Country specific issues:

- Economic analysis - the real value of solar energy in a virtual spot market trading.

Next steps:

- Evaluate the cost of building a 100MW CSP solar electricity plant.
- Analyze the economy of the solar plant within the Israeli electricity market under the following terms:
    - Evaluate exogenous benefits.
    - Consider the way to contract the project.
- Guarantee investment with electricity rates - by defining tariff and long term Power Purchase Agreement.
- Get government approval.
- Get Public Utility Authority final approval.

Germany
Ludger Lorych, Federal Ministry for the Environment (BMU)

Concerning concentrating solar power, Germany is in a very unique situation: we have advanced technologies and very motivated people for implementing these but, because of very limited direct solar radiation, we have no sites for installation.

Germany is engaged in extending renewable energies both nationally and internationally. We undertook great efforts during the World Summit on Sustainable Development in Johannesburg 2002 as well as now with the International Conference for Renewable Energies in June 2004 in Bonn. The aim is the significant reduction of CO2 emissions, taking into consideration that developing countries will and should improve their infrastructure and, therefore, will need even more energy in the near future. Concentrating solar power might solve a few problems simultaneously by reducing CO2 emissions, solving energy shortages, as well as creating jobs and stimulating economies. The last might even happen by international trading in solar electricity. For achieving Germany's long term target -supplying half of our energy demand by renewable energies- all of the studies prove that, in the future, we need to buy solar produced electricity from the south.

In conclusion, Germany depends on strong international cooperation, especially in the field of concentrating solar power. The GMI process, which was started at the Berlin Conference in June

2002 is one important instrument. Continuation of this process is most important, and BMU will continue its support for the GMI.

Electric Power Research Institute
Terry Peterson, Manager, Solar Power & Green Power Marketing, United States

I am very pleased to be here and see the progress made at this meeting toward a CSP Global Market Initiative.

Nearly 30 years ago, EPRI-the Electric Power Research Institute-was born of a conviction that the U.S. electric utility industry should take greater care for its future and, in fact, needed an independent "technology conscience." Today, that "utility" industry has undergone so much structural transformation as to be almost unrecognizable, and it is perhaps more aptly termed the "energy" or "electricity" industry. EPRI has also changed in many ways-but it's still here, and still giving advice about "the right thing to do," technologically, for both the industry and society.

As part of that advice, EPRI and its new international subsidiary, EPRI Worldwide, have concluded that it is now time for GW-scale CSP deployment and have committed to forming an interest group for the mostly unaware potential users and purchasers of CSP generation in our industry. Our main intent for the interest group is to enhance market awareness of this enormous opportunity and thereby increase near-term demand for CSP technologies and speed their growth. I view the CSP Global Market Initiative as perfectly complementary to the EPRI CSP commitment and I look forward to our mutually and cooperatively pursuing a common goal of multi-gigawatt deployment of CSP technologies in this decade.

New Mexico
Craig O'Hare, Special Assistant for Renewable Energy, New Mexico Energy Department

I was appointed by Governor Bill Richardson to work on his renewable energy goals. I am here with Dennis Erickson who is the Governor's science advisor and we are here to help promote CSP for the State of New Mexico. I am from the great and, more importantly, sunny state of New Mexico and extend the greetings of the Governor.

Governor Richardson was the United Nations ambassador for the United States and later was the Energy Secretary under President Clinton and he focused quite a bit on renewable energy and energy efficiency.

The Governor mentioned the 1000 MW CSP initiative during his campaign and has reiterated his support for the initiative. Governor Richardson is now chairperson of the Western Governors' Association (18 states) and he has made energy the #1 priority. At a recent Western Governors' Association meeting, representatives from Nevada, California, Arizona and New Mexico met regarding the 1000 MW initiative and how to proceed. It looks like a feasibility study is the first step. The Governor is very results oriented and would like to be able to point to actions happening not just studies.

Finally, one of the Governor's big emphases with renewable energy is not only the environmental benefit - which he supports - but the economic development aspects of it. This is especially important in rural areas that have been hit with drought for 5 years and they think that this drought will continue. New Mexico is working quite aggressively on renewable energy, and solar energy specifically.

In conclusion, it is not how much coal is left to burn, or whether it can be made clean, but that we have a better technology that we can use today. Coal is advertising that there are 250 years left of coal, and is one of our most abundant and inexpensive energy sources. They also state that they believe that pollution-free power plant technologies will be available by 2020. That is quite a long time and wind and solar will be pollution-free and available before then. To paraphrase the

physicist- philosopher Fritjof Copra: We didn't move beyond the stone-age because we ran out of stones. Similarly, we are not going to move beyond the fossil-fuel age because we've run out of fossil fuels. We will because we've found a better energy to meet our needs and certainly, in our case, that is solar.

Western Governors' Association
Kevin Moran, Director, Washington, DC Office

The Western Governors believe very strongly in collaboration and we work very hard to reach out to stakeholders engaging them in order to create and drive regional and national policies. Our collaboration with this group has been very successful and we would like to continue it. I can pledge to you that I will bring back this (CSP GMI) document, as well as the other lessons I've learned in the last few days, as we continue to work on our 1000 MW initiative and will convey all of this information to them and hope that we can continue this dialogue and this working relationship. I have an appointment to brief the Western Interstate Energy Board as well as another western utility stakeholder group on the initiative and look forward to continuing this successful relationship.