2nd European PV-Hybrid and Mini-Grid Conference

25th/26th September 2003
### Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational Guidelines</td>
<td>1</td>
</tr>
<tr>
<td>Chairman’s Message</td>
<td>5</td>
</tr>
<tr>
<td>Programme outline</td>
<td>7</td>
</tr>
<tr>
<td>Conference Programme</td>
<td>9</td>
</tr>
<tr>
<td><strong>MARKET AND ECONOMICS</strong></td>
<td></td>
</tr>
<tr>
<td>Future Hybrid Systems: Solar and Hydrogen</td>
<td>23</td>
</tr>
<tr>
<td>Lawrence Kazmerski, National Renewable Energy Laboratory, Golden, Colorado, USA</td>
<td></td>
</tr>
<tr>
<td>ASER: Agence Sénégalaise Electrification Rurale - Rural Electrification Policy and Strategy in Senegal</td>
<td>32</td>
</tr>
<tr>
<td>Rolf-Peter Owsianowski, GTZ, Senegal</td>
<td></td>
</tr>
<tr>
<td>Economic Study of 500 kW&lt;sub&gt;p&lt;/sub&gt; Photovoltaic Grid Support System at Mae Hong Son Province</td>
<td>38</td>
</tr>
<tr>
<td>Rakwichian Wattanapong, SERT, Naresuan University, Phitsanulok, Thailand</td>
<td></td>
</tr>
<tr>
<td>Tariff Structure Proposal for PV-Hybrid Systems</td>
<td>43</td>
</tr>
<tr>
<td>Xavier Vallvé, Trama TecoAmbiental, Barcelona, Spain</td>
<td></td>
</tr>
<tr>
<td>Pricing-Based Energy Management Strategies for Hybrid Energy Systems and Mini Grids</td>
<td>49</td>
</tr>
<tr>
<td>Sascha Beverungen, University of Kassel, Germany</td>
<td></td>
</tr>
<tr>
<td>Psychological Aspects of Energy Consumption and Production: a Theoretic Presentation with Input from Practical Experiences</td>
<td>54</td>
</tr>
<tr>
<td>Petra Schweizer-Ries, University of Magdeburg, Germany</td>
<td></td>
</tr>
</tbody>
</table>
SYSTEMS I

Basics of Hybrid Technology for Grid Compatible Stand-Alone Plants
Mohamed Ibrahim, University of Kassel, Germany

Integrated Design Approach for PV Hybrid Systems
Tim Meyer, Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany

Supervisory Control and Data Acquisition (SCADA) System via Satellite Link Technology for Remote and Isolated Photovoltaic-Diesel Hybrid Power System in Indonesia
Andhika Prastawa, Indonesian Agency for the Assessment and Application of Technology, Jakarta, Indonesia

The Regional Replication of Hybrid Power Systems in Rural Chile
E. Ian Baring-Gould, National Renewable Energy Laboratory, Golden, Colorado, USA

Next Generation of AC Coupled Hybrid Systems - 3 Phase Parallel Operation of Grid Forming Battery Inverters
Alfred Engler, ISET, Kassel, Germany

SYSTEMS II

Study Design and Performance of Photovoltaic/Diesel/BS Power Generation System with Application in Egypt
Hassan H. Rakha, New & Renewable Energy Authority, Cairo, Egypt

PV Fuel Cell Hybrid Systems - Possible Applications and Limits
Michael Müller, Steca GmbH, Memmingen, Germany

Wind Diesel Battery Systems for the Greek Islands Sifnos, Serifos and Astipalea
Alfred Engler, ISET, Kassel, Germany

Renewable Energy Sources, Promotion and Integration for the Sustainable Development of Insular Regions of Europe: The Respire Project
Edoardo Tognon, ETA-Renewable Energies, Florence, Italy

PV Hybrid Systems Improvement of Saül village in French Guyana
Jean-Christian Marcel, Transénergie, Ecully, France

Photovoltaic for Isolated Office System (PIOS) Based on Single-User Mini-Grid at Energy Park, SERT, Thailand
Achitpon Sasitharanuwat, Naresuan University, Phitsanulok, Thailand

Stand Alone Power System Coupling a PV Field and a Fuel Cell: First Experimental Results
Didier Mayer, ENSMP-CENERG, Sophia Antipolis, France

FIELD EXPERIENCE I

Implementation Experience of a MSG on the Island of Floreana (Galapagos, Ecuador)
Xavier Vallvé, Trama TecnocAmbiental, Barcelona, Spain

The Future of Village Electrification - More than two Years of Experiences with AC-Coupled Hybrid Systems
Martin Rothert, SMA Regelsysteme, Niestetal, Germany

Five Years Experience in Mini-Grids with AC Coupled PV
Michel Vandenbergh, ISET, Kassel, Germany

Replacement of Diesel Generators by Small PV Plants
Javier Munoz, Universidad Politécnica de Madrid, Spain

Training of Company Abilities to Integrate Social Aspects in PV-Projects for Rural Electrification
Gisela Vogt, Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany

FIELD EXPERIENCE II

Tandem:
Project Ladakh - Photovoltaic in Foreign Countries Modular PV-Hybrid AC-System for the Himalayan Region in India Renewable Energies for Decentralised Energy Supply
Gemot Becker, Thomas Becker TBB – Technisches Büro Becker, München, Germany and Michael Wollny, SMA Regelsysteme, Niestetal, Germany

A New Vision for Remote Villages in Western China: Village Electrification by PV Hybrid Plants – The Solar Energy Program of MoF and KFW in China
Winfried Klinghammer, Project-Consult, Königstein, Germany
High Standard Energy Service by Multi-user PV Hybrid Grids (MSG): An Integrated Approach in "Veinat De Cal Peraire", Catalonia, Spain
Ingo Vosseler, Trama TecnoAmbiental, Barcelona, Spain

Adding PV-Generators without Storage to Medium Size Stand Alone Diesel Generator Sets to Support Rural Electrification in Brazil
Hans Georg Beyer, Universidade Federal de Santa Catarina, Florianopolis, Brazil

Multibat in Austria - an Effective Battery Management on Temple Site
Michael Heidenreich, arsenal research, Vienna, Austria

PV-UPS System at TPM in Malaysia
Peter Kremer, Siemens AG, Fürth, Germany

Mongolia Renewable Energy in Small Towns and Rural Areas Project
Rolf Oldach, IT Power, Chineham, United Kingdom

Opportunities for hybrid systems and small grids in the European Union’s 6th Framework Programme for Research and Technical Development
Jürgen Greif, European Commission, Brussels, Belgium

EVENING LECTURE
Problems and Perspectives of Rural Electrification
Wolfgang Palz, Brussels, Belgium

COMPONENTS: STORAGE, INVERTERS, BACKUPS
Storage for hybrid systems
Philippe Malbranche, GENEC, St. Paul Lez Durance, France

Fuel Cells in Photovoltaic Hybrid Systems for Stand-Alone Power Supplies
Werner Roth, Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany

A New Generation of Hybrid Inverters
Hans Oppermann, Sun Power Solartechnik, Bad Vilbel, Germany

New V/f-Statics controlled Battery Inverter: Sunny Island® - the key component for AC-Coupled Hybrid Systems and Mini Grids
Mike Meinhardt, SMA Regelsysteme, Niestetal, Germany

STANDARDISATION AND PERFORMANCE INDICATION
Recommendations for Small Renewable Energy and Hybrid Systems for Rural Electrification
Alain Schmitt, EDF, Clamart, France

PV-Hybrid Micro-Powerplants and Mini-Grids for Decentralised Rural Electrification in Developing Countries
Alain Schmitt, EDF, Clamart, France

Novel Concepts of Indicators for Performance Verification of Stand-Alone PV Hybrid Energy Service
Ingo Vosseler, Trama TecnoAmbiental, Barcelona, Spain

Assessment of Energy Capture from Small-Wind-Based Hybrid Power Systems
E. Ian Baring-Gould, National Renewable Energy Laboratory, Golden, Colorado, USA

SIMULATION
Technical and Social Simulation of a PV Micro Grid
Carlos Rodrigues, INETI-DER, Lisbon, Portugal

A Simulation Model for Expandable Hybrid Power Systems
Osama Omari, University of Applied Sciences Südwestfalen, Soest, Germany

Design, Simulation and Economic Analysis of a Stand Alone Reverse Osmosis Desalination Unit Powered by Wind Turbines and Photovoltaics
Essam Sh. Mohamed, Agricultural University of Athens, Greece

Integration of Renewable Energy and Hydrogen (RE/H₂) Systems in Diesel Engine Mini-Grids: A Western Australian Case Study
Oystein Ulleberg, Institute for Energy Technology (IFE), Kjeller, Norway

The National Renewable Energy Laboratory Hybrid System Modeling Suite
E. Ian Baring-Gould, National Renewable Energy Laboratory, Golden, Colorado, USA
Village Electrification through PV/Wind Hybrid Systems in the Chinese Brightness Programme - A Comprehensive Training Programme for System Operators and Service Engineers
Hansjörg Müller, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Beijing, China

POSTERS

A - MARKET/ECONOMICS

Potentialities and Impact of Rational Use of Energy and Electricity Demand Side Management in Micro-Grid (A1)
Emmanuel Huard, Transenergie, Ecully, France

Simplified Energy Performance Calculation Method and Economical Analysis of BIPV Systems (A2)
Hans Bloem, Joint Research Centre, Environment Institute, Ispra, Italy

B - SYSTEMS

Hybrid Solar/Wind (PVT/WT) Building Integrated Systems (B1)
Yiantrip Tripanagnostopoulos, University of Patras, Greece

Assessment of the Energy Production by Means of the Clearness Index in Hybrid Systems (B2)
Jarú Méndez Hernández, University of Kassel, Germany

Universal Energy Supply Protocol (UESP) (B3)
Jochen Benz, Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany

B4 cancelled

Power Quality Measurements in Mini-Grids Including Photovoltaic units and battery storage (B5)
Stathis Tselepis, CRES, Athens, Greece

Potential of Steam Energy in PV-Hybrid Systems (B6)
Klaus Brinkmann, University of Applied Sciences Trier, Germany

A Unified Approach to Modelling of Photovoltaic Systems (B7)
Ridha Andoulsi, Laboratoire LAS/INRST B.P., Hammam-Lif, Tunisia

The Hybrid System Project with Mini-Grid in Ginostra, Village of Stromboli Island (B8)
Giovanni Viglianesi, Conphoebus S.p.A. Gruppo ENEL, Catania, Italy

B10 cancelled

C - FIELD EXPERIENCE

Senegalese Agency for Rural Electrification (ASER): Procedure and prescriptions for implementation of "Local initiated rural electrification projects (ERIL)" (C1)
Mansour Dahouénon, GTZ, Dakar, Senegal

Water and Electricity for Mediterranean Farmers [PVP+SHS] or [PV-Diesel-HYBRID]? (C2)
Stratis Tapanlis, University of Kassel, Germany

RES 2.0 a Software Simulation of PV - Diesel Hybrid System for Rural Electrification (C3)
Nipon Ketjoy, University of Kassel, Germany

Two Years of PV-Hybrid Stand Alone Systems on the Island of Kythnos - A Socio-Technical Analysis (C4)
Petra Schweizer-Ries, University of Magdeburg, Germany

Simulation of Inverter Dominated Minigrids (C5)
Oleg Osika, ISET, Kassel, Germany

Multibat in Austria - an Effective Battery Management on Temple Site (C6)
Michael Heidenreich, arsenal research, Vienna, Austria

Adding PV-Generators without Storage to Medium Size Stand Alone Diesel Generator Sets to Support Rural Electrification in Brazil (C7)
Hans Georg Beyer, Universidade Federal de Santa Catarina, Florianopolis, Brazil

Renewable Energy Sources, Promotion and Integration for the Sustainable Development of Insular Regions of Europe: The Respire Project (B9)
Edoardo Tognon, ETA-Renewable Energies, Florence, Italy
D - COMPONENTS: STORAGE, INVERTERS, BACKUPS

Reduction of the Specific Cost of Autonomous Photovoltaic-Diesel-Hybrid Systems by the Use of Variable Speed Diesel Generators (D1) 407
Stratis Tapanlis, University of Kassel, Germany

Power-Quality Improvement in Low Voltage (Mini-)Grids (D3) 413
Jörg Jahn, ISET, Kassel, Germany

Embedded Linux for Web Monitoring of PV-Diesel Hybrid System for Remote Area Power Supply (D4) 419
Boonyang Plangklang, University of Kassel, Germany

E - STANDARDISATION AND PERFORMANCE INDICATION

Assessment of Energy Capture from Small Wind Based Hybrid Power Systems (E1) 272
E. Ian Baring-Gould, National Renewable Energy Laboratory, Golden, Colorado, USA

F - SIMULATION

Photovoltaic Hybrid System Modelling at GENEC (F1) 431
Hervé Colin, GENEC, St. Paul Lez Durance, France

TRNSYS dynamic simulation of a stand alone hybrid wind-PV system powering a reverse osmosis desalination unit with hydraulic energy recovery (F2) 437
Essam Sh. Mohamed, Agricultural University of Athens, Greece

ALPIWATT 2.0: the innovative solution for the stand alone integrated energy system design (F3) 443
Stefano Bechis, Università degli Studi di Torino, Italy

Power Fluctuations in Micro-grids Introduced by Photovoltaics: Analysis and Solutions (F4) 449
Achim Woyte, Katholike Universiteit Leuven, Belgium

Design, Simulation and Economic Analysis of a Stand Alone Reverse Osmosis Desalination Unit Powered by Wind Turbines and Photovoltaics (F5) 288
Essam SH. Mohamed, Agricultural University of Athens, Greece