

Solar panels replaced tarmac on a motorway—here are the results

September 21 2018, by Dylan Ryan



A road to nowhere? Credit: [Robert B.D. Brice/Wattway](#)

Four years ago a viral campaign wooed the world with a promise of fighting climate change and jump-starting the economy by replacing tarmac on the world's roads with solar panels. The bold idea has

undergone some road testing since then. The first results from preliminary studies have recently come out, and they're a bit underwhelming.

A solar panel lying under a [road](#) is at a number of disadvantages. As it's not at the [optimum tilt angle](#), it's going to produce less power and it's going to be more [prone to shading](#), which is a problem as shade over just 5% of the surface of a panel can [reduce power generation by 50%](#).

The panels are also likely to be covered by dirt and dust, and would need far thicker glass than conventional panels to withstand the weight of traffic, which will further limit the light they absorb.

Unable to benefit from air circulation, it's inevitable these panels will heat up more than a rooftop solar panel too. For every 1°C over optimum temperature you [lose 0.5% of energy efficiency](#).

As a result a significant drop in performance for a solar road, compared to rooftop solar panels, has to be expected. The question is by how much and what is the economic cost?

The road test results are in

[One of the first solar roads](#) to be installed is in Tourouvre-au-Perche, France. This has a maximum power output of 420 kW, covers 2,800 m² and costed €5m to install. This implies a cost of €11,905 (£10,624) per installed kW.

While the road is supposed to generate [800 kilowatt hours per day](#) (kWh/day), some recently released data indicates a [yield closer to 409 kWh/day](#), or 150,000 kWh/yr. For an idea of how much this is, the average UK home uses around [10 kWh/day](#). The road's capacity factor – which measures the efficiency of the technology by dividing its average

power output by its potential maximum power output – is just 4%.

In contrast, [the Cestas solar plant near Bordeaux](#), which features rows of solar panels carefully angled towards the sun, has a maximum power output of 300,000 kW and a capacity factor of 14%. And at a cost of €360m (£321m), or €1,200 (£1,070) per installed kW, one-tenth the cost of our solar roadway, [it generates three times more power](#).



The driveway prototype which inspired Solar Roadways. Credit: [Dan Walden/Wikimedia Commons](#), [CC BY-SA](#)

In America, a company called [Solar Roadways](#) has developed a smart highway with solar panels, including sensors and LED lights to display traffic warnings about any upcoming hazards, such as a deer. It also has heating pads to melt snow in winter.

Several of their [SR3 panels](#) have been [installed in a small section of pavement](#) in Sandpoint, Idaho. This is 13.9 m² in area, with an installed capacity of 1.529 KWs. The [installation cost is given as \\$48,734](#) (about £37,482), which implies a cost per installed kW of €27,500 (£24,542), more than 20 times higher than the Cestas powerplant.

Solar Roadway's own estimates are that the [LED lights would consume 106 MWh](#) per lane mile, with the panels generating 415 MWh – so more than 25% of the useful power is consumed by the LEDs. This would reduce performance even further. The heating plates are also quoted as drawing 2.28 MW per lane mile, so running them for just six days would cancel out any net gain from the solar panels.

And this is before we look at the actual data from the Sandpoint installation, which [generated 52.397 kWhs in 6 months](#), or 104.8 kWhs over a year. From this we can estimate a capacity factor of just 0.782%, which is 20 times less efficient than the Cestas power plant.

That said, it should be pointed out that this panel is in a town square. If there is one thing we can conclude, it's that a section of pavement surrounded by buildings in a snowy northern town is not the best place to locate a solar installation. However, perhaps there's a bigger point – solar roads on city streets are just not a great idea.

Running out of road

Roads don't actually represent as large an area as we assume. The UK department of transport gives a breakdown of the [length of the UK's](#)

[different road types](#).

Assuming we can clad these in solar panels, four lanes of every motorway, two lanes on the A & B roads and half a lane for C & U roads (a lot are single track roads and just won't be suitable) we come up with a surface area of 2 billion m².

Which sounds like a lot, until you realise that buildings in the UK's urban areas [occupy an area of 17.6 billion m²](#). So just covering a fraction of the UK's rooftops with [solar panels](#) would immediately yield more power than putting them on roads. That's quite apart from the benefits that a more elevated position would yield for greater power generation.

All of this suggests that only a small fraction of the road network would actually be suitable. And, given the relatively small size of the road network, solar roads could only ever become a niche source of [power](#) and never the shortcut to our future energy supply.

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