The Environmental Impact of Solar PV Systems

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There are many reasons why someone might consider installing a solar photovoltaic (PV) system, not least because it can be considered as an investment or insurance against the rising cost of energy. However, more and more people are starting to question the environmental impact of domestic solar PV systems. Are they as environmentally friendly as they appear to be at first sight? To address this question we must look at carbon and water footprints as well as energy payback and aesthetics. We also need to consider direct and indirect impacts throughout the anticipated lifetime of a solar PV system of 25 years or more.

The Carbon Footprint and Climate Protection

In a lifetime of use, PV systems introduce no CO_2 emissions into the atmosphere. This compares very favourably with traditional fossil fuels or nuclear energy where the emissions are enormous, averaging 900g CO_2/kWh, according to the. European Photovoltaic Industry Association (EPIA). (1)

EPIA also estimates that the CO_2 emissions generated from the manufacture and transportation of PV panels are in the range 21 to 65 g CO_2/kWh. Emissions from transportation have been estimated at < 1% of manufacturing emissions, while decommissioning emissions are thought to be negligible. (2)

The Water Footprint

The situation with water is very similar to that for CO_2 emissions. For PV systems water withdrawal and consumption take place during the manufacturing process and at the end-of-life recycling. Fossil fuel and nuclear power generation use water continuously whereas most PV systems do not use any water so are ideal in areas where water is a scarce commodity. (Large PV arrays in very hot, dry conditions are sometimes water cooled to improve their generation efficiency.)

Energy Payback

Another consideration is energy payback time (EPBT) – the amount of time it takes for the amount of energy generated to exceed the energy used in the production of mono- and polycrystalline PV panels. In Northern Europe this is estimated to be between 3 and 3.5 years. (Around 2 years for the sunnier climes of Southern Europe.) (3)

Aesthetics

This is a very subjective area. There are those that understand and appreciate the benefits of PV arrays and have no problem with their appearance, and others who absolutely hate the look of solar panels and cannot see past that to the benefits. Such detractors tend to focus on the disadvantages just as keen proponents tend to focus on the advantages. Everyone is entitled to their own views on these issues but protagonists and antagonists alike need to consider any evidence with objectivity and realism.

Future Trends

The environmental impact of PV electricity will reduce even further as PV technology develops. Manufacturing processes are increasing outputs for less energy usage, all with a reduction in material used. PV systems are becoming ever more efficient and system lifetimes are increasing. Architects are being encouraged to plan their designs to minimise the visual impact of solar panels.

An example of innovative design is miniature solar panels that are the size of a roof tile. An array of these solar 'tiles' would have a much smaller visual impact than the equivalent in conventional panels. They too have advantages and disadvantages. (4)

Conclusions

The environmental benefits of using solar PV are considerable. There is an environmental deficit to solar PV at the manufacturing stage and at the end of their life. But given that they have a working life of at least 25 to 30 years the benefits far outweigh their environmental cost. PV technology is improving all the time resulting in even more lifetime benefits.

References

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