

## Laboratory Fact Sheet

### 1 Institution

<b>Name:</b>		Institut für Solare Energieversorgungstechnik, Verein an der Universität Kassel (ISET) e. V. Königstor 59, 34119 Kassel/Germany E-Mail: bereich-a@iset.uni-kassel.de <a href="http://www.iset.de">http://www.iset.de</a>
<b>Date of Fact Sheet:</b>	2006-11-28	

### 2 Classification

- independent
- accreditation according to IEC 17025
- long-time DG experience (more than 3 years)
- active in standardisation committees

### 3 Brief historical background

ISET was founded in 1988 as a non-profit organization in the form of a so-called "institute" associated with the University Kassel. Previous work performed by Prof. Dr. Kleinkauf in the Department of Electrical Engineering at the University of Kassel formed the starting point for this institute. With the construction of a new facility in 1990, the space prerequisites for successful research were created. Extensive lab and infrastructure equipment and furnishings, which have been continuously expanded and added to through numerous projects and various special investment programmes of the state of Hesse, ensure that the ISET is able to attract private-sector funding. At the suggestion and with the support of the state of Hesse, a second ISET location was founded in Hanau in 1995. The R&D Division of Biomass Energy established at Hanau has expanded ISET's activities and fields of research to date and rounds off the spectrum of renewable sources of energy dealt with by ISET with a particularly future-oriented field of activities. To supplement the existing labs and experimental facilities, the Design Centre for Modular Supply Technology (DeMoTec) was officially opened in 1998. On more than 600 m<sup>2</sup> of space, R&D work, in particular on the modularization and standardization of systems and components, is implemented in the demonstration and the experiments hall, together with

our industrial partners. Moreover, the latest technologies and future-oriented concepts related to environmentally friendly sources of energy are practically and vividly demonstrated using functional systems.

#### **4 Mission statement**

ISET is an applications-oriented research institute engaged in the design of electrical systems technology for the utilization of renewable sources of energy and for the decentralised power supply. We are committed to the sustainable use of energy and environment to preserve the natural basis of life. We develop efficient solutions, which are both innovative and can be implemented by our industrial and research partners. We support political institutions, government agencies and decision makers with goal-oriented information and useful concepts. We wish to reinforce our expertise in the exploration of renewable sources of energy through hard work and achievements. We dedicate ourselves to being responsible and committed collaborators with team spirit.

#### **5 Institution in brief**

##### **Associations**

ISET is member in the following organizations and associations:

- Anwendungsverbund Gebäudesystemtechnik (AGS), Kassel, Germany
- Bundesinitiative Bioenergie (BBE), Bonn, Germany
- Bundesverband Windenergie e.V. (BWE), Osnabrück, Germany
- Club zur ländlichen Elektrifizierung C.L.E., Freiburg, Germany
- Deutsche Gesellschaft für Sonnenenergie (DGS/ISES), Munich, Germany
- Deutsche Oracle Anwendergruppe e.V. (DOAG), Stuttgart, Germany
- Deutsche Lichttechnische Gesellschaft e.V. (LiTG), Berlin, Germany
- Energie 2000 (Energieagentur Landkreis Kassel), Wolfhagen, Germany
- European Academy of Wind Energy (EAWE), Kassel, Germany
- European Biomass Industry Association (EUBIA), Brussels, Belgium
- European EMTP - ATP Users Group e. V. (EEUG), Offenbach, Germany
- European Fuel Cell Group, Reeuwijk, The Netherlands
- European Installation Bus-Scientific Partnership Forum (EIBA), Brussels, Belgium
- European Power Electronics Association (EPE), Brussels, Belgium
- European Renewable Energy Centers Agency (EUREC Agency), Brussels, Belgium
- European Wind Energy Association (EWEA), Brussels, Belgium
- EUROSOLAR e. V., Bonn, Germany
- Fachverband BIOGAS e.V., Freising, Germany
- Fördergesellschaft Windenergie e.V. (FGW), Kiel, Germany
- Forschungsverbund EMV, Kassel, Germany

- Forschungsverbund Sonnenenergie, Berlin, Germany
- Forschungsverbund Fahrzeugsysteme, Kassel, Germany
- Forum für Zukunftsenergien e.V., Berlin, Germany
- Gesellschaft für Umweltsimulation e.V. (GUS), Pfinztal, Germany
- Interessengemeinschaft für den Einsatz von Batteriespeichern in elektrischen Netzen (IBN) e.V., Magdeburg, Germany
- Kompetenznetzwerk Dezentrale Energietechnologien Nordhessen e.V., Niestetal/Kassel, Germany
- Ost-West-Zentrum e.V., Kassel, Germany
- Technologieforum Nord- und Osthessen e.V., Kassel, Germany
- Verein der Förderer der TÜH Technischen Überwachung Hessen e.V., Darmstadt, Germany
- Weltweite Projekte der EXPO 2000 in Hessen und Pro Nordhessen e.V., Kassel, Germany

### Accreditations

EMC Laboratory accredited in accordance with IEC 17025.

### Number of staff

At the two locations of the institute in Kassel and Hanau some 125 people are engaged, denoting a capacity in human resources of about 95 full-time employees, some 75 are regularly employed staff.

### Main source of funding

In addition to a basic grant from the Hessian Ministry for Science and Art, approximately 80 % of the annual budget of about EUR 6 million (in addition to another EUR 3 million in transitory R&D funds for numerous project partners) is financed by third-party funding.

## 6 Brief summary of competences

<b>Institution: ISET</b>	
Description of competence	
Involvement in standardisation groups/committees	Yes - IEC, CENELEC, DKE (German national organization for standardization)
Certification expertise	EMC (electromagnetic compatibility) PV module testing PV inverter testing climate condition testing
Area of Scientific expertise	<ul style="list-style-type: none"> <li>- PV-inverter research, development and testing</li> <li>- Safety of operation of DG (islanding, detection, disconnection, fault currents,...)</li> <li>- DG integration</li> <li>- Active management of distribution systems</li> </ul>

<b>Institution: ISET</b>	
Description of competence	
	<ul style="list-style-type: none"> <li>- Hybrid and mini grids</li> <li>- Wind power forecast</li> <li>- Intermittency and storage</li> <li>- Power system analysis and economics</li> </ul>
Involvement in consultancy (e.g. for industry and government)	Yes (government and industry)
DG reference project list	<p>European projects:</p> <ul style="list-style-type: none"> <li>- DERlab (coordination)</li> <li>- Fenix</li> <li>- More Microgrids</li> <li>- DISPOWER (coordination)</li> <li>- IRED (coordination)</li> <li>- MicroGrids</li> <li>- DGfacts</li> <li>- Dgnet</li> </ul> <p>National projects:</p> <ul style="list-style-type: none"> <li>- SIDENA (coordination)</li> <li>- DINAR (coordination)</li> <li>- Modulare Systemtechnik (coordination)</li> </ul>
List of recent publications (say last 3 - 5 years)	<p>Selected publications in 2005:</p> <ul style="list-style-type: none"> <li>- J. Bard: Development of Wind Energy and Photovoltaic in Germany and its Integration into the National Grid. In: Advances in Renewable Energy Technologies in Germany, seminar organised by VTD, JGSEE and KMUTT, Goethe Institute Bangkok, Thailand, February 2005</li> <li>- A. Engler: Design and Testing of Microgrids. Eltra Cell Controller Project Workshop 2, Billund, Denmark, February 2005</li> <li>- C. Ensslin: Experience with Wind Power Integration in Germany. 2<sup>ème</sup> Rencontre Maroco-Allemande sur les Energies Renouvelables, Casablanca, Morocco, April 2005</li> <li>- B. Krautkremer, J. Müller : Results of the state founded project « Biogas Powered Micro-gas-turbine ». 14<sup>th</sup> European Biomass Conference, Paris, France, October 2005</li> <li>- J. Schmid: Power networks: The development and improvement of</li> </ul>

<b>Institution: ISET</b>	
Description of competence	
	<p>power transmission and distribution networks to accommodate new distributed generation sources and allow the intelligent management of networks. International Workshop G8 Initiative Oxford, UK, May 2005</p> <ul style="list-style-type: none"> <li>- J. Schmid: Ways to handle the integration of RE power into the grid. 2<sup>nd</sup> Workshop of the International Feed-in Cooperation, BMU, Berlin, Germany, December 2005</li> <li>- M. Braun, T. Degner: Development, Verification and Application of a Battery Inverter Model for the Network Analysis Tool Powerfactory. International Journal of Distributed Energy Resources, Volume 1 No. 4, pp. 321-333, October – December 2005</li> <li>- A. Engler: Applicability of Droops in Low Voltage Grids. International Journal of Distributed Energy Resources, Volume 1 No. 1, pp. 3-15, January 2005</li> <li>- D. Nestle, C. Bendel: Decentralized Electrical Power Generation in the Low Voltage Grid – Development of a Technical and Economical Integration Strategy. International Journal of Distributed Energy Resources, Volume 1 No. 1, pp. 63-70, January 2005</li> <li>- A. Badelin, T. Degner, R. Belhomme, E. Navarro, G. Arnold: Case Studies on the Integration of Renewable Energy Sources into Power Systems. 10<sup>th</sup> Kasseler Symposium Energie-Systemtechnik, Kassel, Germany, November 2005</li> <li>- J. Bard: Electrical Equipment for Small Hydropower Plants – Generators with Permanent Magnet Excitation. 5<sup>th</sup> Thematic Network on Small Hydropower Workshop, Lausanne, Switzerland, June 2005</li> <li>- J. Bard, J. Schmid, P. Caselitz, J. Giebhardt: Electrical engineering aspects of ocean energy converters. 6<sup>th</sup> European Wave and Tidal Energy Conference, Glasgow, UK,</li> </ul>

<b>Institution: ISET</b>	
<b>Description of competence</b>	
	<p>September 2005</p> <ul style="list-style-type: none"> <li>- T. Degner, A. Engler, O. Osika: Modelling of Distributed Energy Resources with ATP-EMTP. EEUG Meeting 2005, European EMTP-ATP Conference, Warsaw, Poland, September 2005</li> <li>- A. Engler, J. Schmid: Inverter Dominated Grid. EXPO World Conference on Wind Energy, Renewable Energy, Fuel Cell &amp; Exhibition, Hamamatsu, Japan, June 2005</li> <li>- A. Engler, J. Oyarzabal, J. Jimeno, J. Ruela, C. Hardt: Agent based Micro Grid Management System. International Conference on Future Power Systems, Amsterdam, The Netherlands, November 2005</li> <li>- A. Engler: DER Distribution Grid – Laboratory Demonstration. 10<sup>th</sup> Kasseler Symposium Energie-Systemtechnik, Kassel, Germany, November 2005</li> <li>- A. Engler, N. Soultanis: Droop Control in LV-Grids. International Conference on Future Power Systems, Amsterdam, The Netherlands, November 2005</li> <li>- C. Ensslin: Integration of Wind Power into Grid Operation – Advanced Prediction Tools and Operator Training. 10<sup>th</sup> Kasseler Symposium Energie-Systemtechnik, Kassel, Germany, November 2005</li> <li>- D. Nestle, C. Bendel: Bidirectional energy management interface (BEMI) for technical and economical integration of DER in the low voltage grid – common technical and legal interface for energy management. 20<sup>th</sup> European Photovoltaic Solar Energy Conference and Exhibition, Barcelona, Spain, June 2005</li> <li>- J. Schmid: The future of DER in Europe, USA and Japan. Energy Demand Management and Renewable Energies Union Fenosa, Madrid, Distributed Energy Resources Workshop, Madrid, Spain,</li> </ul>

<b>Institution: ISET</b>	
Description of competence	
	<p>April 2005</p> <ul style="list-style-type: none"> <li>- J. Schmid: Visions of the Future Electricity Supply Structure – How Liberalisation, Increased Share of Renewable Energies, Decentralised Generation and ICT will change Electricity Systems. IRED round table at the CIGRE Symposium, Athens, Greece, April 2005</li> </ul> <p>More publications can be found on <a href="http://www.iset.de">http://www.iset.de</a></p>

## 7 Laboratory facilities

<b>Facilities</b>	<b>Capabilities</b>
EMC lab	<ul style="list-style-type: none"> <li>- EMC immunity and emission tests for small appliances and generators</li> </ul>
Inverter test lab	<ul style="list-style-type: none"> <li>- parallel operation of up to 22 inverters, loads and cogeneration plant or other generators may also be included</li> <li>- power efficiency test</li> <li>- islanding detection tests (resonant circuit and impedance measurement test circuit)</li> </ul>
PV-module test field	<ul style="list-style-type: none"> <li>- Facilities for detailed long-term performance recording available. See also <a href="http://www.pvtestlab.de">www.pvtestlab.de</a></li> </ul>
Climatic chamber	<ul style="list-style-type: none"> <li>- different sizes and temperature ranges available</li> </ul>
Hybrid and mini-grid system test field (PV / Diesel / Battery / Wind simulator)	<ul style="list-style-type: none"> <li>- As part of ISETs Demotec different hybrid system and mini-grid configurations in the power range up to 100 kW can be realised and investigated. Elements for hardware simulation of LV and MV networks are available.</li> </ul>
Power electronics facilities	<ul style="list-style-type: none"> <li>- rapid prototyping system</li> <li>- EMC scanner</li> <li>- Thermographic camera</li> </ul>
Simulation	<ul style="list-style-type: none"> <li>- alternative power library for SIMPLORER (developed at ISET)</li> <li>- network analysis tools: Powerfactory, Simcal, ATP-EMTP</li> </ul>

## 8 Standardisation activities

- P. Funtan, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, Komitee K373 „Photovoltaische Systeme“
- P. Funtan, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, AK411 2.3 „Solarleitungen“

- J. Giebhardt, F. Schlögl, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, Arbeitskreis K383.0.1 „Kommunikation für Windenergieanlagen“
- B. Hahn, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, Arbeitskreis K383 „Windenergieanlagen“
- J. Kirchhof, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, Arbeitskreis K767.4.4 „EMV-TEM Wellenleiter“
- P. Strauß, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, Komitee K261 „Systemaspekte der elektrischen Energieversorgung“
- P. Strauß, IEC - International Electrotechnical Commission, German Delegation IEC-TC 8 “System Aspects for Electrical Energy Supply”
- P. Strauß, CENELEC - European Committee for Electrotechnical Standardization, German Delegation CLC-TC 8.X “System Aspects for Electrical Energy Supply”
- P. Strauß, IEC - International Electrotechnical Commission, German Delegation IEC-JCG TC21, TC82, TC88 “Rural Electrification”
- M. Viotto, DKE - Deutsche Kommission Elektrotechnik, Elektronik Informationstechnik, Leitung Arbeitskreis K373.0.9 „Bidirektionale Netzsicherheitsschnittstelle“
- M. Viotto, CENELEC - European Committee for Electrotechnical Standardization, Leader of CLC/TC82/WG2 “Inverter”
- M. Durstewitz, IEA Implementing Agreement on Wind Energy Research and Development, Annex XIX – Wind Energy in Cold Climates
- J. Giebhardt, VDI/NALS Richtlinienausschuss A 323 / C 23 zur Erstellung der VDI-Richtlinie 3834 „Messung und Beurteilung mechanischer Schwingungen von Generatoren und Getrieben in Windenergieanlagen“
- B. Hahn, FGW-Fachausschuss „Leistungskennlinie“
- B. Hahn, FGW-Fachausschuss „Instandhaltung“
- G. Klein, VDI-Richtlinienausschuss VDI 4655 „Typische Lastprofile für Ein- u. Mehrfamilienhäuser für den Einsatz von KWK-Anlagen“
- K. Rohrig, Deutsches Komitee der CIGRE beim VDE – deutscher Arbeitskreis zum Studienkomitee C 6 „Distributed Systems and Dispersed Generation“

## 9 Testing activities

- EMC tests
- PV outdoor tests
- Inverter tests
- Battery tests
- Thermo graphical tests
- Tests with microturbines
- Tests with CHP units
- Tests with microgrids
- DG integration tests