



Small PV-Applications

**Rural Electrification and
Commercial Use**

**University of Applied Sciences Ulm,
Ulm, Germany
June 6th/7th, 2011**





Visit Ulm – Ulm's main sights are the minster, with the tallest church spire in the world, the captivating old town and quaint fishermen's quarter, Wiblingen Abbey and Neu-Ulm, Ulm's modern „sister town“ across the Danube.

Location/travel:

Rail: Ulm main station (Hauptbahnhof): ICE/IC/EC trains; also regional trains (IR and NZ)

By road: A7, A8

Airports: Stuttgart, Munich, Memmingen

Symposium Chairmen



Dr. Hansjörg Gabler

Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg, Germany
Hansjörg Gabler held responsible positions at two German Solar Research Institutes and at the Physics Department of a German University. To him, remote electrification is the most distinguished application of Photovoltaic Solar Energy because it may help to make the world a better place.



Prof. Dr. Shahidul I. Khan

Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
Shahidul I. Khan was born in Dhaka, Bangladesh. He received the B.Sc.Engg. and M.Sc.Engg. degrees in electrical engineering from the Bangladesh University of Engineering and Technology (BUET), Dhaka, in 1974 and 1979, respectively, and the Ph.D. degree in electrical engineering from Concordia University, Montreal, Canada, in 1986. In 1976 he joined the System Planning Department with the Power Development Board of Bangladesh. Since 1981 he is with the Department of Electrical and Electronic Engineering, BUET. He became professor in 1995. From 1996 to 1999 he served as visiting faculty at University Technology Malaysia, Johor Bahru, Malaysia. His interests are in power electronics, motor drives and renewable energy especially Solar PV. He has published about 50 papers in national, international Journals and conferences. He has written a chapter of a monograph on Solar Home System and reviewed book on Power Electronics. He has supervised many masters student.

Prof. Peter Adelman

University of Applied Sciences
Ulm, Ulm, Germany

Georg Bopp

Fraunhofer ISE, Freiburg,
Germany

Prof. Dr. Walter Commerell

University of Applied Sciences
Ulm, Ulm, Germany

Prof. Boaventura Cuamba

Eduarde Mondlane University,
Maputo, Mozambique

Dr. Izael Da Silva

Strathmore University – Centre
for Research in Renewable
Energy and Sustainable Develop-
ment, Nairobi, Kenya
Makerere University (CREEC-
Centre for Research in Energy
and Energy Conservation),
Kampala, Uganda

Dr. Hansjörg Gabler

ZSW, Stuttgart, Germany

Dr. Carsten Hellpap

German International Coopera-
tion (GIZ), Eschborn, Germany

Prof. Manfred Horn

National Engineering University
(UNI), Lima, Peru

Prof. Bin-Juine Huang

New Energy Center, National
Taiwan University, Taipei, Taiwan

Prof. Dr. Shahidul I. Khan

Bangladesh University of Engi-
neering and Technology (BUET),
Dhaka, Bangladesh

Michael Müller

Steca, Memmingen, Germany

Kilian Reiche

The World Bank, Washington
D.C., USA

Prof. Dr. Dirk Uwe Sauer

RWTH, Aachen, Germany

Rafael Wiese

BSW-Solar, Department Rural
Electrification, Berlin, Germany

Michael Wollny

SMA, Niestetal, Germany

Prof. Dr. Roberto Zilles

University Saõ Paulo, Brazil

Symposium Focus

- Description of existing markets and state of art technology
- Open discussion of good and of bad examples of systems and distribution strategies
- Development of a vision for small PV-applications, their technologies and markets

You will meet

A colourful and fascinating group of people from all continents who are interested in the topic as:

- manufacturers, suppliers and installers of small PV systems for remote industrial use
- manufacturers, suppliers and installers of small PV systems for rural electrification
- energy consultants, politicians and rural electrification programme planners
- financiers from banks and foundations
- students, engineers and scientists

In the shadow of the exploding market for grid connected Photovoltaics, there grows a beautiful and vigorous flower. We are speaking of the market for 'Small PV Applications', which delivers light to remote rural homes or electricity for remote infrastructure equipment in industrialised and in developing countries. This is a most interesting part of the PV world. Estimations, uncertain as they may be, speak of 150 MW of PV power which is installed annually in small off-grid applications, they speak of stable annual market growth rates of 10 to 15 percent, in terms of money they speak of an annual turnover of well over one billion euro.

The bigger part of this market segment is not depending on political support of renewable energies: for small off-grid needs of electricity, PV is often the least cost solution under first investment, operation cost and reliability aspects.

We are preparing for you, the experts for small PV applications, for component development and production, for system layout and optimization, for market development and financing, a symposium which shall be dedicated in particular to the questions of small 'off-grid' electricity supply with PV. The forthcoming symposium is the follower of a first meeting which was held in May 2009 at the same place and under the same title. The success of this first symposium which was attended by a very interested audience of 160 persons coming from 42 countries was encouraging enough to continue this series of symposia.

The first initiative came from industry. The University of Applied Sciences Ulm, which will host the symposium, the Zentrum für Sonnenenergie- und Wasserstoff Forschung (ZSW) in Stuttgart and the Fraunhofer Institute for Solar Energy Systems in Freiburg discussed the first concepts. A scientific committee, selected from the most experienced actors worldwide from industry, from academia and from market development and financing will guide the process of selecting speakers and publications.

We suggest to concentrate on the following fields of applications:

- power for remote rural households in systems which do not need a distribution grid, known as 'Solar Home Systems',
- power for off-grid civil infrastructure like schools, clinics, churches, mosques and temples, administration offices, water pumping plants or street lighting,
- power for industrial infrastructure like those for telecommunication equipment or remote sensing,
- power for integrated equipment which 'needs no power supply' like solar lanterns, solar radios, mobile phone chargers, known today as 'picosystems'.

We hope, that you will be open to discuss all aspects of these small PV applications, from the components, including the batteries or other alternatives for energy storage, to the systems, from market development and distribution channels to the avenues of financing.

As the chairmen of this second 'Symposium on Small PV Applications' it is our pleasure to invite you. Hoping to meet you in June 2011 for the most interesting exchange of experience, for presentations of the state of the art and of new developments and hopefully also for the common development of a larger vision for this fascinating field.

Dr. Hansjörg Gabler

ZSW
Stuttgart, Germany

Prof. Dr. Shahidul I. Khan

BUET
Dhaka, Bangladesh

Monday, June 6th, 2011

Registration and Check-in starts at 9:00

10.00 **Opening Address**

Achim Bubenzer, University of Applied Sciences Ulm, Ulm, Germany
Eckardt Günther, OTTI, Regensburg, Germany
Hansjörg Gabler, Zentrum für Sonnenenergie- und Wasserstoff-Forschung (ZSW), Stuttgart, Germany
Shahidul I. Khan, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

RURAL ELECTRIFICATION – EXPERIENCE FROM CUTTING EDGE PROJECTS

Chair: Peter Adelman, University of Applied Sciences Ulm, Ulm, Germany

Shahidul I. Khan, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

10.30 **Success of Rural Electrification by Solar PV Systems in Bangladesh**

Shahidul I. Khan, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

10.45 **The Sun Rises in the East (of Africa): The Development and Status of the Solar Energy Markets in Kenya and Tanzania**

Janosch Ondraczek, University of Hamburg, Hamburg, Germany

11.00 **Enlightening Rural Households – Impacts of Solar Home System Usage in Senegal**

Jörg Peters, RWI, Essen, Germany

11.15 **Field Evaluation of PV Rural Electrification Programs in Latin America: Case Studies**

Miguel A. Egido, Instituto de Energía Solar (ETSIT), Universidad Politécnica de Madrid, Spain

11.30 **Discussion**

11.50 **Posters on Projects/Field Experience/Maintenance**

A1 **Maintenance Characterisation of a 13.000 SHS Program in Morocco**

Luis Miguel Carrasco, Instituto de Energía Solar (ETSIT), Universidad Politécnica de Madrid, Spain

A2 **Rural Electrification with Solar Home Systems in Riverside Villages in the Amazon Region: Social Factors Contributing to the Success of Technical Projects and Plans**

Valter Monteiro-Oliveira, Department of Ecology and Resource Management, University of Bonn, Germany

A3 **Appraisal of Success of Solar Home Systems**

Hans-Gerhard Holtorf, University of Oldenburg, Oldenburg, Germany

A4 **Sun Fuel**

Harald Olk, Consultant for Rural Electrification, Herne, Germany

12.00 **Lunch**

Visit to Poster and Trade Exhibition

MARKET DEVELOPMENT, FINANCING, DISTRIBUTION

Chair: Hansjörg Gabler, Zentrum für Sonnenenergie- und Wasserstoff-Forschung (ZSW), Stuttgart, Germany
Boaventura Cuamba, Eduardo Mondlane University, Maputo, Mozambique

- 13.30 **Introduction of Small PV Application in China**
Liu Hong, Qinghai Brightness Engineering Co., Ltd, Xining, Qinghai P.R of China
- 13.45 **Financial Comparative Analysis between the Use of Solar Home Systems and the Use of Diesel Generators by Rural Dwellers in Ghana**
Frank Yeboah Dadzie, ARB Apex Bank, Accra Ghana, Ghana
- 14.00 **A Novel Photovoltaic Power System for Improving Digital Access in Rural Schools and in Indigenous Population in Nayarit, Mexico**
Carlos Ortiz, Greenery Energía, Guadalajara, Jalisco, Mexico
- 14.15 **Status of SHS Dissemination in Bangladesh: Experience with Technology, Financing and Maintenance Requirement**
Shahriar A. Chowdhury, United International University, Dhaka, Dhanmondi, Bangladesh
- 14.30 **Productive Solar Home Systems – Local Markets in Namibia**
Conrad Roedern, Solar Age Namibia (Pty.) Ltd, Windhoek, Namibia
- 14.45 **Discussion**
- 15.10 **Posters on Market Development, Financing, Distribution**
- B1 **Solar Pico Systems - Problems, Opportunities and Solutions**
Andreas Paul, Phocos AG, Ulm, Germany
- B2 **Leveraging Renewable Energy to Create a Sustainable, Holistic Approach to Addressing Rural Poverty in Africa**
Izael Da Silva, Strathmore University – Centre for Research in Renewable Energy and Sustainable Development, Nairobi, Kenya
- B3 **Sustainable Management Model for Rural Electrification of Isolated Consumers Using Biomass Residues and Solar Home Systems**
Giorgiana Pinheiro, Energy Efficiency Department, Centrais Elétricas do Pará, Pará - Brazil
- 15.20 **Coffee Break**
Visit to Poster and Trade Exhibition

SHORT PRESENTATIONS

Chair: Georg Bopp, Fraunhofer ISE, Freiburg, Germany
Michael Wollny, SMA, Niestetal, Germany

- 16.15 **Posters on Components/Storage**
- C1 **PV Charging Enhancement of Solar Home System Using Super-Capacitor**
Bin-Juine Huang, New Energy Center National Taiwan University, Taipei, Taiwan
- C2 **Development of Temperature Controlled Box for Stand-Alone Solar System to Prolong the Battery Life**
Bin-Juine Huang, New Energy Center National Taiwan University, Taipei, Taiwan
- C3 **Hybrid Usage of a Satellite Dish for TV Application and CPV Power Production – An Evaluation**
Stephan Parzinger, Technical University Munich, Germany

- C4 **Quality and Price Advantages for Off-Grid Modules on the Basis of Processed Non-Prime Solar Cells**
Thomas Hillig, Innotech Solar AS, Munich, Germany
- C5 **Initial Testing of Polymer Solar Cells for Solar Home Systems – Applicability, Performance, Issues and Future Perspectives**
Torben Damgaard Nielsen, Risø DTU, Roskilde, Denmark
- C6 **SEPIC Based Low Cost MPPT Charge Controller for Small Solar System**
Shahrear Mahmud, Xentech Electronics, Dhaka, Bangladesh
- C7 **Economic Assessment and Design Optimization of PV-Battery Systems in Rural and Off-grid Electrification Applications**
Dirk Magnor, ISEA, RWTH Aachen University, Aachen, Germany
- Posters on Systems and Pico PV**
- D1 **A Concrete Study on Efficiency of Solar PV System Tied to Smart Grid**
Ahmed Zubair, Dhaka, Bangladesh
- D2 **Electrification of Rural Street through Solar PV System in Bangladesh**
Ahmed Zubair, Dhaka, Bangladesh
- D3 **Comparison of Storage Concepts for PV-Cooling Systems**
Jörg Waschull, Institute for Air Handling and Refrigeration (ILK Dresden), Dresden, Germany
- D4 **Electrification of Rural Mozambique Using Pico PV Systems**
Tobias Zwirner, Phaesun GmbH, Memmingen, Germany
- D5 **Small Photovoltaic Applications in Regions of low Electrification: High Demand, Fast Financial Amortization and Large Market Potential**
Christian Breyer, Q-Cells SE Universität Kassel, Bitterfeld-Wolfen, Germany
- D6 **Global Overview on Cumulative Installed Photovoltaic Power**
Christian Breyer, Q-Cells SE Universität Kassel, Bitterfeld-Wolfen, Germany
- D7 **Environmental and Financial Aspects of Solar PV Based Charging Scheme for Battery-Driven Three-Wheelers**
Jubair Saeed, Bangladesh University of Engineering, Dhaka, Bangladesh
- D8 **Ways to Protect Consumers from Low Quality Pico PV Products**
Carsten Hellpap, German International Cooperation (GIZ), Eschborn, Germany
- D9 **Africa Electrification Initiative (AEI): What are Practitioners Telling us about PV-Based Electrification in Sub-Saharan Africa?**
Dana Rysankova, The World Bank, Washington, DC, USA
- 17.15 **Discussion**
Visit to the Poster and Trade Exhibition

PUBLIC LECTURE: PHOTOVOLTAICS IN AFRICA

Introduction: Hansjörg Gabler, Zentrum für Sonnenenergie- und Wasserstoff-Forschung (ZSW), Stuttgart, Germany

- 18.00 **Photovoltaics in Africa**
Carsten Hellpap, German International Cooperation (GIZ), Eschborn, Germany
- 19.30 **Dinner, Ratskeller Ulm**

Tuesday, June 7th, 2011

COMPONENTS/STORAGE

Chair: Michael Müller, Steca, Memmingen, Germany
Izael Da Silva, Strathmore University – Centre for Research in Renewable Energy and Sustainable Development, Nairobi, Kenya

- 9.00 **Lessons Learned on Storage for Different Types of Stand-Alone PV Systems: Monitoring and On-Site Expertise**
Jean-Christian Marcel, TENESOL SA, La Tour de Salvagny, France
- 9.15 **Optimization of Charging Strategies for VRLA Batteries in Standalone PV Systems**
Georg Bopp, Fraunhofer ISE, Freiburg, Germany
- 9.30 **AMARES: A More Reliable Stand-Alone PV System Thanks to Bi-Battery Storage**
Elisabeth Lemaire, INES-CEA, Le Bourget du Lac, France
- 9.45 **Innovative Small Off-Grid Systems with Lithium-Ion Batteries**
Michael Müller, Steca, Memmingen, Germany
- 10.00 **Hybrid Storage System in Rural Electrification and Industrial Applications**
Walter Commerell, University of Applied Sciences Ulm, Ulm, Germany
- 10.15 **Discussion**
- 10.40 **The Challenge of Cost Effective Small Modules for Rural Electrification in a World of Quickly Decreasing Standard Module Prices - an Opportunity for Local Module Production?**
Winfried Hoffmann, EPIA, Brussels, Belgium
- 11.05 **Coffee Break and Visit to Poster and Trade Exhibition**

PHOTOVOLTAIC SYSTEMS FOR RURAL ELECTRIFICATION AND INFRASTRUCTURE

Chair: Walter Commerell, University of Applied Sciences Ulm, Ulm Germany
Bin-Juine Huang, New Energy Center, National Taiwan University, Taipei, Taiwan

- 11.30 **PicoPV: Policy Implications of a New Technology Option. What is the Difference between Lighting and Electrification?**
Benjamin Attigah, German International Cooperation [GIZ], Eschborn, Germany
- 11.45 **Solar Powered Water Purification System as a Solution for Rural Areas**
Andy Schroeter, Sunlabob Rural Energy Ltd, Vientiane, Laos
- 12.00 **Photovoltaics in Mozambique: Challenges for Electrification of Rural Social Infrastructures and Villages**
Boaventura Cuamba, Eduardo Mondlane University, Maputo, Mozambique
- 12.15 **Commercialization of Solar Energy in the Industrial Sector of India**
Anand Shukla, German International Cooperation [GIZ], New Delhi, India
- 12.30 **Sustainability of Solar PV System in Telecommunication Sector of Bangladesh**
Jubair Sieed, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

- 12.45 **Rural Electrification using off-grid Solar PV powered Energy Kiosks**
Izael Da Silva, Strathmore University – Centre for Research in Renewable Energy and Sustainable Development, Nairobi, Kenya
- 13.00 **Discussion**
- 13.30 **Lunch**
Visit to Poster and Trade Exhibition

PICO PHOTOVOLTAICS

Chair: Kilian Reiche, The World Bank, Washington, DC, USA
Manfred Horn, National Engineering University, Lima, Peru

- 15.00 **Pico PV – An Overview**
Peter Adelman, University of Applied Sciences Ulm, Ulm, Germany
- 15.15 **Rural Electrification in Ethiopia – Consumer Acceptance of PicoPV Systems**
Hannah Muggenburger, Technical University Darmstadt, Germany
- 15.30 **How are “PicoPV” Lamps Performing under Real-Life Conditions in Developing Countries? Results from a 2009-2010 GTZ Field Test and Consumer Survey in Uganda**
Anna Brüderle, iidevelopment GmbH, Frankfurt am Main, Germany
- 15.45 **Solar LED Lights – Investigations and Tests**
Norbert Pfanner, Fraunhofer-Institut für Solare Energiesysteme ISE, Freiburg, Germany
- 16.00 **Practical Experience: Pico PV in Peru**
Manfred Horn, National Engineering University, Lima, Peru
- 16.15 **Discussion**
- 16.40 **Closing Remarks**
Hansjörg Gabler, Zentrum für Sonnenenergie- und Wasserstoff-Forschung (ZSW), Stuttgart, Germany
Shahidul I. Khan, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
- 17.00 **End of the Symposium**



Eckardt Günther, Gabriele Struthoff-Müller

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Your advantage

- You gain comprehensive information about the state of technology as well as latest results from research and development.
- The scope of the conference is intended to encourage a hearty open discussion of problems and future strategies to spread Small PV-Applications
- The speakers are leading scientific and business experts.
- The programme structure and the conference venue best ensure exchange of views between participants and presenters.
- The detailed proceedings book and the CD-ROM with all talks and poster contributions will be handed over at the start of the conference and will serve you well as reference works.

Information about OTTI

OTTI is a non profit organisation founded in 1977. Its aim is the stimulation of the industrial economy and the support of the co-operation between science and industry. OTTI has a 34-person strong team who proffer seminars, specialist forums and conferences. About 6200 specialists and managerial personnel from business, administration and science take part every year.

OTTI is one the leading European conference organisers of purpose-oriented seminars and conferences in the field of renewable energies. Furthermore, we offer courses in the fields of building, construction and the efficient use of energy. Our conferences with the accompanying specialist exhibitions in Kloster Banz belong to the definitive meetings of the solar energy sector in the German-speaking area.

For more detailed information please visit www.otti.eu

Accommodation

Please book your accommodation as soon as possible by yourself.
www.hotels.com

Symposium Venue

University of Applied Sciences Ulm
 Campus Aula
 Prittwitzstr. 10
 89075 Ulm, Germany
 Phone +49 731 50-208
 Fax +49 731 50-28270
 info@hs-ulm.de

Symposium Fee

If registered until April 15th, 2011

Per Person: € 480,00
 Member of OTTI: € 380,00

If registered after April 15th, 2011

Per Person: € 580,00
 Member of OTTI: € 450,00
 Reduced fee for
 Presenters: € 280,00
 Employees of
 Universities: € 350,00

From the third participant on, every other participant of your company profits from our 15% discount on the conference fee.

Fees cover admission to all sessions, invitation to all coffee breaks, a lunch, a dinner and the conference proceedings.

The Symposium Language is English.

Photo Credits:

Title: „Jurtefamilie“ by Prof. Peter Adelman
 Page 1 and 2: Ulm/Neu-Ulm Touristik GmbH (UNT)

2nd Symposium Small PV-Applications

June 6th/7th, 2011 (PVA 3488)

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2nd Symposium Small PV-Applications

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- We are interested in sponsorship. Please send us information and the registration form.
- I cannot participate but wish to order the conference proceedings at the price of € 150,00 (incl. VAT) plus postage and packing – delivery after the conference.
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Registration Conditions

You will receive the relevant papers and confirmation as soon as we have your registration. The fees are exempt from value-added tax (VAT) and are payable in full upon receipt of the invoice.

Payment must be received no later than 14 days before the conference begins (it has to be settled in EURO). All bank charges have to be covered by the transmitter! OTTI reserves the right to refuse admission if the amount has not arrived, unless said amount is paid by cheque on the day. In case transferring occurs later than 14 days before the conference, please keep a copy of the transfer order ready and show it in the organisation office at the conference. OTTI reserves the right to change the programme at short notice for urgent reasons. There is no charge for cancellations made at least 35 days before the event starts. If the booking is cancelled 34 days before the start of the conference a service charge of € 120,- will be made. It is possible to rebook once without extra charge. All cancellations must be in writing. It is possible to send a substitute delegate at any time without additional cost, but we need a written message about the change before the conference starts. Legal domicile and place of fulfilment is Regensburg.

- **Power Electronics for Photovoltaics (LEE-3720)**

June 6th/7th, 2011

Chairman:

Prof. Dr. Bruno Burger,
Fraunhofer ISE, Freiburg, Germany

- **Quality of PV-Systems (QPV-3670)**

June 6th, 2011

Chairman:

Klaus Kiefer,
Fraunhofer ISE, Freiburg, Germany

- **Silicon Photovoltaics (SPV-3735)**

June 6th, 2011

- **Monitoring of PV-Systems (MEE-3718)**

June 7th, 2011

Chairman:

Prof. Gerd Heilscher,
University of Applied Sciences Ulm, Ulm, Germany

All seminars will take place in the NH-Hotel, Munich-Dornach, Germany

Programme will be published in February at www.otti.eu.
Seminar language is English.

Small PV-Applications is Official Side-Event of



Intersolar Europe takes place annually at the New Munich Trade Fair Center. Today, it is the world's largest exhibition for the solar industry, and looks back on a history spanning almost twenty years. In 2010, 1,884 international exhibitors and more than 72,000 trade visitors were welcomed to Intersolar Europe. The accompanying Intersolar Europe Conference consolidates the topics of the exhibition. In 2010, more than 150 speakers and around 2,000 attendees discussed current industry topics and investigated the background of technological, market and political developments.

www.intersolar.de

- **6th European Conference PV-Hybrid and Mini-Grid (IPV-3734)**

April 26th/27th, 2012

Location:

Centre de Congrès - Le Manège, Chambéry, France

Call for Papers:

Deadline for submissions of abstracts:

October 14th, 2011

<http://review.otti.eu>

Papers are invited on the following topics:

- Political-Economic Framework
- Markets, Socio-Economics, and Education
- Components: Storage, Inverters, Back-Up
- Systems Technology
- Field Experience
- Simulation, Design and Testing

You will meet:

Users of renewable energy systems and mini-grid, users involved in rural electrification, manufacturers and suppliers of renewable energy systems and energy storage technology, energy consultants, public utilities, users from developing countries, development programme specialists, energy policy makers, other attendees.

Conference Focus:

- Development and Application of Technologies
- Exchange of Results and Ideas
- Know-how Transfer
- Identification of R&D Needs
- Presentation of Field Experience

Organisation Committee:

Eckardt Günther, Gabriele Struthoff-Müller
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2nd Symposium Small PV-Applications

