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Cover the Roof! The Simple Guide to Rooftop PV Sizing

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Determining the best size for a rooftop PV system depends on a number of factors, most of which have changed dramatically over the last decade. These include the price of the system, subsidies, cost of capital, feed-in tariffs, consumption tariffs, metering, export limitations, component warrantees, consumption profile, system orientation and shading impact.

However, the situation may have simplified in recent times, with some arguing that the best investment today is to cover the entire roof with PV. There are also better tools than ever before to estimate the return on PV investment.

This paper will investigate this claim using information from APVI SunSpot Solar Potential Tool and Solar Analytics smart monitoring. The abstract presents a brief assessment of one scenario. The full paper will add further scenarios for comparison.

The example presented below is a family home in inner-west Sydney.

Figure 1: Jan 18, 16:35

Figure 2: April 15, 10:20

The satellite images in Figures 2 and 3 show that it is a challenging space for rooftop PV, with multiple roof sections and significant shading from trees to the North and West. There is an existing PV array on the north-facing roof section, directly behind the tree. For the purposes of this assessment, we'll assume there is no existing array.

Using the APVI Solar Potential Tool (SunSPoT), one can measure the amount of insolation falling on a particular roof section, taking into account tilt, orientation and shading impact inferred from the 3D model. SunSPoT uses this to calculate the expect energy yield for a given nominal capacity of PV modules.

Seven different sections of roof were compared. One of these is shown in Figure 3. The expected yield of PV on these sections ranged from 850 – 1212 kWh/kWp/yr. Interestingly, the south facing roof section, directly behind the north facing section with the existing array, had better expected output than the existing array despite its suboptimal orientation due to reduced shading.

The largest system to fit on this roof, assuming 17% efficient panels, was 8.62kW. Assuming $3000 fixed cost and $1.20/W marginal cost, this system would cost $13,344. This price represents high quality components and installation, including panel level optimisers to help shaded yield.

Figure 3: SunSPoT output for selected roof section

Assuming 6% fixed interest and a worst-case scenario of 0% self-consumption, i.e. all energy is exported at a rate of $0.13/kWh, such a system would have a payback period of 20 years.

Although this is longer than most investors feel comfortable with, high-quality components should allow the system to last at least that time and present an overall positive investment.

Assuming 40% self-consumption – a more realistic scenario, offsetting a $0.25/kWh consumption tariff, the payback period drops to 12 years.

So in summary, a worst-case scenario with a heavily shaded house, with multiple roof sections and no daytime consumption still benefits from covering the entire roof with PV, although it would be subject to changes in interest rates, tariffs etc.

The full paper will investigate the marginal benefit of each of these roof sections and analyse the self-consumption based on Solar Analytics monitoring of consumption and expected production for this home and for others.