INTRODUCTION

This year's keynote speakers were Professor Ari Rabl of Ecole des Mines, Paris, France, and Dr. Leopold Summerer of the European Space Agency, Noordwijk, The Netherlands. Professor Rabl was a previous keynote speaker at the 2nd symposium in our series, back in 1987. Since that time, he has expanded his field of renown beyond solar energy, and has become a celebrated expert at quantifying the hidden costs of energy systems. One important conclusion that emerged from this presentation and the discussion that followed (which was, as usual, transcribed for reproduction in this volume) is that nuclear energy probably has the lowest environmental cost of all present-day large-scale energy alternatives. But, as Professor Rabl sadly puts it: "Our problem with radioactive waste storage is more societal than technical".

Dr. Summerer's presentation also enabled us to distance ourselves slightly from the kind of solar researches with which most of us concern ourselves, by viewing the situation from Space. In particular, he reviewed the current status of various proposals that have been made to collect solar energy with Earth-orbiting satellites and beam it down for use on the ground. Because such satellites do not suffer from a day-night problem, as do terrestrial-based solar systems, they could in principle provide an alternative to fossil-fuelled base-load electricity. The only problem at the present time seems to be the enormous cost of putting such systems into orbit. However, some of the options that Dr. Summerer discussed indicate that this problem may eventually be solvable.

In addition to the keynote speakers, 70 people from Israel and abroad participated in the 13th Symposium.

It is, of course, always a pleasure to acknowledge our sponsors for their generous help in supporting these symposia. This year they were: Ben-Gurion University of the Negev, the Blaustein International Center for Scientific Cooperation, The Israel Power Engineering Chapter of the IEEE, The Israel Section of the International Solar Energy Society, Ormat Industries Ltd, and Solel Solar Systems Ltd.

Last but not least, this symposium could not have been possible without the hard work of the dedicated staff of the National Solar Energy Center, specifically, Dov Bukovza, Shoshana Dann, Shlomo Kabalo and Vladimir Melnichak. To each of them we owe a big thank you for their preparatory work and for their after-hours attention to details during the symposium.

David Faiman
Sede Boqer, March 2006

Ben-Gurion University of the Negev
The Jacob Blaustein Institutes for Desert Research
84990 Sede Boqer Campus, Israel

13th Sede Boqer Symposium on Solar Electricity Production October 31 – November 1, 2005

Sponsored by:

Ben-Gurion University of the Negev.
Blaustein International Center for Scientific Cooperation.
IEEE – Israel Power Engineering Chapter
International Solar Energy Society - Israel Section
Ormat Industries Ltd.
Solel Solar Systems Ltd.

Program

Monday, October 31, 2005

10:00-10:30 Arrival at the Ben-Gurion National Solar Energy Center, Midreshet Ben-Gurion, Registration

10:30-11:00 **Opening Greetings**
(Chair: Prof. **David Faiman**, BGU Blaustein Institutes, Sede Boqer)
Prof. **Jimmy Weinblat** (Rector, Ben Gurion University)
Prof. **Yair Zarmi** (Director, Albert Katz Int'l School for Desert Studies)
Blaustein Institutes for Desert Research, BGU

11:00-12:15 Session 1: Solar-Thermal Systems

1. *Photovoltaic versus Solar Thermal Electricity Costs*
   Aharon Roy
   Department of Chemical Engineering, Ben-Gurion University, POB 653, 84105 Beersheva, Israel
2. *SEGS technology update review 2005*
   Eli Mandelberg
   Solel Solar Systems Ltd., POB 811, 99000 Bet Shemesh, Israel
3. *Flow rate distribution in evaporating parallel pipes for direct steam generation in parabolic troughs*
   Uri Minzer, Dvora Barnea and Yehuda Taitel
   School of Engineering, Tel Aviv University, Ramat Aviv, 69978 Tel Aviv, Israel
4. *Open Cycle gas turbines for solar applications*
   Joseph Sinai, Chemi Sugarmen and Uri Fisher
   Ormat Systems Ltd., POB 68, New Industrial Zone, Yavneh, Israel
5. *Seeding a direct absorbing receiver by elutriating fine particles from a spouted bed.*
   Hanna Helena Klein
   Department of Environmental Science and Energy Research, Weizmann Institute of Science, 76100 Rehovot, Israel

12:30-13:30 Lunch (continuing late registration)

14:00-15:15 Session 2: Concentrator Photovoltaics

(Chair: Prof. **Moshe Levy**, Weizmann Institute of Science)

1. *Co-generation with concentrating photovoltaics*
   Abraham Kribus and Gur Mittleman
   School of Mechanical Engineering, Tel Aviv University, Ramat Aviv, 69978 Tel Aviv, Israel
2. *Realization of compact, passively cooled, high-flux PV prototypes*
   Daniel Feuermann
   Department of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben Gurion University, 84990 Midreshet Ben Gurion, Israel
3. *Planar photovoltaic concentrators near the Étendue limit*
   Roland Winston[1] and **Jeffrey M. Gordon[2]**
   [1]University of California, Merced, USA, [2] Department of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben Gurion University, 84990 Midreshet Ben Gurion, Israel
4. *Localized irradiation probing of multijunction solar cells: Experimental study*
   Eugene A. Katz, Jeffrey M. Gordon, Wondesen Tassew and Daniel Feuermann
   Department of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben Gurion University, 84990 Midreshet Ben Gurion, Israel

5. *Localized irradiation probing of concentrator solar cells: Modeling*
Wondesen Tassew, Eugene A. Katz, Jeffrey M. Gordon and Daniel Feuermann
Department of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben Gurion University, 84990 Midreshet Ben Gurion, Israel

15:15-15:45 **Coffee break**

15:45-16:45 **Session 3: Invited Keynote Lecture and Discussion**
(Chair: Prof. **Yair Zarmi**, BGU Blaustein Institutes)
Environmental costs of fossil fuels and benefits of solar
Dr. Ari Rabl,
Armines/Ecole des Mines, Paris, France

16:45-17:15 **Coffee break**

17:15-18:30 **Session 4: Photovoltaic Devices**
(Chair: Prof. **Hans Georg Beyer**, Magdeburg University, Germany)
1.. *Shading consideration in photovoltaic solar fields*
Dan Weinstock and Joseph Appelbaum
Tel Aviv University, Ramat Aviv, 69978 Tel Aviv, Israel
2. *An aspect of optimal construction for solar panels*
Moshe Averbukh
Sederot Yerushalayim 2/102, 84771 Beersheva, Israel
3. *Photovoltaic powered salt water chlorination for swimming pools*
Joseph Appelbaum[1] and Kame Khousam[2]
[1]Tel Aviv University, Ramat Aviv, 69978 Tel Aviv, Israel
[2] Queensland University of Technology, Australia

19:00-20:00 Festive Dinner

20:30-22:00 *Concert*
Raimonda Sheinfeld (Piano)

Tuesday, November 1, 2005

8:30-9:45 Session 5: Photovoltaic Cells I

(Chair: Prof. **Oded Millo**, Hebrew University of Jerusalem)

1. *How much can we gain from improved photon management in photovoltaic cells by up- and down conversion?*
   Olivia Niitsoo, Igor Lubomirsky and David Cahen
   Department of Materials and Interfaces, Weizmann Institute of Science 76100 Rehovot, Israel
2. *Local photoconductivity measurements of polycrystalline semiconductor films: The role of grain-boundaries*
   Doron Azulay[1], Oded Millo[1], Isaac Balberg[1] and D. Cahen[2]
   [1]The Racah Institute of Physics, The Hebrew University, 91904 Jerusalem, Israel
   [2] Department of Materials & Interfaces, Weizmann Institute of Science, 76100 Rehovot, Israel
3. *Improvement of Si solar cell parameters due to back Al and B simultaneous diffusion*
   Lev Kreinin, Ninel Bordin, Jack Broder and Naftali Eisenberg
   Jerusalem College of Technology, POB 16031, 91160 Jerusalem, Israel
4. *Solution Processable Sns_2 films and their exploitation in semiconducting polymer devices*
   Eyal Aharon and Gitti L. Frey
   Faculty of Materials Engineering, Technion, 32000 Haifa, Israel

9:45-10:15 Coffee break

10:15-11:30 Session 6: Photovoltaic Cells II

(Chair: Prof. **David Cahen**, Weizmann Institute of Science)

1. *Recent developments in Photovoltaic Dye Cells*
   Jonathan Goldstein[1], Inna Markovich[1], Arie Zaban[2] and Larissa Grinnis[2]
   [1]Orionsolar Ltd., AVX Building, 3 Hamarpeh St., Har Hotzvim Technology Park, 91450 Jerusalem, Israel
   [2] Department of Chemistry, Bar Ilan University, 52900 Ramat Gan, Israel
2. *Substantial improvement of dye sensitized solar cell (DSSC) photovoltaic characteristics by conformal TiO_2 and/or MgO Coatings of the titania nanocrystalline electrode*
   Larissa Grinis, Ashi Ofir, Sveta Kotlyar, Snir Dor and Arie Zaban
   Department of Chemistry, Bar Ilan University, 52900 Ramat Gan, Israel
3. *Enhancing electron transport in nanoporous TiO_2 electrodes for dye sensitized solar cells*
   Ashi Ofir[1], S. Tirosh[1], Th. Dittrich[2], L. Grinish[1] and Arie Zaban[1]
   [1]Department of Chemistry, Bar Ilan University, 52900 Ramat Gan, Israel
   [2]Hahn-Meitner-Institute, Glienicker Str. 100, D-14109 Berlin, Germany

4. *The Effect of orientation in nanocrystallites TiO_2 layers on the electron transport properties: application in dye sensitized solar cells*
   S. Tirosh[1], Th. Dittrich[2], A. Ofir[1], L. Grinis[1], A. Zaban[1]
   [1]Department of Chemistry, Bar Ilan University, 52900 Ramat Gan, Israel
   [2]Hahn-Meitner-Institute, Glienicker Str. 100, D-14109 Berlin, Germany
5. *Chemical bath deposited CdSe/CdS-sensitized porous TiO_2 solar cells*
   Olivia Niitsoo, S.K. Sarkar, C. Pejoux, S. Rühle**, David Cahen** and Gary Hodes
   Department of Materials and Interfaces, Weizmann Institute of Science, 76100 Rehovot, Israel

12:00-13:00 Lunch

13:30-14:30 Session 7: Invited Keynote Lecture and discussion
(Chair: Prof. **Aaron Roy**, Ben Gurion University)
Solar Power from space: Current status and prospects
Dr. Leopold Summerer,
European Space Agency, Noordwijk, The Netherlands

14:30-15:00 Coffee break

15:00-16:15 Session 8: Improvement of System Efficiency and Economics
(Chair: Eng. **Yehuda Bronicki**, Ormat Industries)

1. *Performance control for grid-connected PV systems*
   Hans Georg Beyer
   University of Applied Sciences Magdeburg-Stendal, Magdeburg, Germany
2. *PV Systems with self-cleaning panels*
   Sergey Biryukov
   Department of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben Gurion University, 84990 Midreshet Ben Gurion, Israel
3. *The Economic implications of transferring the Israel fossil electricity economy into a solar renewable energy economy.*
   Dov Raviv and Roy Rosenstreich
   MST Ltd., 8 Heil Hahimush St., 75702 Rishon Lezion, Israel
4. *Electrifying African villages with CPV*
   Dov Raviv and **Roy Rosenstreich**
   MST Ltd., 8 Heil Hahimush St., 75702 Rishon Lezion, Israel
5. *Economics of the Raviv CPV model*
   David Faiman
   Department of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben Gurion University, 84990 Midreshet Ben Gurion, Israel

16:15 Closing Remarks

TABLE OF CONTENTS

I: KEY-NOTE LECTURES