

Abstract. The capture and storage of solar energy at the individual level – personalized solar energy – drives inextricably towards the heart of this energy challenge by addressing the triumvirate of secure, carbon neutral and plentiful energy. Because energy use scales with wealth, point-of-use solar energy will put individuals, in the smallest village in the non-legacy world and in the largest city of the legacy world, on a more level playing field. Moreover, personalized energy (PE) is secure because it is highly distributed and the individual controls the energy on which she/he lives. Finally, the doubling of global energy need by mid-century and tripling by 2100 is driven by 3 billion low-energy users in the non-legacy world and by 3 billion people yet to inhabit the planet over the next half century. The possibility of generating terawatts of carbon-free energy, and thus providing society with its most direct path to realizing a low GHG future, may be realized by making solar PE available to the 6 billion new energy users by high throughput manufacturing. Notwithstanding, current options to harness and store solar energy at the individual level are too expensive to be implemented, especially in a non-legacy world. The imperative to science is to develop new materials, reactions and processes that enable personalized solar energy to be sufficiently inexpensive to penetrate global energy markets and especially the non-legacy world.

Personalized energy at low cost presents new basic research targets. Because personalized energy will be possible only if solar energy is a 24/7 available supply, the key enabler for personalized energy is inexpensive storage. Studies in the Nocera group have led to the creation of a new catalyst that captures many of the functional elements of photosynthesis and in doing so provides a highly manufacturable and inexpensive method to effect a carbon-neutral and sustainable method for solar storage – solar fuels from water-splitting. By developing an inexpensive 24/7 solar energy system for the individual, a carbon-neutral energy supply for 1×6 billion becomes available.