Photovoltaic Nanocrystal Energy Generation (Proposal)

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Involvement of different engineering disciplines

Photovoltaic technologies can be found heavily intertwined with electrical and mechanical engineering disciplines alike. In our particular case, chemical engineering will also be incorporated due to the fact that photovoltaic cells are to be liquidized into organic, plasmonic, liquids which house ionic structures such as ligands. The architecture of such compounds heavily relies on chemical engineering principles associated with organic chemistry such as fluid flow and process design. Meanwhile, the involvement of mechanical engineering principals such as modeling, dynamics and energy conservation is urgently needed. On the other hand how to design, install and maintain photosensitive materials in order to generate energy falls under a major branch of electrical engineering called power engineering, one that is concerned with the generation, conduction, dissemination and utilization of electric power. In short, the design and installation of photovoltaic nanocrystals will be heavily associated with electrical power engineering; how to synthesize plasmonic and organic liquids out of raw elements will hinge on the involvement of chemical engineering and finally how to store the energy generated by nanocrystals relies on the ability of mechanical engineers to develop systems able to store the energy produced for later use.

Situation/Context

Photovoltaic technologies consist of systems that integrate piezoelectric or light sensitive materials in order to generate electrical energy. A cornerstone on which the success of such technologies hinges on is the fact that they use a source that is in infinite abundance to generate energy, that being light. It does so with almost no detrimental environmental impact. However, an impediment towards implementing photovoltaics on a large-scale is cost which needs to be deflated for it to be a viable energy source [1]. A novel proposal aimed at addressing this issue is plasmonic photovoltaic nanocrystals; a new generation of photovoltaic cells which can be produced in a liquid form and thus greatly increasing applications while simultaneously lowering cost [2].

Identification of Problems

Some aspects of photovoltaic technologies are associated with a long list of grievances, a few are as follows: the cost of producing and implementing photovoltaic technologies remains high as very few incentives are given to the heavy weights of the energy industry to invest in more feasible production methods associated with photovoltaic technology. One of the world’s premier nations involved with the production of photovoltaic products is China which has witnessed a 400% annual increase in the photovoltaic production market, a market associated with the manufacture of finished products used for the generation of energy using photovoltaic technology. In contrast, China experienced a mere 2% increase in the photovoltaic energy generation market which refers to how much energy China is actually generating using its photovoltaic production market. Nations such as Germany and Japan have been actively seeking to harness more energy using photovoltaic technologies achieving increases of 56.2% in photovoltaic energy generation while other nations reel in their wake [3]. Moreover, due to the low scale implementation of photovoltaic technologies, their consolidated power output remains low with production up to a maximum of 5 GW of energy per year in the US, an amount dwarfed by a mammoth 3300 GW that the US consumes on a yearly basis, acquiring it mainly from non-renewable energy resources [4].
Research Question

How can photovoltaic technologies be used in order to engage in large-scale renewable energy generation?

Research Methodology

The proposed methodology to be followed throughout the course of this project includes systematic secondary research that will be first conducted using the library’s research tool, Summon, to find books and journal articles with relevance to our research topic. Next, it is our intention to look further into specialized scientific databases such as Science Direct, Pro-Quest IEEE and Access Science in order to gain insight into more technical information associated with photovoltaic technologies. Equally as important, is interviewing professors from our respective majors in order to better understand some of the technical information found in journal articles and to log any pertinent notions that they may have. Finally, periodic team meetings will be held to review and evaluate information, assess current progress and conduct appraisals of one another’s progress.

Possible solutions

Possible solutions to the issues of cost and low-scale implementation of photovoltaics include adopting and integrating plasmonic photovoltaic nanocrystals into a wide array of applications. In fact, 250 billion nanocrystals can be fitted onto a single pin’s head at only a fraction of the cost that traditional photovoltaic technologies, such as solar panels, would require [2]. Moreover, to prevent the nanocrystals from sticking to each other in plasmonic liquids, ligands can be introduced to the organic mix. Ligands are ions or molecules which attach themselves to metallic structures [2]. In fact, integrating photovoltaic nanocrystals into paint has been proposed so that structures like buildings can become energy self-sufficient. Of equal importance, is government involvement in policy making, providing incentives and sanctioning. It is within governmental authority to create policies which would make excessive consumption of non-renewable energy undesirable through fines and penalties while subsidizing research in the fields of renewable energy with an emphasis on photovoltaics. In turn, this will increase the funding available to scientific research aimed at developing and implementing cost efficient photovoltaic technologies.

Statement of evaluation

The mere use of photovoltaic technologies considerably reduces the environmental impacts of energy generation bringing them down close to nil. However, through the nationwide adoption of photovoltaic technology, particularly plasmonic photovoltaic nanocrystals, the cost of doing so will be significantly reduced. Furthermore, their miniaturized size facilitates their use in a vast array of applications. On the other hand, photovoltaic nanocrystals have been traditionally known to be inefficient in converting sunlight into electrical energy but now due to the addition of ligands this short coming has been substantially eliminated. Finally, the use of cadmium selenide in order to fabricate the ligands has been suspected to cause impairments in the human nervous and immune systems, as such the use of this particular compound should be revisited.
References


