Powering Innovation

Bright Idea

Sometimes a new path becomes clear when you see the pitfalls of the old one. Brian Gramm was researching large-scale renewable energy, such as wind farms, when a totally new approach dawned on him. Rather than trying to make green energy look like the old, big-plant electrical grid, why not generate power right where it's used, and let consumers have their own miniature power plants that can go anywhere?

"There are situations where large-scale solar is right, like office buildings. But the things that most of us use daily, most often, really don't require much power," said Gramm. He co-founded Peppermint Energy, a South Dakota company that makes a portable, plug-and-play solar generator called the FORTY2. Like a solar plant in a suitcase, the FORTY2 draws enough juice from the sun to power lights, laptops — even a dorm fridge. A battery stashes power and delivers it after sundown.

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Brian Gramm
Peppermint Energy

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A 3D printed prototype made of strong ABS plastic helped Peppermint Energy design its FORTY2 solar generator .

Inspiration to Distribution

The FORTY2 changed a lot between idea and delivery. At first, Gramm thought the device would resonate most with U.S. consumers — tailgaters and campers seeking off-the-grid recreation. But experts were most excited about what the FORTY2 could do in the developing world, where three billion people live without reliable electricity. If Peppermint's device could power lights for working and learning after sunset, equipment for disaster relief, and refrigerators for penicillin, it could change lives.

Think of it: Lifesaving medicine could reach places it couldn't go before. The device could also spark commerce in remote areas as entrepreneurs find ways to monetize free reliable power. To do the most good, Gramm realized the FORTY2 had to be robust. In a portable size, providing the spikes of intense power that refrigeration demands was a big engineering challenge. Gramm set about assembling the talent, resources and relationships to put his vision to work. "Honestly all I had at this point was a bit of an idea, and a picture," he said.

Once engineers had honed the device as far as possible in CAD, Peppermint needed a physical prototype. "It was hard for anybody, including me, to truly appreciate size and scale when you're looking at it onscreen," Gramm said. At three feet wide and likely to weigh 60 pounds, the FORTY2 required a seriously robust housing, complex and strong enough to hold all of its components. Fused Deposition Modeling™ (FDM®) was the only 3D printing method that could deliver.

The first full-scale prototype, built in a Fortus® 3D Production System, revealed some of the design considerations that led to the FORTY2's delightfully simple operation. "It's only when you see it in physical form that you realize the form and function should be the same," Gramm said. For example, a power switch is unnecessary; just opening the FORTY2 turns it on. The Peppermint team also decided to make the whole device even smaller than intended after carrying the first prototype proved awkward. Gramm said if he had to do it all again, he'd use 3D printing even earlier in the process.

Modeling Relationships

Surprisingly, the prototypes helped build another essential element to success: relationships. "Ever try to ask a vendor 'Make me a custom thing that works in concert with a bunch of other stuff that I can't show you'?" said Peppermint president Chris Maxwell. Full-size prototypes facilitated discussions with manufacturers and component vendors. Best of all, Maxwell said once the product was tangible, potential investors felt they were buying into a business, not just an idea. Some even took the prototype home for a weekend.

In a second iteration, the team discovered a 1/4-inch flaw in the FORTY2's design, which Gramm said would have been overlooked in CAD. Additionally, the powerful battery required for refrigeration made it necessary to scale back other components. "We were able to make changes that I would estimate saved us at least a quarter of a million dollars in tooling," said Gramm. Because of the two FDM prototypes, the team committed to production with confidence rather than hope.

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