

PHOTOVOLTAICS – STUDENT QUESTIONS

Guest Speakers: Robert Singh and Christopher Delp

My question is to Mr. Singh. I would like you to please elaborate on what you were saying earlier about, it doesn't necessarily mean that because you're in a warmer climate you get the best out of a solar panel. I'm partly interested in that because I come from a very warm country. And I'm thinking about solar working there.

The fail temperature, the modules in themselves, if you have a lot of heat, if you get over a certain temperature, the efficiency of that module, because of the makeup of the panel, the efficiency goes down, because it gets too hot above, I think it's about 50, if I remember correctly, about 50 degrees C or somewhere in that range. If you get higher than that, you're going to see the efficiency start to drop.

So you can make that up a little bit. You can have higher solar irradiance. But when you're doing your analysis and your PVsyst report, you get to plug those things in there to see what happens. The data that you're pulling when you plug into PVsyst, you pull it from a national database. Airports all would have that data. And you pull that data, and you plug it right into your PVsyst report. And it has all that, the irradiance, it has the temperatures and all that stuff that the software will use to do the analysis.

So it doesn't mean that it's not good. It means that at certain times your temperature would cause the panels to decrease in efficiency. However, because of the amount of irradiance you have and the hours of irradiance, it would be beneficial, it could still be beneficial. Doesn't necessarily mean that it's not a good place to do solar.

And if I get back to the question you asked me. Those two, the purple and the green, there were actually losses. The red was the actual real power that's produced. The green was a system loss, and the purple was like a collection of system loss. So it just shows that your cables would have loss, if you've got an [INAUDIBLE] or a loss and you go through cables and then the entire system loss that you're dealing with. So when you look at the whole thing, you have to look at how much loss that you're going to have that you're not getting any revenue for versus what you're getting out of it. You want to minimize your losses in the solar system.

How sensitive are the solar firms to extreme weather conditions like floods or snowstorms or something like that?

Yeah, so the snowstorm doesn't affect it as much as long as you can get the solar irradiance through to the panels. And remember, the panels are going to be hot if you've got the irradiance out there. So the snow's going to melt. And as the panels are tilting, it's going to roll off.

Clouds, however, is an issue. You get clouds that pass over. Then you'll see production drop. So in some places like Puerto Rico, they require you to put batteries in so you can have that small ride-

through. So if you get a cloud cover that comes in and the production drops, then it doesn't really affect the entire grid. So in today's scheme with the percentage of solar that we have on the grid, it's not really a major issue.

But they're looking into that as we get more and more into larger scale and higher percentage of renewables on the grid like wind and solar. You would need to have more storage technology. And storage is one of the big things that people are looking at. There's a lot of different battery storage out there. And there's pumped hydro, and there is compressed air, and a whole set of different things that you could be looking at.

How about heavy rain and flooding? I'm sure they would have those two a lot.

No, it doesn't affect it. The rain. As long as the water doesn't get up and float the panels away, you'll be fine.

And one last thing. How upgradeable are these panels? I mean, if a new technology comes up in some years, can we increase their efficiency by just upgrading?

Yeah, you can change out the panels. It can be very expensive. You got to take an analysis on what it will cost you to change the panels and also the gain that you can get out of it. However, there's other technologies out there that are injecting signals back into the solar panels. And across the p-n junction to help stabilize that a little bit more. That would increase the efficiency of the panels.

So people are also doing R&D research into that. And if you Google it, there's a couple of companies out there that are injecting signals back into the solar panels that are creating that effect. We haven't done it. I haven't done any of it yet. But there's some technology out there that claims they're doing it.

Now my question, because I do have a fairly extensive history in solar, and I came here from Boulder, Colorado. I had solar on my house. And have worked with it a fair amount is somewhere along your lines. Like, how do we find out these sources for these international jobs for those of us who do want to go international? Do you have any suggestions as to where to find these resources? I'm aware of Solar Energy International, but other than that--

Well, the answer to that is the same as the education question that I often get. Is what kind of education do I need to get in order to enter in? Really, the answer is that you're doing the right thing right now, obviously. Professor Philippidis is doing a fabulous job. I got to tell you, I mean, it would be great to have taken this course, obviously, before I started in at the company. So for me it was a lot of just diving in and learning a lot of the details and terminology and so forth. But to answer your question, it's the same scenario with the jobs, basically. You get in to somewhere, you insert yourself somewhere. And you already have some access, it sounds like, to the solar industry.

And just as you say, look, we want to do a project in-- And then the contexts tend to organically come out of those activities. That's what I've experienced. If you put yourself out there and you think outside the box and you're looking for ways to finance your project, you're looking for ways to build your project, you're looking for those resources, it's going to take you outside the borders of the United States. And very quickly you will be interacting with all manner of all different countries. So that's been my experience, anyway, in terms of being able to just grow a contact list. A very large contact list of solar professionals in other countries.

And I can add to that. If you're looking for all the networking. If you're looking for different companies you can get into that work in these international markets, you may want to take a trip or visit to the solar power show, SPI, Solar Power International, that sometimes is here in Orlando. And a wind show will be here in Orlando coming up soon. I'm not sure where the next SPI show will be. But there's a lot of international companies there. And you can go there and talk to some of them.

What are the main obstacles when the company tries to go into a new country besides competition with other companies?

One of the major things there, you've got to know the landscape of that country. You've got to understand the labor force. You've got to understand the laws that you're dealing with. The work ethics in that country. And depending on the landscape of some of those countries, whether you can get through the permitting process easily.

We've strategically stayed away from some countries because we don't understand the market. But some of the South American countries, we're actually doing some stuff there because I was born in South America. So I understand the landscape a little better. So you've got to really understand the landscape of the country to go into that market. You may have to partner with people to start with that's local in the country, rather than just say, I'm going here and I'm going to do work. Because you're going to learn the hard way.

OK, how do laws make [INAUDIBLE]?

Well, the permitting process is one of the big things. Does the government control the utility? What's going to happen after the next election? How stable is the government? If you have a 20-year PPA and a new government comes in and says, I'm going to cancel it all, what do you do?

And then, like Chris was saying, what are you going to do after that? Where are you going to arbitrate it? Where are you going to take the legal case? And how well is that going to stand up?

I was wondering what type of environmental jobs are connected with this type of work? If it's something that you pull people from the area already that are familiar with the environment in that? Or if you do any training for them?

We don't have any environmental person within our company. But the developers do because they have to do environmental studies. If you put a solar plant in a certain area, how is that going to impact the natural habitat? How is that going to impact the surrounding communities?

For instance, there was a solar project that was built in Ivanpah in California, the power tower, large mirrors. They claimed, well, it happens that if the birds fly through, they get fried by the mirrors, right? So those kind of things you've got to study. The migration path of these birds that fly through these areas. What type of birds that fly through there that you're going to kill. Or could potentially be killed from it.

The same thing with wind turbines. Where are you putting up wind turbines? Migratory path of birds, they have to study those things. I'm not sure if I answered your question.

Yeah, it seems like it's more something that-- I think with building anything, I think you have to know about the location.

How it's going to affect the location, [INAUDIBLE], if I was going to change the habitat of that area. You could have environmental groups that are probably going to object to you doing certain things in the area. We built a project up in San Luis Obispo in California. And you have to be careful with the power of the machines that drive the pilings to the ground, because if it's above a certain db level, it wakes the rats up, the kangaroo rats. And they don't want you to wake them up during the day or disturb them. So you have to get machines that are lower noise level. So there's a lot of stuff that comes out of the woodwork when you do that.

Thank you.

You're welcome.

Can you give us an idea of the workforce that has a master's degree? Like the students here will, do you see them having an advantage as they enter this market? From your experience so far, something that is more specific, I guess, to [INAUDIBLE]?

Yeah, high-level professionals, basically, anyone with a master's degree and over. Master's, doctorate. Basically, that has grown, if I recall correctly, it's grown 89% since they started tracking that information back in 2012, I believe. So that's been part of this massive growth.

Now 55% of the massive growth is just basic installation, construction jobs out in the field putting these things together. The other 45% is that upper-level management and things of that nature. It's going to require engineers, people with engineering degrees, people with, obviously, your degrees in finance, your degrees sometimes in law, things of that nature to put these all together.