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Industry-scale harvesting and re-use of low grade heat enabled by microtechnology

Sebastian Gerke
IBM Research - Zurich, Switzerland

In 2015, participants of the 'United Nations Framework Convention on Climate Change, 21st Conference of the Parties' in Paris decided to limit the rise in global temperatures by 2100 due to global warming to under 2°C. The participating countries have agreed that one of the main means to achieve this objective is to lower the global output of the greenhouse-gas CO_2. In addition, several nations have decided to make the change without using fission energy. Achieving both these goals is a big challenge for the future. Nowadays about 75% of our primary energy is wasted in unusable heat. This is primarily caused by inefficiencies in the existing energy generation and consumption. To contribute to improved efficiency of energy use we have introduced several technologies. A high concentrator photovoltaic thermal system produces electrical as well as thermal energy with a system efficiency of ~80%. Integration of MEMS based liquid cooling technology directly into the carrier of multi-junction solar cells, allows a concentration in the focus of up to 2000 suns. Therefore, a single hybrid system with a 40 m^2 parabolic dish is able to generate of up to 12 kW of electrical power and 20 kW of thermal power. A similar approach of re-use of energy can be employed to improve the efficiency as well as ecological impact of electrical consumers. For instance, today more than 120 TWh of electrical energy is used to operate the data centers around the world, which constitute the backbone of our service economy. A chip integrated hot water cooling allows to redirect three-quarters of this energy. This is environmentally friendly, lowers overall operating costs and enables new business models. Both waste heat from solar systems and data centers can be used to drive adsorption heat pumps and thus convert waste heat into cooling when needed.

Biography

Sebastian Gerke studied Electrical Engineering and Mechatronics. He worked for several years in the field of Novel Generator Technologies and Energy Efficient Embedded Systems. After his PhD with a topic in Material Research for Photovoltaic, he joined the Smart System Integration group of IBM Reserach in Zurich.

sge@zurich.ibm.com

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