Outstanding Environmental Research

Annual Conference of the KIT Climate and Environment Center on July 16, 2015 – Sparkasse Environmental Awards Ceremony – Keynote Speech about Remote Sensing of the Atmosphere

Facility to study evaporation in solar-operated desalination plants. (Photo: Jana Stengler)

During the annual conference of the KIT Climate and Environment Center, three young scientists of KIT will be handed over the Sparkassen-Umwelt-Preis (Sparkasse Environmental Award) by Karlsruhe Institute of Technology (KIT) and the Environmental Foundation of the Sparkasse Karlsruhe Ettlingen. Jana Stengler studied a solar-operated desalination plant for drinking water production. Dr. Daniel Kampa investigated the filtration of oil mist during pressurized air generation. Dr. Heidi U. Heinrichs analyzed the long-term impacts of electric mobility. Representatives of the media and the interested public are cordially invited to attend the conference on July 16, 16.30 hrs, at the Tulla lecture hall on KIT Campus South.

The 2014 Sparkasse Environmental Award in the total amount of EUR 15,000 is to acknowledge outstanding doctoral, diploma, and master's theses or academic projects relating to environmental research. The departments of KIT are requested to propose candi-

KIT Climate and Environment Center: For an environment worth living in

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dates. For the year 2014, the award is granted to one diploma thesis and two doctoral theses. In addition, recognition awards are granted to two master's theses. The three winners will present their work at the annual conference of the KIT Climate and Environment Center.

Jana Stengler receives the Sparkasse Environmental Award for her doctoral thesis "Studies for the conception and design of a flash evaporator for a low-temperature solar power plant" written at the Institute for Technical Thermodynamics and Refrigeration (ITTK) of KIT. She studied a concept of a solar-operated desalination facility that produces drinking water as well as electric power, such that it can be run autonomously. So far, desalination facilities operated in extremely dry, but oil-rich regions, such as Saudi-Arabia, have produced drinking water from seawater with a high consumption of fossil fuels. An alternative concept for drinking water production consists in flash evaporation of seawater by a solarthermal process. The solar-operated desalination facility studied by Jana Stengler can be run in a decentralized manner with a flexible capacity and meets drinking water needs also in countries with a bad infrastructure, e.g. in settlements. For this, only small investments are required. Within the framework of her diploma thesis, Jana Stengler designed an experimental-scale test facility, built it, and commissioned it to study a novel evaporator geometry. Work focused in particular on processes of droplet formation and separation during flash evaporation of water. The experiments revealed the suitability of the evaporator geometry developed. From the measurement results, Jana Stengler derived rules for scaling up the evaporator geometry to commercial desalination plants. A pilot plant demonstrating the feasibility of the concept will be taken into operation in Bad Salzuflen, North Rhine-Westphalia, in August 2015.

The excellent doctoral thesis written by Dr. Daniel Kampa at the KIT Institute for Mechanical Process Engineering (MVM) focused on the "Filtration of oil mist". His work was aimed at identifying potentials of reducing energy consumption when producing pressurized air. Global energy consumption is closely associated with the production of greenhouse gases, such as carbon dioxide (CO_2) that is deemed to be the cause of anthropogenic climate change and disturbance of the ecological equilibrium. The share of industry in worldwide energy consumption is 46%. Of these, 10% are used for the generation of pressurized air. In most cases, pressurized air is produced with oil-lubricated screw compressors. For cooling, oil is injected into the screws compressing the air. Due to the rotation of the screws, this oil is dispersed in the form of finest droplets. These oil droplets are mostly removed from pressurized air by a multi-stage filter system. If

pressure loss of the filters with the required separation efficiency would be reduced by 20%, the amount of energy saved in Germany alone would correspond to the energy consumed by a small city. To reduce pressure loss, Daniel Kampa developed a mechanistic model for the prediction of pressure loss. Using this model, he explained pressure loss by transport phenomena. His findings may be used by filter manufacturers for optimizing pressure loss.

An “Analysis of long-term impacts of electric mobility on the German energy system in the European energy grid” was made by Dr. Heidi U. Heinrichs within the framework of her doctoral thesis. Increase in electric vehicles results in a flexible demand for electricity and their potential use as energy storage systems, both of which are new challenges in the long-term planning of the energy system. When planning the power plant resources and their extension in particular, long-term impacts on the energy system have to be taken into account. Heidi U. Heinrichs developed an instrument to analyze these long-term impacts. The instrument combines three models: Two energy system models for the integrated analysis of development of the European internal energy market and the extension of decentralized electricity production in Germany as well as one electric mobility model. In this way, she succeeded in studying the interactions between electric mobility and the energy system in an integrated manner. In the long-term analysis, the instrument revealed that load shifting will gain importance with increasing electric mobility and plug-in hybrids. This will facilitate integration of renewable energies and reduce costs. At the same time, reduced CO_2 emissions of electric vehicles will improve the environmental compatibility of the transport sector. Heidi U. Heinrichs concludes that electric vehicles and their load shift potential represent one of the key technologies for CO_2 reduction in the transport sector.

The recognition awards of KIT and the Environmental Foundation of the Sparkasse Karlsruhe go to Marion Heublein for her thesis “Towards a rigorous fusion of GNSS and InSAR observation for the purpose of water vapor retrieval”. It deals with atmospheric water vapor modeling and was written at the Institute of Photogrammetry and Remote Sensing (IPF). The other winner is Eva Dreger for her thesis “Fluorescence spectroscopy of the formation of organic substances during autotrophic nitrogen conversion” written at the Engler-Bunte Institute, Division of Water Chemistry and Water Technology.

At the annual conference, the scientific spokesperson of the KIT Climate and Environment Center, Professor Frank Schilling, will report about current developments and research activities. The key-

note speech will be made by Professor Johannes Orphal, Head of the Institute of Meteorology and Climate Research – Atmospheric Trace Gases and Remote Sensing (IMK-ASF) on “Vom Wetter zum Klima: Fernerkundung der Atmosphäre” (From the weather to the climate: Remote sensing of the atmosphere). On the occasion of the conference, the graduates of the GRACE graduate school will be handed over their certificates. A poster exhibition will cover the doctoral theses written at GRACE. Here, the KIT Climate and Environment Center, together with the University of Darmstadt and the ESADE Business School, Barcelona, conveys specific and interdisciplinary knowledge as well as key qualifications to doctoral students to prepare them for a career in science or industry or at their own company.

Program of the 2015 Annual Conference of the KIT Climate and Environment Center (in German only)

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More about KIT Climate and Environment Center: http://www.klima-umwelt.kit.edu/english.

Karlsruhe Institute of Technology (KIT) is a public corporation pursuing the tasks of a Baden-Wuerttemberg state university and of a national research center of the Helmholtz Association. The KIT mission combines the three core tasks of research, higher education, and innovation. With about 9,400 employees and 24,500 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.

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