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No Photon Left Behind: Advanced Optics at ARPA-E for Buildings and Solar Energy

HOWARD M. BRANZ, Program Director, Advanced Research Projects Agency - Energy (ARPA-E), USDoE

Key technology challenges in building efficiency and solar energy utilization require transformational optics, plasmonics and photonics technologies. We describe advanced optical technologies funded by the Advanced Research Projects Agency - Energy. Buildings technologies include a passive daytime photonic cooler, infra-red computer vision mapping for energy audit, and dual-band electrochromic windows based on plasmonic absorption. Solar technologies include novel hybrid energy converters that combine high-efficiency photovoltaics with concentrating solar thermal collection and storage. Because the marginal cost of thermal energy storage is low, these systems enable generation of inexpensive and dispatchable solar energy that can be deployed when the sun doesn't shine. The solar technologies under development include nanoparticle plasmonic spectrum splitting, Rugate filter interference structures and photovoltaic cells that can operate efficiently at over 400°C.