

## REQUEST FOR APPLICATIONS

**EPRI, Shell, and the City of Houston have joined forces with Greentown Labs and the Urban Future Lab at NYU Tandon School of Engineering on the Low-Carbon Hydrogen Accelerator (LCHA), a first-of-its-kind program for startups enabling a low-carbon hydrogen economy. The partners are actively seeking applications from startups that are advancing hydrogen production, storage, and distribution. LCHA is the latest program in the Greentown Launch family of programs, Greentown Labs' flagship corporate partnerships accelerator program.**

### **Program Benefits for Startups:**

- The opportunity to partner with industry leaders EPRI, its member utilities, and Shell to accelerate commercialization via technology validation, feasibility studies, pilot demonstrations, and other development and commercial partnerships
- An assigned engagement lead and access to experts and leadership from EPRI and Shell that will be matched with your team to craft a custom engagement plan for the six-month program
- Mentorship, networking opportunities, and partnership-focused programming from Greentown Labs' and the Urban Future Lab's communities of climatetech startup experts
- Exclusive access to the Greentown Labs, Urban Future Lab, EPRI, and Shell networks
- Membership and desk space within Greentown Labs for the duration of the program

### Why a Low-Carbon Hydrogen Accelerator and What We're Looking For

Large-scale commercialization of low-carbon hydrogen will play a key role in the transition to a decarbonized economy. Because of its versatility, hydrogen is uniquely suited to help realize decarbonization goals. Hydrogen's ability to act as both a carrier for electricity and a fuel means it can be used for a broad range of applications, including in hard-to-decarbonize sectors<sup>1,2</sup>. As more intermittent renewable energy comes onto the grid, hydrogen can also act as an electricity storage medium, allowing grids to make full use of wind, solar, and other intermittent renewables. Most importantly, hydrogen dramatically reduces the carbon intensity of our energy systems<sup>3</sup> when generated via low-carbon methods, such as electrolysis with electricity from renewable sources.

Low-carbon hydrogen is enjoying unprecedented commercial and political momentum; over \$300B is announced or projected to be spent on hydrogen projects globally through 2030<sup>4</sup>. With the launch of the U.S. Department of Energy's [Hydrogen Shot Initiative](#) in 2021, the U.S. federal government has both identified hydrogen as a key energy solution for the future and highlighted the importance of reducing the cost of low-carbon hydrogen. If

<sup>1</sup> <https://news.climate.columbia.edu/2021/01/07/need-green-hydrogen/>

<sup>2</sup> <https://www.sciencedirect.com/science/article/pii/S2590174520300155>

<sup>3</sup> <https://www.iea.org/reports/the-future-of-hydrogen>

<sup>4</sup> <https://hydrogencouncil.com/en/hydrogen-insights-updates-july2021/>



price reduction goals set by the Hydrogen Shot Initiative are met, experts predict a five-fold increase in low-carbon hydrogen use, leading to critical carbon dioxide emission reductions and billions of dollars in revenue and jobs created by the growing industry<sup>5</sup>.

Together with Greentown Labs and the Urban Future Lab, EPRI and Shell recognize the need to accelerate the development and commercialization of low-carbon technologies required to enable economy-wide decarbonization. As leaders in the utilities and energy industries, respectively, with domain expertise, R&D facilities, and access to global customers, EPRI and Shell are uniquely positioned to drive this transformation in partnership with startups innovating at the cutting edge of low-carbon hydrogen. LCHA is supported by the City of Houston, the location of Greentown Labs' newest incubator and a city whose world-class energy infrastructure, low-cost electricity, and human capital position it to become a global hydrogen hub<sup>6</sup>.

To meet our ambitious clean hydrogen targets together, **LCHA seeks startups between TRL 3 and TRL 7 that meaningfully advance low-carbon hydrogen production, enhance hydrogen storage and distribution, or provide digital solutions or business model innovations for the management of hydrogen supply chains.**

## Program Scope

This call for applications has three subsections: low-carbon hydrogen production, hydrogen storage and distribution, and digital solutions and business model innovations.

### **Low-Carbon Hydrogen Production: Cost, Reliability, & Scalability**

The DOE's [Hydrogen Shot Initiative](#) calls for the cost of clean hydrogen to be driven down to \$1/kg or less in order for low-carbon hydrogen to become cost-competitive for most applications<sup>7</sup>. Additionally, reliability and scalability are key concerns, especially for green hydrogen, or hydrogen produced from electrolysis using renewable electricity. Intermittent renewable power sources can rapidly degrade electrolyzer equipment, making reliability a challenge. Furthermore, ensuring consistent high-purity, highly-pressurized output is key to meeting the needs of real-world applications. Finally, as hydrogen deployment scales, modular production technologies will be needed to match supply with demand, in terms of both location and quantity produced.

### Technologies of Interest (Non-exhaustive):

<sup>5</sup> <https://www.energy.gov/eere/fuelcells/hydrogen-shot>

<sup>6</sup> <https://static1.squarespace.com/static/5bd0cda394d71a3556faeb6c/t/6022ff8c59eed438f73aaea/1612906382736/Houston+Hydrogen+Whitepaper+Final.pdf>

<sup>7</sup> <https://www.energy.gov/eere/fuelcells/hydrogen-shot>



- Solutions that reduce the cost of low-carbon hydrogen relative to the cost of traditional electrolysis
  - Example: Technologies that reduce the cost and critical materials dependencies of electrolyzers
- Innovations for avoiding or counteracting degradation effects of intermittent operation on electrolyzer equipment
- Innovations for effectively integrating electrolyzers with renewables (e.g., solar, photovoltaics, wind), especially in the context of power electronics, connection interface, optimized conversion (or lack thereof), and control
- Innovations for effectively integrating electrolyzers with the grid, especially in the context of enabling additional value streams
- Technologies for safely enhancing pressure and/or purity of electrolyzer-produced hydrogen
- Modular approaches for decentralized and/or step-wise low-carbon hydrogen production

### **Hydrogen Storage & Distribution: Safety, Reliability, & Efficiency**

Once produced, hydrogen must be stored and transported to its destination of use. Safety, reliability, and efficiency become critical factors regardless of what transportation method is used. Innovation is needed not only to address challenges in current hydrogen supply chains, but also to open new possibilities for future supply chains. Novel carriers offer promise if they are cost-effective, provide a high energy density, and offer a high usable capacity throughout their lifecycle.

#### Technologies of Interest (Non-exhaustive):

- Technologies for existing hydrogen supply chains
  - Technologies that can enable liquid hydrogen supply chain at scale, including breakthrough technologies that significantly reduce the cost of hydrogen liquefaction
  - Technologies for hydrogen detection in open environments and detection of leaks in pipelines and vessels
  - Novel technologies that can provide assurance, and allow control, of hydrogen quality
  - Materials innovation for hydrogen pipelines and/or storage
  - Inspection and maintenance technologies for pipelines and other infrastructure
- Technologies for future hydrogen supply chains
  - Novel and cost-effective hydrogen transportation technologies with a high energy density for the complete system package and high usable capacity that will still be met at the end of service life
  - Innovations in ammonia decomposition and purification: technologies that enable efficient cracking of ammonia to get desired hydrogen purification levels at scale

- Next-generation heavy-duty compressors that can enable, for example, heavy-duty vehicle value chains by meeting the reliability, capacity, and cost requirements of refueling—beyond an incremental cost improvement on existing technology

### **Digital Solutions and Business Model Innovations**

As the hydrogen economy emerges, digital tools for end-to-end supply chain optimization will be key to ensuring the hydrogen economy operates with maximum efficiency in terms of both cost and carbon. Additionally, as both demand and production scale, software and business model innovations can help accelerate deployment by finding new ways to connect producers and offtakers.

#### Technologies of Interest (Non-exhaustive):

- Digital solutions for supply chain integration and optimization (including IoT, AIoT, and machine learning solutions)
  - Optimization of CO<sub>2</sub> and other GHG emissions reductions across supply chain
  - Optimization of cost across supply chain
- Solutions that connect hydrogen producers and offtakers through software platforms and/or business model innovation

### **Out of Scope**

Technologies out of scope for LCHA include the following:

- Hydrocarbon-based hydrogen production technologies with unabated carbon emissions (commonly known as “gray” or “brown” hydrogen)
- Hydrogen production technologies that require carbon capture in order to be considered low-carbon (commonly known as “blue” hydrogen)

### Partnership with EPRI and Shell

EPRI and Shell bring unique and complementary perspectives on the emerging hydrogen economy.

As a research coalition with a member base primarily made of utilities, EPRI intricately understands the complexities of bringing new technologies onto the grid. EPRI’s [Low Carbon Resource Initiative](#) brings together more than 45 leading energy companies and \$125M+ to drive the advancement of technologies that enable deep decarbonization across our economy.

As a fuels major, Shell understands how to commercialize and safely manage a high-energy-density commodity. Furthermore, Shell sees a future where hydrogen fuel plays an important role in mobility and hard-to-decarbonize transport sectors such as heavy-duty trucking, marine and aviation as well as heavy industry such as cement, steel, and chemicals.

At the same time, EPRI and Shell's interests include many overlapping opportunities. Together, EPRI and Shell have identified two main engagement pathways for startup participants in LCHA.

- **Validation Track:** Suitable for startups at TRL 3-5, the validation track offers an opportunity to run a lab characterization project at an EPRI or EPRI member research facility and to be considered for admission to [Shell GameChanger](#). Within its lab characterization projects, EPRI offers support as a third-party independent technology validator for cost-benefit analysis, balance of system analysis, market feasibility studies, and other analyses. Shell GameChanger offers possible pre-seed and seed investments, among other benefits.
- **Demonstration Track:** Suitable for startups at TRL 5-7, the demonstration track offers a number of possible frameworks. Depending on strategic fit, the startup may have the opportunity to pursue a commercial demonstration with an EPRI member utility and/or commercial or development partnership outcomes with Shell business lines or networks (such as joint development, piloting opportunities, investment from [Shell Ventures](#), and licensing agreements).

Applicants will be asked to specify their relevant track and identify their ideal engagement framework within the application. Some startups accepted to the program may work with both EPRI and Shell in a collaborative engagement; others may work with only one organization or the other. Startups will be evaluated for the program based on the specificity and strength of the strategic alignment they identify with one or both organizations.

### Eligibility

- Submit your completed application through the online portal by Feb. 9, 2022
- Be available for virtual and/or in-person interviews after the application deadline, if selected for further rounds
- Disclose the status of any intellectual property (IP) relevant to your submission. **Do not submit confidential information in the application process.** Awardees may enter into non-disclosure agreements in order to protect their intellectual property throughout LCHA.
- Applicants may apply from anywhere in the world. Depending on the course of the COVID-19 pandemic, events may take place in-person (at Greentown Labs in Boston or Houston, at the Urban Future Lab in NYC, or near EPRI facilities in Charlotte, NC), virtually, or a combination of both in-person and virtually. Travel costs will be covered up to \$10,000 / startup for US-based startups and \$15,000 / startup for international startups.
- If you are selected as a LCHA participant, a CEO/founder of your company will be required to attend all program events in order to enjoy full program benefits. Depending on the COVID-19 pandemic, events may take place in-person, virtually, or a combination of both. A tentative timeline is as follows:
  - Kickoff Event: April 7, 2022

- Workshop 1: May 25-26, 2022
- Workshop 2: June 29-30, 2022
- Workshop 3: July 27-28, 2022
- Workshop 4: Aug. 24-25, 2022
- Final Showcase: Sept. 29, 2022
- Greentown is committed to increasing diversity, maintaining an inclusive community culture, and creating a more sustainable planet for all. We welcome applications from founders and teams of all backgrounds, regardless of their ethnicity, race, gender, religious beliefs, sexual orientation, age, marital status, veteran status, or whether or not they have a disability.

### Greentown Labs

Greentown Labs is a community of climate action pioneers working to design a more sustainable world. As the largest climatetech startup incubator in North America, Greentown Labs brings together startups, corporates, investors, policymakers, and many others with a focus on scaling climate solutions. Driven by the mission of providing startups the resources, knowledge, connections, and equipment they need to thrive, Greentown Labs offers lab space, shared office space, a machine shop, an electronics lab, software and business resources, and a large network of corporate customers, investors, and more. With its headquarters in Somerville, Mass. and a recently opened incubator in Houston, TX, Greentown Labs is home to more than 180 startups and has supported more than 400 startups since the incubator's founding in 2011. These startups have collectively created more than 7,800 direct jobs and have raised more than \$1.5 billion in funding. For more information, please visit [www.greentownlabs.com](http://www.greentownlabs.com) or [Twitter](#), [Facebook](#), and [LinkedIn](#).

### Greentown Launch

Greentown Launch, Greentown Labs' flagship corporate partnerships accelerator, enables forward-thinking corporates to mobilize the cleantech ecosystem to advance their sustainability goals, super-charge their external innovation strategies, and forge meaningful partnerships with industry-disrupting startups. The Greentown Launch team works closely with a corporate to craft a customized program, drawing on a proven roadmap rooted in coaching the startups and the corporate toward mutually beneficial partnerships. Greentown Launch has a demonstrated track record: the accelerator's nine completed programs have led to 24 signed contracts. These collaborations have taken the form of pilots, licensing agreements, investments, joint development agreements, and more.

### The Urban Future Lab at NYU Tandon School of Engineering

Founded in 2009, the [Urban Future Lab](#) at NYU Tandon School of Engineering is New York City's longest running cleantech startup incubator. As an integral part of the [NYU Tandon Future Labs](#) network (<https://futurelabs.nyc/>), UFL provides unmatched access to industry stakeholders, strategic advice, marketing and branding support, investor networks, and a community of like-minded founders. Our portfolio includes industry-leading startups in the areas of renewable energy, smart buildings, agriculture, transportation, and



resource-efficiency. The Urban Future Lab is leading the way to a more sustainable world by connecting people, capital, and purpose to advance market-ready solutions to address climate change. For more information, please visit [ufl.nyc](http://ufl.nyc) or find us on Twitter. For more information about NYU Tandon please visit [engineering.nyu.edu](http://engineering.nyu.edu).

### EPRI

The Electric Power Research Institute, Inc. (EPRI, [www.epri.com](http://www.epri.com)) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI members represent 90% of the electricity generated and delivered in the United States with international participation extending to 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; Dallas, Texas; Lenox, Mass.; and Washington, D.C.

### LCRI

The Electric Power Research Institute (EPRI) and Gas Technology Institute (GTI) are together addressing the need to accelerate development and demonstration of low- and zero-carbon energy technologies through the Low-Carbon Resources Initiative (LCRI, <http://www.LowCarbonLCRI.com>). This five-year initiative is targeting fundamental advances in a variety of low-carbon electric generation technologies and low-carbon energy carriers, providing scientific credibility and objectivity to the global decarbonization effort. [Learn more.](#)

### Shell

Shell Global Solutions (US) Inc., a subsidiary of Royal Dutch Shell plc. Royal Dutch Shell plc is incorporated in England and Wales, has its headquarters in The Hague and is listed on the London, Amsterdam, and New York stock exchanges. Shell companies have operations in more than 70 countries and territories with businesses including oil and gas exploration and production; production and marketing of liquefied natural gas and gas to liquids; manufacturing, marketing and shipping of oil products and chemicals and renewable energy projects. For further information, visit [www.shell.com](http://www.shell.com).

### Contact:

- Michela Grunebaum; Greentown Labs Senior Program Manager, Partnerships; [mgrunebaum@greentownlabs.com](mailto:mgrunebaum@greentownlabs.com)