LUMINESCENCE solar power

LUMINESCENT SOLAR POWER FOR LOW COST BASE LOAD SOLAR ENERGY GENERATION

The challenge in solar energy today is not the cost of photovoltaics (PVs) electricity generation, already competing with fossil fuel prices, but rather utility-scale energy storage costs. Alternatively, low cost thermal energy storage (TES) exists, but relies on expensive concentrated solar power (CSP). A technology able to unified PV conversion with TES may usher in the era of efficient base-load renewable power plants.

Conceptually, if PVs efficiency would tolerate high temperatures, for example, 600C, it would be beneficiary to concentrate solar radiation onto PVs, harvesting the available free energy, while in parallel harvesting the high-quality thermal energy through CSP. **Doubling the conversion efficiency this way cannot be done with PVs as their efficiency decreases sharply with temperature, but can be done optically**. In this talk I will present a new concept named luminescence solar power (LSP), where solar radiation is focused onto a photoluminescence (PL) absorber that absorbs the light, take the heat and emit "cold" radiation towered a PV. The emission has a narrow line shape that matches the band-edge absorption of a dual-junction PVs, which offers concentrated-PV above 35% efficiency with minimal heating of the PV. The heat remains at the PL-absorber at 600C, collected by heat transfer fluid (HTF) and converted to electricity at 40% turbine efficiency. Such an idea of using PL to separate free-energy (electricity) and high temperature heat has never been explored before, even though each component of the system, namely the CSP, PVs and the PL-absorber relay on mature technologies. A detailed analysis based on experimental validation of the concept in the lab shows that practical LSP efficiency may reach 32%, far exceeding conventional side-by-side PV/CSP efficiency, and leading to potential reduction of solar energy storage levelized cost of electricity (LCOE) to below ¢3/kWh. According to SunShot estimations, baseload solution at 3 ¢/kWh will allow solar energy portion to reach 50% of the entire EU production.