Awarded project in alphabetical order
New INDIGO, NPP Call on Energy (« smart grids » and « new energy material »)
January 2014

The final funding decision on New INDIGO call on Energy 2013 was taken on 16 January 2014. 7 collaborative research projects with 3 year duration have been selected for funding, out of the 53 proposals submitted.

The list of the funded projects, as well as the partners involved can be found below.

For further information, you may contact the Call Secretariat at: Doerte.Merk@dlr.de

Bio-e-MAT

Low-Cost and Efficient MFC Materials for Bioelectricity Production from Waste Materials

Project coordinators:

- Tampere University of Technology (TUT), Department of Chemistry and Bioengineering, Tampere, Finland
- Council of Scientific & Industrial Research (CSIR), Indian Institute of Chemical Technology, Hyderabad, India

Project partners:

- Indian Institute of Technology Guwahati (IITG), Department of Chemical Engineering, Guwahati, India
- Yildiz Technical University (YTU), Department of Environmental Engineering, Istanbul, Turkey

The main aim of the project is to design a novel MFC with low-cost and efficient electrode and separator materials that can be used for biological electricity generation from waste streams. Electricity production with microbial fuel cells is a novel energy production technology that has not reached full scale application yet. Development of low-cost and efficient MFC materials and a novel MFC design will be a large step in biological electricity production towards industrial application. The use of organic waste materials for energy recovery contributes also to waste management. The consortium will join their expertise in material science, electrochemistry, process technology, waste water treatment, bioengineering, bioenergy production and biotechnology to meet the project objectives. The research aims at 1) developing low-cost and efficient electrode and membrane materials for electricity production in MFCs, 2) developing a novel MFC design, 3) testing the biocompatibility of the electrode materials by enriching and managing open exoelectrogenic cultures from environmental samples, and 4) optimizing electricity production from different waste materials and studying the suitability of the new MFC materials with different waste streams. The research project Low-Cost and Efficient MFC Materials for Bioelectricity Production from Waste Materials (Bio-e-MAT) will be done in collaboration with an interdisciplinary research team consisting of two Indian and two European partners.

INOTES

Innovative Thermal Energy Storage Systems

Project coordinators:

- Hochschule Bremerhaven (HS-BHV) - Institut for Process Engineering, Bremerhaven, Germany
- Indian Institute of Technology Kanpur (IITK) - Department of Mechanical Engineering, Kanpur, India

Project partners:

- Gaziosmanpasha University (GU) - Department of Chemistry, Tokat- Turkey

On one hand, the use of fossil energy has to be reduced due to its negative impact on climate change caused by the related emission of greenhouse gases. On the other hand, there is an increasing demand of energy worldwide. Renewable energy sources as well as efficient use of primary energy are the current needs to solve these challenges. Sustainable thermal energy storage for industrial waste heat and heat from renewable sources is not available today, either due to technical, environmental or economic reasons.

In this regard, the latent heat thermal energy systems using phase change material (PCM) for thermal energy storage (TES) and its transport is quite attractive. Energy is stored as a combination of sensible and latent heat. During the phase change between solid and liquid thermal energy is absorbed or released almost at a constant temperature which provides the unique capability to control temperature during the process of thermal energy storage. Organic and inorganic compounds are the two most common groups of PCMs. Most organic PCMs are non-corrosive and chemically stable, exhibit little or no subcooling, are compatible with building materials, have a high latent heat per unit weight and low vapour pressure. Their disadvantages are low thermal conductivity, high changes in volume on phase change and ﬂammability. Inorganic PCMs, on the other hand, have a high latent heat per unit volume and high thermal conductivity, are non-ﬂammable and are very cheap. However, they are corrosive to most metals and suffer from decomposition and subcooling, which can influence their phase change properties. The applications of inorganic PCMs require the use of nucleating and thickening agents to minimize subcooling and phase segregation. In spite of its several advantages and potential, inorganic PCMs are yet to be commercialized in a significant way, primarily because of the lack of scientific understanding about the efficiency of these materials which is strongly governed by the phase change phenomenon (melting/solidification).

The goal of this project is to fill these knowledge gaps, and to develop and characterize advanced inorganic PCMs.

InSOL

Innovative Material Systems for Solar Energy Harvesting in Photoelectrochemical Cells

Project coordinators:
- Albert-Ludwigs-Universität Freiburg (FMF) - Freiburg Materials Research Center FMF, Freiburg, Germany
- Indian Institute of Technology Delhi, Physics Department, New Delhi, India

Project partners:
- Universiteit Antwerpen (EMAT) - Electron Microscopy for Materials Science EMAT, Antwerp, Belgium
- Max Planck Institute for Polymer Research (MPIP) - Max Planck Institute for Polymer Research, Mainz, Germany

The InSOL project combines theoretical and experimental investigations for the development of new earth-abundant material heterostructures for direct conversion of solar energy to hydrogen fuel through photoelectrochemical (PEC) cells.

The generation of hydrogen from renewable energies is globally considered as a major step towards the transformation of our economies based on fossil fuels to carbon free economies. In comparison with other renewable energy conversion technologies such as photovoltaics or wind power, hydrogen has the great advantage of being a storable fuel with high energy density and hence meets the demand of a constantly available energy source.

NANOMFC

MULTI-FUNCTIONAL NANOCOMPOSITE MATERIALS FOR LOW-TEMPERATURE CERAMIC FUEL CELLS

Project coordinators:
- Aalto University, Aalto University School of Science- Department of applied physics, Altoo, Finland
- Indian Institute of Technology Delhi (IIT- Delhi) - Department of Chemical Engineering, New Delhi, India

Project partners:
- Universidade de Aveiro (UAVR) - Materials and Ceramic Engineering Dept./CICECO, Aveiro, Portugal
- Vestel Savunma Sanayi A.S. (VSS) – Commercial sector, Ankara, Turkey
- Universitetet i Oslo (UiO) - Department of Chemistry, Solid State Electrochemistry (FASE), Oslo, Norway
- Central Glass and Ceramic Research Institute (CGCRI)- Fuel Cell and Battery Division, Kolkata, India

This proposal deals with a new highly potential fuel cell technology, low-temperature solid oxide fuel cell (LT-SOFC) or so-called ceramic fuel cell (CFC) working at 300-600 deg-C operating on hydrogen and renewable energy fuels. The ceramic fuel cell is based on multi-functional nanocomposite materials which enable to reach a high power density. This fuel cell type imposes still major scientific challenges such as understanding properly the working principle, stability, and material and cell optimizations, among others.

The aim of the project is to provide a world-class fuel cell through combining high-level research expertise and multidisciplinary know-how from leading research groups in EU and India. The project is highly innovative and includes risky research going beyond present state-of-the art in the field. To achieve the aim, three major objectives have been set: 1) through science and technology, solve the scientific basis of multi-functional nanocomposites, developing durable materials, standardizing laboratory measurements practices, and building a 25W test cells, 2) through cooperative models increase the impact and international visibility of research in the fields both in Europe and India; 3) through research training and exchange, educate talented young researchers in leading-edge research in LTCFC technologies and provide international perspectives and, strong networking skills.

PVMARS

Copper Zinc Tin Sulphide (CZTS) absorber material prepared by Modified Activated Reactive Sputtering (MARS) technique for high efficiency thin film solar cells

Project coordinators:

- Indian Institute of technology Madras (IITM) - Department of Physics, Chennai, India
- Institute for Energy Technology (IFE) - Department for Solar Energy, Kjeller, Norway

Project partners:

- Indian Institute of technology Madras (IITM) - Department of Physics, Chennai, India
- Vellore Institute of technology (VIT) Vellore - School of Advanced Science, Vellore, India
- Istanbul Technical University, Energy Institute (ITU) - Energy Institute, Istanbul, Turkey

Copper Zinc Tin Sulphide (CZTS) is a potential photovoltaic material which is addressing both the technical advantages and cost factors. The solar cell stack is : Soda lime glass / Molybdenum (Mo) 500- 700 nm by Sputtering / p-CZTS (1- 2 micro meters) /n- CdS (chemical bath deposition) /i-ZnO (50-90 nm by sputtering) /Al:ZnO (500-1000 nm by sputtering). Of the several technical challenges, the most important ones being addressed here:

a) Obtaining desired phase and stoichiometry for optimized optical and electrical properties. The growth technique should be industrially viable (either for a large area production or for a quick batch production).

b) Surface of CZTS should be as smooth as possible for a good hetero-junction between p-CZTS and n-CdS

c) The top transparent electrical contact (TCO) should be ohmic

d) A good modelling of the entire device to guide the growth process and growth parameters

The project will focus on these four points.

Stabiliz-E

Stabiliz-Energy

Project coordinators:

- fortiss GmbH (fortis) - Software and Systems Engineering, Munich, Germany
- Amrita Vishwa Vidyapeetham (Amrita) - Center for Wireless Networks and Applications, Kerala, India

Project Partners:

- Evoleo Technologies, Lda., (Evoleo) - Research and Development Department, Maia, Portugal
- VTT Technical Research Centre of Finland (VTT) - Energy Systems Communication Networks, Tampere, Finland
- Indian Institute of Technology Kanpur (IIT- Kanpur) - Electrical Engineering, Kanpur, India

Today, energy production and distribution undergoes a change of paradigm comparable to the change from line-based to package-based communication in information and communication technology (ICT). There is an immense need to move from traditional, centralized, static energy grid towards a decentralized and dynamic grid, which gives more freedom to producers, distributers, and consumers.
While the European continent faces the challenges of improving stability and reliability of excessive green energy in the network, Indian infrastructure deals with inadequate or lack of electricity. Given the diverse nature of power grids in EU and the Indian sub-continent, renewable integration and enhancing the availability of the network is the most pressing issue for both sides.
Stabiliz-E focuses on self-stabilization in terms of “availability” and “Quality of Service” which is considered as stable Energy. ICT empowers power grids with capability of real-time information and two-way energy flow.
The actual key clear goals of Stabiliz-E project:

1. Design and implement low cost real-time monitoring and control devices to be deployed in remote and cost dependent regions
2. Devise and deploy over the low cost infrastructure, automatic methodologies to analyze, decide and reconfigure in near real time the network.

WISC

Window Integrated Solar Collector

Project coordinators:

- Institute of Photonic Technology (IPHT) - Dep. of Nanobiophotonics, Jena, Germany
- Indian Institute of Technology Delhi (IIT- Delhi) - Centre for Energy Studies, New Delhi, India

Project partners:

- University of Jyväskylä (JYU) - Dep. of Physics/ Nanoscience Center, Jyväskylä, Finland

- Norwegian University of Science and Technology Organisation (NTNU) - Department of Electronics and Telecommunications

Today's trend of increasing window areas especially in public and office buildings results in the problem of excess heat collection inside (greenhouse effect), which leads to higher energy consumption in air conditioning and thus for higher costs. All attempts so far to address this problem have been connected with shrinking of window areas or have involved some other reasons to reduce the overall illumination through the windows, for example via dark tint of the glass. Thus, these solutions always reduce also the natural illumination and lightning, which is most of the time a highly desired property, and the main reason for the increased window area. The most modern state-of-the-art techniques involve wavelength selective transparency, which has been used to somewhat prevent the long wavelengths, i.e. the heat radiation (IR part), to penetrate the window. However, even this helps for the excess heating, all this radiation will be reflected back to outdoor and its energy lost. At the same time, as the preventing of the global warming yields pressure to reduce the total energy consumption it also demands to invest more and to increase the efficiency of renewable energy sources. From these the most obvious and widely utilized is the solar energy, whose global energy market has been vastly increasing during recent years.
Most of the sun's radiation energy is located exactly on the IR part of the spectrum.

To answer both of the above demands, i.e., to reduce the energy consumption of the buildings via reduced air condition needed, and at the same time to increase the amount of solar energy collected, the project proposes a novel principle of separating the heat (IR part) from the visible light and use it for energy generation, without scarifying parts of the window areas or otherwise reduce the visible illumination.