



Robotics solving solar's vegetation management problem

PES talks to Renu Robotics' CEO Tim Matus again for an update on the latest concerning autonomous technology in the solar industry.



PES: Tim, it's great to talk to you again. Please bring us up to speed on how Renu Robotics' autonomous technology is solving the solar industry's growing vegetation management problems. What's the latest on the Renubot?

Tim Matus: It's great to talk to PES again and, as you can imagine, we've been busy. Renu continues to expand, we're cutting grass at utility-scale solar facilities in various regions of the US and we've even rolled out a new company logo. In the past year, we've more than doubled in size, while fulfilling orders for existing customers and talking to new potential ones. Back in early 2019, there were a handful of us and now we're 70+ employees and still growing. We've been looking for a new building to expand our operations, engineering, manufacturing and Mission Control.

Our primary core market remains solar power plants, but we've also entered the commercial airport market as well. On the solar side, we're operating in 16 states from Maine to Hawaii.

PES: Renu is operating at solar facilities across the US as we see industry projections of exponential growth not only in the states, but also globally. With more large solar facilities going online every year, that must mean more acreage and growth potential?

TM: It certainly does. Current projections estimate there are more than one million acres in the United States alone to maintain and that's growing as we speak, especially after the Inflation Reduction Act (IRA) became law. It's led to a massive amount of investment in the solar industry and incentivises decarbonisation efforts, which favours a product like the all-electric Renubot.

Plus, with the Solar Investment Tax Credit (ITC), there's a section that applies both to commercial solar and utility-scale solar facilities. The combined IRA and ITC tax credits can save companies building new solar facilities as much as 40% in some cases.

The growth of the solar industry is rapidly expanding on every continent and is likely to do so for a decade or more. Even before the pandemic, there were labor shortages, reliability issues, damages and safety and environmental concerns during routine mowing at these facilities. The Renubot is becoming the preferred solution.

PES: It would seem like with diversity of the sites in the US, it's a great opportunity to prove your worth. Is there a timetable to begin global expansion?

TM: We're getting almost daily inquiries from all over the world about when will the Renubot be available abroad. That's to be determined based on several key market-driven factors, but, yes, we'll be expanding at some point in the future.

We continue to hone our understanding of vegetation management issues on utility-scale solar plants. Every solar site is different in its design and specifications, so the Renubot's ability to navigate precisely is a prerequisite, considering the limited space between the rows of panels and the wiring underneath.

We've developed artificial intelligence for autonomous operations and use multiple sensors for situational awareness. There are a number of other technological and communications capabilities that make it an autonomous vehicle unlike anything on the market today.

Our Generation-3 is designed specifically for vegetation management on large solar plants and other energy facilities. Real-time Kinematic GPS provides horizontal accuracy within two centimeters or within an inch.

PES: One differentiating factor with the Renubot we've noticed is that it allows O&M managers the flexibility to mow at night, is that right?



Tim Matus

TM: That's exactly right. The fact the Renubot can mow at night has been a game changer for some O&M managers, since it has never been done before. They like the fact that the grass can be mowed at night in a certain sector of the facility, before crews arrive in the morning for maintenance or repairs. This is an industrial machine that's rugged, reliable and significantly cuts vegetation management costs and carbon emissions.

PES: You mentioned how Renu is learning all the time and with more Renubots now out in the field than at any time in your company's history, how have lessons learned translated into the bot's capability and performance?

TM: That's a great question and I'll point out we celebrated The 100th Bot Bash in early May, signifying the 100th Renubot to come off the assembly line. Getting back to your question, the Renubot was designed by solar O&M professionals specifically for vegetation management on these locations.

This collective experience internally supported by conversations with asset owners and O&M managers were the guidelines we used in enhancing the Gen-3. It has a streamlined body frame that is only 28 inches high to safely mow under panels and solar site infrastructure. The bot's powered by a high-energy lithium battery, so its weight is optimised utilising the latest battery storage techniques and rapid-charging capabilities. The Renubot is designed to mow 100 acres or more per month. We use the 5-5-5 rule as a general guide, meaning it takes five hours to fully charge and the bot can mow five acres during a five-hour span.

When its lidar detects something in its path, maybe some equipment that has been left behind, the bot stops, can go around it as well as wait for the object to be removed. It can mow a 15° incline with no problem, go through ditches and has a self-adjusting mowing deck, from 1.5 inches to 9.5 inches, for maximum flexibility.

Its innovative features include controls for energy usage optimisation, self-diagnostics and operational area setup. The bot's enhanced environmental assessment capability will allow it to utilise data so it can learn and assess the facility infrastructure as it travels.

The more discussion there is about climate change and the world's use of renewable energy as it strives for a carbon-free economy, the better it is for the fully electric Renubot, which is great for the environment and certainly helps in the fight against climate change.

PES: In the past you've talked about the Renubot as a Robot as a Service or RaaS model. Besides the bot itself, what are the other components in the model?

TM: A lot of people are familiar with a SaaS model for software, so our RaaS model is a complete system for vegetation management. The Renubot can mow in the field anytime in a 24-hour period and when it completes its 'cycle,' it returns to its Recharge Pod to replenish its battery and can receive software updates there or in the field from Mission Control.

The Recharge Pod is 7.5 feet wide and 11 feet long. It's five feet in height, so the bot has plenty of room. It houses the electronics for charging and RTK communications. The pod weighs about 1,200 pounds and we coordinate with customers so there's a flat level surface where it will sit, preferably on concrete or a gravel base.



When the bot approaches, the pod doors are opened and bot slowly enters, connecting the charge contacts on the back of the bot and near the base of the pod. The pod provides protection in all climates and is normally equipped with three individual converters for charging. A customer can add converters for a quicker charging cycle – up to six, in fact. But a pod with three converters is typical and its electrical setup can be either standard AC or DC or both, depending on the electrical availability.

If there's an area where electricity isn't readily available, our Solar Charger is the solution. This is the redesign of the original Solar Skid, but now each skid is a more

compact three-panel configuration. The new configuration is three skids together to comprise one Solar Charger, which is connected to the Recharge Pod. Each skid is a self-ballasting unit that produces 1,200 to 1,500 watts with a 5 to 25 kilowatt-hour (kWh) battery storage option. If a customer wants a faster charge, then we can add more skids or another complete Charger. It's another environmentally friendly component that means O&M directors will never have to worry about fuel spills again.

The other critical piece we've built in the RaaS model is Mission Control. It's located in Renu's corporate offices where technicians continuously monitor, control and update





the bots in the field. System access can allow for security checks, software updates and adjusting maintenance schedules.

Mission Control gives owners and operators peace of mind with a secured and encrypted data flow, allowing for a high-level overview of their facilities' maintenance plan. Whenever it's convenient, asset owners and O&M providers can monitor performance, location and schedules with computers, tablets or cell phones through the Mission Control customer portal.

This centre allows for automatic reporting, triggering of alerts and allowing for text or email messages to be sent to any device. Mission Control also is linked to a Service Management System, allowing for a seamless transition for 'trouble tickets' and maintenance repair documentation.

It also offers automated predictive analytics through machine learning. This leverages the built-in automated reporting and notification system to alert users of reliability and/or maintenance concerns.

PES: We've seen Renu steadily grow during the past five years, especially the past couple of years. What's on the horizon?

TM: There are several ideas being discussed about the future of the Renubot and most are

in the categories of other O&M measures, such as cleaning, inspection or security.

When we're talking to customers we're also asking, 'what do you need a bot to do for your facility?' The answers are usually similar to the concepts I've mentioned and sometimes they're not, but we'll make market-driven decisions in the end.

Our Solar Charger and the Recharge Pod's future modifications could range from aesthetic design changes to standardisation of AC/DC charging capabilities.

Mission Control will have the future expansion and will range from enhanced reporting and mapping to video and image capture from the Renubot.

There also will be far more data collection possibilities to help O&M managers. Additional real-time communications and chat capabilities between operators and a facility's O&M staff also are being considered.

We're not only solving problems in the field, but Mission Control is giving owners and operators more confidence with a secured and encrypted data flow about their facilities' maintenance. It's true that more and more asset owners and O&M managers are realizing the Renubot can significantly cut maintenance costs and provide an invaluable

carbon-free solution to their annual maintenance issues.

PES: Would you agree that as the solar industry grows, technology will continue to develop to meet demand?

TM: Yes, definitely, and more than five years ago we saw an increasing demand for vegetation management in which an industrial autonomous mower was the solution. As we fine-tuned the Renubot, we also saw it needed an ecosystem around it, so we developed Mission Control for oversight and the Solar Charger for remote charging needs. We've responded to customers' requests on how the Renubot can be a turn-key solution for their solar or energy facility and have continuous oversight and data collection that benefits the facility.

Giving customers flexibility is why we offer either ownership or a lease model. But when they compare what they're currently paying for vegetation management, owning a fleet of Renubots makes fiscal sense.

PES: Tim, thanks again for taking time to give us an update on Renu Robotics' growth. We look forward to talking again in the future.

TM: It's always great to catch up with PES Solar.

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