



Introduction

- James Post is CEO of ECOprou Technology BV, a Dutch Prefab Construction start-up.
- ECOprou developed roof-integrated solar PV. The solar roofs can be combined with many building construction systems, as well as ECOprou's proprietary approach.
- James is an entrepreneur in the crossfield of energy and electronics since 1975, a writer & speaker at worldwide conferences



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Roof Integrated Solar PV Dec. 6, 2019

Current Solar Roofs

- Most solar roofs have a 'technical' look, which makes even the biggest ECO-fan doubt to install these panels.
- Using blackened built in the roof solar panels are a [higher cost] option, but aesthetically still not good enough.
- Solar tile roofs are good-looking, but more expensive and requires structural changes
Not popular; Tesla will likely change this.



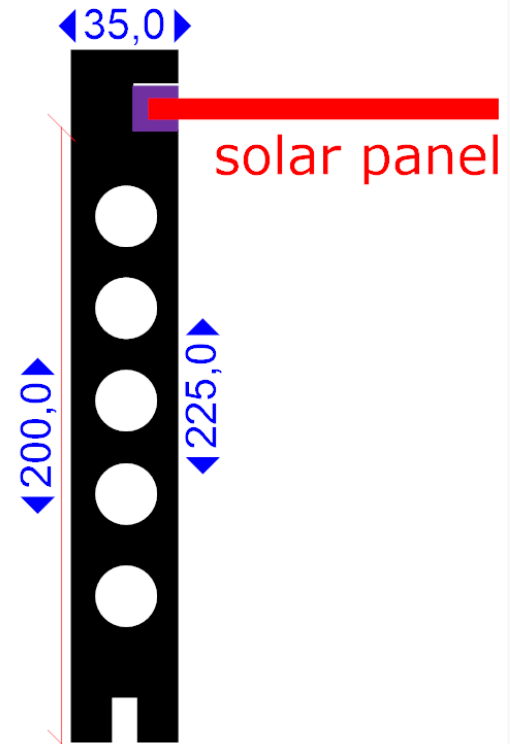
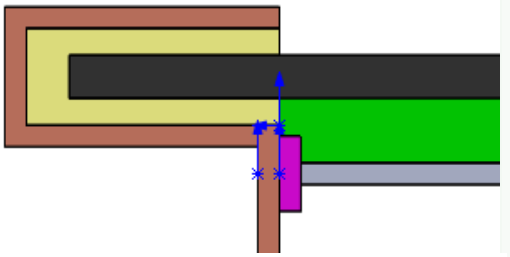


An alternative approach



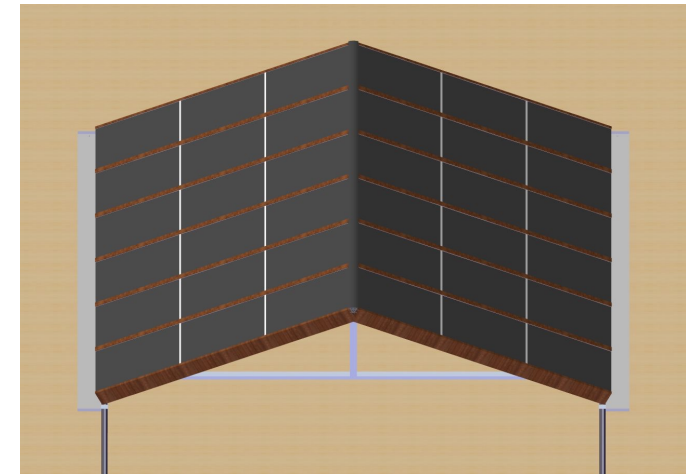
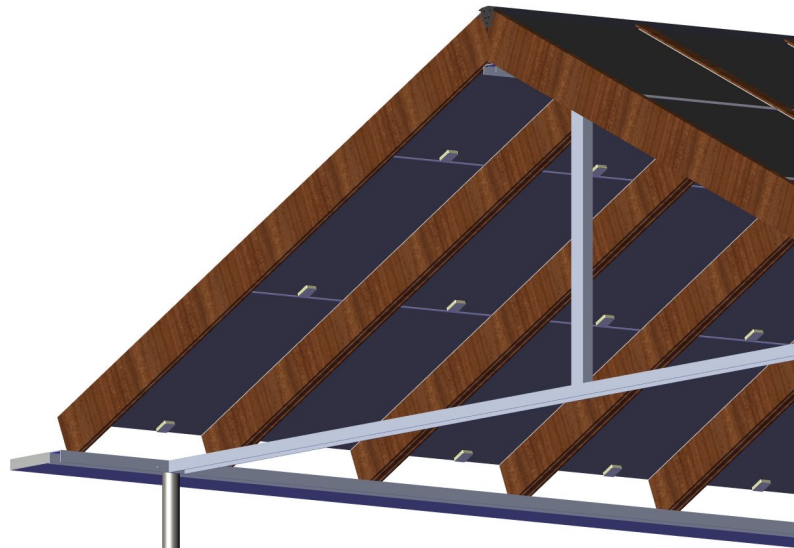
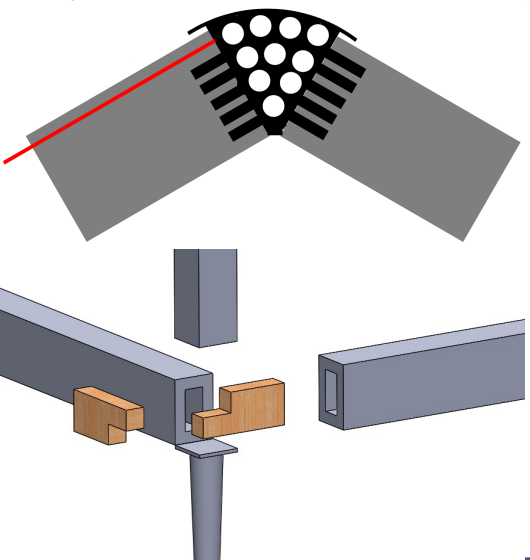
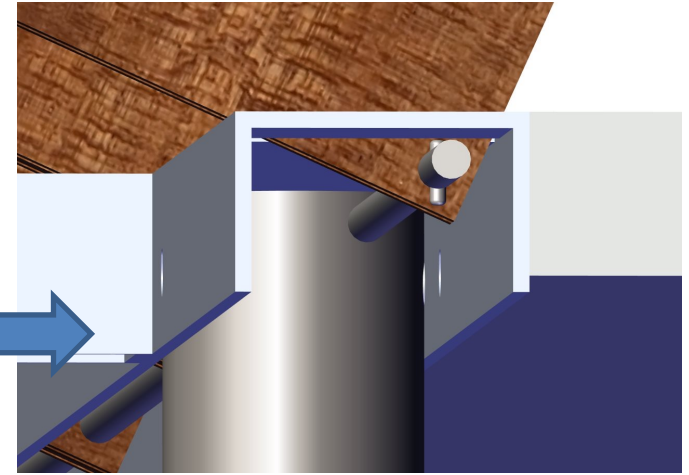
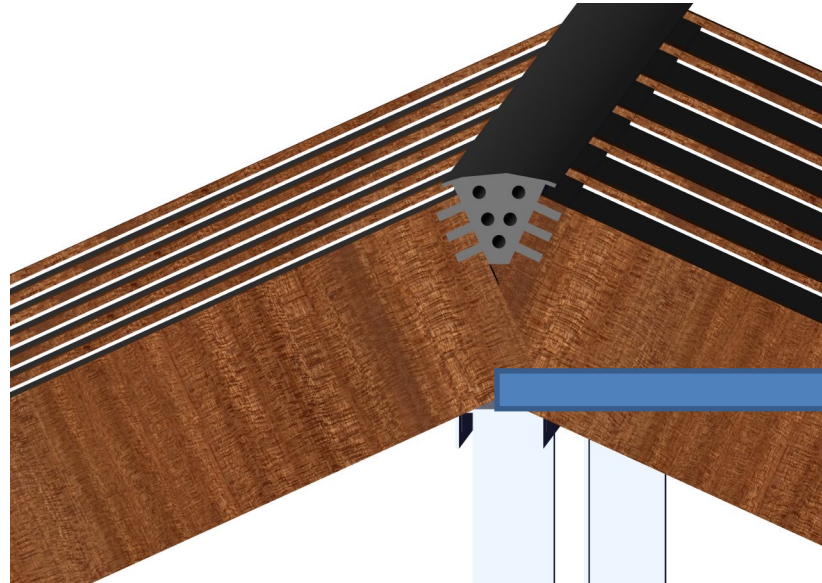
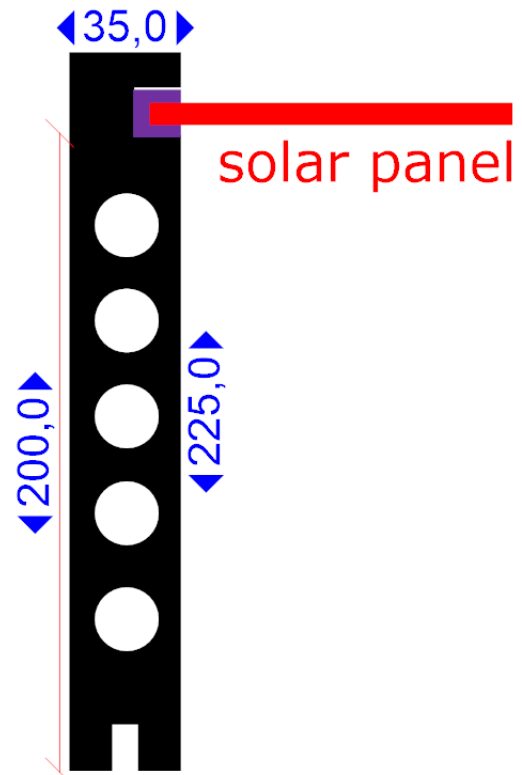
- Roof Integrated Solar PV panels (RIPV) are aesthetically pleasing & economic. The solar gazebo/carport is **substantially cheaper** than roof-installed solar panels!
- Adding wall units and a floor creates ultra-cheap multi-functional garden buildings; e.g. garage/barn, guesthouse/office/sauna
- A great alternative for the -aesthetically poor- installing on new and existing roofs

Installation



- Most architects do not favor solar panels on “their” roofs and usually do not design the roof to be expanded with solar panels
This makes installation cumbersome
- Roof-integrated Solar PV is (almost) as easy to install as a traditional roof:
 - Using aluminum profiles + frame or rafters
 - With custom-made rafters, holding the panels

The custom solar PV rafter

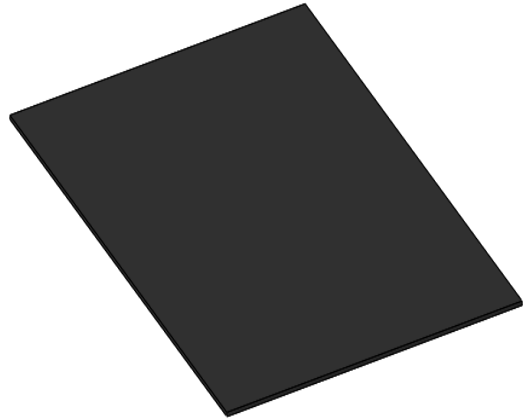


Roof-integrated Solar PV

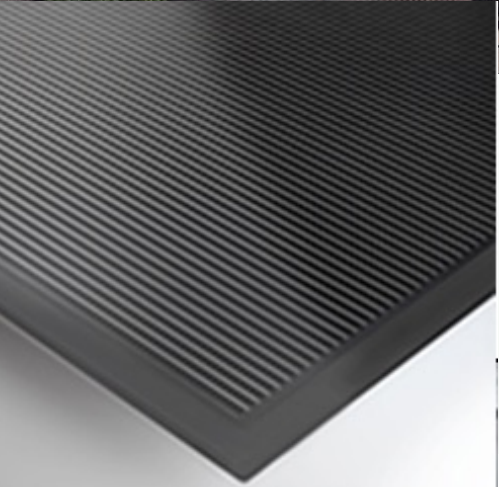
Compare to glass roofs



- Using the decades-proven approach of glass roofs & walls, replacing glass with frameless CIGS matte-black panels, finally makes solar roofs aesthetically attractive.
- All parts of this solar roof are matte-black; people don't recognize this as a solar roof!
- An option is to replace part of the solar PV panels by glass; reducing cost & creating the interesting option of skylights.



Comparing technology



- Traditional c-Si solar PV panels contain cells that are put into series with each other (as the cell voltage is rather low).
 - When shade falls onto one cell, the yield of the cells in series are equally affected!
- With CIGS solar PV panels, the cells are in parallel: only shaded cells are affected.
- CIGS has better low light & thermal specs.

Comparing cost & yield



- C-Si panels are currently 30-40% cheaper than CIGS. But as the yield is $\sim 10\text{...}15\%$ higher, this justifies higher cost over time. In case of shading, savings add up higher.
- Example: CIGS panels cost \$ 680 for 1 kW – c-Si panels cost \$ 400 for 1 kW. The c-Si panels yield 800 kWh/year = \$ 200 – CIGS panels (@ 12.5%) 900 kWh/year = \$ 225
- Not valuing aesthetics, break even is 6-12 years (shade dependent).

Roof-integrated Solar PV

Frameless solar panels



- As roof-integrated solar PV is not yet common, obtaining frameless panels in small quantities can be challenging.
- The only European vendor of frameless CIGS panels went bankrupt last month; notably the Chinese competition is harsh
- We obtained one lot of 1,943 CIGS panels –as of December 5 ~ 85,000 are in stock-
- At ~ 50% this is an attractive opportunity!

Roof-integrated Solar PV

Frameless solar panels



- Currently, there are 2 other bonafide manufacturers of frameless CIGS panels (130...150Wp) in Japan and Taiwan –min. order is 1,320 panels (1 container)
- We can assist with smaller volumes after the current stock has been depleted.
- As long as bankruptcy stock is available (a matter of days) prices for the high-quality German CIGS panels are **less than 50%!**



Thanks for your attention!

In the forum discussion you can bring up all questions, concerns and suggestions.



- **Contact me:** skype: jaap-james
- **Video link:** <https://tinyurl.com/ecopro-video>

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