

RESIDENTIAL ROOFTOP REPORT

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INSIDE:

2017 RESIDENTIAL
ROOFTOP OUTLOOK

SOLAR LOANS
VS. LEASES

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RAIL-LESS MOUNTING
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SPOTLIGHT ON BUTYL
RUBBER FLASHING

A SUPPLEMENT TO

**SOLAR
BUILDER**

PRESENTED BY

 Roof Tech

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Roof Tech clients give high marks to our products!



Luke Niemiec, Acushnet Heating and Solar

“The install took half the time the same job would have taken using rails.”

“E Mount AIR locks down tight on all sides. Its lightweight design is ideal for our region where snow and ice can add so much extra weight to the roof.”



Ryan Potter, Green Seal Environmental

“I finally found that go-to product I had been searching for.”



Jeff SchockaConger, Aquilla Solar

“In Minnesota, temperatures top 100° in summer and can easily plunge to -35° in winter, so it’s critical that any mounting system can withstand those fluctuations.”



David Oropeza, Border Solar

“With RT-[E] Mount, all parts for a 2KW PV system fit into a single bag, so our installers just carry one lightweight bag to the roof and pull each piece as needed.”

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2017

RESIDENTIAL SOLAR OUTLOOK

Photo credit: Roof Tech



**HERE ARE THREE ROOFTOP PV
MARKETPLACE STORYLINES TO WATCH**

By Chris Crowell

RESIDENTIAL SOLAR OUTLOOK

I stared at this screen for way too long, trying to figure out a good way to intro into “here’s the 2017 outlook for residential solar installs!” before realizing how futile it was. Donald Trump was elected president, so who knows what the future holds for anything, let alone solar, which he’s only said this about on-record: “I know a lot about solar, the problem with solar is it’s very expensive.”

But having said that, there are storylines to watch.

1. RESIDENTIAL SOLAR ALREADY LOSING TO UTILITY PROJECTS

The U.S. solar market just shattered all previous quarterly solar PV installation records. According to GTM Research and the Solar Energy Industries Association’s (SEIA) Q4 2016 U.S. Solar Market Insight report, 4,143 MW of solar PV were installed in the United States in the third quarter of 2016, a rate of one MW every 32 minutes. That pace quickened further as the fourth quarter of 2016 was expected to surpass that historic total.

“Coming off our largest quarter ever and with an extremely impressive pipeline ahead, it’s safe to say the state of the solar industry here in America is strong,” said Tom Kimbis, SEIA’s interim president.

So, that’s good news ... right?

This may depend on the segment you serve. The report points to an “unprecedented rate of project completion” in the utility-scale segment as a key growth driver. In fact, the utility-scale segment represented 77 percent of solar PV installed in the third quarter of the year.

GTM Research anticipated that a massive 4.8 GW of utility PV projects came online in the fourth quarter of 2016 — more than was



Photo credit: RoofTech

installed across the entire utility PV segment in all of 2015. With 375 MW installed, the segment grew 15 percent over the second quarter of 2016 and 37 percent annually. Part of this growth is attributed to a community solar pipeline that is finally beginning to materialize, a segment that accounted for a record 20 percent of the non-residential PV market in Q3 2016.

This past quarter marks the sixth consecutive quarter in which more than a half GW of residential PV was installed; however, the segment is experiencing a slowdown from its peak growth quarters. The residential PV segment grew just 2 percent year-over-year and actually fell 10 percent from last quarter’s total. The report cites changes in the sales cycles in mature state markets, like California, and challenges posed by rate design reform, such as the elimination of net metering in Nevada, as reasons for the shift.

2. THE NEVER-ENDING NET METERING DEBATE

Worries about Trump’s thoughts on solar are maybe not your concern because solid residential solar business starts with solid, supportive local policy, i.e. net metering. Here

are some of the most recent net metering debates:

ARIZONA

A Value of Solar (VOS) decision in late December effectively ended NEM. The Arizona Corporation Commission’s (ACC) 4-1, while not great for rooftop solar in the state, isn’t as detrimental to the industry as the one Nevada passed in 2015. Arizona is going to let current solar adopters keep their net metering deals, and the immediate cost to new customers isn’t as stark. Compensation under the new methodology would initially be set at around 11 cents per kilowatt-hour for most customers, close to the current retail rate net metering credit, but that rate will decrease in future rate cases, and new solar customers aren’t protected over the longer term.

CALIFORNIA

A time of use framework decision, deferred into January, will set the stage for how time of use (TOU) rates will be implemented in upcoming utility rate cases. The proposed decision adopts SEIA’s proposal to incorporate marginal T&D costs into the calculation of peak TOU hours, better reflecting reality and improving solar economics.

ILLINOIS

Illinois legislators voted to pass energy legislation without anti-consumer, anti-solar proposals like mandatory demand charges and ending net metering, and will revise the state's Renewable Portfolio Standard (RPS). The RPS will now also include provisions to ensure a mix of utility-scale wind and solar, community solar and rooftop solar will all be required to meet the 25 percent target.

FLORIDA

Following a decisive, solar choice victory on Election Day, the Florida Public Service Commission unanimously approved a comprehensive four-year rate settlement agreement developed jointly by Florida Power and Light Co., the state's Office of Public Counsel and major customer advocacy organizations. The agreement is expected to keep FPL's typical bills lower than they were in 2006 through at least the end of 2020. The forward-looking agreement positions Florida for a significant expansion of solar energy, enabling 1,200 MW of new solar capacity.

MAINE

The Maine Public Utilities Commission just cannot come to an agreement on how to handle solar incentives. When we were putting this together in the waning hours of 2016, the decision had been delayed into 2017. The commission held a public hearing on the matter in October and received hundreds of written comments.

MICHIGAN

At the zero hour, Michigan lawmakers passed SB 437, which amended the Michigan Public Service Commission Enabling Act. The primary purpose of this bill was to expand the state's RPS to 15 percent over 10 percent, which is nice, but it also has put a "grid charge" on the table for solar adopters.

NEW YORK

SEIA expects more work to be done on the NY Value of DER (VDER) tariff, and the solar advocacy group and its allies have proposed a gradual transition away from NEM,

IS NET-METERING UNDERVALUED?

The Environment America Research and Policy Center recently published *Shining Rewards: The Value of Rooftop Solar Power for Consumers and Society* (2016 edition) that reviewed 16 recent analyses of rooftop solar. Its findings show that those who go solar generally deliver greater benefits to the grid and society than they receive through net metering.

FINDINGS FROM THAT REPORT:

- **Avoided energy costs.** Solar energy systems produce clean, renewable electricity on-site, reducing the amount of electricity utilities must generate or purchase from fossil fuel-fired power plants. In addition, solar photovoltaic (PV) systems reduce the amount of energy lost in generation, long-distance transmission and distribution, which cost U.S. ratepayers about \$21 billion in 2014.

- **Avoided capital and capacity investment.** By reducing overall demand for electricity during high-load daytime hours that form the peak period for most utilities, solar energy production helps ratepayers and utilities avoid the cost of investing in new power plants, transmission lines, distribution capacity and other forms of electricity infrastructure.

- **Reduced financial risks and electricity prices.** Because the price of solar energy tends to be stable over time, while the price of fossil fuels can fluctuate sharply, integrating more solar energy into the grid reduces consumers' exposure to volatile fossil fuel prices. Also, by reducing demand for energy from the grid, solar PV systems reduce its price, saving money for all ratepayers.

- **Increased grid resiliency.** Increasing distributed solar PV decentralizes the grid, potentially safe-guarding people in one region from other areas that are experiencing problems. Emerging technologies, including smart meters and small-scale battery storage systems, will enhance this value.

- **Avoided environmental compliance costs.** Increasing solar energy capacity helps utilities avoid the costs of installing new technologies to clean up fossil fuel-fired power plants, or meeting renewable energy requirements, and avoid the cost of emission allowances where pollution is capped.

There's also a 2014 paper from the Lawrence Berkeley National Laboratory that concluded residential solar has little impact on residential rates but could erode shareholder returns. So, which states are being swayed by which sides?

initially for larger C&I customers, with a “value stack” that includes fixed components to ensure that projects are financeable.

NEVADA

NEM legislation and competitive retail legislation are both expected in 2017. A favorable rooftop decision by the PUCN in December in Sierra Pacific’s rate case re-established NEM for a limited number of new customers, and sent a message from the Commission: It did not expect the dramatic impact of the 2015 NEM decision and is seeking to remedy it. Nevada Power’s rate case is up next and will be one to watch to see if the PUCN extends similar treatment to Las Vegas-area ratepayers.

OHIO

Governor John Kasich vetoed Substitute House Bill 554. The bill would have further weakened the state’s energy standards by turning the requirement for utilities to purchase renewable energy and invest in energy efficiency into voluntary goals, with no compliance obligations, through 2019. With Governor Kasich’s veto, the standards frozen two years ago were reinstated on Jan. 1, 2017.

TEXAS

El Paso electric is expected to once again seek demand charges for new solar customers in its upcoming rate case. The demand charge proposal was rejected in a 2016 settlement of the most recent case.

UTAH

Following the example of its backward-thinking neighbors (see: Nevada, Arizona), Utah’s investor-owned utility Rocky Mountain Power (another Berkshire Hathaway Inc. subsidiary), proposed a series of

fixed charges on rooftop PV owners, which would have similarly disastrous effects on the rooftop solar industry in that state. The case, filed in November with a request to end NEM in December, has been deferred by the Utah PSC in to 2017.

3. THE BIG PICTURE OUTLOOK

MJ Shiao at GTM Research spoke to us prior to releasing its post-election US Solar Market Insight report, but he made sure to note that all updates in that report would be due to market changes themselves and not any Trump administration factors.

“First and foremost, we don’t know what Trump will actually implement in his proposed energy policies so we [and everyone else] can’t say definitively what the effect will be,” Shiao said. But here are things to keep an eye on:

■ Dissolution or non-enforcement of the Clean Power Plan.

“Since this was done through the EPA, the Clean Power Plan could be scuttled or simply not enforced by the Trump administration. That means we likely see fewer plant retirements due to carbon emissions and less impetus for the procurement of utility solar. Since the targets don’t really start until the start of the next decade, this is a longer term dampener.” In its forecasts, GTM has CPP as an upshot driver but it’s not built into its base forecasts.

■ **ITC Rollback.** “The general consensus is that ITC could be threatened in a comprehensive tax reform package. However, because it would be legislative driven, it’s more difficult to enact and more difficult to gauge as far as viability. We’re also keeping an eye on the proposed

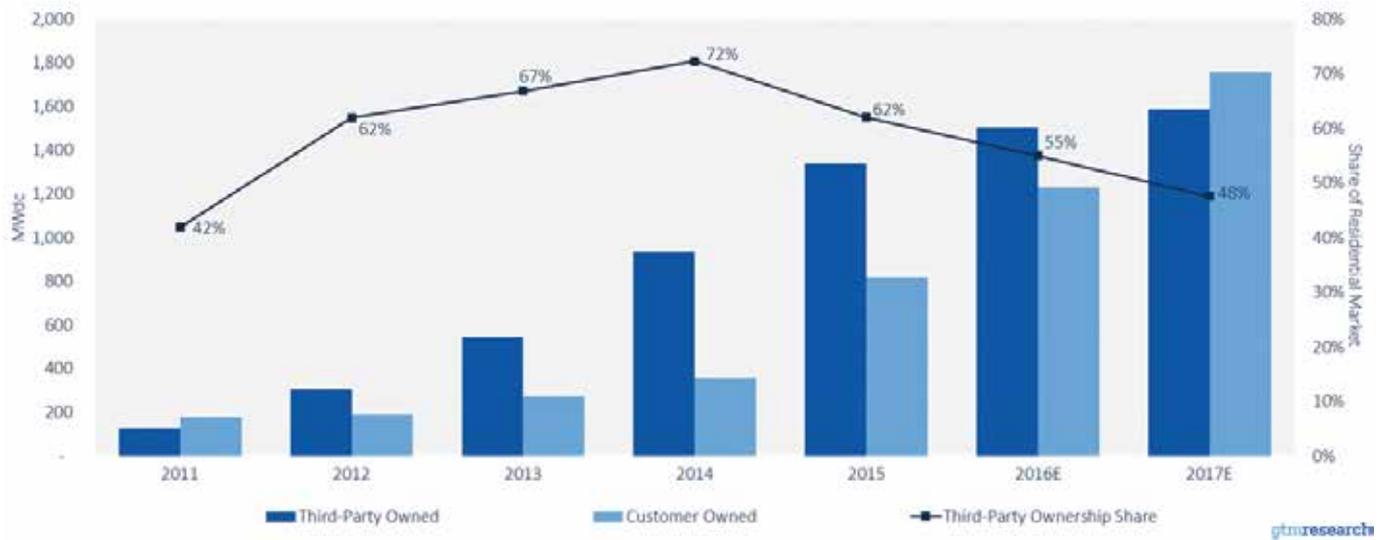
Storage ITC. What we’ve heard early on is that there’s little interest by the new administration in pushing this through.”

■ **Tariffs/Duties on Chinese commodities and trade deals.** “One of Trump’s promises was a tariff on imported Chinese goods. Within solar hardware, we already have duties on cells, modules, aluminum and steel — and in many cases, these tariffs are being sidestepped by suppliers through reorganized supply chains. It’s difficult to imagine that new tariffs would have much additional impact on solar costs. Similarly, a rejection of the Trans-Pacific Partnership would eliminate an avenue for removing existing tariffs on Chinese modules and also eliminates some vague/broad encouragement of collaboration on cleantech [although no one really knows what that would have looked like].”

To reiterate, none of those bullet points fundamentally changes GTM’s view on the U.S. market, according to Shiao. Most of the near-term drivers will continue to be rooted in state-level policies, net metering reform and the market conditions overall (e.g., national installer weakness, rapidly declining module and system prices).

The biggest immediate loss for the industry is in its certainty. A number of U.S. solar companies have already witnessed a decline in stock value, including First Solar and SunPower Corp., while coal stocks have received a boost. This is the main cause for GlobalData’s concern. Previously, GlobalData projected that renewables excluding hydropower would be the fastest growing power source in the United States, increasing to an installed capacity of 216 GW by 2025, but this is now subject to change depending on the new government’s energy policies. ■■

Chris Crowell is managing editor of *Solar Builder*.



GTM Research forecasts more loans than leases by next year.

THE TREND TO OWNERSHIP

AND WHAT IT MEANS FOR YOUR SOLAR INSTALLATION BUSINESS

By [Chris Crowell](#)

The residential rooftop market has seen quick shift away from leasing toward customer ownership over the past two years, driven by the decreasing cost of solar and the increasing number of loan products available to customers.

The plethora of financing options now available in response to the dropping prices and proven concepts made this possible, but so too did the transparency in system costs and financial returns among all of those options.

When the numbers are presented plainly over the lifetime of a system, a buyer will rarely go with a lease. The most recent Solar Marketplace Intel Report from online solar marketplace EnergySage showed that more than 90 percent of EnergySage users chose to own their system outright. Just 11 percent entered the marketplace with a stated interest in a third-party owned system to begin with, and the reason is obvious: These days, system ownership results in larger savings, and loans offer more flexibility than leasing.

Transparency also leads buyers to choose better systems. Again, as demonstrated by EnergySage's side-by-side quote comparison tool, interested buyers can not only compare financial metrics, but also the quality of the installer and all of the system components, providing a full value picture.

Suddenly, a customer isn't just making a passive decision to try and lower their electric bills, but making an investment. If you are now going to own the system, why not

get the best bang for your buck? This could lead to greater interest in high efficiency systems from household names, like Panasonic and LG.

WHAT THIS MEANS FOR THE INSTALLER

Loans mean choice, which also means more business for the solar installer — especially the smaller, regional installers. GTM noted that local installers in particular have taken advantage of these loans, which has leveled the playing field. The larger players — SolarCity, Sunrun, Vivint, etc. — are now starting to offer loans too, but where leases were predicated on size and scale, a model dominated by loans looks more like the regular construction industry, filled with nimble, local companies.

Anecdotally, we had a side conversation with an installer in 2016 who had once formed a fairly large, national business and his since decided to sell that in favor of staying small. He noted how little money there is in scaling up to that top tier because there's a ton of overhead, and there isn't much of a pricing advantage over the smaller installer.

But transparency and choice means increased competition. What value can you provide customers that others cannot? Knowing the direction the industry seems to be headed, think about how this will influence your business. #

Chris Crowell is managing editor of *Solar Builder*.

TIPS BY ROOF TYPE

EXPERTS SHARE TIPS FOR MOUNTING ON COMPOSITION SHINGLE, TILE, SLATE AND METAL RESIDENTIAL ROOFS By **Debbie Sniderman**

COMPOSITION SHINGLES

The biggest challenge with shingle roofs, according to Barry Cinnamon of Spice Solar, is making sure the roof mount is attached to the rafters, which are under the shingles and can't be seen.

"They are difficult to find, and it's hard to train to ensure installers hit the middle of the rafters," he says. "There are no magic X-ray tools to help installers find where the middles are. They have to be trained to find the rafter and use trial and error. When they miss, they're trained to seal the holes they make."

When using flashing, make sure to notch it to fit around nails, says Jolene Ciosek with EcoFasten. This best practice allows the flashing to extend up and under the third course of shingles. Also, position the flashing between vertical joints of shingles as an additional waterproofing measure.

TILE

Tile is going to require a different approach, and a great option for installing on these sensitive roofs is going with hooks. Jared Wiener, VP of marketing at SolarRoofHook, says the design determines what type of hook to use since they vary by tile size, the height between peaks and valleys, adjustability and whether there are battens present on the roof. Before hooks, the only option for

taking these roofs solar was replacing the entire roof.

Wiener says by the time installers are up on the roof, it's too late to change an array's design, so adjustable hooks add value by saving time when it matters most. Installation involves only a few steps: drilling and sealing a pilot hole, driving the mounting screw through the hook and driving the mounting screw through the hook and placing the tile back on top. Tiles don't have to be penetrated. The base or the height of the hook can be adjusted on the roof without being removed.

Remember that even the strongest tiles are brittle and break easily, so Ciosek recommends keeping time on the roof to a minimum. Be especially careful not to drop tools while on a tile roof. Before installing, replace any cracked or damaged tiles too because the last person on the roof will usually be blamed for any recent damage.

SLATE

As a material, slate is very heavy, expensive and brittle. It is challenging to work with because it sits flush with the sheeting on the roof or underlayment, and there is no elevation between tiles that allow a hook to go underneath it. There's no ability to notch it, and it should never be drilled in any way because cracks will ulti-

mately cause leaking and void the homeowner's roof warranty.

The slate and composition shingle combo method is the fastest and lowest cost option. It involves removing the slate and placing shingles where the standoff would normally go into in the rafter, using a lag with flashings to protect the roof. Since it is underneath the solar array, it is not noticeable. Make sure the top edge of the flashing extends up and under the third course of slate.

METAL

For installs on metal standing seam roofing, use roof mounts that use clamp-to-seam technology via oval-point set screws that won't penetrate the roofing material. Making holes is not recommended. Be sure the mounts you use will not void a roofing manufacturer's warranties.

On corrugated metal, use a mount that attaches to the sides of the panel, as opposed to in the valley where moisture accumulates. Or, use mounts with waterproofing technologies such as EPDM rubber bushings that will form a compression-fit seal once the fastener is attached. ■

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OFF THE RAILS

AN OVERVIEW OF RAIL-LESS MOUNTING BEST PRACTICES

By Milton Nogueira



Roof Tech's system being UL 441 section 25 tested: Water spray, water shedding test for Pipe Flashing.

Rail-less PV mounting is catching on. There are a variety of approaches out there, and this article will be an overview of general best practices and then an explanation of our company's approach.

BENEFITS AND CHALLENGES

The benefits of going rail-less starts with lower parts count, less weight and direct shipment to a site. Beyond the basic array configurations, staggered installs and single module installations become easier. This translates to a bill of materials and ease of logistics and shipping that drives costs lower too.

A benefit of being able to fasten the mounting screws directly into the roof decking, judging by installer feedback, is cutting the array install time in half. Such a difference leads to a big reduction of soft costs related to the man-hours up on the roof. We can all grasp how important this is not only for the cost savings but also because of how stressful roof work can be.

A challenge we've seen in rail-less mounting is, without a rail, it can be more difficult to route cables and harnesses, which makes cable clips more important. If a roof is uneven, the leveling can become cumbersome and the use of string lines to verify leveling becomes important. In such

cases, flexibility is key. RoofTech has engineered the L-Foot option, for example, which allows for the mounting of a rail system above the RT-[E] Mount, which is helpful in the cases of uneven roofs and installing a frameless PV laminate with RoofTech's integrated flashing base.

CODE, WARRANTIES AND BEST PRACTICES

A key to installing quality, integrated flashing is not disturbing the seal of the asphalt shingles because separating the shingles can actually have an impact on the warranty of the asphalt roof product. Roofing manufacturer warranty statements do degrade the warranty terms of the



Roof Tech's RT-[E] Mount going through ASTM 2140, static water pressure test — 6-in. of water column for 6 hours.

roofing product due to the failure of seals/blow-offs/wind damage.

As far as code, roof top structures must be installed by the manufacturer's instructions, and flashing must be installed in a way to prevent water intrusion. There isn't a specific standard for the flashing of PV mounting structures. The IBC 2015 1507.2.9 specific to flashing of asphalt shingles adds to the shingle manufacturer's printed instructions specific to flashing on their roofing products.

The current recommendation from the National Roofing Contractors Association (NRCA) suggests that a "pipe flashing" be applied to solar mounting structures on steep slope asphalt roofs (roofs with an inclination equal or superior to 2/12 or 9.5 degrees).

The metal pipe flashing upper flange must slide or be placed under the underlayment, which is actually how pipe flashing has always been installed. I interpret it as the only way to shed moisture above the underlayment away from the lag, however I still have reservations as far as the shedding of the existing moisture (humidity, wind driven rain, condensation, ice dams) under the flange that can eventually run into the lag assembly. This isn't a big deal on the vent pipe, but on a lag bolt that is structurally securing the array to the frame?

Pipe flashing is for pipes and vents. Pipes and vents are connected to mechanicals under the roof and usually through a large hole on the sheathing, so it is important to use a broad metal flashing and sealant. In

my view, this is a safe and proper way to flash the conventional lag bolt/rail system too because you may have fewer attachment points. But you have to be careful with too few attachment points as you may end up with roof torsion issues that will be detrimental to many aspects of the roof and the array.

Good design with proper thermal splicing can make this type of attachment last longer with the fewest number of issues related to thermal contraction and expansion of the array. Be sure to check the sealant used for the lag for compatibility with the roof and also choose the one with the highest service temperature.

TEMPERATURES AND THERMAL STRESS

The common extruded aluminum alloy T6061 temperature coefficient at our ambient temperature range is 0.0000135 in./in degrees F. A 10-ft-long section can expand and contract over 1/8 in. on a 100 degrees F differential. Yes, it is an extreme, but consider a roof/array that's exposed at night to 50 degrees F and reaches 90 degrees F ambient temperature moving through the day. Knowing that the array temperature could top at 60 degrees F above ambient, this differential now climbs to 100 degrees F.

Now, try to picture the effect of this contraction and expansion in the long term — the attachment points (screws), the nuts and bolts of the array, the sealant, the electrical bonding and the reliability of the attachments. The minimal impact from

thermal contraction and expansion, the better.

Rail-less systems can have less of an impact on the attachment points from the thermal stress since the aluminum extensions or rails are much shorter than a long-rail approach. With the Roof Tech approach, this length is limited to the frame of the module itself. #

Milton P. Nogueira is senior business development manager for Roof Tech.

THE ROOF TECH APPROACH

In Roof Tech's design, 5-mm (3/16-in.) fasteners are used for anchoring the bases so the PV modules can clamp to the roof (either decking or rafter), and the adjacent row of modules are independent. The result is a point load that can be 60 percent lower than the conventional lag/rail system, which is important for higher snow locations. The supports aren't exposed to the pressures of a conventional rail/lag bolt system due to thermal stress. The mounting screws are not much bigger than the nails used to secure the asphalt shingles and are flashed and sealed to service temperatures up to 250 degrees F. For this reason, it can't and it shouldn't be flashed with the conventional pipe type flashing.

MOUNTING WITH BUTYL RUBBER

HOW ROOF TECH GETS A LEAK-PROOF SEAL

By Chris Crowell

Butyl rubber was first developed in the early 1930s, and its traditional applications are pool linings, flexible flashing for construction and lining tubeless tires. It has a unique combination of barrier properties, such as high damping, resistance to ozone, weatherproofing and heat aging that make it an ideal choice for many construction applications. For instance, butyl rubber is commonly added to asphalt compositions in the manufacturing of roofing materials to improve the weatherproofing and low-temperature properties of the asphalt.

Butyl rubber is the secret sauce Roof Tech uses to seal each attachment point in the rooftop mounting system that the company is now bringing to the United States after perfecting the system on more than 400,000 residences in Japan the past 18 years.

THE WEATHER TEST

No matter how the attachment of a PV array is achieved, the ultimate sealing point is exactly at the penetration in the roofing paper where a lag or fastener gets attached to the frame or roof sheathing, typically with sealants. Sealants usually have a maximum service temperature in the 160- to 200-degree F range, whereas RT butyl performs at 248 degrees F, providing more protection under heat distress.

Milton Nogueira Jr., senior business development manager for Roof Tech, says its RT butyl flashing provides tested impermeability and elasticity; it is easy to mold yet is highly resistant to punctures. Butyl tape allows for expansion and con-



Roof Tech's butyl rubber flashing in action.

traction, even with extreme fluctuations in temperature, while preventing moisture from passing through. It has a minimum effective life of 20 years and is resistant to aging from weather, mildew, acids, alkalis and salts.

At the laboratory, RoofTech tested complete roofing sets under extreme conditions of constant UV light, 145.4-degree F temperature, 50 percent humidity and a water spray every two hours. The specimens were monitored throughout the testing time and were evaluated at 7,500 hours (almost one year later). RT butyl tape was still flexible and performing its job.

THE FULL SYSTEM

The code states that roof-mounted PV system flashings must be installed in a manner that prevents moisture from entering penetrations through the roof plane. The current suggested guideline by the National Roofing Contractor Association for the installation of a PV system on a steep slope asphalt shingle roof — in terms of the flashing of the PV system stanchions — is that the metal flange should be applied underneath the roofing paper (under the upper underlayment) to achieve the proper water shedding. Nogueira says such a step can only be accomplished along with the installation of a new roofing system, and this can't be done on a retrofit of a PV system installed above an existing roof, which is the majority of installations in the United States.

Even though the roofing paper is called a secondary layer to protect the roof decking, you could look at it as the first layer because it is the first one applied, and if the roofing material or anything else fails, the roofing paper or felt will have to protect the roof decking from moisture intrusion.

The Center for Environmental Innovation in Roofing does not recommend water shedding flashings on the roof where there is potential ice damming, such as eaves or overhangs and all around the PV array. Waterproof flashings are recommended in areas where ice damming may occur.

The other issue with installing metal flashing between roofing shingles that needs further examination, according to Nogueira: the effect on the warranty of the roofing material itself. The separation of the shingles can be treated as a failure to seal the roof (blow-offs), which



Wind driven rain simulation at Yanegiken's laboratory with Hurricane Katrina level wind speeds.

could drastically reduce the warranty from the roofing manufacturer. Nogueira says the roofing manufacturer will become more involved as far as recommendation for the installation of PV systems on top of their roofing products based on future codes yet to be adopted.

The RT-[E] Mount is supplied with the RT butyl tape flashing, and the company claims 100 percent waterproofing on low and steep slope asphalt roofing applications while still fully complying with code requirements.

In fact, RoofTech says it has the only rail-less PV mounting system with integrated flexible flashing certified by the ICC. It is fastened with 5-mm stainless steel screws, so there is no need for a pilot hole and, by code, the area for attaching to the rafter is wider than when compared to the usual 8-mm lag bolt. This allows the installer to easily meet code without the risk of splitting a rafter.

In addition to the butyl tape, each PV module is secured with multiple fasteners to spread the mechanical load evenly throughout the roof surface and, more importantly, to alleviate the torsion applied to a roofing system due to thermal stresses. Nogueira says the thermal contraction and expansion of an array that is built mostly with aluminum with a high coefficient of thermal expansion will have the most movement on top of a roof.

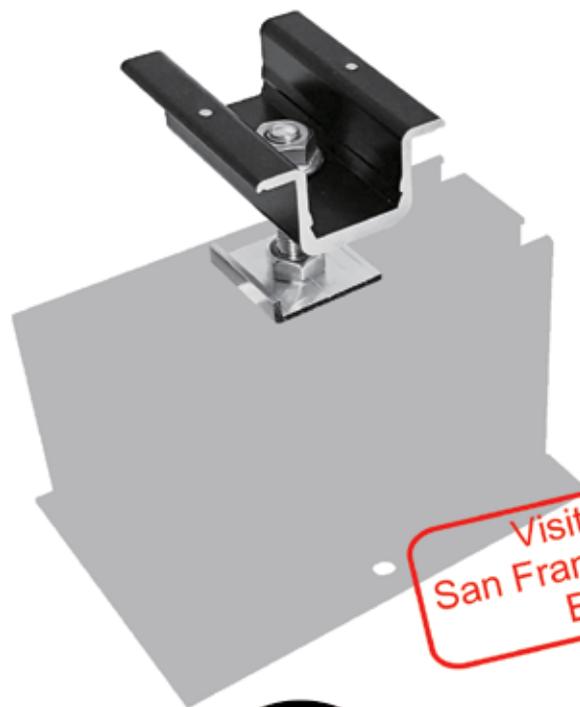
The Roof-Tech design, with a module frame, has mitigated the effects with a minimum distance between adjacent rows that can be as low as 3 mm (1/8 in.). Mid and end clamps are 4-in. wide for the purpose of distributing the clamping pressure on a larger surface of the PV panel frame. ■■■

Chris Crowell is managing editor of *Solar Builder*.

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