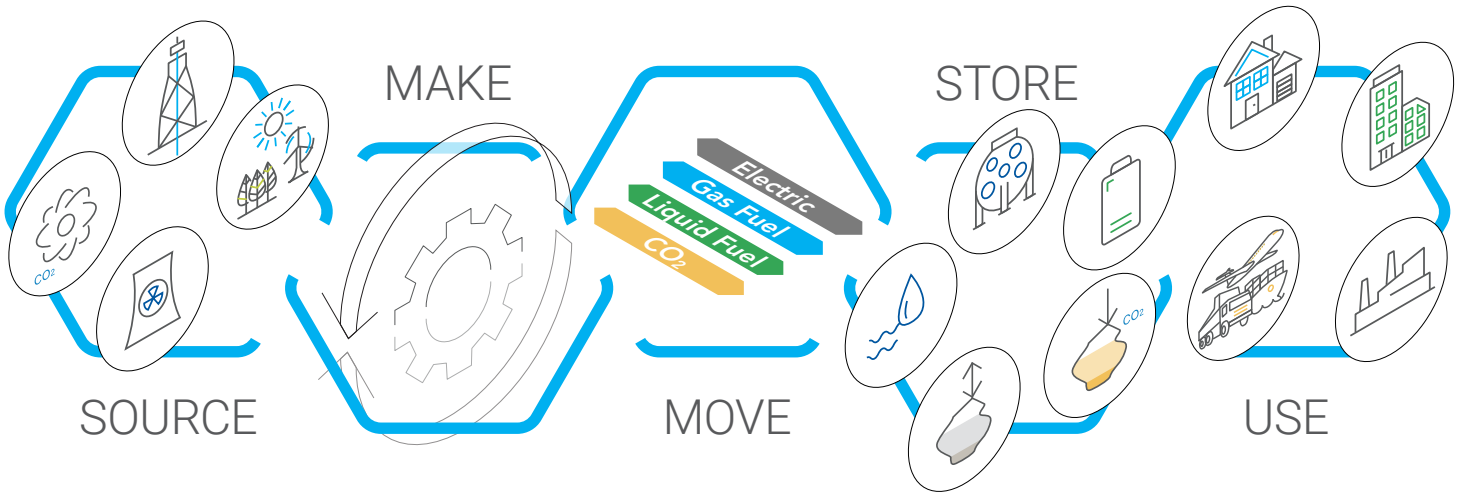
HYDROGEN TECHNOLOGY CENTER

GTI ENERGY
solutions that transform

GTI Energy Hydrogen Experience and Capabilities



GTI Energy provides clients and partners the capabilities, laboratories, and large complex multi-faceted hydrogen projects to expand the use of hydrogen throughout our nation's economy.

GTI Energy's Hydrogen Technology Center

GTI Energy's Hydrogen Technology Center (HTC) is a compilation of top-tier subject matter experts, thought leadership, recently upgraded labs and facilities, and the experience of decades of successful hydrogen projects. GTI Energy has deep and unbiased hydrogen related technology knowledge and technical expertise to assist government, industry and businesses to safely and effectively expand their companies into the hydrogen economy.

GTI Energy's 18-acre research campus, minutes from Chicago's O'Hare airport, houses GTI Energy's HTC which offers test bays for hydrogen technologies, testing of hydrogen and blended gases, evaluation of hydrogen effects on piping materials, assessment of hydrogen on appliances and expert staff knowledgeable about hydrogen technologies and hydrogen building and safety codes and standards.

LCRI LOW-CARBON RESOURCES INITIATIVE

HyPER

H2@Scale U.S. Department of Energy

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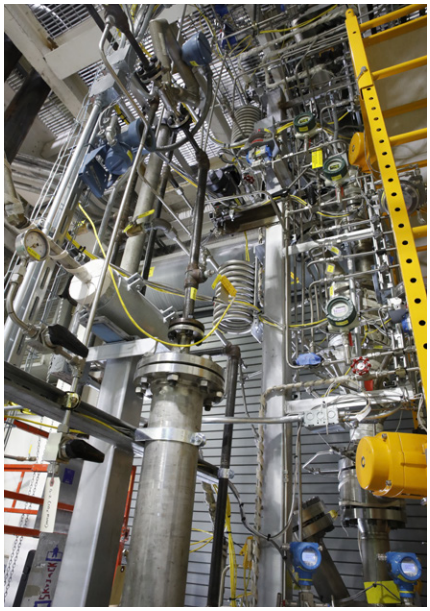
A Leader for Over 60 Years

GTI Energy continues to be a leader in hydrogen technology assessment, development, and deployment, and has been, for over 60 years. From the development of the phosphoric acid fuel cell starting in the 1960s, to leading the natural gas industry in assessing the effect of hydrogen blends on distribution pipe and consumer appliances in 2021, GTI Energy offers a wide range of experience, capabilities and project oversight that enhances any hydrogen partnership or collaborative.

Currently GTI Energy is performing over 90 hydrogen projects and is the prime contractor on several large hydrogen collaboratives as well as co-leading administration of the **Low Carbon Resources Initiative (LCRI)** with EPRI—an RD&D collaborative with over 54 members and access to over $135M dollars.

Innovative Hydrogen Generation

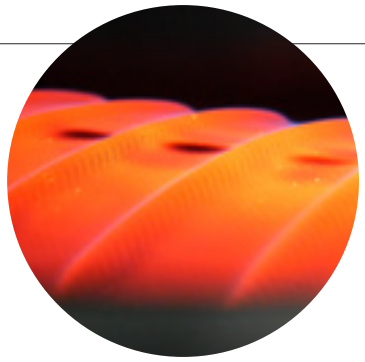
GTI Energy's hydrogen generator is an innovative hydrogen production technology that captures 98% CO_2 during the production process and shifts chemical reactions to favor production of more hydrogen. The outputs are high-purity streams of Hydrogen and CO_2 which can be stored or transported to where it is needed. This technology is operating at GTI Energy's Illinois campus and at a 1.5MW pilot plant at Cranfield University in the UK. With the potential to develop zero-carbon hydrogen reforming as part of scale up, this technology will significantly accelerate affordable decarbonization of heat, power, and transport.



Hydrogen Innovation and Technical Assistance

Assisting the Energy Industry

GTI Energy is currently engaged in numerous projects funded by USDOE and the energy industry to test pipe materials (both plastic and metal) and industrial equipment and consumer appliances to understand the effects of natural gas hydrogen in blends. GTI Energy is also assisting the energy industry with the redesign of the natural gas system and end use technologies so that the future hydrogen economy can be realized.



Blending Impacts on Building Equipment

While impacts will vary across product designs, generalized blending levels are:

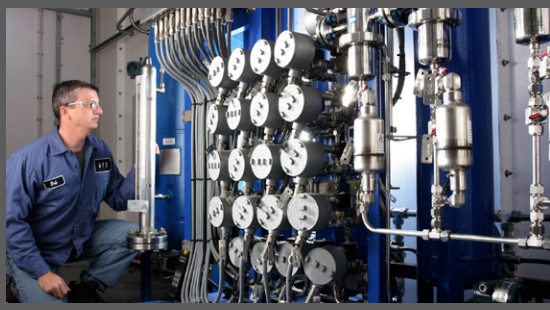
Low Blending: <10% H_2 by volume	No minor equipment adjustments
Medium Blending: 10%–30% H_2 by volume	Adjustments necessary with components and combustion controls
High Blending: > 30% H_2 by volume	Specially-designed equipment are required (e.g, Hydrogen Boiler)

H2@Scale in Texas and Beyond

In a USDOE **H2@Scale project**, GTI Energy and partners are creating the first dedicated renewable hydrogen infrastructure network in Texas. It will integrate commercial hydrogen production, distribution, storage, and use in multiple applications to assess safety and reliability. GTI Energy is shaping a framework around the development of hydrogen hubs to advance them at the pace needed to meet aggressive decarbonization goals.

GTI Energy Facilities

Many GTI Energy testing and deployment facilities are supporting projects focused on ensuring the safe and reliable use of hydrogen as well as assessing hydrogen powered equipment and related technologies. These facilities include the Combined Heat and Power Renewable Energy Test Center, the Residential/ Commercial test center, the Pipe Materials and Pipe Farm facilities and the Environmental Lab as well as the hydrogen generator bay and the hydrogen pad (outdoor space for larger hydrogen technology assessment). These facilities are currently being supported by over 75 companies representing the energy industry and equipment manufacturers. Projects managed by GTI Energy and supported by these facilities or projects engaged in off-site technology deployment have the option to utilize a GTI Energy-developed secure IoT data collection and cloud-based data analytics infrastructure.



Technology Development: Reducing Risk & Building Confidence

Since 1941, GTI Energy has maintained its commitment to solving important energy challenges, turning raw technology into practical solutions that create exceptional value for our customers. We believe the most effective way to address these challenges is to provide innovative solutions—from concept to commercialization.

Demonstration

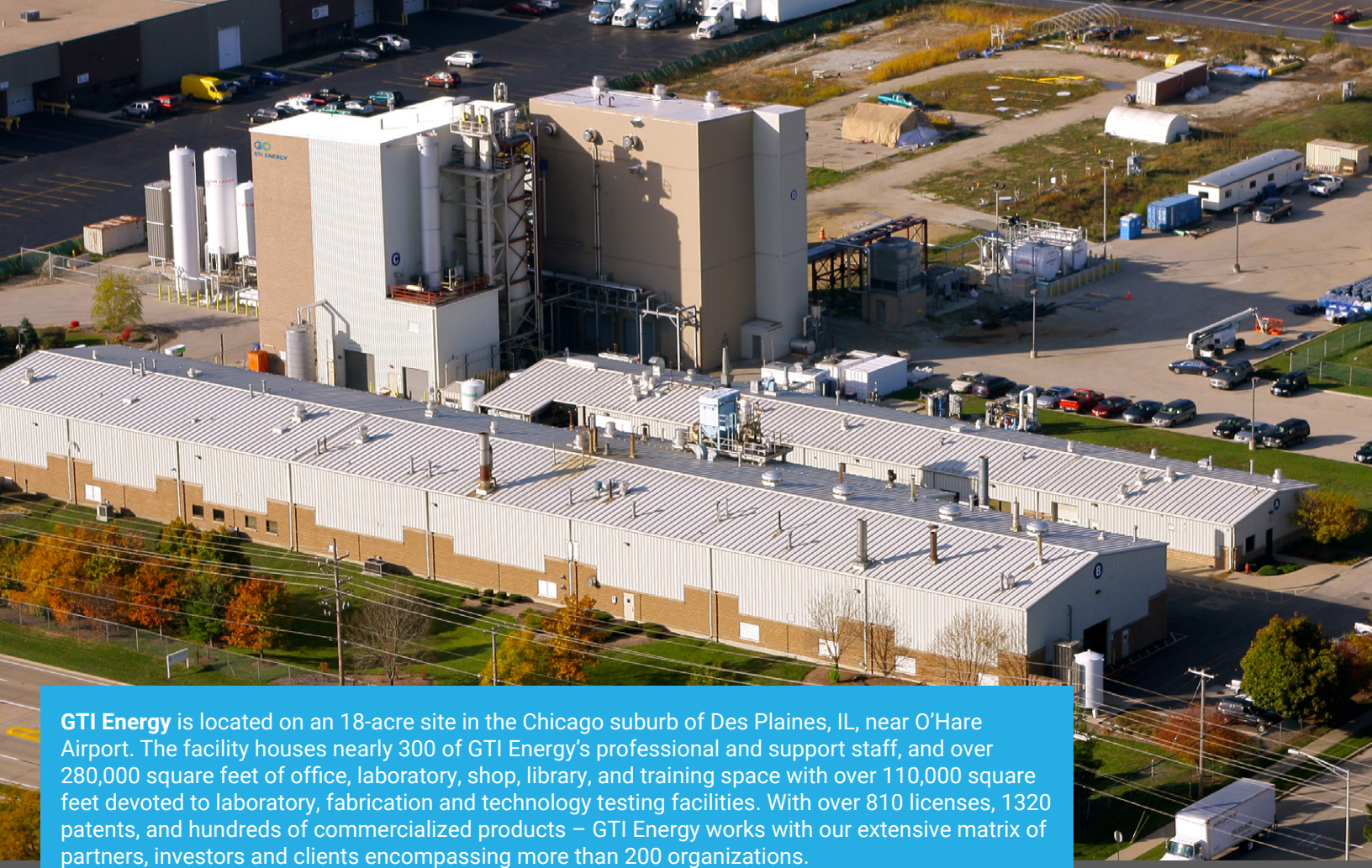
Process Design package for Commercial Plant

Pilot-Scale Tests

Bench-Scale Tests

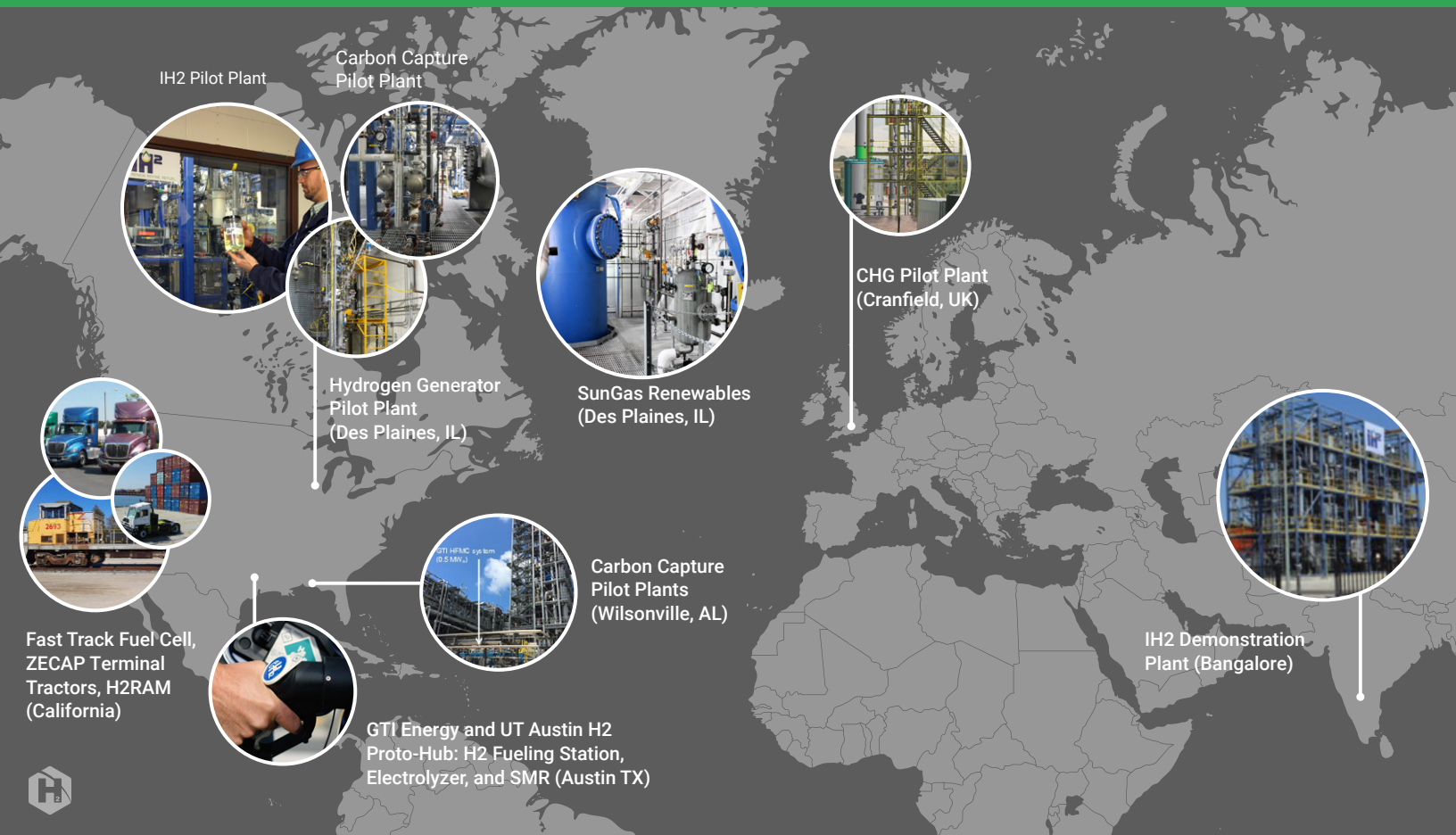
Proof of Concept

Modeling / Simulation



GTI Energy is located on an 18-acre site in the Chicago suburb of Des Plaines, IL, near O'Hare Airport. The facility houses nearly 300 of GTI Energy's professional and support staff, and over 280,000 square feet of office, laboratory, shop, library, and training space with over 110,000 square feet devoted to laboratory, fabrication and technology testing facilities. With over 810 licenses, 1320 patents, and hundreds of commercialized products – GTI Energy works with our extensive matrix of partners, investors and clients encompassing more than 200 organizations.

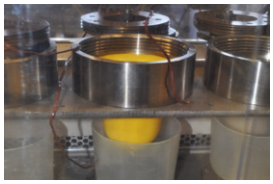
GTI ENERGY PILOTS AND DEMONSTRATIONS ACROSS THE GLOBE



Project Collaboratives

GTI Energy is known for its ability to lead or be a partner in large collaborative technology deployment projects. Currently, GTI Energy is active in several large USDOE-funded technology deployment projects some as the prime contractor, and others as a member of the team. The following table describes a few of the current collaborative projects (hydrogen and other) in which GTI Energy is engaged.

A sample of collaborative GTI Energy-led R&D projects focused on hydrogen or transportation

Project Name	Project Description	Value/Partners
H2@Scale U.S. Department of Energy	The *H2@Scale in Texas and Beyond* project will demonstrate co-located multiple renewable hydrogen generation (SMR and electrolysis) and multiple hydrogen use applications (vehicles, drones, and power generation). The project also includes a hydrogen framework study of the viability of renewable hydrogen at the Port of Houston.	$12M Sponsor: USDOE Project partners: 18
	The HyBlend project will conduct evaluations of metal and polymer piping and pipeline materials to assess hydrogen compatibility (e.g., steel and poly-ethylene), provide life-cycle analysis of technologies using hydrogen and natural gas blends, and quantify the costs and opportunities for hydrogen production and blending.	$14.4M Sponsor: USDOE Project Partners: 8 National Labs: 30 Industry
HyPER	The HyPER project is collaboration between Cranfield University, GTI Energy, and Doosan Babcock. During the project a state-of-the-art 1.5 MWth hydrogen production pilot plant at Cranfield University will be designed, constructed, and operated.	Phase 1: $10M (funded) Phase 2: $13M Sponsor: UK Dept. for Business, Energy and Industrial Strategy Project Partners: 3
H_2EDGE Hydrogen Education for a Decarbonized Global Economy	GTI Energy is supporting an EPRI workforce development initiative designed to cultivate an emerging industry workforce to advance hydrogen technologies and use. Project focuses on developing newly trained personnel as well as enabling existing labor force to migrate into the hydrogen field.	$2M Sponsor: USDOE Project partners: 6
Multiple Hydrogen Transportation projects  	GTI Energy and four project teams are developing a variety of hydrogen-fueled transportation technology demonstrations in California: Switcher locomotive (H2RAM), drayage (Fast Track Fuel Cell Truck), regional haul trucks (Symbio H_2 Central Valley Express), and terminal tractors (ZECAP). All four projects involve deployment of vehicles fueling stations, safety training, education, and community outreach.	$29M Sponsors: California Energy Commission, California Air Resources Board Project Partners: 24
M2M 94 Clean Fuels Across I-94	Implement a strategically placed network of DC fast chargers, compressed natural gas (CNG), and propane stations within the Michigan to Montana (M2M) Corridor along I-94 from Port Huron, MI to Billings, MT.	$10M Sponsor: USDOE Project Partners: 12