



Emissions from solar power technologies continue to fall

Photovoltaic (PV) technologies which harness solar energy in solar power installations are making rapid progress. The latest life cycle analysis of four current PV systems shows a trend for all of these to have significant and increasing environmental benefits in terms of reducing emissions compared with conventional electricity production.

All forms of electricity generation create emissions at some point during their life cycle. PV systems generate sulfur dioxide, carbon dioxide, and nitrogen oxide emissions, resulting from the fossil energy used in production. The production of PV systems is also responsible for toxic metal emissions, including arsenic, cadmium, chromium, lead, mercury and nickel, as all these elements are present in fossil-fuels.

PV technologies are becoming ever more popular as a means to generate electricity and at the same time significantly reduce emissions harmful both to human health and to the environment. Today's solar electricity systems have an energy payback time (the time needed to generate the energy that was consumed for manufacture and installation) of one to two years in Southern Europe and three to three and a half years in more northern parts. Typically, PV technologies have a technical lifetime of 25 years or more, which means that solar electricity is a highly sustainable and effective option to reduce CO₂ emissions.

Researchers supported by the European Commission, under the Integrated Project CrystalClear¹ and the U.S. Department of Energy² used data from 12 PV manufacturers to determine the emissions from four major PV technologies: multicrystalline silicon, monocrystalline silicon, ribbon silicon and thin-film cadmium telluride.

The thin-film cadmium telluride technology emitted the lowest amount of harmful emissions because it uses the least energy during production. However, the differences in emissions between these PV technologies were very small in comparison to the significant emissions that could be saved by switching from conventional energy technologies to PV. The researchers suggest at least 89 per cent of air emissions associated with electricity generation could be prevented if PV replaced energy from the average European grid. When PV replaces fossil fuel sources, it prevents all associated emissions.

Even those PV systems incorporating heavy metals create considerably lower emissions than conventional energy generation: For example, the sum of potential cadmium emissions from the whole life-cycle of cadmium telluride systems is 90-300 times lower than those emitted routinely from a coal fired power station equipped with the best systems to limit particulate emissions. In a scenario where PV units were produced partly using energy from existing PV – known as a PV breeder – there is significant potential to further cut greenhouse and toxic gas emissions.

In addition to progress in terms of production capacity and life cycle environmental performances, thinner films and greater efficiency are trends that will further reduce PV lifecycle emissions. Production energy sources may also change. This means that environmental indicators should be frequently updated.

1. CrystalClear is funded under the European Commission's Sixth Framework Programme. For more information see: <http://www.ipcrystalclear.info/default.aspx>

2. Photovoltaic Environmental Research Center, Brookhaven National Laboratory. www.pv.bnl.gov www.clca.columbia.edu

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