Innovation Incubator

IN²

DEMONSTRATING SOLUTIONS
ANNUAL REPORT 2022

Founded by: WELLS FARGO | NREL

CONTENTS

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FROM THE DIRECTORS

"The proof is in the pudding" is actually a variation of an older saying: *the proof of the pudding is in the eating*. In other words, a person must judge the value, quality, or truth of something based on direct experience with it. As the Wells Fargo Innovation Incubator (IN^2) welcomed nine new companies into its portfolio in 2022 and collaborated on research projects and demonstrations, it thrills us to report that the pudding tastes good!

Demonstrating solutions with real-world partners for actual customers and communities is the first critical test where the market judges a particular technology. Though several of our portfolio companies have worked with NREL to deploy their technology over the years, in 2022 we launched our first ever demonstration cohort with BlocPower, NineDot Energy, Kit Switch, Community Energy Labs (CEL), and CorePower Magnetics. Each startup brought partners ready to install their tech and NREL researchers helped these companies with deployment, from test design, to placement, to techno-economic analysis. You will read more about these exciting demonstrations in the coming pages.

Our agriculture portfolio joined in on the demonstrations this year and took advantage of field trial work with our partner Farmers Business Network, an opportunity now made available to every company in IN^2. From Montana, to Illinois, to Indiana, startups planted solutions and harvested results.

We also welcomed four companies into our next agriculture cohort to work on collaborative research projects with the Donald Danforth Plant Science Center in St. Louis, Missouri: Robigo, Cytophage Technologies, Edison Agrosciences, and Peptyde Bio. They joined alum from our agriculture portfolio in St. Louis to network and learn at AgTech NEXT, where IN^2 graduate CoverCress shared their successful partnerships with Bunge, Chevron, and acquirer Bayer.

The IN^2 Channel Partner award recipients concluded their 2022 projects, which each advanced our shared goal of getting cleantech into the market and engaging a diverse pipeline of companies and founders. Four partner organizations used their awards to deliver revolving loans; provide coaching and training for cohorts of black, indigenous, and people of color (BIPOC); and support underrepresented investors and founders.

The funds delivered through IN^2 supported six historically Black colleges and universities as well as thousands of BIPOC people and organizations including 134 students, 70 farmers, 11 startups, six community partners, and 1,820 businesses.

2022 also brought together our advisory boards to reflect on the success of IN^2 and continue to build on the success of the program. To date, our portfolio of 65 now boasts $1.64 billion in follow-on capital since joining the program. The IN^2 boards sought new ideas on how to strengthen support for early-stage startups with assistance in the lab and help them leap over the technology valley of death. Board members also looked further down the commercialization continuum to develop new ways to support later-stage companies and our alumni on the notoriously bumpy road toward low carbon impact.

Innovation is something we embrace, and we are excited to roll up our sleeves and ask the challenging questions, while seeking inspiring answers. Thank you for a great 2022 and we look forward to more partnerships in the future.

IN²: SUPPORT AND ENGAGEMENT

The Wells Fargo Innovation Incubator (IN²) is a $50-million collaboration between the Wells Fargo Foundation and the U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL) to provide technical assistance and validation to promising cleantech startups. The technology incubator's goal is to quickly and successfully drive to market innovative technologies that will lower carbon emissions and de-risk them for investment.

Founded in 2014 and administered out of NREL's Innovation and Entrepreneurship Center (IEC), we continue to demonstrate better ways to evolve the built-environment and agriculture sectors and find innovative ways to unlock expansion opportunities. The IN² portfolio includes 65 companies that each received up to $250,000 in nondilutive funding. The companies use the funding to engage the world-class talent and facilities at NREL and the Donald Danforth Plant Science Center. The program matches each company with an expert researcher in their technology area and uses a team of relevant researchers, labs, and equipment to support a collaborative technical assistance project.

In 2022, we launched the first all-demonstration cohort, meaning each of the five startups chosen will complete the program with an actual demonstration of their technologies alongside a community partner. Several of these demonstrations began and neared completion in 2022.

Partnership Demonstrates Success: NREL and the Danforth Center

The access to resources at two of the nation's most highly regarded research facilities sets IN² apart. The research into affordable housing and commercial buildings takes place at NREL's South Table Mountain campus in Golden, Colorado. As a national laboratory, NREL is a global leader in advancing energy efficiency, sustainable transportation, and renewable power technologies and provides the knowledge to integrate and optimize energy systems. Our companies receive not only expert guidance from researchers at the lab, but also the benefit of access to multimillion-dollar user facilities.

Research with our agtech startups takes place at the Danforth Center in St. Louis, Missouri. The Danforth Center is the world's largest independent plant science institute. Founded in 1998, the nonprofit research institute's mission is to improve the human condition through plant science. The Danforth Center has 32 scientific teams; $250 million in competitive research funding from government agencies, industry, and foundations; and a greenhouse complex that provides 54,130 square feet of active growing space.

The agtech track, which receives technical assistance from the Danforth Center, debuted in 2019, and the indoor ag cohort launched in 2021 with NREL's support. Many of those companies are already seeing results and all have gained insights from their experiments.

IN² by the Numbers

Our numbers demonstrate our success:

65
portfolio companies

$1.64B
In external funds raised by companies since joining IN²

88:1
For every $1 invested by IN², portfolio companies raise more than $88

197%
employment growth for the IN² portfolio of companies

11
mergers & acquisitions of IN²-assisted startups

DEMONSTRATIONS: FROM READY-MADE MODULES TO CONTROLS TO V2G

Kit Switch

For its 10th cohort, IN^2 brought together participants who were ready to scope and perform a demonstration project and who had a partner ready to install their tech. Three of the teams began their demonstrations in 2022 with the others expected to launch in 2023. Alongside technical assistance from NREL, this cohort aims to de-risk new customer acquisition by providing a concrete example of success.

Kit Switch

Kit Switch is working with Habitat for Humanity LA, deploying a pilot in Los Angeles, as well as another separate pilot in San Francisco.

"We create the building blocks to form apartments inside existing structures, starting with plug-and-play kitchens," said Armelle Coutant, co-founder and CEO of Kit Switch. "In terms of creating more circular and sustainable cities, reusing existing structures is a less carbon-intensive way to create infill housing. Our minimodules are designed for flexible layouts and reconfigurability, enabling spaces to stand the test of time and adapt to changing uses."

An all-women-led team, Kit Switch creates tools to turn empty hotels, garages, and other underutilized spaces into more permanent and affordable housing options through the addition of kitchens. The Kitchen Kit includes a back wall panel that hosts preinstalled electricity and plumbing, simplifying installation.

Kit Switch creates a kitchen layout by pulling from a library of standard building blocks, allowing customers to pick the right package for their needs. To promote local partnerships, Kit Switch works with contract manufacturers instead of owning its own facility. A software system creates specific models and specifications they can send to those manufacturers. NREL helps by creating a software framework that can generate design iterations, keep track of design changes, and optimize off-site production, shipping, and on-site assembly processes.

"Our value is providing an all-inclusive kit, from framing to fixtures, thoughtfully engineered for ease of installation," Coutant said. "Instead of spending weeks building a new kitchen, our products arrive on-site ready to connect to the building plumbing and electrical supply through a plug-and-play access panel."

During the IN^2 program, Kit Switch's goal is to test its installation process, taking a module from the factory all the way to having someone live in a unit using a Kit Switch kitchen.

"Being recognized as a part of the IN^2 program is incredibly validating for the mission and impact we are working towards," Coutant said. "It was a really special moment."

Community Energy Labs (CEL)

CEL's new method of building controls hosts the controller on their servers and monitors the data, which allows them to use the same system on each building. The company's model-predictive control uses a physical model of a building to manage energy to its optimum while keeping occupants comfortable. CEL can work with any type of communicating thermostat, or they can retrofit existing thermostats with smarter versions.

"Our system controls smooth out preexisting power spikes. This lets us maintain a very good thermal comfort range in the building at a much lower price for energy and demand prices," CEL Founder and CEO Tanya Barham said.

CEL began its first demonstration in Contra Costa, California, in early October 2022. The testing and validation campaign spanned 15 weeks, and another campaign is slated to begin in the 2023 cooling season. In November 2022, CEL performed eight installations in the Pacific Northwest.

"We have signed contracts with more schools, but we want to make sure we're not rushing things," Barham said. "We are always placing occupant comfort and operator ease at the forefront of what we do. That means giving our early adopters time to experience the product and gain trust in the technology. For our early installs, that trust must come first. That also means sufficiently testing newer control algorithms before we deploy in the field."

As CEL continues with installations, the team at NREL runs software tests on the algorithms. They use building models to see if the lab controllers are a good fit and use data collected during CEL's installations at more than 20 school campuses across the West Coast to monitor performance and find possibilities for improvements.

"It's like baking a cake—there's always variation for different buildings. NREL gives us good information for testing recipes and validates that our core recipes are good," Barham said. "It's game changing. It's a big help."

NineDot Energy

The key part of NineDot Energy's success is understanding the ideal time and place to improve grid stability.

"We're trying to pinpoint where on the grid the power is needed most," Co-Founder and CTO Adam Cohen said. "Where on the grid can you interconnect at lower costs without having impacts on the system and which location will provide the most help when the grid needs support."

During the summer of 2022, NineDot installed a demonstration of its vehicle-to-grid (V2G) charging system in a Brooklyn, New York, parking garage.

NineDot's method is to charge the electric vehicles (EV) overnight, during hours when there is lower demand on the electrical grid, and then send the charged energy back to the grid during high-demand hours, such as in the afternoon and early evening.

Community Energy Labs

NineDot Energy

"There's lots of batteries on wheels in parking lots all across the densest part of New York," Cohen said. "If they are parked in the right place at the right time, they can act as a storage battery, providing energy to the local grid when needed."

NREL is assisting NineDot with finding the optimal time and location to manage energy supply versus demand in the New York City area.

The demonstration lasted three months, and there are plans to resume it during the summer of 2023 when the New York City grid feels the most stress. NineDot partnered with Fermata Energy to help develop the V2G process, and Revel Transit, Inc., which has a fleet of all-EV rideshare vehicles in New York City.

Working with NREL gives NineDot the benefit of comprehensive data evaluation as the company strives to validate the charging process under different conditions.

Cohen said it was a breakout year for NineDot. When they started their IN^2 program in February 2022, the company was just him, his fellow co-founders and two part-time employees. NineDot now has 25 full-time employees and is actively hiring.

Managing Success Over the Valleys of Death

With an often treacherous and winding journey to commercialization, startups must move their technologies across the pathway of research and development, prototype, demonstration, and deployment while avoiding missteps. IN^2 provides experienced guidance and connections to help participants succeed. Portfolio companies live in rare air with the support of IN^2 and others, raising $1.64 billion in external funding and seeing 197% employment growth since the program's launch in 2014. Three examples rise to the top of each summit in the journey:

Blue Frontier

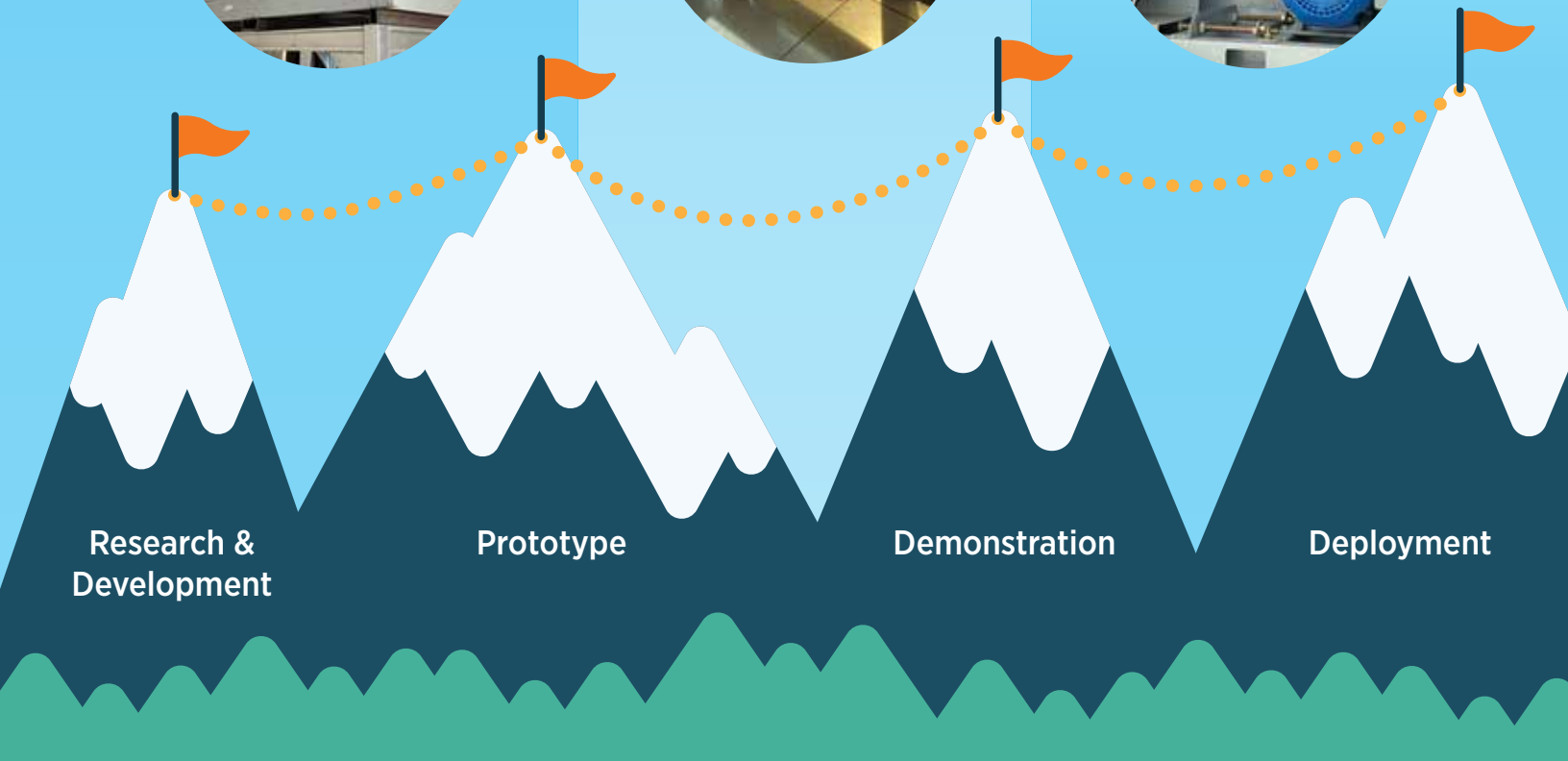
Blue Frontier started the IN^2 program with promising air conditioning technology but also with an unoptimized design, material property challenges, and uncertain performance. Through the IN^2 program and a partnership with NREL, it exceeded technical expectations by developing models and component testing that led to novel, optimized designs, and eventually a prototype. The IN^2 program significantly de-risked product development, accelerating the path to market.

UbiQD

One of the biggest challenges in commercializing a new building-integrated hardware technology is real-world demonstration because of the associated costs and risks. UbiQD leveraged the IN^2 program to deploy electricity-generating solar windows in the cafeteria on NREL's Golden, Colorado campus. The learnings and validating datasets proved invaluable to UbiQD on its journey to scale and productize the technology.

Turntide Technologies

IN^2 arranged rigorous NREL testing to demonstrate the commercial viability and performance of the Smart Motor System™, Turntide's energy conservation measure targeting rooftop HVAC units. With third-party technical validation in hand, Turntide scaled its groundbreaking technology to customers seeking new ways to reduce energy use. Wells Fargo also piloted Turntide motors to demonstrate their commercial viability, energy efficiency, and performance.



OUR PORTFOLIO

IN^2 selects startup companies that have a high probability of making a real economic and environmental impact in the market. These active projects provide viable solutions in affordable housing, commercial buildings, and sustainable agriculture.

Peptyde Bio

Affordable Housing

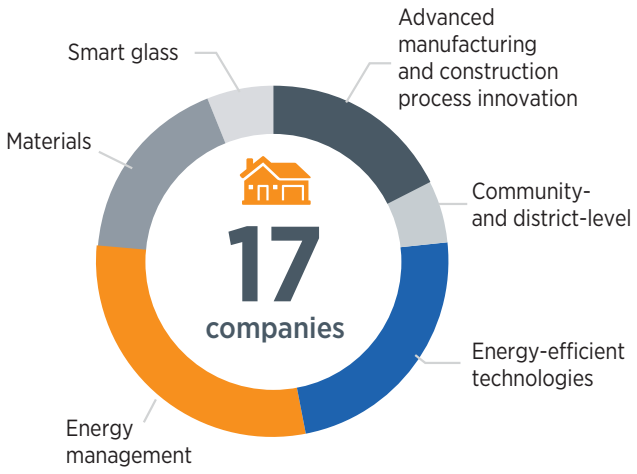
Green building materials, techniques, and appliances can reduce energy consumption by an average of 33%[1] and water use by about 30%[2]. These savings are significant, as energy costs can be as much as 22% of household income after taxes for the lowest-income households.[3] Several of these startups demonstrated their products in 2022, from a thermal coating, to prefabricated kitchens, to advances in geothermal heating and cooling.

BlocPower

"Shifted Energy would not have been able to accelerate R&D from lab to field studies without the help of IN[2] and the world class researchers and facilities of NREL. The Inflation Reduction Act is opening up unprecedented opportunities to add grid-impacting scale around efficiency and demand flexibility. Our project got out in front of these opportunities to lay critical groundwork around heat-pump water-heater control strategies including proving out lab work with deployments with families. This work will also help Shifted Energy scale these solutions across underserved communities.

– Forest Frizzell

Co-Founder and CEO, Shifted Energy



[1] Good Energies. "Greening Building and Communities: Costs and Benefits." 2008.

[2] Kats, Greg et al. "The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force." 2003.

[3] U.S. Bureau of Labor Statistics, U.S. Department of Labor. Consumer Expenditures in 2009. Report 1029. 2011.

AeroShield manufactures a super-insulating, nanoporous form of gel for energy-efficient windows. NREL conducts lab material characterization and durability analyses of the AeroShield material, models whole-building energy to quantify the predicted savings on building energy use and cost, and conducts techno-economic analyses to help the company apply its resources strategically.

BlocPower helps low and moderate-income multi-family housing building owners and tenants in cities harness energy efficiency and complete renewable energy retrofits, replacing fossil fuel-based systems with carbon-free technologies, and digitizing components of energy-efficiency transactions. For the BlocPower IN^2 project, NREL created physics-based models of typical apartments using a cold-climate heat pump and thermal energy storage device. These apartment models, along with their HVAC equipment, are typical for the buildings that BlocPower will use for demonstrations in New York City.

Darcy Solutions develops groundwater-sourced heating and cooling systems designed to eliminate hydrocarbon emissions and reduce HVAC costs in buildings. Darcy's technology allows for greater efficiency in each underground pipe, so installations require less drilling, resulting in less capital cost upfront. For Darcy's IN^2 project, NREL created models of system components as well as the buildings these systems would serve. The models allowed NREL to provide design assistance to Darcy for various system configurations and applications.

EnKoat re-engineers traditional architectural coatings, like paint, plaster, and stucco, into energy-saving coatings by incorporating phase change materials. NREL predicted energy efficiency with modeling and optimization tools, conducted material system performance optimization and verification, and worked with EnKoat on the development of a stakeholder engagement and market transformation plan.

Kit Switch works with Habitat for Humanity LA to install and analyze its prefabricated kitchen modules with integrated plumbing and electrical systems in underutilized spaces. Each unit can be pre-manufactured, flat-packed, and assembled on-site for reduced costs and timelines. Instead of demolishing the 6 billion square feet of vacant buildings zoned for housing in the United States, Kit Switch offers to make them viable again. In its work with NREL, Kit Switch installed demonstrations in California while NREL helped with process efficiency and network connections.

NeoCharge's integrated software platform will synchronize charging of electric vehicles and appliances. The company's smart splitters allow fast simple charging at home and reduce carbon emissions by up to 55%. NREL tested load profiles for typical equipment that may pair with smart splitters in real-world applications in its Systems Performance Lab. In 2023, NREL will also run tests on the Smart Splitters in the lab.

NeoCharge

Radiator Labs designs insulated, smart thermostatic radiator covers networked to a central-heating plant. The system redistributes steam flow from overheated to colder rooms to increase comfort and reduce energy costs and emissions.

Shifted Energy develops a power controller and accompanying software that converts existing electric water heaters into intelligent, grid-interactive water heaters. NREL provided technical assistance with the controller's forecasting algorithm and is performing lab validation of their algorithms using actual water heaters, including both electric and heat pump types. As part of its IN^2 project, Shifted Energy also works with Hawaii Energy to demonstrate the heat pump water heater controllers in affordable housing units.

SPAN is reinventing and redesigning the in-home electrical panel. Its goal is to make it easy and inexpensive to integrate renewable energy sources into the average electrical panel. SPAN looks to NREL to evaluate its panel in the lab's smart-home simulation system and to characterize the potential value of its panel for effective grid operations/management.

Stash Energy develops a ductless heat pump with built-in thermal energy storage and a thermostat that allows electric utilities to balance heating and air-conditioning demand to lower costs. In its IN^2 project with Stash, NREL provided technical assistance via materials and heat exchanger testing in its Thermal Testing Facility lab.

Tallarna (formerly Pivot Energy Services) designed a cloud-native platform that provides tooling and analytics to capture the energy performance of buildings, tailored specifically for financial and insurance underwriting. Tallarna and NREL collaborated on how to enhance Tallarna's energy performance estimations, primarily through the use of URBANopt software.

Our Alumni

- Adept Materials
- Blokable
- Glass Dyenamics
- Pre Framing Corp
- STRATIS
- Whisker Labs

Kit Switch

Demonstrating Solutions for Housing

Energy efficiency in the housing market is difficult, but necessary, and all startups working with IN^2 are making great progress. Here are just two examples:

Darcy Solutions

When building multifamily structures, or even commercial buildings, geothermal heating and cooling is often discarded because it requires too large of a footprint outside the building for the ground loop.

Darcy Solutions looks to change that by using the superior heat-exchange capacity of water instead of the conduction-based exchange of rock and dirt. This dramatically reduces the number of holes put in the ground, lowering the footprint requirement by more than 95%. Darcy Solutions puts a heat exchanger into a well, submerging it in groundwater that can exchange up to 50 times the amount of energy as a traditional system, with a 20% cost savings.

"Geothermal is the most environmentally friendly technology because there are no fossil fuels used on site, and economically, it's the most efficient technology by 50% to 80% in some cases," Darcy Solutions Co-Founder and CEO Brian Larson said.

This is because instead of burning coal, fuel oil, propane, or natural gas to heat a building, Darcy Solutions simply moves the heat from the earth to the building.

Darcy Solutions has three installations up and running in Minneapolis and St. Paul, Minnesota, and two of the three are retrofits as opposed to a new building.

"Our work with NREL highlighted what's possible and set the bar from an energy-modeling standpoint," Larson said. "We think geothermal is a key part of enabling the transition for low- and moderate-income housing. At the end of it all, they should be seeing lower-cost utility bills and a healthier environment."

NeoCharge

NeoCharge created a 240-volt splitter that helps people install EV charging in their home without having to hire an electrician. It is a plug-and-play solution that reduces a significant barrier to EV adoption by making it easy to plug in immediately and take it with you when you leave, which is especially important for renters.

A smart splitter, like NeoCharge's, allow users to charge EVs at half power overnight. Utilities are now even incentivizing this tactic because of the savings.

"We're helping to optimize home energy usage," NeoCharge CEO and Co-Founder Spencer Harrison said. "We integrate data to help you save money on your utility bill and reduce emissions. You can track your charging to help with one car, multiple cars, or even appliances in the home."

NeoCharge continues to work with experts from the IN^2 program to improve its products. NREL conducts different testing of the smart splitter to help NeoCharge eventually move beyond EVs. Harrison said he believes homes need to electrify to reach global decarbonization goals, and it must be done with equity in mind.

"At the end of the day our electric grid was built more than a century ago and it wasn't built to handle all these electric devices that are coming on the market," Harrison said. "We need to find ways to reduce load on the grid. There's a big opportunity and there's something we can do with our skills to make an impact."

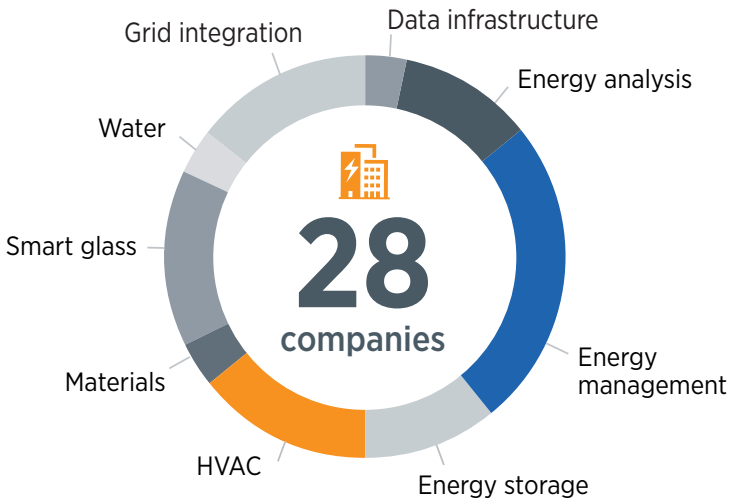
Commercial Buildings

Commercial buildings are responsible for 18% of total U.S. energy consumption.[4] To tackle this number, portfolio companies embarked on several demonstrations in 2022, including better controls in school buildings, helping architects better design clean-energy structures, and pioneering vehicle-to-grid energy transfer.

NineDot Energy

> "IN² helped us jump this from a cool laboratory idea to where it could be transformational for the industry. Phase one was how to build it. With phase two, we built it, and we sent it to NREL, and they tested it. From that, the performance of the unit allowed us to move forward to field trials."
>
> **– Daniel Betts**
> *CEO and Co-Founder, Blue Frontier*

> "The IN² program and partnership with NREL enhanced our credibility, proved our energy savings potential, and led to the funding of our first proof of concept. Because of this, we had a head start in our thermal energy storage technology development and will soon establish ourselves as leaders in this field by bringing a critical clean technology to market."
>
> **– Said Al Hallaj**
> *Founder and CEO, NETenergy*



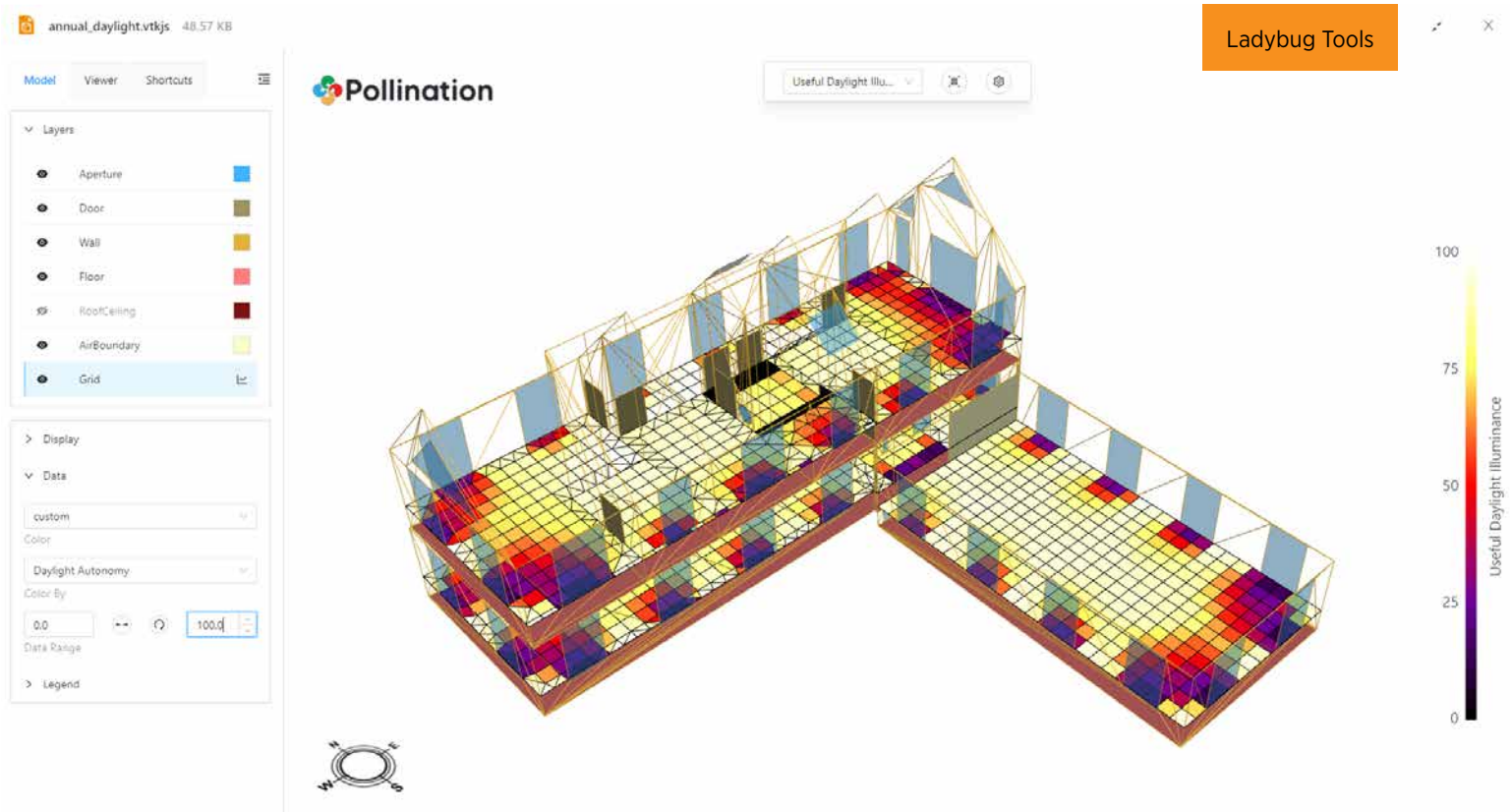
[4] U.S. Energy Information Administration. "Monthly Energy Review, December 2022." 2022.

Blue Frontier works to commercialize the integration of low-cost thermochemical energy storage with a revolutionary air-conditioning technology. To maximize the efficiency of the Blue Frontier air-conditioning technology, NREL assessed materials (alloys, desiccants, and others), performed bench-scale experiments on components (air turbulator, membrane, desiccant), performed sub-system modeling, and offered design assistance from the project's findings.

Community Energy Labs (CEL) builds technology for clean, all-electric, self-driving buildings, focusing on installations in public school district buildings. CEL provides an innovative platform for carbon-free, affordable, and reliable building control without disrupting power markets or the grid. As part of its IN^2 project with NREL, CEL is conducting demonstrations of its product on several K–12 schools in the Pacific Northwest. NREL assists in evaluating CEL's model predictive controls and applications in schools.

CorePower Magnetics designs, optimizes, and manufactures high-performance electric motors, inductors, and transformers that are 10 times smaller, lose half as much power, and can withstand next-generation operating conditions. These components enable electric vehicles to travel farther and redefine the operational limits of the power grid to accelerate renewable adoption. As part of its IN^2 project, CorePower is working with Eaton to demonstrate its power-dense transformers in electric vehicle applications. NREL is also providing technical guidance and techno-economic analysis.

Ladybug Tools is a collection of computer applications that supports the design process for sustainable buildings and net-zero districts seeking to employ cutting-edge energy technologies. NREL is helping Ladybug Tools improve key back-end features of its software to expand its capabilities and improve interoperability with other platforms.



Ladybug Tools

NineDot Energy works with Fermata Energy and Revel Transit, Inc., to support grid reliability by using the batteries in fleets of electric vehicles (EVs) to supply energy back to the grid during times of peak demand. The project uses Fermata Energy's bidirectional charging stations and software to perform vehicle-to-grid (V2G) operation with the energy stored in Revel's EV fleet. NREL and NineDot continue to evaluate data after the first installation in Brooklyn, New York. NREL is helping NineDot to identify the "golden spots" in the New York grid where V2G vehicles could be most effective.

Turntide Technologies develops a reliable, efficient, and intelligent motor system that works in concert with IoT building automation technology. The system is less expensive to own and operate than its conventional alternative. NREL is currently conducting follow-on work with Turntide to validate the energy savings of the unique control algorithms for its intelligent motor system and maximize energy savings based on climate and building type. Turntide is conducting a demonstration of its motors on the roofs of two Wells Fargo bank branches.

UbiQD produces nanomaterials for energy harvesting that provide a simple, scalable, low-cost, and aesthetically pleasing approach to solar windows. NREL is conducting durability assessments of UbiQD's prototype devices using an appropriate industry standard for window technologies, as well as relevant standards from the photovoltaics industry. NREL is also conducting varied materials characterization studies related to fundamental properties of UbiQD quantum dots and Luminescent Solar Concentrator devices. The project also includes a demonstration of five windows installed at the NREL Café on the Golden, Colorado campus.

Yotta Energy develops modular energy storage integrated with solar, designed to reduce cost and expand development of energy storage and grid resiliency on commercial buildings. NREL characterized the technology performance of two Yotta Energy prototype units as compared to a baseline unit, first in a laboratory environmental chamber, subjected to a range of ambient conditions, and then an outdoor installation.

Our Alumni

75F
7AC Technologies
Apana
Cypris Materials
EdgePower
ESS
Geli
Go Electric
Heliotrope
J2 Innovations
LiquidCool Solutions
Maalka
NETenergy
NEXT Energy Technologies
PowerFlex
ProStar Energy
simuwatt
Thermolift
VG SmartGlass
WattIQ

Demonstrating Clean Energy Efficiency in Buildings

Since its inception, IN^2 has prioritized aiding companies that drive clean energy technologies and practices in commercial buildings. Many of the companies that joined in earlier cohorts have successfully deployed their tech into the market. Here are just two examples:

Blue Frontier

According to Blue Frontier CEO Daniel Betts, given present trends, by 2050 the electricity consumption of global air conditioning will equal the entire consumption of electricity of both India and China today.

To combat this, Blue Frontier is making an air conditioning system that is three times more efficient than a traditional unit. This revolutionary technology uses a salt solution to create desert air conditions in a heat exchanger and then cools that air via indirect evaporative cooling. It dehumidifies a mixture of outdoor fresh air and air coming from the building which results in lower temperatures than a traditional swamp cooler. It can be used anywhere in the world, regardless of outdoor humidity.

The IN^2 program helped Blue Frontier select and evaluate the noncorrosive salt solution they use. It also helped them model more than 500 different designs so the team could settle on the most optimal solution.

Blue Frontier is starting field trials with the help of a partnership with Canada-based Modern Niagara.

"It's an actual air conditioning system," Betts said. "It went from IN^2 lab testing all the way to real product and is now ready to go into buildings. That's really exciting."

Ladybug Tools

Ladybug Tools is a collection of computer applications that supports the design process for sustainable buildings and net-zero districts seeking to employ cutting-edge energy technologies.

"Before our software, energy modelers would typically start from scratch and retrace over the entire design model," Co-Founder Christopher Mackey said. "Now, you can start with that same design model and run a few commands on top of it to get to a clean analytical model that's suitable for building simulations."

The open-source Ladybug Tools project has been downloaded more than half a million times. Mackey believes designers have used the open-source form of their software on more than a thousand buildings.

Participation in the IN^2 program helped Ladybug Tools to revise the software. NREL assisted in creating a new file type to facilitate interoperability between CAD platforms and simulation engines. This allows for concurrent coordination between the engineer, design team, and the project managers to make the best, most sustainable decisions.

"Just this past year, we started selling our first products around this," Mackey said. "We're transitioning from grant support over to sales supported. The future is looking very bright for us."

Blue Frontier

Sustainable Agriculture

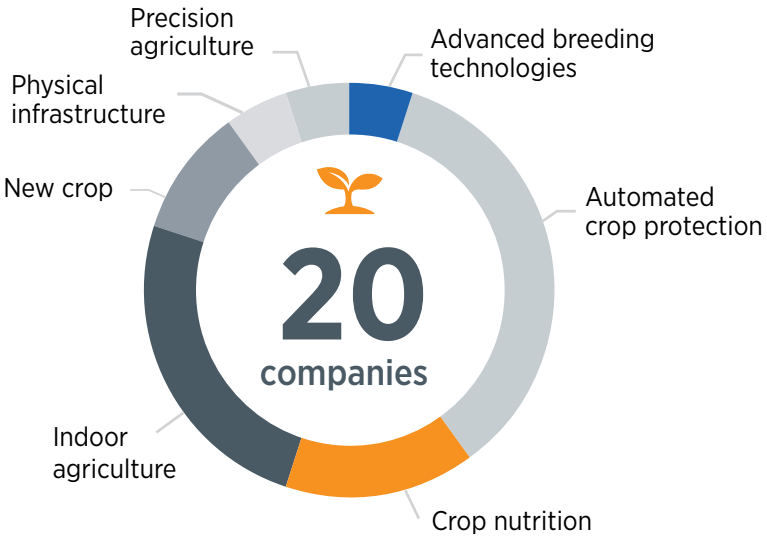
The food system alone contributes up to a quarter of all global greenhouse gas (GHG) emissions and uses 50% of habitable land and 70% of freshwater withdrawals worldwide.[5] In 2022, portfolio companies demonstrated progress in several ways, including with a usable carbon calculator, preparation for planting sunflowers in the spring, and a higher-yield crop of hemp.

Peptyde Bio

"The IN² program supports the extension of Atlas' calcium and magnesium ion-sensing technology to the sensing of nitrogen ions, enabling both scale and scope opportunities in the agricultural space. Engagement with NREL and researchers at the Danforth Plant Science Center has yielded introductions to customers, collaborators, and investors. IN² has been a game changer for Atlas."

– Dr. Eva Deemer

Chief Technology Officer, Atlas Sensor Technologies



[5] Schrempf, Bridget et. al. "Hungry for Change: Are companies driving a sustainable food system?" 2020.

Atlas Sensor Technologies develops real-time water hardness sensing combined with sensors to detect nitrogen compounds for improved crop development. Atlas successfully developed a new in-line nitrate sensor, the prototype of which will be tested at the Danforth Center for functionality and fit with applications in different greenhouse environments.

CarbonBook successfully completed their collaboration with the Plant Growth Facility at the Danforth Center and is working to implement lessons learned for their commercially available carbon calculator.

Cytophage Technologies uses synthetic biology to generate bacteriophage products that specifically target and eliminate problematic bacteria. They are currently working with scientists at the Danforth Center to extend their technology, previously demonstrated effective in humans and animals, to commercially important crops.

Edison Agrosciences leverages selective breeding technology to increase the amount of rubber already produced by the sunflower plant to create a domestic supply, prevent further tropical deforestation, and reduce forced/child labor. Their project will be conducted in the field, with planting planned for spring 2023.

GrowFlux develops and evaluates a lighting optimization algorithm for greenhouses. They are currently working with the Danforth Center to test the application of their technology in a greenhouse production setting.

New West Genetics creates proprietary hemp seed bred for high yield and stability for food, feed, biomass, and nutraceutical products. They successfully completed their project and pivoted to supplemental research and development projects leveraging the IN^2 community.

Peptyde Bio discovers, designs, and develops novel biofungicides based on natural plant-derived antimicrobial peptides. They made substantial progress on their project and intend to apply for field trial support for the upcoming season.

Robigo is creating the next generation of sustainable microbial pesticides that are more effective in controlling disease, environmentally friendly, and nontoxic to field workers. They are currently designing and scoping their collaborative project with the Danforth Center, which will likely begin in spring 2023.

SunPath designed a lighting system that delivers actual sunlight deep inside buildings via fiber optics. The technology aims to save money, increase crop yield and quality, and offer environmental sustainability. They continue to work on the development of a prototype to be tested at the Danforth Center.

Our Alumni

AgroSpheres
Aker Technologies
CoverCress Inc.
EarthSense
Intrinsyx Bio
mobius
Plastomics
Pluton Biosciences
RNAissance Ag
SolGro
TerViva

Overcoming Indoor Ag Challenges

In 2021, combining experts from both the Danforth Plant Science Center and NREL, IN^2 launched a cohort of five startups focused on indoor agriculture working toward breakthroughs in lighting, water use, sensors, and more. Here are just two examples:

CarbonBook

CarbonBook CEO Daphne Preuss wants more attention on indoor agriculture and greenhouse gas emissions—to tackle climate change, the world must get it under control.

"Much of the focus in the press, government grants, and grocery is on outdoor agriculture," Preuss said. "However, indoor-grown produce can have 10 times the carbon footprint as produce grown outdoors. We're trying to help people be mindful of that."

To accomplish this, CarbonBook created a carbon calculator that allows indoor farms to track all of their carbon emissions that come from day-to-day operations, so they know where to focus. It accounts for some of the major factors that create emissions, like greenhouse lights, whose energy could come from a coal-powered plant instead of solar or geothermal energy, or fertilizer, because producing it uses natural gas.

During its IN^2 program, the Danforth Center team performed a trial in a greenhouse to help the CarbonBook team develop its software.

"The combination of NREL, Danforth, and all of the network that IN^2 has, really catapulted us forward," Preuss said. "We came in with an idea, a concept, and we left with a finished product that's in the market now."

New West Genetics

New West Genetics (NWG) investigates and identifies traits at the genomic level to improve the sustainability of crops, specifically hemp. During their time working with IN^2, the team focused on the variation within a hemp crop's ability to sequester carbon and found substantial variation for root system architecture across NWG's diverse crop database.

"Understanding underlying genomic traits enables breeders to quickly forward lines, in this case to select lines that are better able to respond to climate change," CEO of NWG Wendy Mosher said.

Working at the Danforth Center allowed NWG to do much more phenotyping than they could do on their own. They took a broad swath of genetic lines and analyzed them for sustainability and yield traits.

"An exciting development on the yield side is a game-changing trait called AMPLIFY™. We've tested this trait and put it into multiple lines and in every single one it doubles the yield," Mosher said. "We're even seeing more than doubling on some lines."

Working Together

Several IN² startups are now working together, using each other's skills to help fulfill their goals.

CoverCress Inc.

Aker Technologies and CoverCress Inc.

CoverCress Inc. (CCI) is developing a new oilseed crop they named CoverCress™, derived from the weed field pennycress, to use as a biofuel once it is fully to scale. CoverCress is an alternative crop that is grown off season from corn and soybeans. The idea is to give farmers a crop in the winter months they can then sell as a biomass fuel source.

"Without the IN² connection, we probably wouldn't have known anything about Aker at all," said CCI Vice President of Agronomy Chris Aulbach.

Aker Technologies CEO and Co-Founder Orlando Saez believes collaborating with CCI was the result of their work with scientists at the Danforth Center during their IN² projects, which led them to discuss how Aker's remote sensing technology could help CCI tell their economic impact story to growers. "Innovation happens because of proximity. When people get closer together, great things happen," Saez said.

Aker can deeply diagnose plants, including identifying any problematic pathogens or environmental stresses. CCI wanted to learn the quality and uniformity of emergence for pennycress after planting. Aker helps CCI determine the success and failure of air seeding, knowing how many seeds emerge into plants. Aker can also help determine if the stand is worth the expense of the fertilizer. Finally, Aker's data helps CCI explain to farmers if their pennycress will be a good harvestable crop.

IN² is often referred to as a family, and a family feels comfortable leaning on each other. Saez is happy the two companies share a goal and a set of outcomes. Finding that with another company can be tricky, but the types of companies in the IN² family seem to make it easier.

"IN² was fantastic in that it created the capacity to do this project with CoverCress. It gave us the opportunity and that was very catalytic," Saez said.

75F and J2 Innovations

In 2019, IN^2 invited its portfolio companies to participate in the VERGE conference to highlight their energy-related technologies. During that event, 75F and J2 Innovations met for the first time.

As an alumni of IN^2, and recently acquired by Siemens, J2 was presented as a program success story. The company creates a software framework for connecting devices that makes it easier for smart buildings and smart equipment to work together.

75F joined IN^2 years later with its technology to "make dumb buildings smart," according to CEO and Founder Deepinder Singh. "We control indoor quality, HVAC, temperatures, and energy so people can stay comfortable while saving money."

After realizing that 75F could leverage J2's framework, the two companies began working together.

"J2 is complementary because 75F does a great job in handling the new equipment, and J2 does a great job of working with existing legacy equipment," Singh said.

"Because of J2, we can go to a customer site and have the best of both worlds. If the customer doesn't want to upgrade everything in one go, J2 allows them to keep some of the older stuff."

Both companies announced a collaboration to improve the energy efficiency of mid-sized commercial buildings. 75F and J2 will standardize on the use of a tool that allows community members to contribute peer-reviewed, plug-and-play digital twin models of building controls and equipment. These models can easily become templates for building systems, reusable by anyone else in the community thereafter.

75F and J2 point to their involvement in IN^2 as a shared experience that made it easier to connect.

Scott Muench, J2's vice president of customer experience, believes IN^2 provides a resource pool many other startups don't have access to. "There's a huge wealth of knowledge in that group and if you partner with someone that's like-minded, you already have something in common," he said.

75F

OUR ECOSYSTEM

To boost impact, IN^2 fosters an ecosystem of expertise and support. The IN^2 Channel Partner network includes more than 60 incubators, accelerators, and universities that mentor and refer companies to the program. The Wells Fargo Board of Directors reviews applicants, providing business expertise and guidance. Two external advisory boards, the Commercial Buildings and Housing Board and the Sustainable Agriculture Board, select the final participants. The Farmers Business Network (FBN) provides field trial opportunities and exposure to commercial markets to agtech startups.

In 2016, IN^2 launched the $5 million Channel Partner Award program to support events, strategic meetings and trainings, and large collaborative initiatives between the Channel Partners. The program expanded in 2020 and will deliver an additional $5 million in Channel Partner Awards through 2024.

In the Field with the Farmers Business Network

The following companies completed field trials with FBN through IN^2 support over the 2022 growing season:

- **Intrinsyx Bio** held trials in Indiana and Illinois, collecting usable data for learning how to adjust their product
- **New West Genetics** held a trial in Montana to test two hemp hybrids for yield and quality and plan to expand horizons into new locations
- **EarthSense** tested in fields near Illinois/Western Indiana and, while it underestimated logistical hurdles with bigger fields and weather patterns, learned what it takes to adapt at scale.

Other field trials:

- **CoverCress Inc.** completed FBN trial last winter and discussions continue for a commercial partnership
- **Aker Technologies** works with CoverCress and other IN^2 companies to provide data collection on their field trial projects.

Companies looking to perform field trials in summer 2023:

- **CarbonBook**
- **Pluton Biosciences**
- **AgroSpheres**

IN² Award Catalyzes New Growth

In plant biology, one cell becoming two is common, but one plant biology company becoming two is rare. However, a catalyst provided by IN² in 2022 enabled Plastomics, an IN² participant at the Danforth Center, to divide, and a new company, Solis Agrosciences, to sprout.

The catalyst: an award given to BioGenerator, a member of the IN² Channel Partner network that helps introduce startups to the IN² pipeline. BioGenerator recommended Plastomics for the IN² program in 2020 and helped Solis Agrosciences get its start in 2022.

The creation of Solis began when Plastomics' clients kept asking for services Plastomics could provide, but it took them away from their core product and mission.

"Plastomics was starting to get requests for fee-for-service work that was not core to their main purpose, which is focused on chloroplast manipulation," Solis Agrosciences, Inc. President Dr. Mary Fernandes said.

"The IN² money in the spring of 2022 was absolutely critical to getting the company going," President of BioGenerator Ventures Charlie Bolten said. "An IN² Channel Partner Award to BioGenerator funded the equipment purchase so Solis could build a lab and start commercializing research projects."

Solis does not just work on nuclear transformation. It has added many new services and grown its list of clients.

"After starting with nuclear transformation in soybean," Fernandes said, "we've expanded to gene editing, molecular biology, plant growth, and transformation in other crops such as corn, tomatoes, and rice. We're just getting started and there's so much to do."

Strategic DEI Awards Broaden Reach

Four organizations received a Strategic Award as part of IN^2's diversity, equity, and inclusion (DEI) initiatives. In 2021, IN^2 provided $350,000 in awards to organizations within the Channel Partner network with funds that came from the Wells Fargo Foundation's contributions to IN^2.

Innovation Corridor Investments

With its award, Innovation Corridor Investments launched a new female and DEI-focused fund.

"I'm using the award to create an ecosystem that supports the further development and scaling of partners in cleantech and climate tech," said CEO and Founder Eric Drummond. "We are identifying the gaps in the market around the lack of diverse inclusion. We don't want to just put the capital in the market, we want to put the capital in the market surrounded by a supportive ecosystem."

Drummond's goal is to eventually have the fund support 30–40 companies in its portfolio, all either launched by underrepresented individuals or groups or have an underrepresented group on the executive team.

"We should all band together to do what we can do. Maybe we can reverse the climate change process," he said.

Centrepolis Accelerator

Dan Radomski is executive director of Centrepolis Accelerator, which invests up to $20,000 in select entrepreneurs from underrepresented backgrounds in the form of a no-interest loan that startups have 24 months to pay back.

Centrepolis started the program four years ago to provide dedicated services and funding to cleantech hardware and companies operated and managed by underserved entrepreneurs, including women, people of color, veterans, and those with disabilities. The program gives inventors, startups, or small businesses a place to go for help with design and engineering.

"We're unlike other incubators and accelerators in our focus on hard-tech innovation. We've created a process to ensure the hard tech is designed and engineered with durability and reliability top of mind," Radomski said. "We bring experts to you and make them a part of your team, a true extension of our clients. Applying the experts, manufacturers, and product development discipline—that's what makes us unique."

AgLaunch

AgLaunch wants to ensure farmers are at the center of innovation and the changing dynamics of agriculture by connecting early-stage agtech startups directly with farmers. According to President Pete Nelson, AgLaunch is set apart from other accelerators and farmer-trial programs because the AgLaunch farmer becomes a true partner for the startup by providing expertise, data, and time.

Nelson said their DEI award allowed them to scope and begin to execute a more targeted approach. "It was incredibly helpful in terms of helping us start the process of supporting a real, focused effort around recruitment and support of BIPOC startup founders," Nelson said.

AgLaunch coordinated a two-day workshop with HBCUs to create programs for students, faculty, and other BIPOC founders to encourage agtech ideas and build toward creating new startups. These founders will work with AgLaunch's entrepreneurship team and farmers to develop an idea or a case study. Four BIPOC startups pitched at the AgLaunch Innovation Challenge during the National Black Growers Council annual meeting with more programs rolling out in 2023.

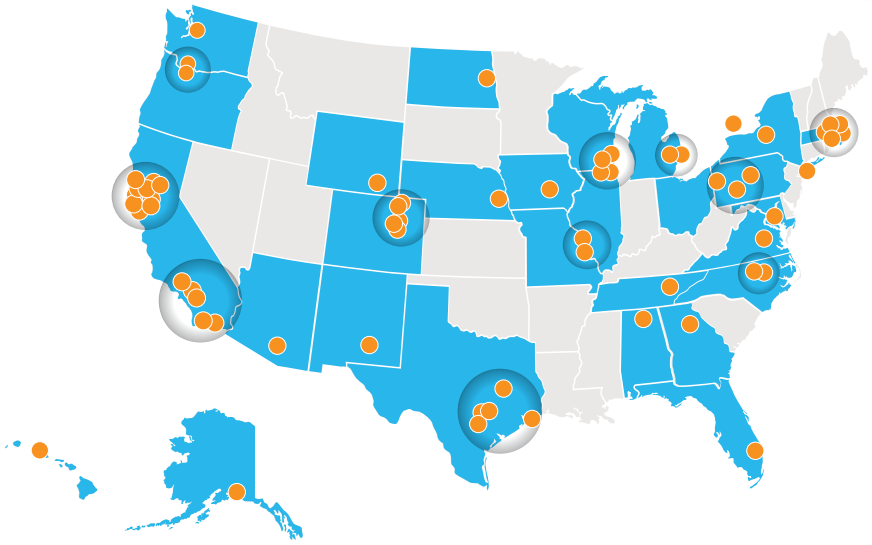
Elemental Excelerator

Elemental Excelerator runs a variety of programs to encourage individuals to join the climate sector, focusing on traditionally excluded groups. The programs include internships and other ways to support innovators, including coaching sessions and workshops.

"It's important to do this work because, as we know, many individuals impacted by climate change or severe weather events are most likely excluded groups," Antoinette West, career pathways manager for Elemental Excelerator, said. "We want to inspire and engage more individuals from traditionally excluded groups to come into science, tech, and engineering."

The goal is to make sure all participants can leverage their experiences with climate change, including those who have lived experiences from frontline communities or who are traditionally excluded from climate innovation, and combine that with their skills and passions into a career with meaning that lets them contribute to society as a whole.

IN² Channel Partners



ACRE/Urban Future Lab | New York, NY

Activate | Berkeley, CA

AgLaunch | Memphis, TN

AgStart | Woodland, CA

Arrowhead Center | Las Cruces, NM

BioGenerator | St. Louis, MO

BRITE Energy Innovators | Warren, OH

Browning the Green Space | Boston, MA

Caltech | Pasadena, CA

Carnegie Mellon University, Wilton E. Scott Institute for Energy Innovation | Pittsburgh, PA

Cleantech Group | San Francisco, CA

Cleantech Open | Los Angeles, CA

Cleantech San Diego | San Diego, CA

Coachella Valley Economic Partnership | Palm Springs, CA

Colorado Cleantech Industries Association | Longmont, CO

Colorado State University Energy Institute, Powerhouse | Fort Collins, CO

Daugherty Water for Food Global Institute at the University of Nebraska | Lincoln, NE

Dominion Energy Innovation Center | Ashland, VA

Elemental Excelerator | Honolulu, HI

Evergreen Climate Innovations | Chicago, IL

F3 Tech Accelerator | Easton, MD

Greentown Labs | Somerville, MA

Grand Farm/Emerging Prairie | Fargo, ND

FORGE | Somerville, MA

HBCU Clean Energy Initiative | Miami, FL

HudsonAlpha | Huntsville, AL

Imagine H2O, Inc. | San Francisco, CA

Innosphere | Fort Collins, CO

Innovation Corridor Foundation | Denver, CO

Iowa State University | Ames, IA

Larta Institute | Los Angeles, CA

Launch Alaska | Anchorage, AK

Los Angeles Cleantech Incubator | Los Angeles, CA

MaRS | Toronto, ON

Mass Challenge | Boston, MA

New Energy Nexus | San Francisco, CA

NextEnergy Center | Detroit, MI

North Carolina Biotechnology Center (NCBiotech) | Durham, NC

Northeast Clean Energy Council (NECEC) Institute | Boston, MA

Northwestern University | Evanston, IL

Portland State University Business Accelerator | Portland, OR

Powerhouse | Oakland, CA

Prospect SV | San Jose, CA

Rice University | Houston, TX

Stanford, TomKat Center for Sustainable Energy | Stanford, CA

Syracuse Center of Excellence | Syracuse, NY

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Texas State University | San Marcos, TX

The Water Council | Milwaukee, WI

The Yield Lab | St. Louis, MO

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University of Georgia, Innovation Gateway | Athens, GA

University of North Carolina, Institute for the Environment | Chapel Hill, NC

University of Texas at Austin, Austin Technology Incubator | Austin, TX

University of Texas at Austin, Texas Venture Labs | Austin, TX

University of Washington | Seattle, WA

University of Wisconsin-Madison, Wisconsin Energy Institute | Madison, WI

VertueLab | Portland, OR

ADVISORY BOARDS

The IN² External Advisory Boards determine the companies accepted in each cohort. They provide insights and expertise in sector trends, challenges, and opportunities and technical understanding of the technologies, both traditional and emerging. The two boards have expertise in either 1) the commercial and residential built environment or 2) agriculture and the food-energy-water nexus.

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Christine Daugherty
Deputy Director Business Development, Bill & Melinda Gates Foundation

Laura Dwyer
Business Development, DuPont Ventures

Vonnie Estes
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Venture Partner, Lewis and Clark Ventures

Millie (Mulumebet) Worku
Professor of Animal Sciences, North Carolina A&T State University

Wells Fargo Board of Directors

The Wells Fargo Board of Directors is comprised of executives and senior managers from Wells Fargo, representing more than a dozen lines of business who guide the strategic direction and the program. Board members provide applicant feedback and subject-matter expertise related to commercial and residential buildings, diversity, sustainability, agtech, cleantech, finance, law, supply chain management, government relations, and more.

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Senior VP, Government Relations

Team

The program management team at Wells Fargo, the National Renewable Energy Laboratory, and the Donald Danforth Plant Science Center work together to grow the IN² ecosystem and to help our cleantech and agtech companies realize success.

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Vice President, Public Affairs Communications, Wells Fargo

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Elliott Kellner
Senior Program Manager - Innovation Team, Danforth Center

Monica Kurtz
Communications Lead, NREL

Lauren Magin
Startup Portfolio Manager, NREL

Tonya McCabe
Operations, NREL

John Moon
Vice President, Climate Aligned Philanthropy and Partnerships Lead, Wells Fargo

Minna Onken
Project Coordinator, Danforth Center

Kimberlee Ott
Channel Partner Engagement, NREL

Opening Doors to the Future

IN^2 has proven what patient capital can do. So many programs, even with the best intentions, lose funding or interest too soon. Now entering its ninth year, IN^2 boasts a portfolio of 65 impactful companies. Sixty-five companies we continue to celebrate and support on their journey to market impact. We are proud as we look back on our early cohorts, 75% of whom have exited with acquisitions or public offerings. To us, this means more than economic success. It is paving the path to environmental impact, which sits at the very heart of IN^2.

What's next for IN^2? We want to open our doors even wider, and we hope you will do the same. That means welcoming partners who want to run specialized cohorts through our model or demonstrate innovative technologies with pilot projects. With world-class lab experts serving as an unbiased third party to support both market partners and startups, the win-win-win is a reality we now enjoy as our portfolio matures. It also means opening the doors to our Channel Partner network, fostering the access and collaboration of incubation and university programs across the nation, and using their unique capabilities in each region to create opportunities for all.

Wells Fargo Innovation Incubator (IN²)
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