Next Generation Solar Cells

2017 EU-US Frontiers of Engineering Symposium
US National Academy of Engineering
European Council of Applied Sciences, Technologies, and Engineering

Session Co-Organizers

Marko Topic
University of Ljubljana, Slovenia

Hugh Hillhouse
University of Washington, U.S.A
Ultimate Theoretical Efficiency of Solar Energy Conversion

Carnot Limit
\[ \eta = 95.0\% \]

Heat Source
\[ T_H = 5760 \text{ K} \]

Heat Sink
\[ T_C = 288 \text{ K} \]

Solar Thermal Limit,
\[ \eta = 85.4\% \]

Solar Cell Limit,
\[ \eta = 86.8\% \]

Typical Panel,
\[ \eta \approx 17\% \]
What is a Solar Cell?

Semiconductor

Sunlight

Electron Selective Contact

“Conduction” Energy Band

e-

Hole Selective Contact

“Valence” Energy Band

h+

Electrons
Current World Primary Energy Usage ~18 TW
86,000 TW of Sunlight Reaches the Earth’s Surface

In less than two hours, enough solar energy strikes the earth’s surface to meet the world’s energy needs for an entire year
Speakers

Dirk Weiss (First Solar, USA)
Bernd Rech (Helmholtz Center, Germany)
Joey Luther (NREL, USA)
Stephan Buecheler (EMPA, Switzerland)