

2011-2019

IMPACT + GROWTH REPORT



GREENTOWN LABS

greentownlabs.com



THE LARGEST
CLEANTECH STARTUP INCUBATOR
IN NORTH AMERICA



It comes down to the cooperation, the collaboration, but more importantly, the people. When you walk around and you meet the people here, you're inspired.

—Thomas Kinisky, Chief Innovation Officer & SVP, Saint-Gobain Chairman, Saint-Gobain North America.

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A NOTE FROM OUR CEO



EMILY REICHERT

In 2011, a group of cleantech entrepreneurs graduated from MIT and decided to share rent in a dilapidated warehouse in East Cambridge, Mass. Today, less than 10 years later, that community of four startups has grown into the largest cleantech incubator in North America that's currently home to more than 100 companies across a 100,000-square-foot campus.

We've accomplished a lot in the past eight years: we've supported more than 230 startups, forged partnerships with industry-leading global corporations, built programming that's uniquely tailored to hardware-focused cleantech entrepreneurs, and nearly doubled our community size and campus footprint year-over-year. But what we're most proud of is what our startups have accomplished in this short time.

Of the 230 companies that have called Greentown Labs home, more than 88 percent are surviving and thriving! These companies have collectively raised more than \$750M in funding and created more than 6,500 jobs. Moreover, they're all working toward a shared vision: to develop and deploy solutions to our greatest climate and environmental challenges. They're creating transformational innovations across all sectors of our economy: electricity, transportation, buildings, manufacturing, agriculture, and water—the sectors that also happen to be the biggest sources of greenhouse gas emissions.

From long-duration energy storage and hydrogen transportation infrastructure to membrane filtration and advanced cooling towers for industrial facilities, our members are tackling climate change from every angle.

We're grateful for their work and dedication to their mission because we know, as the 2018 Intergovernmental Panel on Climate Change (IPCC) report stated, in 2020 we have about 10 years left to act on climate. The IPCC report demands a rapid scale-up of emerging technologies that can mitigate greenhouse gas emissions. That's where our entrepreneurs come in, but we know startups can't achieve these goals on their own. We need private markets (industry leaders), capital (investors), and regulations (policymakers) to step up, do more, and commit to taking bold action on climate. Our planet's future and future generations depend on it.

This report is a brief summary of our community's achievements since our founding in 2011. I'm inspired by what our industry and ecosystem have done in the past 10 years and can't wait to see what we do together in the next 10! There's much work to be done, but I'm confident if we come together as a community, we can address our climate challenge.

Onward and upward,
Emily Reichert, Ph.D.
CEO, Greentown Labs

STARTUP STATS

SINCE OUR FOUNDING IN 2011

» **230+**
COMPANIES INCUBATED

» **88%**
STARTUP SURVIVAL RATE

» **\$750M+**
FUNDING RAISED

\$232M
IN REVENUE

430+
PATENTS

21+
SERIES A
FUNDING ROUNDS

8+
SERIES B
FUNDING ROUNDS

FIRST-EVER
SERIES C FUNDING ROUND
IN 2019

6
ACQUISITIONS

ECONOMIC IMPACT

» **\$1.56B**
IN ECONOMIC IMPACT

6,500
JOBS

\$550M+
IN LABOR INCOME

\$845M+
IN VALUE ADDED



WELCOME TO GREENTOWN LABS

The Largest Cleantech Startup Incubator in North America

2011



Greentown is founded in a Cambridge warehouse by four companies looking to share the cost of rent and resources.



Greentown moves to 337 Summer St., a 19,000-square-foot space in Boston. Then-Boston Mayor Thomas Menino joins for the space's opening.

2013



Greentown hires its first employee, Emily Reichert, who still serves as Greentown's CEO.



Faced with skyrocketing Boston rents, Greentown searches for a different location. Greentown holds a successful \$30,000 Indiegogo campaign to help finance its new home.



With the support of Somerville, Mass. Mayor Joseph A. Curtatone, Greentown moves to the city, opening a 33,000-square-foot facility at 28 Dane St.

2015



Massachusetts senators, including U.S. Senator Elizabeth Warren, and gubernatorial candidates tour Greentown.



With Massachusetts Governor Charlie Baker and Lt. Gov. Karyn Polito, Greentown announces it will expand into a second building in Somerville located at 444 Somerville Ave. The expansion would bring Greentown up to almost 100,000 square feet and provide room for more than 100 startups.

2016



Greentown breaks ground on its new building.

2017



Greentown moves into its headquarters.

2018



Greentown hosts Massachusetts Governor Charlie Baker for the grand opening of the 444 Somerville Ave. building.

2019



U.S. Senator Ed Markey announces the Green New Deal at Greentown, two days after he and N.Y. Rep. Alexandria Ocasio-Cortez introduce the bill in Washington, D.C.



Massachusetts Speaker of the House Robert DeLeo announces his \$1B GreenWorks program.



U.S. Senator Ed Markey serves as the keynote speaker of Greentown's DEMO Day.

MEMBER GROWTH

2011

4

2012

15

2013

25

2014

40

2015

45

2016

50

2017

55

2018

92

2019

110



WHERE WE CAME FROM

Greentown Labs' story begins with four startups. They didn't intend to found North America's largest cleantech incubator—all they wanted to do was share rent and resources.

Promethean Power Systems needed to find new prototyping space after one of its founders graduated from MIT, eventually locating a warehouse on Cambridge's Charles Street. They combined forces with three other startups in 2011, all of which had founders who'd graduated from MIT and seen firsthand how out-of-reach lab space can be for new companies.

As news spread about the warehouse, more cleantech companies joined the ragtag group of startups. Promethean co-founder Sam White describes the group as "a hodgepodge of nomads" who would trade technical tips and work alongside each other late into the night.

When the co-founder of Coincident spent hours helping Promethean edit a grant proposal, White "realized something special was going on."

Soon, the spirit of collaboration spread to every facet of entrepreneurship. From sharing equipment to swapping staff to lending emotional support, the cleantech startups who banded together were benefitting far beyond a smaller rent check.

"We would bring in investors, and they couldn't just come in and see us, because everyone was in the hallways—we'd say, 'here's this company, here's that company,'" White explains. "When we had technical hurdles, we would lend engineers to help with a problem. Some of the technical breakthroughs happened because of the collaboration among us."

The benefits of that collaboration carried the unforeseen incubator from the Cambridge warehouse to Boston's Fort Point neighborhood—which was just then being dubbed the "Innovation District" by Boston's late Mayor Thomas Menino—to Somerville's Union Square. The number of companies jumped from four to 17 to 25 to 55 in a few short years. Greentown expanded to an additional building in December 2017, and the 100,000-square-foot campus now offers prototyping and wet lab space, shared office space, a machine shop, electronics lab, and a curated suite of programs and resources with capacity to house more than 100 cleantech and climate-oriented startups.

Today, Greentown offers startups the resources, expertise, and support they need to change the world. Whether that involves introductions to strategic partners or high-end equipment or the community itself, less than a decade after its founding Greentown has buoyed hundreds of cutting-edge startups that are tackling our biggest climate and environmental challenges.



➤ From left: Greentown Labs founders Jason Hanna, Sam White, Sorin Grama, and Jeremy Pitts.

➤ THE FOUNDING FOUR



Promethean Power Systems' mobile chilling technology serves 60,000 dairy farmers throughout India.



OsComp Systems built a gas compression technology that kept equipment temperatures low to maximize efficiency. OsComp is now Reach Production Solutions, which manages multiphase wells.



Altaeros builds powerful SuperTowers to bring internet access to rural areas.



Coincident, now Embue, offers building owners, property managers, and tenants the necessary insights to save energy and money.



PROMETHEAN POWER SYSTEMS

Imagine you're a dairy farmer in a rural Indian village. Your village only gets seven hours of power a day, which isn't enough to operate a traditional milk chiller to keep your milk from spoiling.

Diesel generators are a flawed option, since they're expensive and harmful to the environment. So your milk has to travel many miles to a chilling center. If bacteria's already built up in your milk, it gets dumped. If it's still safe to use in some form, a dairy processor only gets a 7 percent margin—versus 27 percent on dairy products that demand high-quality raw milk.

Promethean Power Systems changes all that. The company's thermal energy storage system serves 60,000 farmers throughout India, and has replaced roughly 3 million liters of diesel fuel. What's more, farmers are able to get more money because the dairy processors buying their milk, now a permanent off-taker, make a higher margin on their milk, according to Promethean co-founder Sam White. This win-win makes an enormous impact on the farmers' business operations and success.

Promethean's thermal storage technology offers instant cooling and backup cooling power. Promethean's technology has many other applications, including mobile chilling that eliminates the need for compressors and transporting refrigerated food.

"When electric trucks start to become pervasive, you're not going to be able to use that diesel engine anymore to run the compressor," White explains. "So we're going to be sitting in a position where it's only our battery that can be economically viable, because we don't need a compressor once it's charged on the EV reefer truck. We charge it at the food plant and it lasts the whole shipping route."

Promethean recently received funding from Acumen, a social impact VC. The company is leaving its Series B round open to fill the remaining \$1 million of investment.

PROMETHEAN POWER SYSTEMS BRINGS SUSTAINABLE DAIRY CHILLING TO OVER 60K DAIRY FARMERS <<



WHERE WE ARE TODAY

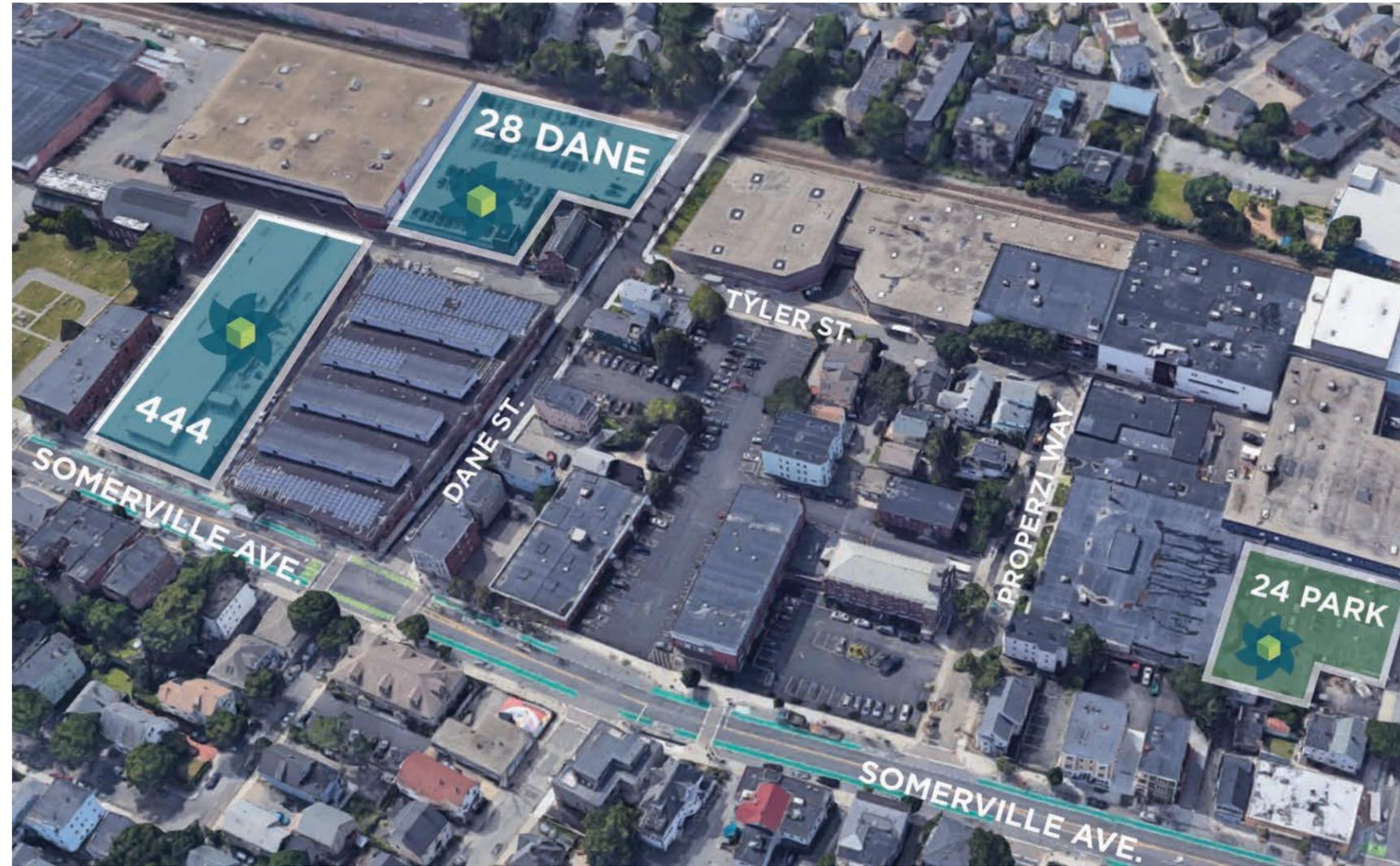
A CLEANTECH CAMPUS

Greentown Labs' operations span three buildings in Somerville, Mass. The facilities provide startups with the prototyping space, wet lab, offices, equipment, and other resources they need to help their technology take off. In all, Greentown's campus is nearly 100,000 square feet and is home to more than 100 cleantech startups, making it the largest cleantech incubator in North America. The three buildings have unique offerings:

444 Somerville Avenue: Greentown Labs' headquarters has desk room for more than 400 employees, a 26-bench wet lab, 10,000 square feet of prototyping lab space, and event space for more than 500 people.

28 Dane Street: This 33,000-square-foot facility includes the machine shop, the electronics lab, and lab space for mid- to larger-sized startups.

24 Park Street: A 7,000-square-foot satellite location is home to our largest Series A member companies.



A DAY IN THE LIFE

Want to learn about how to get a Small Business Innovation Research grant? How to work with corporates? How to protect your IP? Greentown Labs has your answers. The incubator hosts 600 internal events each year, meaning that on any day members can find a series of Lunch and Learns, expert panels, and industry-specific workshops designed to equip them with the knowledge, resources, and connections they need to succeed.

The special sauce of Greentown owes a lot to the community itself. Greentown co-founder Sam White always praises the lucky run-ins between members in the kitchens or at events that lead to collaboration and fruitful connections. And with an alumni member keeping the community hydrated with its smart water dispenser, Greentown has brought the phrase "water cooler conversation" to a whole new level!



This is ground zero right now for all of the big thinking for clean energy and climate solutions.

– Charlie Baker, Governor of Massachusetts

GREENTOWN
COMMUNITY BY
THE NUMBERS

>> 570+
COMMUNITY MEMBERS

>> 100+
COMPANIES

>> 2-3
EXTERNAL EVENTS PER MONTH

>> 600
INTERNAL EVENTS PER YEAR

>> 10K+
VISITORS PER YEAR

APPLICANT PROFILE + PROCESS

Greentown Labs receives about 100 membership applications every year. Its team carefully curates and pre-screens all of its applicants through customized and strategic tracking of the most promising and exciting cleantech startups around the world. Once the Greentown team connects with an early-stage company interested in membership, they're asked to complete a thorough questionnaire that tells Greentown critical information about their company, including their cleantech commitment, fundraising achievements, technology readiness level, needs, and why they want to join Greentown. Top candidates are then invited to visit Greentown. If the in-person conversation goes well, then the Board of Directors makes final decisions on all applications.

OUR MEMBERS AT A GLANCE

No two Greentown members are the same, but once they're settled into the community, a "typical" member company often has:

⇒ 10 EMPLOYEES
⇒ \$5M IN FUNDING
⇒ TECHNOLOGY READINESS LEVEL OF 7

Most companies stay at Greentown for just over two years and raise 83 percent of their funding while at the incubator. Together, Greentown member companies have:

⇒ RAISED MORE THAN \$750M
⇒ GENERATED \$232M+ IN REVENUE
⇒ CONDUCTED 10K PROTOTYPE TESTS
⇒ SECURED 430+ PATENTS

APPLICANT POOL AT A GLANCE

APPROXIMATE APPLICATIONS TO DATE: **450**

MEDIAN NUMBER OF JOBS: **4**

MEDIAN FUNDING RAISED: **\$100K**

COUNTRIES: **25**

AVERAGE TECHNOLOGY READINESS LEVEL: **5**



OVER \$1M IN MEMBER RESOURCES

Greentown members gain access to more than \$1M worth of member resources ranging from hardware equipment to software tools to legal services. Resources include:

- PROTOTYPING LAB
- WET LAB
- OFFICE SPACE
- MACHINE SHOP
 - HAAS CNC Machining Center • Lagun TRAK Programmable Mill
 - Epilog 50W Laser System • 3x Markforged Onyx 3D Printer
 - Southbend Lathe • Artisan's Asylum makerspace access
- SOFTWARE LICENSES
 - Solidworks • Keysight Advanced Design System
 - Altium • MathWorks • and more
- ELECTRONIC TESTING EQUIPMENT
- IN-KIND LEGAL SERVICES
- AND MORE

Greentown purposefully defines cleantech broadly with an air toward "doing more with less," and supports entrepreneurs who are developing solutions for the key carbon emitting sectors.

ELECTRICITY **AGTECH + WATER**
TRANSPORTATION **MANUFACTURING**
BUILDINGS **PLATFORM TECHNOLOGY**

THE LOCAL ECOSYSTEM + GREENTOWN LABS

- 89% of startups receive support from MassCEC
- \$11M+ in funding from MassCEC to Greentown startups
- 66% of alumni companies are based in Greater Boston
- 24% of applicants spun out of universities
- 71% have employees from key local universities
- 27% of applicants participated in a local accelerator

> From left: Raptor Maps' Kira Ewanich, Austin Coffin, and CEO and co-founder Nikhil Vadhavkar.



RAPTOR MAPS USES AI TO MAINTAIN
SOLAR PV WORLDWIDE

RAPTOR MAPS

Raptor Maps uses artificial intelligence and thermal imaging to maintain two percent of solar panels worldwide—but its path there was far from linear.

The team originally wanted to reduce the use of pesticides and fertilizers in agriculture by taking aerial thermal images. When they made their software available online, they noticed something surprising: solar farm operators were flocking to drone-based thermal imaging.

Solar entrepreneurs and experts at Greentown Labs helped co-founders Nikhil Vadhavkar and Eddie Obropta understand why their software was unexpectedly useful and ultimately pivot their business, explains Obropta, the company's CTO.

As the industry booms and solar farms pop up all around the world, the capacity to maintain and operate those fields has lagged. When a field isn't producing its maximum energy output, it can be challenging to determine what—and where—the problem is.

"You can see issues and anomalies in solar farms just in the thermal imagery," Obropta says. "You are able to see electrical issues that you can't see with the naked eye. That's awesome for the solar industry."

Raptor Maps' drone-based thermal imaging can pinpoint electrical issues and outages, damaged modules, and

obstructed modules (think dust, bird droppings, or overgrown trees) down to the exact solar module. Obropta calls this precision "unprecedented."

Raptor Maps is operational in 25 countries, and has digitized 12 gigawatts of solar—equivalent to 60,000 acres—since its founding in 2015. The company monitors about 40 million panels.

Raptor Maps has teamed up with Enel Green Power, one of Greentown's corporate partners, to manage real-time operations across the corporate's global solar portfolio.

In addition to solar farm operation and management, Raptor Maps now helps with the setup and construction of the farms, and aims to grow that side of the business. This includes terrain information, equipment tracking, site design, work order management, and more. Ultimately, Raptor Maps intends to be a locus for all solar farm information.

"We are looking to basically expand out that construction product. We want almost every new solar site being built to be able to benefit from using Raptor Maps software during construction," Obropta says.



>> Eddie Obropta, co-founder and CTO of Raptor Maps.



A FOCUS ON CLEANTECH SOLUTIONS

Innovation is a crucial tool as we redesign how we power our homes, travel our streets, and build our cities. Greentown Labs supports companies whose technologies can majorly bolster the fight against climate change. Renewable energy, circularity, biomimicry—you name it, Greentown startups are developing it to build a more sustainable world.

> From left: MassCEC CEO Steve Pike, Ivys Energy Solutions CTO Chris O'Brien, Greentown Labs CEO Emily Reichert, Somerville Mayor Joseph A. Curtatone, U.S. Senator Ed Markey, Ivys Energy Solutions CEO and President Darryl Pollica, and PDC Machines Engineer Chris Basilico.



“
Greentown Labs: These are the technologies that will harness the sun, and the wind, and the oceans. These are the technologies that can be the tools for new, worldwide climate diplomacy. This is the revolution that people have been waiting for.”

—U.S. Senator Ed Markey



ELECTRICITY

Electricity production is the second leading cause of greenhouse gas emissions in the United States, with almost two-thirds of electricity generated by fossil fuels. We need forward-thinking, sustainable technology that can modernize our grid as we turn away from the fossil fuels that have harmed our planet. And that's exactly what Greentown Labs' member companies are working on, from "virtual" microgrids to astrophysics-inspired battery management systems.

Source: The U.S. Environmental Protection Agency, 2017 data



> Shawn Murphy, CEO and CTO of Titan Advanced Energy Solutions.

TITAN TECHNOLOGY INCREASES BATTERY LIFESPAN AND SUSTAINABILITY <<

SPOTLIGHT

TITAN ADVANCED ENERGY SOLUTIONS

Batteries are integral to clean energy. From wind and solar storage to electric vehicles, we need to rely on batteries more than ever as we reorient society toward sustainability. But there's a problem: it's difficult to tell how much life batteries have left, so they're retired prematurely. We forfeit their full potential and produce them in excess.

Titan Advanced Energy Solutions solves this problem by borrowing principles from astrophysics to create a battery management system that is faster, more accurate, and less expensive than the current standard.

"We can do in a second what it takes current systems 18 to 20 hours to do, and the cost of our equipment is 100 times less," explains Sean O'Day, co-founder, president, and CCO of Titan. "It's a real step change in the way you can test new and used batteries."

Before co-founding Titan, Shawn Murphy (who serves as both the company's CEO and CTO) worked as the head of Space Science and Technology of Draper Laboratory and the director of Shell TechWorks. He drew on those experiences to tackle battery management system challenges.

Murphy's solution uses ultrasound technology to accurately measure lithium-ion batteries. This approach measures both the state of charge (think of the battery percentage on your phone) and the state of health (think of where your phone battery is in its overall lifespan). The ability to precisely measure these two metrics has striking impacts: up to 20 percent increase in state of charge (capacity) and up to a 125 percent increase in state of health (life cycles).

"It's a very different approach—we're observing it at the molecular level as opposed to taking measurements and estimating," O'Day says. "Think of it as a real-time CAT scan of the battery, versus a blood test that you get from your doctor once a year."

Once Murphy ran the fundamental equations to prove his approach was feasible, he brought his idea to O'Day. Titan took off quickly from there.

"We spoke for a long time," Murphy recalls. "It started somewhere around 10:00 in the morning and ended in a sushi restaurant in Marblehead that night. We came up with the name of the company, we came up with the general premise of the company, we shook on the division of the company. Everything happened from 10:00 in the morning to 9:00 in the evening—so in 11 hours, everything was struck."

Titan's technology has a broad range of applications, most notably electric vehicles, energy storage, and second life batteries.

Batteries are considered depleted from electric vehicles when they're at just 70 percent state of health, O'Day and Murphy explain, which leaves plenty of power potential for other uses. Titan's technology can accurately test the batteries' state of health and earmark them for reuse. The company is piloting its approach with leading car manufacturers.

Using batteries to their full potential means that we can produce—and dispose of—fewer batteries. This reduction, according to Titan's research, could lead to a decrease of carbon dioxide emissions and other greenhouse gases by 2,765,000 metric tons annually starting in 2020 and 37,327,500 metric tons annually beginning in 2030.

"You see a lot of articles about, 'What are we going to do with all these batteries coming out of all these cars?'" O'Day notes. "Our piece of the value stream is, before you send it to a final recycling process, when it comes out of its first life, to cost-effectively enable it to be repurposed—to fully utilize that battery."

Whereas typically measuring batteries requires extensive training, Titan's battery management system is simple and safe to use. It can also detect internal gas formation very early on, which means more battery fires can be prevented.

Titan joined Greentown Labs in May 2018, but that wasn't Murphy's first time working out of the cleantech incubator. As director of Shell TechWorks, Murphy was an anchor tenant when Greentown first moved to its Somerville location in 2013.

The Titan team cites Greentown Launch's Schneider Bold Ideas Challenge as helping them connect with the corporate partner. "That led to our most recent investment—Schneider came in as a strategic investor in Titan, they co-led our Series A," O'Day says.

"When we decided we needed a lab space, we said, 'We need to come to Greentown,'" O'Day says. "It's just an obvious ecosystem that makes sense for us to be a part of—we're right in the heart of cleantech development in this part of the country. All of the support, all of the visibility that we've been given to potential investors or corporate partners is, I think, unmatched to any other type of place we could've resided for the last 15 months."



We can do in a second what it takes current systems 18 to 20 hours to do, and the cost of our equipment is 100 times less. It's a real step change in the way you can test new and used batteries.

—Sean O'Day, Co-founder, President and CCO of Titan Advanced Energy Solutions



HEILA TECHNOLOGIES DELIVERS 'VIRTUAL' MICROGRIDS FOR SUSTAINABLE AND RESILIENT ENERGY

➤ U.S. Sen. Ed Markey speaks to Francisco Morocz (right), CEO and co-founder of Heila Technologies, at Greentown Labs' 2019 DEMO Day.

HEILA TECHNOLOGIES

Our energy grid was built around centralization. But as renewable energy sources such as solar and wind gain traction, the grid needs to adapt to include an array of components.

"With the decrease in cost of elements such as solar panels and batteries, we, as a society, have begun a move toward a more decentralized structure of energy generation and storage," explains Francisco Morocz, CEO and co-founder of Heila Technologies.

That's where microgrids come in. Microgrids are smaller networks that use local energy sources. They're typically connected to the grid and can rely on its energy if necessary, but can also run independently in "island" mode.

HEILA



For microgrids to work with the larger grid, communication is key, as utilities need to navigate peak times and potential disruptions to ensure electricity is always available.

"People started putting up solar panels because they wanted local, renewable, and cleaner energy—and that is great, but their intermittent nature has also been quite disruptive, because now the utility is losing revenue at certain times of the day, but they still have to keep up with the ups and downs of intermittent generation," Morocz says. "So, you still must have part of the grid infrastructure kind of running in idle, just waiting for when a cloud passes by so you can provide power to the customers when needed."

Communication benefits both the microgrid and the utility company. A microgrid can rely on the larger grid for energy when it must, but at other times it can support the grid by setting the import or export of power according to the needs of the system.

Traditionally, the monitoring, control, and communications needed for this type of behavior are expensive and difficult to set up and need to be altered with each new component. These roadblocks have slowed down the adoption of microgrids.

Heila, however, has created a platform that simplifies this process. A Heila device is installed in each energy asset and allows them to be used by either a site controller, a utility ADMS, or both.

With Heila's technology, the microgrid doesn't have to be cohesive, like a system of assets set up and owned by one person. This is especially important as putting solar panels on individual homes continues to increase in popularity. If four homes each had solar panels and batteries installed, a Heila device deployed at each house would turn them into what Morocz calls a "virtual" microgrid. This setup is appealing to utility companies and has the potential to become widespread.

"The grid can better handle large fleets of distributed assets, people get resilient systems that are cleaner, so everybody wins," Morocz explains.

The Heila team first dreamed up the device when one of its co-founders was installing a microgrid at Stone Edge Farm in California wine country in 2015. The Heila-enabled microgrid is now fully functional, and Heila has four additional projects with private entities and utilities.

The next stage for Heila is scaling up; in 2020, Heila aims to work with utility companies to reach large percentages of their customers.

In the future, Heila's technology could enable energy selling or trading among neighbors. For instance, if one person has solar panels and storage (which provide energy during the day) and their neighbor has wind turbines and storage (which typically gather the most energy at night), they could swap energy. This type of relationship would require regulatory changes in most of the mainland United States, Morocz explains, but it might be permitted in certain areas of Puerto Rico to combat widespread grid outages in the wake of Hurricane Maria.

Heila joined Greentown in December 2016 and has taken advantage of the incubator's engineering software licenses, connections with investors, and general wealth of knowledge for startup leaders. Morocz also singles out FORGE, Greentown's sister nonprofit that addresses crucial gaps for startups with physical products, as a critical resource Heila has utilized during its time at Greentown. FORGE's Manufacturing Initiative connects startups with regional manufacturers and has supported Heila's commercialization efforts.

"The Manufacturing Initiative has been very useful for us," Morocz says. "Our first and second prototypes were built here by us in the machine shop, and then the folks at the Manufacturing Initiative were responsible for putting us in contact with the people that, today, we contract the work out to. So that has been key."

TRANSPORTATION

As the top cause of greenhouse gas emissions in the United States, transportation releases almost 1.9 billion metric tons of carbon dioxide equivalent into the air each year. Greentown Labs members are engineering ways to get people where they need to go without harming our planet, from localized hydrogen refueling stations to portable EV chargers to cutting-edge truck power generating systems.

Source: The U.S. Environmental Protection Agency, 2017 data



IVYS ENERGY SOLUTIONS SPURS A NEW FUELING FRAMEWORK <<

IVYS ENERGY SOLUTIONS

Everyone knows the drill: you take the exit for a station, pull up to one of a dozen pumps, and fill your vehicle with fuel that was truck-delivered there.

That's what putting gasoline in your car looks like. But the team at Ivys Energy Solutions doesn't think that's what filling up your fuel-cell electric vehicle needs to look like.

Fuel-cell electric vehicles (FCEVs) have electrochemical engines that split hydrogen and combine it with oxygen from the air, with water as the byproduct. FCEVs have two major advantages over battery-powered vehicles: they charge more quickly—think a few minutes rather than many hours—and are much lighter, which helps extend range.

"Here's an electric vehicle that only makes water emissions," says Darryl Pollica, CEO and co-founder of Ivys. "It's a silent vehicle that can be filled up in three to five minutes. So that's a completely different paradigm than taking an electric wire and charging a chemical battery onboard the vehicle."

Like with battery-powered electric vehicles, infrastructure is a major concern in the adoption of FCEVs. The Ivys team explains that California, which is at the forefront of FCEV promotion and use in the United States, is tackling this problem by building hydrogen fueling stations that mimic gas stations.

"That's one of the key differences about how we're approaching this," explains Ivys CTO Chris O'Brien. "So far, the development of the

infrastructure has been, 'All right, let's just build the commercial network so that anybody can just go out and buy a hydrogen car, and they will be able to fill it up and drive it anywhere ... and then wait for people to buy the cars.'"

Ivys' approach is more distributed and focuses on the fleet model. Its SimpleFuel hydrogen refueling stations are compact and movable, which makes them easier, quicker, and far cheaper to install. The standalone stations also don't need to have hydrogen trucked in—SimpleFuel stations are designed to fill 10 to 20 cars a day, so the hydrogen can be generated right inside the SimpleFuel station.

The SimpleFuel stations are ideal to help transition two use cases to FCEVs: captive fleets and tethered fleets. A captive fleet includes vehicles that don't leave the premises, such as forklifts in a warehouse, while tethered fleets are vehicles such as delivery vans or municipal vehicles that return to a home base frequently. Given SimpleFuel's small size, they're also ideal for urban environments.

There's precedent for new vehicle technologies getting started with fleets, according to O'Brien. Once FCEVs become widespread, SimpleFuel stations could supplement larger fueling spots that resemble today's gas stations. But O'Brien and Pollica weren't willing to wait for that day to help FCEVs get on roads and warehouse floors.

"We felt, having been in the industry for two decades, that this is what the industry needed to start moving the needle," Pollica explains. "Because we're so tired of waiting for this thing to come. The world needs this stuff now. We need a mix of EVs, whether it's battery or fuel-cell EVs, so that's why we formed Ivys back in 2014—to specifically address this need. The problem here is the infrastructure, and we have the knowledge and the know-how to approach this problem."

Ivys has four projects in operation so far, including in an alley outside Greentown Labs and in a Toyota hydrogen car manufacturing plant in Japan to fuel FCEV forklifts. Toyota has significant interest in rolling out FCEVs and has become a repeat Ivys customer, according to Pollica and O'Brien.

The Ivys team is working with national and international organizations to adapt standards to support the SimpleFuel model. The SimpleFuel station next to Greentown will play a key role in this process, according to O'Brien.

"A lot of the testing to improve those international standards is going to happen here in the alley," he says. "So this is going to have a global impact."

O'Brien says Greentown was the right place to build a device like SimpleFuel, and recalls how Greentown CEO Emily Reichert and Somerville Mayor Joseph A. Curtatone gave Ivys their support for the alley station on the same day Ivys broached the idea.

"You need someplace like this, where people are more free to say, 'Actually, why don't we just take this opportunity to change the way we've been doing things for the last 100 years, because actually, this is a fundamentally new technology and it doesn't need to follow the same model,'" O'Brien explains. "That's been great for us, being able to have the launching pad here to be able to do this kind of stuff, the support of the other companies here who are doing similar things, and being able to lean on the Greentown staff."

➤ Blackburn Energy's electrifying technology installed on a diesel truck.

BLACKBURN ENERGY BRINGS CLEAN ELECTRICITY TO DIESEL TRUCKS

BLACKBURN ENERGY

Andrew Amigo came up with the idea for Blackburn Energy while sitting in traffic. As he watched a truck's drive shaft spin, he realized he could harness its lost kinetic energy and convert it into renewable electricity.

"Everything clicked into place for me," Amigo says. "Right there in my car I started taking notes, and started scratching out the idea of using the drive shaft and the wasted energy of the truck to create clean electricity, store it, and then reduce the amount of fossil fuels that the transportation industry has to burn."

Trucks have an idling problem. Long-distance truckers spend 100 to 200 nights a year sleeping in their vehicles, and need the engine running to provide heat, air conditioning, or power to electronics. More than a billion gallons of diesel are used this way each year, according to Amigo—equivalent to almost 11 million tons of CO₂.



This is the beginning of an electrification revolution.

—Andrew Amigo, CEO and founder of Blackburn Energy

Blackburn's technology generates renewable energy that can fuel electric auxiliary power units (APUs), eliminating the need to run engines overnight. The same system allows drivers to turn off their vehicles during deliveries while still operating the power lift gates.

Amigo sees Blackburn's technology as an intermediary step to fully electric trucks.

"This is the beginning of an electrification revolution," he says. "One day there will be electric trucks, but that day is pretty far away. For now, the goal is to electrify everything we can—we want to electrify everything on a diesel truck, including engine components, which will increase the fuel economy of the trucks in a pretty significant way."

A key component to this stepping stone, Amigo emphasizes, is that the technology is widely accessible. Virtually any mechanic can install the system on virtually any large truck.

"We learned in customer discovery that it had to be available and accessible to the entire industry from the beginning," Amigo says. "It cannot be what we call 'trickle-down technology.' We said, 'we want to have something that is so inexpensive, so simple to use, that the people at the bottom of the pyramid can start using it right away, and not have to wait a decade for it to filter its way through the system to get to the average person.'"

The company can continue to electrify non-electric trucks bit by bit, according to Amigo. Blackburn also offers carbon credit reports to its users, which allow trucking companies to see—and show others, including their customers—how much clean energy they're generating.

Blackburn is commercialized, and has a facility in Amesbury, Mass., in addition to its space at Greentown Labs. Throughout its road to commercialization, Amigo says, Blackburn has taken advantage of the Manufacturing Initiative—run by FORGE, Greentown's sister nonprofit.

"When you're trying to cross from that R&D, prototype company into a commercial company, you have to attract a different group of people, and getting to them is hard," Amigo explains. "A whole variety of people at Greentown have been unbelievable to us in opening doors and getting resources. When you're the little guy, that's such a big help."



SPARKCHARGE ADDRESSES ELECTRIC VEHICLE RANGE ANXIETY WITH PORTABLE, ULTRA-FAST CHARGER

SPARKCHARGE

It's almost inevitable: when the topic of EVs comes up, someone will express worries about range. Insufficient charging infrastructure has long hampered the adoption of EVs, as people worry about getting stranded or being limited in their routes.

When Joshua Aviv took an environmental economics class at Syracuse University, the professor told him, "If you want to change the world, electric vehicles are the way to go." So Aviv dreamt up a solution in his dorm room to EVs' range problem: a portable, off-grid, ultra-fast EV charger.

"EV owners can have range delivered to them for any application and any situation—whether it be for emergency or for convenience," explains Aviv, co-founder and CEO of SparkCharge.

SparkCharge makes charging your EV as simple and convenient as ordering in food. Users can request a charge from a concierge service provider via a phone app, and the provider will bring SparkCharge's unit right to the user. The units are stackable, meaning that providers can combine multiple battery packs' power.

The invention also changes the game if you've run out of charge—rather than getting towed and then charged, a provider can meet you wherever you are. And with SparkCharge's convenience charging model, you can even set up your car to automatically order more range when it's getting low.

The portable devices charge a vehicle at one mile per minute, which is a top-tier speed and far faster than wall outlet chargers.

SparkCharge has a business-to-business sales model, meaning it doesn't set prices for users, but Aviv observes that prices are usually comparable to what users would find at charging stations. SparkCharge has customers and is shipping nationally.

The company joined Greentown Labs in 2018, four years after Aviv founded it at Syracuse. Aviv says he's learned a lot from the Greentown community's CEO meetings, and appreciates the incubator's efforts to introduce SparkCharge to customers and investors.

The company has 12 people on its team, and will grow to 15 soon, Aviv says. In the coming months, SparkCharge will scale its production and develop a second version of its charger, which will include faster charging speeds and additional capabilities.



People usually get excited when they hear about SparkCharge's portable charger and its various applications, according to Aviv.

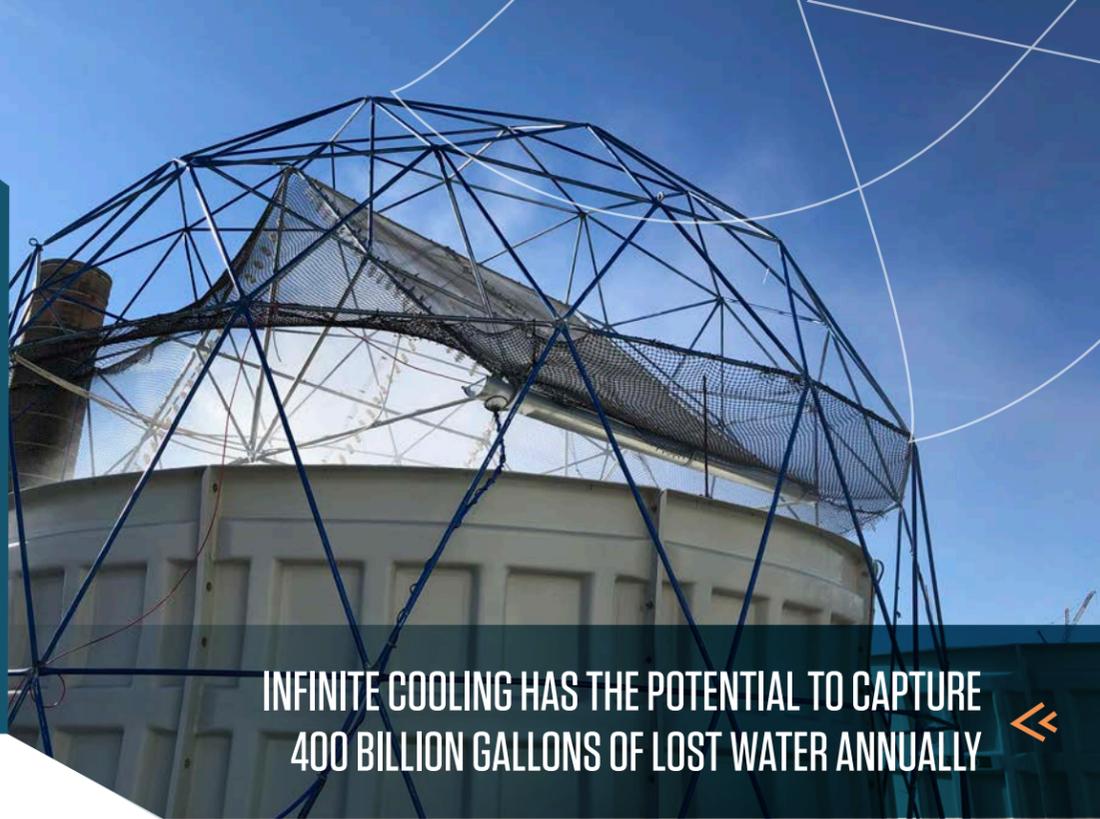
"It's a no-brainer," he says. "It's something the industry needs, it's something the industry wants, it's something that's a must-have."



>> From left: U.S. Senator Ed Markey, SparkCharge CEO Joshua Aviv, and Somerville Mayor Joseph A. Curtatone.

AGTECH + WATER

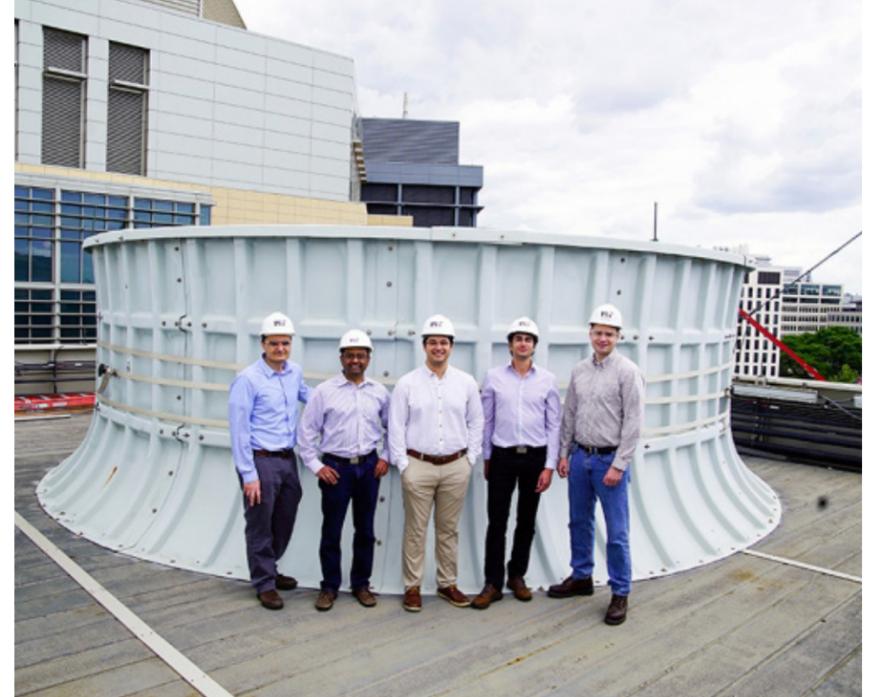
How do you make agriculture and water sustainable while tackling the challenges of providing for a growing global population? Greentown Labs supports startups that are answering that question from a multitude of angles, including extending produce lifespan, capturing water typically lost in industrial processes, and making indoor growing more reliable.



INFINITE COOLING HAS THE POTENTIAL TO CAPTURE 400 BILLION GALLONS OF LOST WATER ANNUALLY <<

Infinite Cooling joined Greentown Labs in late 2018, and grew its team from three to nine throughout 2019. Khalil says the Manufacturing Initiative—run by FORGE, Greentown’s sister nonprofit—has been critical in helping the company find the right contacts.

“When we were looking for our first contract manufacturer, we went to the Manufacturing Initiative, and they helped us identify our needs and what’s available and get recommendations from folks,” Khalil says. “We’ve been able to get quite a bit of help.”



>> The Infinite Cooling team.



Water scarcity is one of the largest problems of this century. This is basically a new source of water.

—Maher Damak, CEO and co-founder of Infinite Cooling

SPOTLIGHT

INFINITE COOLING

Industrial cooling towers use about as much water as all U.S. households combined—a whopping 2 trillion gallons each year. That water emerges in plumes and is lost to the atmosphere.

Infinite Cooling uses electric fields to capture 20 percent of water losses from those power plants, data centers, and other industrial facilities. The recovered water can be reused in the cooling tower, reducing the plant’s water consumption and cutting its costs.

Remarkably, the recovered water is essentially distilled water that’s safe to use for drinking or for agriculture—even if the original water used in the cooling tower wasn’t.

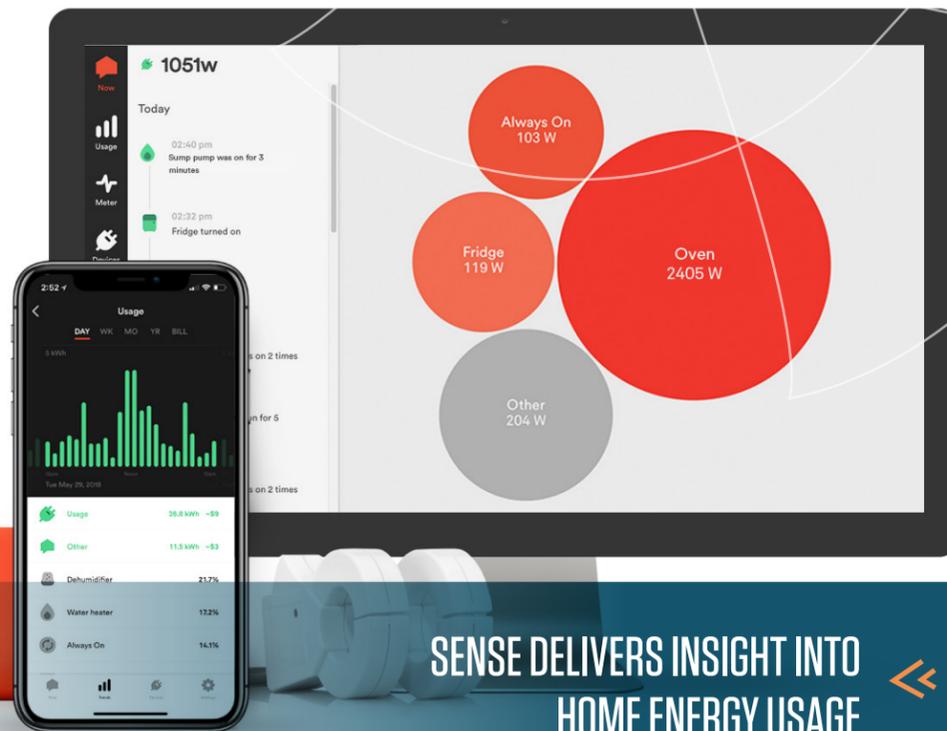
“This is one area where you can have a huge impact,” says Maher Damak, CEO and co-founder of Infinite Cooling. “Water scarcity is one of the largest problems of this century. This is basically a new source of water.”

Damak and fellow co-founder and CTO Karim Khalil developed the company’s technology while completing their PhDs at MIT. Its water saving potential is enormous—if Infinite Cooling’s electric fields were applied to all cooling towers in the United States, 400 billion gallons per year could be saved. There are economic benefits as well; Infinite Cooling estimates that a 600 MW system could save \$1 million per year by using the water recovery system.

In 2020, the company’s setting its sights on a “larger-scale installation,” the founders say.

BUILDINGS

From lighting to heating and cooling to actual assembly, transforming the building sector is a key challenge in fighting climate change. Incorporating sustainability into new buildings isn't enough—we need to come up with innovative solutions to make existing structures equally eco-friendly, from foundation to roof and wall to window.



running. You can tap into this livestream of your home on the Sense energy monitor app.

“The fact that you see this in real time, somehow that makes a connection,” Phillips says. “You can see what’s going on right now. That’s the thing that engages people. If people are looking at this to see when the TV turned off last night, while they’re looking at it they say, ‘Wait, why am I using 5,000 watts right now? Something’s going on in my home.’”

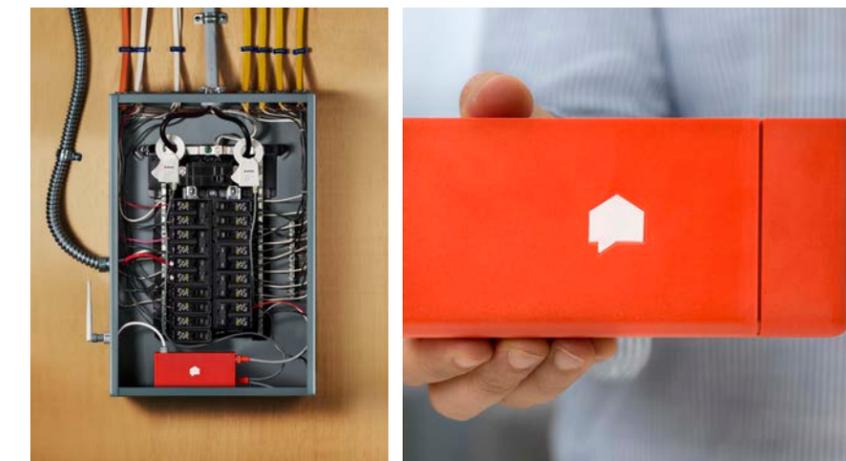
Sense gives people the knowledge they need to reduce their energy costs and usage, with profound effects on the environment: the company estimates that its users are saving a total of 53 million pounds of CO₂ annually, which is equivalent to 26,500 metric tons.

“Many people find they’re able to track down some unknown energy hogs in their home,” Phillips says. “If you had water leaking in your basement you would know it, but if electricity is being wasted, you don’t know it. It’s some energy wasting thing you didn’t know about, like your treadmill that uses 50 watts when it’s plugged in doing nothing. We call it ‘always on,’ or ‘vampire load,’ where it’s using power when you think it’s off.”

In the future, the energy monitor will help with safety and security as well, giving you a heads up on potential issues, such as if your AC is going to break or if you’re at risk of having an electrical fire.

Sense’s hardware team worked out of Greentown Labs starting in 2016, utilizing the machine shop to build the device. Greentown also connected Sense with two of its investors, Shell and Schneider Electric.

“There was a lot of exposure to upstream companies—so suppliers of tools, suppliers of software, manufacturing companies,” says John Watlington, director of hardware at Sense. “At least once a week, there was somebody having a lunch meeting. It’s finding the services you need to build stuff, to get stuff done.”



Sense is now headquartered in Cambridge, Mass., and has a team of about 50 people.

The future of Sense’s home energy monitoring is energy optimization, Phillips says. Energy optimization adjusts energy usage for non-time-dependent applications, like charging your electric vehicle at some point during the night, to the most ideal time. As utilities increasingly commit to reducing greenhouse gas emissions, they will need to ramp up the amount of renewable energy resources on the grid and to influence the timing of energy use to better match the variable supplies. Phillips envisions Sense would function as an automated middleman between the energy user and the utility.

SENSE

If your house could talk to you about your energy usage, what would it say?

The creators of Sense think it would say you could reduce your energy usage by at least 20 percent—and tell you how.

Sense is a home energy monitor that gives real-time insight into your home’s energy usage. Its co-founders got their start in speech recognition, developing a predecessor to Siri that became the voice interface for Samsung and others.

That background in speech recognition informed the way they approached home energy monitoring. Sense gives each energy user in your house a distinct voice—your fridge, your microwave, your treadmill,

and every other object that gets plugged in starts reporting its individual usage patterns.

“It’s like doing speech recognition with 30 people all talking at the same time,” explains Sense CEO and Co-founder Michael Phillips.

Once it’s installed in your electrical panel, the Sense monitor takes energy measurements one million times per second. Sense uses those high resolution energy measurements as input to machine learning, which identifies an increasing number of devices in a home.

Sense is consumer-facing to its core. That means you get more information than just how many watts you’re using—you learn when your TV turned on, when the garage door opened, or when your washing machine finished

MANUFACTURING

Inefficient, high-waste manufacturing processes need to be rewritten for our sustainable future. The transformation of this wide-ranging sector requires a number of highly innovative solutions.



VIA SEPARATIONS TACKLES MANUFACTURING'S EXORBITANT THERMAL ENERGY USAGE

VIA SEPARATIONS

Imagine you're cooking pasta. If you waited for all the water to boil off rather than straining the pasta, think about how much longer it would take. The longer it takes, the more energy it uses.

That's basically what happens in vast numbers of manufacturing processes. Filtration membranes aren't sturdy enough for chemical separations, so an immense amount of thermal energy is used.

Via Separations' solution? Build a better membrane.

"When people think about membranes and filtration, it's basically synonymous with water, but we're using more energy separating chemical compounds from one another than we are in water

filtration, we're spending more money doing that, and we're creating more emissions doing that," explains Shreya Dave, the company's CEO and co-founder.

"Plastic and paper and fertilizers aren't going away, and the embodied energy and embodied emissions for that are really significant," she adds. "Twelve percent of U.S. energy consumption goes to separating and purifying chemical compounds."

Via Separations' technology can reduce the energy needed for chemical separation by 90 percent and save manufacturers the associated heating costs. In certain situations, the membrane can even improve manufacturers' throughput.

Via Separations has its pick of industries to zero in on, but is starting with two: food and beverage and paper. In the future, the company will address chemicals and plastics.

"The paper industry has huge energy implications—we're talking about saving half as much energy as is used for all air travel in the country," Dave says. "This is not by changing anyone's habits, but just improving the manufacturing process. That's what gets me out of bed."

Via Separations came to Greentown Labs in 2018, drawn to the incubator's 26-bench wet lab. In 2020, the 12-person company will focus on scale-up, lifetime and durability tests, and field trials.

"We're talking about saving half as much energy as is used for all air travel in the country. That's what gets me out of bed."

—Shreya Dave, CEO and co-founder of Via Separations



>> The Via Separations team.

THE MANUFACTURING INITIATIVE, RUN BY GREENTOWN LABS' SISTER NON-PROFIT FORGE, HELPS STARTUPS WORK WITH REGIONAL MANUFACTURERS TO BUILD THEIR PRODUCTS AT SCALE.

>> 1,000+ CONNECTIONS MADE BETWEEN STARTUPS AND MANUFACTURERS

>> 120+ CONTRACTS

>> \$10.8M+ IN KNOWN ECONOMIC IMPACT

PLATFORM TECHNOLOGY

In order to revolutionize the systems and processes used in the sectors listed previously, we need powerful software platforms and robots to enable our transition to a clean energy future. While the Greentown community is heavily focused on hardware technologies, each and every hardware solution within the community includes a critical software system to run the technology. Moreover, some Greentown members are entirely focused on developing software solutions to provide safer and more reliable systems to digitize the grid and predict industrial equipment failure.



> Jon Garrity, CEO and co-founder of Tagup.

TAGUP TRANSFORMS CRITICAL INFRASTRUCTURE MANAGEMENT WITH PREDICTIVE DATA <<

TAGUP

A Q&A WITH CEO AND CO-FOUNDER JON GARRITY

Tagup has been an active part of the Greentown Labs community for years. The predictive asset management company participated in the incubator's first Greentown Launch accelerator, PROPEL, in 2015, which led to a pilot project and purchase order for two of the participating startups—including Tagup. CEO and Co-founder Jon Garrity has served as the Greentown Labs community board member for the past two years, representing the needs of members on the Board of Directors.

Q: Tell us a bit about yourself and how you founded Tagup.

A: I previously worked at General Electric in their energy business, and I started the company with a classmate from MIT, Will Vega-Brown, who went on to do his PhD in artificial intelligence.

Basically, we saw that GE and other manufacturers would remotely monitor some of the highest value equipment, like gas turbines or jet engines, and then provide services so they could predict when they would fail, or they could improve uptime and availability. We realized, with new technology, that capability could be economical for any equipment type. So with the rise of cloud computing and new methods of machine learning, we could make that technology capability accessible.

We started with grid-type assets, transformers in particular, and we've expanded from there. That was way back in mid-2015. We basically incorporated and came straight to Greentown—we were part of the PROPEL program and have been here since.

Q: What do you want people to know about Tagup?

A: That we are a machine learning company that uses new innovations in analytics and computing to make our critical infrastructure more reliable, safe, and sustainable.

Q: When you say “critical infrastructure,” can you explain what you’re referring to?

A: Primarily the grid and power generation assets. Transformers, switchgear, conductors. We’re also looking at rotating machinery, things like wind turbines.

Q: What’s the environmental impact of this technology?

A: A few different things. For generating assets like wind turbines it’s very explicit—we make them more reliable, and so by increasing the availability you make wind more competitive as a supply power. For transformers, part of it is making infrastructure and the grid more reliable and resilient. Transformers have oil, they can explode, and so avoiding the environmental considerations of equipment failure is part of what we do as well.

Q: Are these assets monitored now?

A: Most of the critical ones are monitored to some extent. There are no available methods today that are deployed to understand when something will fail—just that there’s something wrong. Our analytics can actually quantify time to failure and probability of failure in a given period of time, which allows for much better decision making around equipment maintenance, procurement, and operation.

Q: Can you boil down how you do that?

A: We take all that sensor data—and often, but not always required, historical examples of equipment failure—and then we run it through new machine learning models using distributed computing infrastructure. We have thousands of computers that are running all these calculations, and then we collect the results and make them available via web application. So I can pull it up on my iPhone, and you could see the real-time probability of failure for any of thousands of assets around North America and Europe.

Q: What stage is the company?

A: We’re a seed-stage company, we raised a \$2.1 million pre-seed round in mid-2017. We’re raising another round now. We’re 15 people in total, and we now have almost 50,000 transformers in our analytics, and a handful of other equipment types as well.

Q: You’ve been the community board member at Greentown for the last couple of years. Tell us about that experience.

A: It has been wonderful. Where the experience has been most fulfilling for me has been when I can engage with the community in the capacity of the community board member—get feedback from all the different startups that are here, learn what their problems are, make sure that members’ issues are represented at the board, whether that’s things like power in the lab or internet service or call rooms, but also more strategic things, like value of the community, investor resources, and making sure that Greentown remains a highly competitive, best-in-class place to work for cleantech startups.

LINEVISION

Here's something that might surprise you: we have little insight into our transmission lines.

"Almost all lines today are not monitored," explains Hudson Gilmer, CEO and co-founder of LineVision. "It's kind of a crazy situation that in an age of sensors and IoT we don't monitor the backbone of the electric grid. LineVision is working to change that with a mission to monitor, optimize, and protect the world's critical energy delivery infrastructure."

One of the main benefits of monitoring is increased safety. LineVision's sensors can detect problems with the lines, such as if they're hanging too low, suffered storm damage, or are dangerously blowing in the wind. This ability has huge impact potential, Gilmer explains, referencing the PG&E blackouts in California.

"If PG&E's lines were equipped with our systems, they would be able to be much more surgical about saying, 'OK, we don't need to shut half the state down; these are the lines that are at risk,'" he says.

Through monitoring, utilities can also safely increase the utilization of their lines. Without real-time monitoring data,

they set line ratings based on worst-case weather assumptions—resulting in congestion, which cost U.S. ratepayers an estimated \$8 billion last year. This congestion disproportionately hurts clean energy projects through curtailments and lower revenues.

LineVision's sensor-based monitoring calculates a dynamic line rating, which allows utilities to accurately understand how much energy they can safely transmit and take advantage of the wind's cooling effect on lines, increasing capacity on existing lines by 15 to 40 percent.

LineVision's third main application is asset health monitoring, which is crucial given that most transmission lines in the United States were built more than 40 years ago.

The 15-person company has done a number of projects with large utilities, and is moving toward broader deployments, according to Gilmer. The core team has worked together for over five years developing its sensor and cloud analytics technology. LineVision has customers on three continents, including five top U.S. utilities, and has set its sights on widespread installation.

"Our business plan we call the 'METL Plan,' which stands for 'monitor every transmission line,'" Gilmer explains. "We believe passionately that adding monitoring makes the grid more efficient, safer, and cleaner. Our business plan has us continually reducing the cost and footprint of our

systems so that we can roll it out across our clients' grids and establish this as the best practice for operating transmission lines."

LineVision joined Greentown Labs in October 2018, and Gilmer says he's found immense value in sharing tools, approaches, and best practices with his fellow members.



We believe passionately that adding monitoring makes the grid more efficient, safer, and cleaner.

—Hudson Gilmer, CEO and co-founder of LineVision

LINEVISION DELIVERS UNPRECEDENTED
INSIGHT INTO THE ELECTRIC GRID



MEMBER DIRECTORY

AGTECH + WATER	

BUILDINGS

TRANSPORTATION	

ELECTRICITY		

MANUFACTURING	

PLATFORM TECHNOLOGY	

ECOSYSTEM MEMBERS*	

➤ Member list as of December 2019. Visit www.greentownlabs.com to learn more about Greentown Labs' members.

*Ecosystem membership offers a "hot desk" at Greentown Labs and is geared toward new entrepreneurs, service providers, and other cleantech champions.



GREENTOWN ALUMNI COMPANIES

After an average of two years at Greentown Labs, companies typically advance their technologies, raise funds, and develop the connections, knowledge, and stability to graduate from the incubator. Greentown helps those companies find office space near its Somerville, Mass. campus, and continues to be a resource for its alumni long after they graduate.

From there, Greentown gets to watch and celebrate as its alumni take off.

» 135
ALUMNI
COMPANIES

» 77%
OF ALUMNI
COMPANIES ARE
STILL IN EXISTENCE

» 6
HAVE BEEN
ACQUIRED

» THEY'VE
COLLECTIVELY
GENERATED
\$157M
IN REVENUE



SPOTLIGHT

BEVI

The Bevi co-founders realized that when it came to bottled water, people's behavior didn't make economic sense: They were paying a high markup when they could get the same thing from their taps.

"Buying a single-use, plastic bottle of water, it's not an economic decision," explains Bevi Co-founder Sean Grundy. "That knowledge gave us a lot of confidence. People can't be making the choice to drink bottled beverages as a rational, cost-saving choice—it's got to be a result of convenience or a result of brand, the conception that beverages in single-use, plastic bottles are higher quality, or the result of some kind of misinformation, like fear of filtered tap water. And those were areas where we thought we could compete."

They were right. Bevi machines have served over 100 million bottles' worth of water and seltzer since the company's founding, a number that's now growing by more than 10 million each month. Bevi has machines in dozens of states and employs about 120 people.

The internet-connected machines mix flavorings into water on-demand, making them the perfect replacement for a fridge stocked with seltzer and bottled water—which saves not only packaging but the fuel needed to deliver beverages. Bevi makes maintenance easy by monitoring the machines' supply levels and service needs.

The Bevi team joined Greentown Labs before officially incorporating, and put one of their first machines in the incubator. Grundy remembers making good friends while at Greentown, and adds that the staff connected Bevi with an investor who went on to finance 20 percent of its seed funding.

"In terms of the value of Greentown, a lot of it came from the community," Grundy says. "If I would've done one thing differently early on, because we really started working on Bevi in June 2013 and then moved into Greentown in August, I would've moved into Greentown right in June. At that time we were spending our own cash, but even then, I would've moved in earlier. Because once you move into Greentown, and once you're around other teams working on similar problems, and teams that have, say, taken a prototype to market, it changes your perspective on what you need to get started and it changes your perspective on what progress looks like. It provides this network of people who have done similar things before."



» Bevi co-founders Frank Lee, Eliza Becton, and Sean Grundy.





NBD NANO USES BIOMIMICRY TO MANIPULATE WATER AND OIL <<

NBD NANO

A Q&A WITH CO-FOUNDER DECKARD SORENSEN

NBD Nano changes the way surfaces interact with water and oil. Co-founders Deckard Sorensen and Miguel Galvez turned down the job offers they had upon graduating college to make NBD Nano a reality, and their gamble worked out.

The company joined Greentown Labs in January 2013, and now has an 8,400-square-foot office in Lexington, Mass. In 2015, Forbes named Sorensen to its 30 Under 30 list.

> The NBD Nano team, including co-founders Deckard Sorensen (front row, center) and Miguel Galvez (front row, left).



Q: Tell us a bit about yourself and how you got to the point of founding NBD Nano.

A: While I was at Boston College, I was looking at biomimicry. Biomimicry is a new, innovative field of biology, which is set to look at nature for inspiration for sustainable technology. That's where I came across the Namib Desert beetle. You know how our namesake is NBD Nano? NBD actually stands for Namib Beetle Design.

The Namib Desert beetle lives in an area of the world that only gets a half inch of rainfall per year, however every morning it climbs to the top of a sand dune, sticks its back up to the wind, and drinks 12 percent of its weight in water. It does that by alternating hydrophobic, or water-hating, and hydrophilic, or water-loving, regions on its back. It drinks 12 percent of its weight in water by attracting fog in the hydrophilic parts, and then channeling it on the hydrophobic parts down to its mouth.

So we use this beetle as inspiration to create hybrid, functional surfaces that modify how liquids interact with them. What NBD Nano is, at its core, is a specialty chemical platform where we have figured out how to modify and functionalize our core chemistry materials so that we can have different interactions of water and oils with our surface.

Q: What are some of the applications of this?

A: We've commercialized two products to date. The first one is our Invisiprint technology. Invisiprint is a hydrophobic and oleophilic technology, so water-hating and oil-loving. What we've figured out is a specific surface wettability that, once you put a fingerprint on the surface, it actually spreads the oils on the surface and allows the light to pass through. So even though you're putting a fingerprint down, it appears invisible. We've commercialized that with one of the leading screen protector brands, named ZAGG. That's just an initial demonstration—you can imagine that there are many other surfaces

that have a fingerprint problem. The second product is called RepelFlex. It's a fluorine-free, solvent-free UV hard coat that still has anti-stain properties. There's a number of different applications there. The first application that we've entered is in the electronic accessory market, and have done some significant trials in the cable market, as well as leathers.

Q: We're always eager to learn about Greentown Labs' members' climate stories—how is NBD Nano cleantech?

A: We were able to apply our hydrophobic coating to the external side of tubes in a steam condensation unit. So we actually were able to pilot, with the Tennessee Valley Authority, 10-meter-long tubes with our hydrophobic coating on there in a steam power plant environment. What we were doing is improving the condensation heat transfer rate, which means you can actually use less fuel to have the same amount of energy output. We were improving it anywhere from five to 35 percent—it depends on where you are in the power plant, in terms of the tube location. We've since licensed that to a tube manufacturer that's looking to implement that in power plants around the world, and that would mean a reduction in carbon emissions.

The other is we had a grant from the Department of Agriculture, where we were directly mimicking the Namib Desert beetle and applying hybrid coatings to fog nets. What a fog net is, it's a passive collector of water for agricultural purposes. We were able to pilot our fog nets in California and show, from the addition of our coatings, a 5-7x improvement of passive water collection.

NBD NANO HAS RAISED ROUGHLY \$14.5 MILLION IN VENTURE CAPITAL, AND IS NOW GENERATING REVENUE. THE 14-PERSON COMPANY IS SCALING UP, ACCORDING TO SORENSEN.



PARTNERS

Greentown prioritizes partnerships with multinational corporations that have made science-based climate commitments. These companies are leading the charge on corporate responsibility and sustainability across their business units and are actively pursuing partnerships with next-generation technologies to enable a clean energy economy.

Partners provide crucial support for Greentown Labs' startups by becoming strategic partners, investors, customers, and pilot sites. Through these relationships with Greentown and its startup members, corporate partners become embedded in the cleantech ecosystem and get introduced to the field's most groundbreaking technology. Partnership also gives organizations the chance to make their businesses more sustainable and to demonstrate their climate commitments.

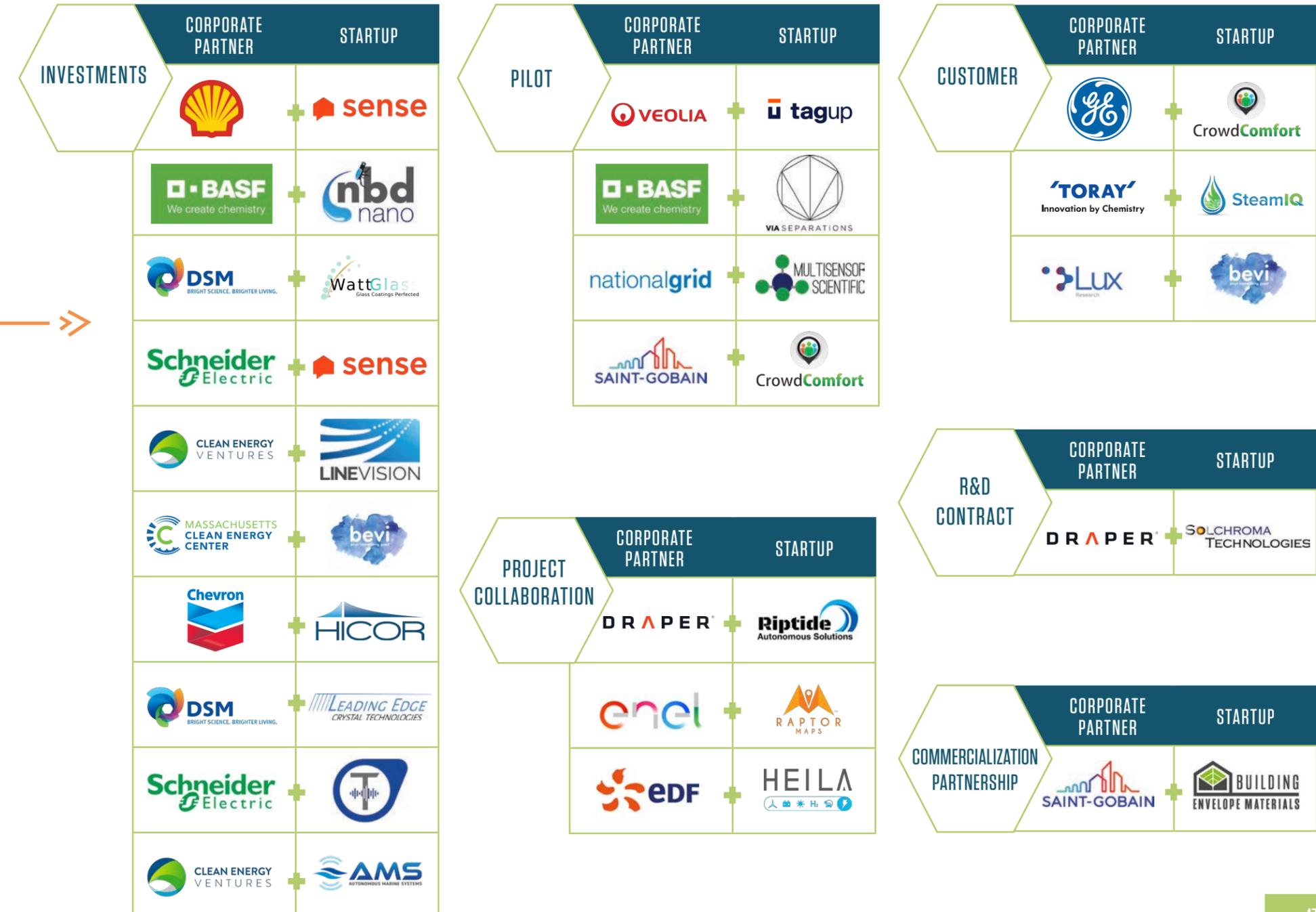
Day-to-day, these partnerships involve countless chances for entrepreneurs and corporates to exchange ideas and form connections. These opportunities include pitch days, lunch and learns, office hours, tours, corporate innovation days, and more.

SELECTED ENGAGEMENTS BETWEEN STARTUPS AND CORPORATE PARTNERS

Collaboration between startups and corporate partners takes many forms at Greentown Labs. From investments to pilot projects to R&D contracts, entrepreneurs and corporates are working together to bring cleantech innovation to market.

“The heart of this partnership has and always will be the opportunity to share knowledge, culture, and community. There’s nothing like Greentown Labs that we’ve seen anywhere else in the world.”

— Minas Apelian, Vice President of Internal and External Venturing, Saint-Gobain





SAINT-GOBAIN

Saint-Gobain has been a committed Greentown partner since 2014. The leading building materials company was integral to the opening of Greentown's headquarters, donating over \$1 million worth of products and becoming the presenting partner of the building's Town Green event space.

Saint-Gobain installed a Materials Library in Greentown's prototyping lab, where startups can get samples of the various coatings, plastics, ceramics, and more that are under Saint-Gobain's umbrella. Saint-Gobain's onsite environmental testing chamber lets Greentown entrepreneurs test their technology under varying temperatures, pressures, and humidity, and led to a joint-development agreement with Building Envelope Materials, a Greentown alumni company. Saint-Gobain has numerous employees stationed at the incubator, and often uses Greentown as a living lab to test its materials and products.

In 2019, Saint-Gobain partnered with Greentown's internal accelerator, Greentown Launch, for the InNOVAte 2019 Challenge. The program culminated with a pilot project agreement with Inovues, a startup participant that improves buildings' energy efficiency through a non-disruptive window retrofit system.



BASF

BASF is the founding partner of Greentown's wet lab, an 1,800-square-foot BSL-1 lab that allows startups to innovate in water, advanced materials, and green chemistry right next to their prototyping lab and office space. When Greentown moved into its headquarters, BASF was eager to step up and support Greentown startups with this new offering. BASF also sponsors two benches in the wet lab, allowing companies to work in the space rent-free and developing deep ties with those startups.

BASF led Greentown alumni company NBD Nano's \$8 million Series B round in 2017, and in 2019 partnered with Greentown's internal accelerator, Greentown Launch, for the Circularity Challenge, a program focused on breakthroughs in the plastics, energy storage, and recycling value chains.



BASF is committed to developing sustainable solutions to global challenges, such as climate change, and we believe partnering with Greentown Labs and working alongside their innovative startup companies will help us all move closer to a sustainable future.

— Bernhard von Vacano, Global Head Scouting and Incubation, Advanced Materials & Systems Research, BASF



ENEL

When it came time for Enel to open its second Innovation Hub in the United States, the company saw Greentown as a perfect fit. At its Boston Innovation Hub headquarters in Greentown—its 10th worldwide—Enel taps into Boston's vibrant startup ecosystem. Enel's North American business unit works with Greentown member company Raptor Maps to manage real-time operations on the corporate's solar fields through drone-based thermal imaging. Greentown is supporting Enel's Boston Innovation Hub through ecosystem connections and targeted innovation scouting.



With this new hub in Boston, we are continuing to grow our network of Innovation Hubs in the most forward-thinking communities around the world. Enel is working relentlessly to boost the energy sector's sustainability by implementing its open innovation model, whereby the new Boston Hub, coupled with the existing one in San Francisco, focuses our attention on the wealth of innovative solutions offered by North America, a strategic energy market which presents significant growth opportunities for our group.

— Ernesto Ciorra, Chief Innovability Officer (Innovation and Sustainability), Enel Group



SCHNEIDER ELECTRIC

Schneider Electric partnered with Greentown on the Bold Ideas Challenge in 2018, a Greentown Launch accelerator program focused on distributed energy technology. As a result of that program, Schneider Electric co-led Greentown member Titan Advanced Energy Solutions' \$10 million Series A round.



We care about innovation, we care about our planet, and want to do as much as we can to nurture this innovation ecosystem.

— Rodolphe Héliot, Business Incubation Director, Schneider Electric Ventures



PARTNERS DIRECTORY

TERAWATT PARTNERS		
		
		
		
		
		
		
		

GIGAWATT PARTNERS	
	
	
	
	
	

MEGAWATT PARTNERS	
	
	
	
	

KILOWATT PARTNERS	
	
	
	
	
	

Partners as of December 2019.



GREENTOWN LAUNCH

How can a partnership between a startup and a corporate be successful? That question powers Greentown Labs' internal accelerator, Greentown Launch.

Greentown Launch is the incubator's most comprehensive method of helping startups and corporates engage in ways that will help them both prosper. Cleantech startups often struggle to scale through traditional venture capital due to technology risk and long investment horizons, and partnership with corporates can be an effective route toward commercialization. Startups benefit from the corporate's customer base, industry knowledge, and resources, while corporates often rely on startups to stay on the cutting edge of their industries' innovation.

But startups and corporates live in different worlds, and can struggle to get in sync. That's where Greentown Launch comes in.

Greentown Launch programs start with a topic that one of our Terawatt-level corporate partners wants to address. In the past, these have included solar materials, hydrogen innovation, distributed energy technology, the built environment, and more.

Startups are identified through a rigorous application and selection process. During the program, participants are paired with mentors from both the Greentown ecosystem and from the corporate partner to help them work effectively with a corporate. A series of workshops over the six-month accelerator give Greentown Launch participants the tools, resources, and knowledge they need to make a partnership appealing to the corporate.



This formula works. In the four years since Greentown Launch began, corporate partners have invested over \$20 million in startups, and more than 65 percent of startups finish the program with a partnership outcome such as a pilot project, commercial deal, joint development agreement, or investment. These partnership outcomes tangibly help the startups move toward commercialization.

TRACK RECORD

- \$20M+ in investments in the last 4 years
- >65% of startups leave the program with a partnership outcome
- 7 completed programs
- 7 corporate investments
- 1 joint-development agreement
- 1 technology validation
- 1 licensing agreement
- 1 commercial agreement
- 1 commercial pilot program

PROGRAM HISTORY

- 2019 **Circularity Challenge** | BASF (We create chemistry)
- H2 Refuel Accelerator** | Shell, Toyota, NYERDA (NEW YORK STATE OF OPPORTUNITY)
- InNOVate 2019 Challenge** | SAINT-GOBAIN
- 2018 **The Bold Ideas Challenge** | Schneider Electric
- 2017 **SunRISE II** | DSM (BRIGHT SCIENCE. BRIGHTER LIVING.)
- 2016 **SunRISE I** | DSM (BRIGHT SCIENCE. BRIGHTER LIVING.)
- 2015 **Propel** | Shell

INOVUES

AN INNOVATE 2019 CHALLENGE PARTICIPANT | PILOT PROJECT WITH SAINT-GOBAIN

Ever notice heat leaking out of your windows in the winter? Those days could be numbered.

Inovues wants to use its non-disruptive window retrofit system to improve existing buildings' energy efficiency. Its adaptable Glazing Shields, which can be securely mounted on either side of the original window glass using a non-intrusive attachment mechanism, can increase window insulation by up to tenfold and reduce energy consumption by up to 40 percent.

This approach is cheaper, faster, and less resource-intensive than installing new window systems.

"It'll transform a single- or double-glazed window or glass curtain-wall into a high-performing double- or triple-glazed system without removing or replacing the original glass or drilling or altering any part of the frame," explains Inovues Founder and CEO Anas Al Kassas. "There will be a small air gap between the old glass and the new high-performance glass that together increases the insulation dramatically."

Inovues successfully finished the InNOVate 2019 Challenge with a pilot project. Inovues will install its window retrofit system at Saint-Gobain's North America Research Center, which is located in Northborough, Mass.

The pilot installation will help Inovues showcase its patented and tested technology, and will also serve as an example for prospective partners and investors who are eager to see the system installed on an actual building.

Al Kassas says he learned a great deal from the knowledgeable mentors he was paired with during the program. One mentor introduced him to Failure Modes and Effects Analysis (FMEA) and the Poka-yoke technique typically used in manufacturing processes, which he says were invaluable process analysis tools.

"Having advisers that are industry experts was really helpful," Al Kassas says. "We were able to address some business and technical challenges that require deep understanding of commercial construction and building materials that general mentors typically don't have."



➤ Inovues CEO and Founder Anas Al Kassas.



WHERE WE'RE GOING



When I think about Greentown, I think about the story of how we're going to save this planet.

— Darryl Pollica, CEO and co-founder of Ivys Energy Solutions

Greentown Labs is all about forging connections. We need to work together in order to win the fight against climate change, and nowhere is the power of collaboration more apparent than at Greentown.

We've seen firsthand the magical outcomes of relationships between startups and corporates, inventors and manufacturers, entrepreneurs and fellow entrepreneurs. As we look toward the future, we want to bring even more groups to the table—passionate citizens, civic leaders, and policymakers. We want to be the link between key partners, creating a leading community of climate champions that's a nexus of collaboration, innovation, and change.

We want to change the way people think about, engage with, and use energy. We want to change how we build our buildings, how we get around our cities and towns, how we grow our food, how we manage our water.

We believe in the power of entrepreneurs in the climate battle. We believe that support and amplification of cleantech startups—from corporates, politicians, and private citizens—will drive progress.

We aim to be the leading hub where people from all over the world congregate to work toward the shared goal of a sustainable future. As we plan to expand our reach into Houston, Texas, and beyond, we will continue working to be a conduit for the cleantech revolution that will move society forward.

» **We need you in this fight. Will you join us?**





OUR VALUES

The Greentown Labs team views driving climate impact through entrepreneurship, partnership, and collaboration as its North Star. In order to curate, support, and foster its community of startups and corporate partners to achieve their shared goals, the team uses the following values as its compass.

» **We are OPEN**

We believe in transparency and integrity, and use these qualities as a guiding compass in all of our communications, behaviors, and attitudes. We are open to diverse perspectives, community members, and partners, and seek them out as often as we can.

» **We are RESPECTFUL**

We follow the golden rule and treat others how we want to be treated. We are thoughtful, helpful, and kind to our colleagues, community members, and partners, and we treat them all equally.

» **We are APPRECIATIVE**

We celebrate and acknowledge wins within our team and community—both big and small. We are empathetic and patient with our colleagues and our community members.

» **We are RESOURCEFUL**

We hustle with purpose. We're collaborative and pragmatic in our approach to pursuing new opportunities and solving big challenges.

» **We are RESILIENT**

We are driven by a passion for our mission and we subscribe to an optimistic mindset. We persevere in trying times with the grit of an entrepreneur.

» **We MAKE WORK FUN**

We find humor and joy in our day-to-day operations and strive to create genuine camaraderie among our team. We welcome and encourage spontaneous team time amidst the buzz of our everyday activities.





OUR TEAM

Emily Reichert, Ph.D.
Chief Executive Officer

Ryan Dings
Executive Vice President + General Counsel

Suzanne Oakley
Part-time Chief Financial Officer

Joubin Hatamzadeh
Vice President of Operations

Julia Travaglini
Vice President of Marketing + Communications

Katherine MacDonald
Sr. Director of Strategic Partnerships

Gregory Ralich
Director of Lab + Member Resources

Andrew Takacs
Director of Corporate Partnerships

Cayman Somerville
Director of Strategic Member Growth

Graham Flynn
General Accountant

Carey Ann Comeau
Sr. Manager, Wet Lab Operations

Katherine Geusz
Sr. Manager, Strategic Partnerships

Steve Cassidy
Facilities Manager

Jenn Ibañez
Stakeholder Engagement Manager

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Steve Sansone
Machine Shop Manager

Michela Grunebaum
Launch Program Coordinator

Jacqueline Johnson
Marketing + Events Coordinator

Faith Kelhofer
Executive Communications Coordinator

Erin Silver-Wheeler
Operations Coordinator

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Development Coordinator, UMass Lowell

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Many members of the Greentown Labs team made significant contributions to the development of this report. Special thanks are due to Cayman Somerville, Sam Crum, Erin Silver-Wheeler, Faith Kelnhofer, Jenn Ibañez, and Andrew Takacs for gathering data; Reena Karasin for writing the report; and Julia Travaglini for leading this project.



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