Life Cycle Assessment of Solar Photovoltaics

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Photovoltaics (PV) is one of the renewable technologies that has been gaining importance globally in the last decade. The International Energy Agency (IEA) estimates a total installed power of PV of around 136.5 GW at the end of 2015. Silicon-based (mono-Si, multi-Si, ribbon-Si) and thin-film (such as cadmium-telluride, gallium-arsenide etc.) photovoltaic (PV) technologies account for the vast majority of the commercial market for PV technologies, representing the first and second generations of PV technologies, respectively. When it comes to recycling and disposal, silicon, cadmium, tellurium, gallium, arsenic etc. are environmentally taxing. The emerging technology of organic photovoltaics and perovskite photovoltaics, referred to as a third and fourth generations of PV technology, respectively, provides a solution to this problem. Despite the growing public attention on properly treating the PV wastes, the technological details and corresponding life cycle environmental implications of recycling PV panels, especially the third and fourth generation PV systems, remain questionable.

This project builds upon the previous life cycle analysis studies performed by Process-Energy-Environmental Systems Engineering (PEESE) on PV systems [1-4]. The objective is to investigate effective recycling approaches of PV systems at the technology and policy levels, and systematically study the implications of waste treatment and recycling of solar cells on the life cycle energy and environmental profiles of solar PV energy systems.

Relevant Publications by PEESE:

1. Gong, J., Darling, S.B., & You, F. (2015). Perovskite Photovoltaics: Life-Cycle Assessment of Energy and Environmental Impacts. ***Energy & Environmental Science***, 8, 1953-1968. [Cover Art of July 2015 issue of *Energy & Environmental Science*]
2. Yue, D., You, F., & Darling, S.B. (2014). Domestic and Overseas Manufacturing Scenarios of Silicon-Based Photovoltaics: Life Cycle Energy and Environmental Comparative Analysis. ***Solar Energy***, 105, 669-678. [Featured in ***Nature***, (2014) 510: 317]
3. Darling, S.B., & You, F. (2013). The case for organic photovoltaics. ***RSC Advances***, 3, 17633-17648.
4. Yue, D., Khatav, P., You, F., & Darling, S.B. (2012). Deciphering the Uncertainties in Life Cycle Energy and Environmental Analysis of Organic Photovoltaics. ***Energy & Environmental Science***, 5, 9163-9172. [Highlighted Graphic Abstract of November 2012 issue of *Energy & Environmental Science*]