http://www.voiceofsandiego.org/science/article_37811382-9d69-5936-adeb-5db1395225e3.html?mode=print

The Not-So-Sunny Side of Solar Panels

Posted: Monday, February 16, 2009 12:00 am | *Updated: 7:08 am, Thu Dec 3, 2009.*

By JONATHAN PARKINSON

Sunday, Feb. 15, 2009 | It's emission-free energy as abundant as San Diego sunshine. Indeed, for many clean tech advocates, there's little not to love about solar power. Solar panels are widely hailed as a potential environmental and economic savior for San Diego, a fast-evolving technology that promises both job creation and a greener future.

But even though they're typically considered far cleaner than their fossil-fuel counterparts, solar panels themselves come with a list of potential environmental impacts — some known, others still incompletely understood. Among those risks: the release of greenhouse gases during manufacture and problems disposing of chemical byproducts in countries like China, where production is sometimes poorly regulated.

Experts strongly encourage the use of solar panels, but also stress the need to ensure proper techniques are used in both manufacture and disposal in this rapidly changing industry.

"There's an irony, you're trying to save the environment by buying a solar panel, and the manufacture (of solar panels) is emitting greenhouse gases in the process," says Ray Weiss, a professor of geochemistry at the Scripps Institution of Oceanography. Electricity is used to manufacture solar panels, resulting in greenhouse gases — and some other kinds of emissions stem from solar panel production as well.

Weiss' research focuses on trace gases like nitrogen trifluoride, or NF3, a greenhouse gas 17,000 times more potent than carbon dioxide. NF3 is commonly used in the manufacture of electronics and some solar panels. The gas is confined but a fraction often escapes during the process. In October, Weiss and other scientists found NF3 levels were increasing at 11 percent each year, although the cause is unclear. Production of some other panels involves another gas called sulfur hexafluoride — the most potent greenhouse gas known to science.

How much greenhouse gas does solar panel manufacture emit? The answer depends on the type of solar panel, says Vasilis Fthenakis, head of the Photovoltaic Environmental Research Center at Brookhaven National Lab. Fthenakis and has conducted extensive research on the environmental impacts of solar and compared it with other technologies like fossil fuel to get a better idea of the big picture.

"There's nothing that's completely risk-free," says Fthenakis. "But photovoltaic compares very favorably with all other technologies."

In one recent study, Fthanakis and his colleagues found solar photovoltaics can reduce emissions by 89 percent or more when compared to fossil fuel. Emissions of particulates like coal dust and soot from fossil fuels were "two, three orders of magnitude higher than photovoltaics." Thin film solar panels usually offer a greater reduction in carbon dioxide emissions than silicon panels, even though they're typically less efficient at capturing solar energy.

"There are lower emissions for thin film than for other competing modules — at least with today's technology," says Fthenakis.

In particular, there's a difference in what's known as energy payback time, or EPBT — the amount of time that's needed before a solar panel has generated more energy than was used to produce it. The EPBT varies not only depending on the type of cell but also on the location; solar cells in sunny areas generate more electricity and thus have a lower EPBT.

http://www.voiceofsandiego.org/science/article_37811382-9d69-5936-adeb-5db1395225e3.html?mode=print

To take one example, in a sunny region like San Diego a cadmium telluride cell — a type of module made using an alloy of two rare metals — has an EPBT of nearly 10 months, meaning that you have to use it for at least 10 months before it generates more energy than it consumed during manufacture — and before you're reducing emissions. A silicon solar cell, by contrast, has an EPBT of about two years. It's an added plus, of course, that thin film cells are often cheaper.

Fthenakis concedes, however, that his estimates of emissions for solar cells compared to fossil fuels don't reflect gases like sulfur hexafluoride or nitrogen trifluoride. Once these are taken into account, the resulting impact from solar panels could be higher than estimated. "That's an area we're still investigating," he says.

Essentially, says Weiss at Scripps, the bottom line is this: "Definitely you should buy solar panels — as long as you're going to use them for at least two years!"

But there are other impacts besides greenhouse gas. Manufacture of solar panels, like computers and almost any other electronics, makes use of a bevy of toxic chemicals, many of them carcinogens. The United States and European Union, for example, have strict restrictions on use of these chemicals, and manufacturers in the West don't typically pose a problem. But many solar panels use materials produced in countries with lax environmental laws — and that can lead to the same kinds of problems that have bedeviled the electronics industry, says Sheila Davis, executive director of the Silicon Valley Toxics Coalition, an electronics industry watchdog group that recently released a report on toxic waste in solar power.

"Many of these components are manufactured overseas in Asia, and the supply chain isn't very closely monitored. There's very little transparency in the supply chain," Davis says.

What we do know is hardly reassuring: A March 2008 Washington Post report found at least one Chinese plant, a major silicon producer for solar panels, was cutting costs by dumping toxic chemicals on nearby farmland. Just how common these kinds of problems are isn't clear, although China is not typically known for stringent enforcement of environmental restrictions. Today the world's third-largest supplier of solar cells and many other solar manufacturing plants are located in China.

And some believe the outsourcing of solar panel manufacture could — under certain circumstances — pose troubling implications. David Pellow, an associate professor of ethnic studies and sociologist at UCSD, is co-editor of a book entitled "Challenging the Chip" about the toxic legacy of high-tech electronics. In the past he's studied the environmental justice movement, international waste management and globalization in high tech. In light of his research on toxic waste in the semiconductor industry, he believes, some of the lessons other high-tech sectors have learned over the years are relevant to the solar industry as well.

"It's really important to embrace green industries, but only if we can be sure they're green, and we need to examine these kinds of impacts," Pellow says. The semiconductor and electronics industry was long perceived as being a "green" industry, he says, and thus many of its more egregious impacts went unaddressed for years. The same precautionary approach that should have been applied to electronics, he believes, should apply when regulating rapidly expanding new industries like solar.

"Solar has this magical quality — this ethereal, hygenic image. … But there's no industry out there that's going to have no environmental impact. That's why it's about minimizing the impacts, not eradicating them. We need to look beyond just the lifecycle impacts of products and ask — where are these products coming from? How are they being created? What are the extractive processes for the materials involved?" If manufacture is being outsourced, he believes, whether for solar or any other industry, it's vital to ask these kinds of questions to avoid exporting environmental damage.

These cautions, of course, apply to most industries that outsource manufacturing, as Fthenakis at Brookhaven points out. "It's not a black eye on the solar industry, it's a black eye on environmental regulations in China. There's pollution in many sectors in China, and that includes photovoltaics."

And most solar power companies are committed to addressing any problems, says Monique Harris, a spokeswoman with the Solar Energy Industry Association. "First of all — the industry is constantly looking at ways to use less toxic material. The folks in the industry are looking at ways to solve environmental problems, not create them."

That's why, Davis at the SVTC argues, it's especially important to ask these questions now, while the burgeoning solar industry is still growing. "There is a window of opportunity while the industry is expanding to look at these issues."

With that in mind, many activists and scientists are calling for more solar companies to offer to recycle their products. Typical solar panels are estimated to have a lifespan of 25 to 30 years. Since many of them contain toxic substances like cadmium, just as with any other electronic device it's important to recycle them. Already some progress has been made in this direction; in the European Union, 75 percent of manufacturers have already agreed to recycle their solar panels once they reach the end of their effective lifespan, and in the United States at least two companies, First Solar and Solar World, now promise to accept worn-out panels for recycling; many others, though not all, are interested in doing the same.

"Some companies have already signed up for it," Fthenakis says, "some others were skeptical, some others don't think it's necessary yet. We hope that the industry will adopt recycling." There may be some persuasive economic incentives to do so as well. "There are metals like indium in some solar cells that you don't want to waste — indium is expensive. So there's an incentive to recycle it."

Pellow at UCSD believes that the experience of the electronics industry may be applicable here as well. "There's such a strong and direct connection to the electronics industry we don't need to reinvent the wheel." It's important, he agrees, to take measures in advance to avoid a repeat of the e waste crisis, where disposed electronics have been shipped to third world nations for disassembly and disposal.

And Davis with the SVTC believes recycling is key to reducing the impacts of solar: "it's really important for companies to set up systems to recycle in advance." The SVTC is working to encourage recycling, she says. "A couple companies have responded positively and implemented a take-back program," she says, although she hopes to see more progress. Ultimately, it's the success of these kinds of initiatives that will help determine just how green any given solar panel will be. When it comes to environmental impact solar photovoltaics are hard to beat — but no energy, even if it's as abundant as light from the sun, is free.

Jonathan Parkinson is a San Diego-based freelance writer. Please contact him directly at jlparkinson1@gmail.com with your thoughts, ideas, personal stories or tips. Or set the tone of the debate with a letter to the editor.

Posted in Science on *Monday, February 16, 2009 12:00 am Updated: 7:08 am.*