

Forbes

Dec 2, 2021, 02:23pm EST

## Vaulting Into Global Energy Storage Markets: Energy Vault Is A Player To Reckon With

**Peter Kelly-Detwiler**

Contributor

[Sustainability](#)

*I cover the energy industry.*

How could a large quantity of 35-metric ton blocks of polymer-infused dirt possibly increase the quantities of wind and solar resources that increasingly power our growing clean energy economy? It turns out, those gigantic blocks may play a key role in storing and releasing energy in our power grids - if we lift and stack them or lower them at the right speed, in the right place, and at the right time.

That's what the founders of Energy Vault realized, and several years ago they set out to build a structure - out of massive building blocks - that could construct or deconstruct itself, absorbing or releasing energy during the process.

The technology was promising enough that Japan's SoftBank Vision Fund committed \$110 million to the company in the summer of 2019.

I wrote a [Forbes.com piece](#) at that time, as the company was in the process of erecting a 70-meter (about 20 stories) tall Commercial Demonstration Unit in Arbedo-Castione Switzerland, that would raise and lower its bricks with cranes and deliver services to the Swiss power grid.

That 5 megawatt (MW)/35 megawatt-hour (MWh) facility was intended to prove the technology's ability to deliver a variety of energy storage services, ranging from fast responsive ancillary services that balance the grid and keep frequencies within desired parameters, to longer duration energy supplies that would complement the variable output of a growing fleet of renewable wind and solar assets.



The 1.0 version that proved the concept  
CREDIT: ENERGYVAULT

---

In the past two years since then, Energy Vault has made remarkable progress – moving from a conceptual technology company to a well-financed player with multiple signed contracts, a robust business pipeline, and boasting a new iteration of its technology. So when I had a chance to engage in a follow-up conversation with CEO Robert Piconi, I jumped at the opportunity.

**The original tower of power:** During our conversation, Piconi explained that the original Swiss project was successfully interconnected with the Swiss grid in July of 2020, and employed a series of six cranes to raise and lower the 35-ton composite bricks, each sized to deliver one megawatt-hour (1 MWh) of energy storage. How, one might ask, does that work? If you go back to the high-school physics class that many of us suffered through, you may remember that an elevated weight represents potential energy. That is, it takes a specific amount of energy to raise a given mass to a specific height, and an equal amount of energy is released as it falls (assuming no friction losses).

So how does that translate into energy storage on the grid? Well, if you utilize motors to raise one of those massive composite bricks, you use electric energy in the process. If you lower that mass over the same distance, the attached cable can spin a motor generator delivering back electric energy. With friction losses, about 15 to 20% of that energy is lost as heat, so your round trip efficiency (RTE) translates to about 80-85% (compare that to lithium ion batteries with about 87-90% RTE, although if you have to warm or cool the batteries, you can end up in a similar efficiency range). Pumped hydro storage plants do something similar: they move masses of water up an elevation and then let that water descend at speed through turbines that spin and generate energy (and generally have RTEs in the mid-to high 70% range).

**Bringing additional capital to the game:** On the heels of that initial success, Energy Vault began lining up commercial customers in power grids around the planet. The company now has 2.5 gigawatthours (GWh - a GWh is equal to 1,000 MWh) of executed agreements or LOIs worth up to \$880 million, including its recently announced agreement to provide 1.6 GWh of energy storage to support DG Fuels across sustainable aviation fuel projects in Louisiana, Ohio and British Columbia.

As a consequence of that customer interest, the company needed more capital to build the projects. So Piconi and team went out seeking additional funds, raising an

undisclosed amount from Saudi Aramco Ventures in April of 2021, an additional \$20 million from Helena announced in July and yet another 100 million in a Series C funding round announced shortly thereafter. Then, in September, Energy Vault announced it would go public on the New York Stock Exchange via a merger in Q1 of next year with Novus Capital Corporation II (NYSE: NXU), a special purpose acquisition company (SPAC), which is expected to provide up to \$388 million in additional funding.

**Building a better brick:** Crucial to the company's success has been the evolution of its underlying technology. Piconi noted that the previous brick technology utilized pre-fabricated base and top plates made with high performance concrete, with the remaining content being up to 96% local soil, using technology based on materials science research from Mexican cement company CEMEX. The original tower structure also incorporated a special method for grabbing and lifting each brick. In the current iteration, that has all been improved, with the base and top plates being eliminated. Now, the bricks will be moved with trolleys and industrial elevator lifting systems, thereby eliminating any special features or hooking mechanisms.

---



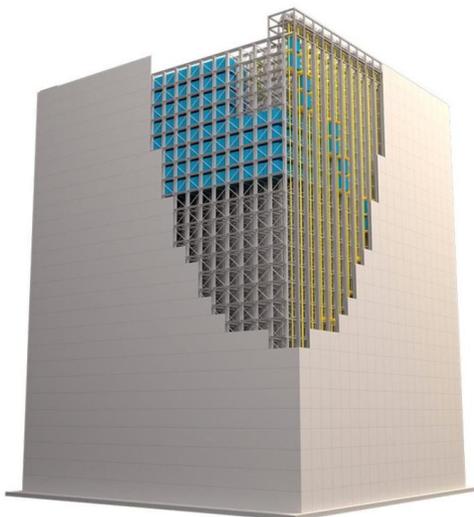
Grabbing the 35 ton bricks in the first iteration  
ENERGY VAULT

In the current version, the CEMEX polymer is infused into the core material, providing the necessary structural strength without the need for external support. The polymer is the magic ingredient. Piconi explained, "The polymer is actuated with water, and reacts with soil. The recipe is adapted to every location based on site-specific geologic samples." The blocks have been designed to allow trolleys to shuttle them to the vertical "lifting systems" (think large industrial elevators), while also being capable of being continuously elevated and lowered over the course of several decades.

"This is all about sophisticated materials science," he indicated, with the benefit that numerous waste materials can be incorporated into the bricks. "They can include anything from the remains of crushed up wind blades to mining waste tailings and even power plant coal ash." Piconi noted that a large East Coast utility shipped two tons of coal ash to Switzerland for testing in the CEMEX material science lab as a pre-cursor to testing at an EPA certified lab in the US, which was completed in 2019.

**Version 2.0 – no longer a tower, but a (pretty big) building:** At the same time that it announced the Saudi Aramco Energy Ventures investment, Energy Vault unveiled its newest storage platform, EVx™, evolving from the original tower design to a modular building architecture offered in 10 MWh (10-brick) increments. The building approach facilitates an easier permitting process, expediting approvals and construction timelines. More importantly though, the new platform fully decouples the power and energy aspects of the storage facility.

---



With a structure that is 40% lower and a more optimized footprint, the platform allows more bricks to be utilized at any one time, thus providing more power over shorter durations when required. A 50 MWh system occupies approximately 1.5 to 2.0 acres, depending on the power required (more capacity means more horizontal space, since you are lifting more bricks at the same time). Piconi indicated the space requirements are roughly three to four times greater than a typical lithium-ion storage facility.

Unlike the previous tower structure with its six cranes, the new rectangular buildings can be fitted with a greater number of high efficiency motors (about 98% efficiency) and generators, with horizontal trolleys that move the bricks into place. Typically, the blocks move at 2.5 to 2.9 meters (about 8 to 9.5 feet) per second, but can be accelerated or slowed via computerized control to allow for higher or slower electricity discharge.

Piconi said the overall design change was driven by feedback from utilities and energy companies to Energy Vault. “They came back with two questions: First, could you make it lower in height, and second, could you offer a two to four-hour solution as an alternative to lithium ion.”

A number of energy companies wanted the type of storage solution that could economically provide the flexibility to offer both higher power (i.e. 50 MW) over shorter durations of four hours as well as longer durations of six to 12 hours. “So, we lowered the height and made it a building – it’s a foundation and a fixed frame structure that supports the lifting systems, trolleys and composite blocks.”



A building to power tomorrow's grid  
ENERGY VAULT

So how fast can the company deliver a finished building once a contract is signed? Piconi explained that the system typically takes nine to 12 months to build, with the major constraint being the fabrication time of the brick composites. “We could do it faster with two brick machines instead of one if the customer wants a system delivered faster.”

Although the polymer was developed by CEMEX under their strategic collaboration, the brick machine was designed by Energy Vault and uses 40 hydraulic pistons to compress the polymer-infused dirt and other materials. The brick machines themselves take about three to four months to manufacture and then are delivered to customer sites for localized brick fabrication.

**What’s next?** With the capital raise behind it, and prospect of additional resources available from the forthcoming SPAC event, Piconi asserted that now it’s all about project development and execution.

“We realized that getting fully funded would help us execute more quickly to fulfill global demand. With the capital we’ll raise from the SPAC transaction, we expect to be fully funded with no debt, so we can focus 100% on execution.” In addition to the 2.5 GWh of executed agreements and LOIs, we are in active dialogue with customers across five continents on their current and future grid-scale energy storage needs.”

Piconi views Energy Vault’s effort as part of a much bigger environmentally-focused and global transition that urgently needs to occur. In addition to making bricks from local dirt and industrial waste, Energy Vault is looking at replacing concrete and carbon-intensive steel frames with environmentally friendly and sustainable materials.

“All companies should recognize their responsibility to use innovation to architect solutions that are sensitive to the environment and the communities around them,” he affirmed. “Companies should prioritize their R&D to develop more sustainable solutions to accelerate our transition to more circular economy.”

\*\*\*\*\*

---

#### Forward-Looking Statements

This communication includes certain statements that are not historical facts but are forward-looking statements for purposes of the safe harbor provisions under the United States Private Securities Litigation Reform Act of 1995. Forward-looking statements generally are accompanied by words such as “believe,” “may,” “will,” “estimate,” “continue,” “anticipate,” “intend,” “expect,” “should,” “would,” “plan,” “predict,” “potential,” “seem,” “seek,” “future,” “outlook,” “designed,” and similar expressions that predict or indicate future events or trends or that are not statements of historical matters. These forward-looking statements include, but are not limited to, statements regarding estimates and forecasts of financial and performance metrics, projections of market opportunity, Energy Vault’s readiness to go to market, expectations and timing related to the rollout of the business of Energy Vault, Inc. (“Energy Vault”) and timing of deployments, including with respect to any customer agreements, such as the agreement with DG Fuels and the associated projects, expectations with respect to revenue generated under the agreement with DG Fuels, the consummation of the agreement with DG Fuels, the proposed features and designs of the EVx and the Energy Vault Resiliency Center (EVRC) platforms, the availability of low-cost and locally sourced materials to produce

“mobile masses,” ability to service customer expectations, customer growth and other business milestones, potential benefits of the proposed business combination and PIPE investment (the “Proposed Transactions”), and expectations related to the timing of the Proposed Transactions.

These statements are based on various assumptions, whether or not identified in this communication, and on the current expectations of Energy Vault’s management and the management of Novus Capital Corporation II (“Novus”) and are not predictions of actual performance. These forward-looking statements are provided for illustrative purposes only and are not intended to serve as, and must not be relied on by an investor as, a guarantee, an assurance, a prediction, or a definitive statement of fact or probability. Actual events and circumstances are difficult or impossible to predict and will differ from assumptions. Many actual events and circumstances are beyond the control of Energy Vault and Novus.

These forward-looking statements are subject to a number of risks and uncertainties, including changes in domestic and foreign business, market, financial, political, and legal conditions; the inability of the parties to successfully or timely consummate the Proposed Transactions, including the risk that any regulatory approvals are not obtained, are delayed or are subject to unanticipated conditions that could adversely affect the combined company or the expected benefits of the Proposed Transactions or that the approval of the stockholders of Novus or Energy Vault is not obtained; failure to realize the anticipated benefits of the Proposed Transactions; risks relating to the uncertainty of the projected financial information with respect to Energy Vault; risks related to the rollout of Energy Vault’s business and the timing of expected business milestones; risks related to the inability or unwillingness of Energy Vault’s customers to perform under sales agreements; risks related to Energy Vault’s ability to obtain and maintain a performance bond; risks related to Energy Vault’s receiving partial payment in the form of subordinated debt; risks related to timing delays that impact the sales price due to Energy Vault under its announced agreement with DG Fuels demand for renewable energy; ability to commercialize and sell its solution, including at anticipated sizes, costs, capacities and capabilities; ability to negotiate definitive contractual arrangements, such as purchase orders and sales agreements, with potential customers, including with DG Fuels, as contemplated by the announced agreement; the impact of competitive technologies; ability to obtain sufficient supply of materials; ability to obtain necessary permits and meet building code specifications; ability to protect its intellectual property; the impact of Covid-19; global economic conditions; ability to meet installation schedules; construction and permitting delays and related increases in costs; risks related to the performance of systems delivered to DG Fuels; the effects of competition on Energy Vault’s future business; the amount of redemption requests made by Novus’ public shareholders; and those factors discussed in Novus’ Registration Statement on Form S-4 relating to the business combination under the caption “Risk Factors”, and its Annual Report on Form 10-K for the fiscal year ended December 31, 2020 and the preliminary proxy statement/prospectus, in each case, under the heading “Risk Factors,” and other documents of Novus filed, or to be filed, with the SEC. If the risks materialize or assumptions prove incorrect, actual results could differ materially from the results implied by these forward-looking statements. There may be additional risks that neither Novus nor the Company presently know or that Novus and the Company currently believe are immaterial that could also cause actual results to differ from those contained in the forward-looking statements. In addition, forward-looking statements reflect Novus’s and the Company’s expectations, plans or forecasts of future events and views as of the date of this communication. Novus and the Company anticipate that subsequent events and developments will cause their assessments to change. However, while Novus and the Company may elect to update these forward-looking statements at some point in the future, Novus and the Company specifically disclaim any obligation to do so. These forward-looking statements should not be relied upon as representing Novus’s or the Company’s assessments as of any date subsequent to the date of this communication. Accordingly, undue reliance should not be placed upon the forward-looking statements.

---

#### Important Information and Where to Find It

This communication is being made in respect of the proposed merger transaction involving Novus and Energy Vault. Novus has filed a registration statement on Form S-4 with the SEC, which includes a preliminary proxy statement/prospectus of Novus, and certain related documents, to be used at the meeting of stockholders to approve the proposed business combination and related matters. Investors and security holders of Novus are urged to read the preliminary proxy statement/prospectus, and any amendments thereto and other relevant documents that will be filed with the SEC, carefully and in their entirety when they become available because they will contain important information about Energy Vault, Novus and the business combination. The definitive proxy statement will be mailed to stockholders of Novus as of a record date to be established for voting on the proposed business combination. Investors and security holders are also able to obtain copies of the registration statement and other documents containing important information about each of the companies as and when such documents are filed with the SEC, without charge, at the SEC’s web site at [www.sec.gov](http://www.sec.gov). The information contained on, or that may be accessed through, the websites referenced in this communication is not incorporated by reference into, and is not a part of, this communication.

#### Participants in the Solicitation

Novus and its directors and executive officers may be considered participants in the solicitation of proxies with respect to the Proposed Transactions. Energy Vault and its executive officers and directors may also be deemed participants in such solicitation. Information about the directors and executive officers of Novus is set forth in its Annual Report on Form 10-K for the fiscal year ended December 31, 2020. Additional information regarding the participants in the proxy solicitation and a description of their direct and indirect interests, by security holdings or otherwise, are included in the preliminary proxy statement and other relevant materials filed or to be filed with the SEC when they become available. Novus stockholders and other interested persons should read the preliminary proxy statement carefully before making any voting decisions. As they become available, these documents can be obtained free of charge from the sources indicated above.

---