



2023 Hydrogen Economy Task Force Annual Report

Report to the Illinois General Assembly



JANUARY 26, 2024

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Purpose of the Hydrogen Economy Task Force

The Hydrogen Economy Task Force (“HETF”) was created by [Public Act 102-1086](#). The Task Force was established to create a plan to facilitate the deployment of hydrogen into the state’s economy. Task Force membership consists of twenty-four members, including appointments representing members of the Illinois General Assembly; the Governor’s Office; Illinois state government; education and research institutions; manufacturing and trade associations, and community-based organizations. Since the [current statute](#) governing the HETF will not expire until 2026, the task force will likely submit at least two more annual reports.

This submission constitutes a status report regarding the task force’s findings to date. The HETF will address additional issues and findings in the future as the legal, regulatory, and economic underpinnings of the hydrogen economy evolve.

The HETF was assigned the following duties in the statute:

- Establish a plan to create, support, develop, or partner with a Hydrogen Hub in this State, and determine how to maximize federal financial incentives to support Hub development;
- Identify opportunities to integrate hydrogen in the transportation, energy, industrial, agricultural, and other sectors;
- Identify barriers to the widespread development and use of hydrogen, including within environmental justice communities; and
- Recommend government policies to catalyze the deployment of hydrogen in the State economy.

Five working groups have been established to delve deeper into issues surrounding the hydrogen economy. These teams met between meetings of the main task force and reported back to the task force on their research and findings. The working groups include:

- Regulatory/Safety
- Workforce/Entrepreneurship/Education
- Communities/Environmental Justice
- Commerce Development/Investment
- Interstate Coordination

The HETF has conducted virtual meetings roughly every other (odd) month beginning in November of 2022. Meetings are open to the public and typically include a panel discussion on a broad topic of interest, status reports from the working groups, and discussion between task force members and invited guests. Meeting agendas and approved minutes can be found on the [Hydrogen Economy Task Force page](#) on the Department of Commerce and Economic Opportunity web site.

As noted above, one objective of the HETF established by the statute was to foster development of a regional clean hydrogen “Hub” in Illinois. Established as part of the hydrogen hub program included in the federal Bipartisan Infrastructure Law, the Department of Energy will be providing grants to the established regional hubs across the USA. These clean hydrogen hubs will create networks of hydrogen

producers, consumers, and local connective infrastructure to accelerate the development and use of hydrogen as a clean energy source that can deliver or store tremendous amounts of energy while serving to decarbonize the economy. Representatives from the Midwest Alliance for Clean Hydrogen (MachH2) presented to the HETF in early 2023 as they were waiting for DOE decision on regional hydrogen hubs, addressing their plans to establish a regional Hub for Illinois, Michigan and Indiana and how the state of Illinois could assist in these efforts.

The [US Department of Energy recently announced](#) that MachH2 will be among the hubs selected for a federal award. MachH2 will receive approximately \$1 billion with other Hub awards ranging from \$1.25B to \$750M. The announcement cited MachH2's plans to "enable decarbonization through strategic hydrogen uses including steel and glass production, power generation, refining, heavy-duty transportation, and sustainable aviation fuel." MachH2 plans to produce clean hydrogen via renewables, nuclear, and natural gas. Up to \$1 billion of the remaining funding remains available in the federal government for demand-side support for the hubs to drive innovative end-uses for hydrogen-based technologies.

The Basics of Hydrogen

Hydrogen is an energy carrier that can be produced, stored, transported, and used without toxic pollution or CO₂ emissions. Hydrogen can be produced from a range of resources that are diverse and abundant including natural gas (potentially with carbon capture and sequestration (CCS) in the future) via reforming; biomass with gasification; and nuclear power, wind power, solar power and other zero-emission electricity sources via electrolysis. R&D activities are on-going for new technologies and with new resources to produce non- or low-GHG hydrogen. The vast majority of hydrogen is currently supplied using natural gas reforming. Clean hydrogen, which is produced with zero or near-zero carbon emissions, is supported through the federal Hydrogen Hubs grants and in the federal Inflation Reduction Act and could play a vital future role in reducing GHG emissions from some of the most energy-intensive sectors of our economy, including industrial and chemical processes and hard-to-electrify transportation sectors such as the long-haul heavy-duty truck transportation, aviation, and marine sectors. Hydrogen has a long history of safe use in the chemical and oil refinery industries. An understanding of hydrogen properties, proper safety precautions and engineering controls, and established rules, regulations, and standards are the keys to this successful track record. With proper handling and controls, hydrogen can be as safe as, or safer than, other liquid and gaseous fuels we use today.¹

Current and Potential Uses of Hydrogen as a Fuel and Feedstock

Currently, the U.S. produces about 10 million metric tons of hydrogen annually with petroleum refining and ammonia production accounting for more than 90% of the hydrogen usage. Today, nearly 95% of the hydrogen produced in the U.S. is from natural gas (NG) by a process called "steam methane reforming (SMR)." While it provides the lowest cost option for producing hydrogen today, NG SMR generates about 10kg of CO₂ equivalent GHG emissions for every kg of hydrogen produced. CO₂ emissions from SMR can be drastically reduced if the CO₂ is captured and sequestered geologically underground. However, this adds to the production cost and does not eliminate GHG emissions

¹ US Department of Energy, Hydrogen and Fuel Cell Technologies Office. "Safety, Codes and Standards Basics". Available at <https://www.energy.gov/eere/fuelcells/safety-codes-and-standards-basics#:~:text=With%20proper%20handling%20and%20controls,fire%2C%20explosion%2C%20and%20asphyxiatio>
[n](#)

in the upstream natural gas supply chain and does not completely eliminate CO₂ emissions in SMR plants.

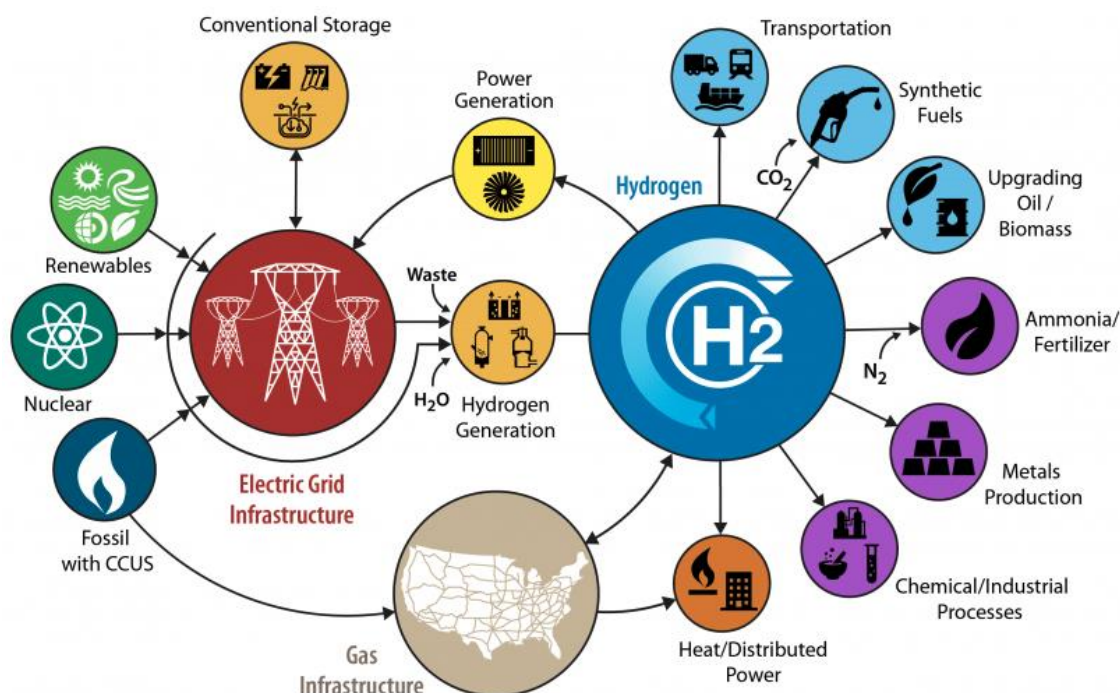
Another process for using natural gas to produce hydrogen is Auto Thermal Reforming (ATR) which converts hydrocarbons into syngas through a combination of partial oxidation and steam reforming. The main benefits of ATR over SMR stem from its heating principle. Unlike the furnace heating needed for SMR, heat is delivered directly inside the autothermal reformer. Thus, the ATR process emits no flue gases because all CO₂ emissions are in the product syngas stream. Carbon capture is easier and uses smaller pre-combustion capture units instead of SMR's post-combustion flue gas stream capture.

An alternative to SMR and ATR for producing hydrogen is electrolysis. In electrolysis, water is split into its elements, hydrogen and oxygen, using electricity. If the electricity is produced using zero-carbon electricity such as wind power, solar power, or nuclear power, the amount of CO₂ emitted is essentially zero. However, producing hydrogen today by electrolysis using electricity is more expensive than SMR (especially without CCS). To make the electrolysis hydrogen more economically attractive, the Department of Energy issued its first Earth Shot, the Hydrogen Shot, in 2021 with the goal to reduce the cost of hydrogen produced via electrolysis by more than 80% to a cost of \$1 per kilogram within a decade (2031).

Hydrogen emits fewer greenhouse gases when burned as a fuel and can be used as a source of process heat or to power an internal combustion engine. The emissions from burning hydrogen are water vapor and nitrogen oxides (NO_x), which can be minimized through control of combustion conditions and the use of after-treatment. Hydrogen serves as a fuel for fuel cells. Hydrogen fuel cells can convert the chemical energy in the fuel directly to electrical energy which enables them to operate at higher efficiencies (about 50-60%) than combustion engines (about 30-40% efficient).² In fuel cells, the only product is water. Since a kilogram of hydrogen contains about the same amount of energy as a gallon of gasoline, successful achievement of the DOE Hydrogen Earth Shot goal could provide a cost-effective approach to decarbonizing the hard-to-electrify portions of the transportation, industrial and manufacturing sectors.

[H2@Scale](#) is a U.S. Department of Energy (DOE) initiative that brings together stakeholders to advance affordable hydrogen production, transport, storage, and utilization to enable decarbonization and revenue opportunities across multiple sectors. The figure below provides a visual representation of the various sectors and applications that can be impacted by hydrogen production and utilization.

² US Department of Energy, Office of Energy Efficiency and Renewable Energy. "Fuel Cells." Available at <https://www.energy.gov/eere/fuelcells/fuel-cells>



Today, most of the hydrogen consumed in the U.S. is produced onsite where it is used in petroleum refining and ammonia production, the two largest markets for hydrogen. Production of ammonia is a carbon intensive process responsible for about 1.5% of global CO₂ emissions. It uses natural gas as a feedstock with 2.8 tons of CO₂ produced for every ton of ammonia.³ Whereas in today's plants the hydrogen is produced by steam reforming of natural gas, in the future hydrogen could be produced by replacing the steam reforming with autothermal reforming to facilitate CO₂ capture and sequestration or by electrolysis using renewable energy which would eliminate CO₂ emissions.⁴ Thus, ammonia production can be decarbonized by over 90 percent if clean hydrogen is used. Given that about 88% of ammonia is used for fertilizer production, use of clean hydrogen in ammonia production can reduce agricultural CO₂ emissions significantly.⁵

While decarbonized hydrogen is generally preferable, CO₂ is an important byproduct in ammonia synthesis because it can also be used to convert the ammonia to urea using CO₂ captured from the hydrogen plant. Therefore, autothermal reforming may generally be more appropriate for ammonia plants. Alternatively, hydrogen produced by using renewable energy and CO₂ captured from nearby ethanol plants can be used to convert the ammonia to urea. This process has the added benefits that the CO₂ emissions associated with ethanol plants (Illinois is producing 1.4 billion gallons of ethanol/year

³ US Department of Energy, Office of Energy Efficiency and Renewable Energy. "H2IQ Hour: Ammonia: From Fertilizer to Energy Carriers." May 2021. Available at: <https://www.energy.gov/eere/fuelcells/articles/h2iq-hour-ammonia-fertilizer-energy-carriers>

⁴ See the "Hydrogen GHG Emissions (or Carbon Intensity) by Source" section below for a discussion of hydrogen production methods.

⁵ US Department of Agriculture. "U.S. National Clean Hydrogen Strategy and Roadmap". June 2023. Available at <https://www.hydrogen.energy.gov/library/roadmaps-vision/clean-hydrogen-strategy-roadmap>. See references 76 and 77 in particular.

which translates to roughly 3.92 million tons of CO₂) are essentially 100% CO₂ and being biological in origin (fermentation process) do not represent CO₂ emissions from fossil fuels.⁶

By 2050, it is expected that 4-5 million tons per year of clean hydrogen could be consumed by ammonia plants to decarbonize all domestic demand for conventional uses, such as fertilizer production.⁷ The current ammonia market is approximately \$70 billion/year at 180 million tons.⁸ Ammonia is also being considered as a maritime fuel. The ammonia market is projected to triple by 2050 if the maritime fuel use opportunity emerges. Thus, the future ammonia market creates an opportunity for large-scale demand for clean hydrogen.⁹ Importantly, development of an early ammonia market for clean hydrogen demand provides an additional opportunity pathway to the Midwest Hydrogen Hub which aims to create a regional economy of scale between hydrogen producers and end-users.

There are 11 million acres of corn planted in Illinois.¹⁰ 98% of those acres receive nitrogen fertilizer at an average rate of 172 pounds per acre, higher than for any other state and well above the US average of 149 pounds/acre.¹¹ Under the assumption that all the nitrogen fertilizer is produced from ammonia, the amount of ammonia used by Illinois farmers is 927,080 tons per year (11 million x 0.98 x 172)/2000) with an associated ammonia market of \$960 million (927,080 tons @ \$1,035 /ton in 2022). There is one ammonia production facility in Illinois, the Coffeyville Resources facility located in East Dubuque with a production capacity of 350,000 tons annually.¹² Cronus Chemicals is planning to build a 2300 metric tons per day (840,000 tons annually) ammonia/urea facility in Tuscola, with operations expected to commence in 2026.¹³ In summary, Illinois is the largest consumer of ammonia with most ammonia imported from other states. It is worth mentioning that [CF Industries](#), the largest ammonia producer in the world with US production facilities are in Oklahoma, Mississippi, Louisiana, and Iowa, is headquartered in Northbrook, Illinois.

⁶ US Department of Agriculture. "U.S. National Clean Hydrogen Strategy and Roadmap". June 2023. Available at <https://www.hydrogen.energy.gov/library/roadmaps-vision/clean-hydrogen-strategy-roadmap>.

⁷ US Department of Agriculture. "U.S. National Clean Hydrogen Strategy and Roadmap". June 2023. Available at <https://www.hydrogen.energy.gov/library/roadmaps-vision/clean-hydrogen-strategy-roadmap>. See reference 58 in particular.

⁸ US Department of Energy, Office of Energy Efficiency and Renewable Energy. "H₂IQ Hour: Ammonia: From Fertilizer to Energy Carriers." May 2021. Available at <https://www.energy.gov/eere/fuelcells/articles/h2iq-hour-ammonia-fertilizer-energy-carriers>

⁹ US Department of Agriculture. "U.S. National Clean Hydrogen Strategy and Roadmap". June 2023. Available at <https://www.hydrogen.energy.gov/library/roadmaps-vision/clean-hydrogen-strategy-roadmap>.

¹⁰ AgFax. "Illinois Corn, Soybeans: Planting and Acreage Decisions in 2022." November 2021. Available at <https://www.agfax.com/2021/11/08/illinois-corn-soybeans-planting-and-acreage-decisions-in-2022/>

¹¹ US Department of Agriculture. 2018 data available at <https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.ers.usda.gov%2Fwebdocs%2FDataFiles%2F50341%2Ffertilizeruse.xls%3Fv%3D0&wdOrigin=BROWSELINK>

¹² Statista. Table available at: <https://www.statista.com/statistics/1266392/ammonia-plant-capacities-united-states/>

¹³ Offshore Technology. "Petrochemicals complex profile: Cronus Chemicals Tuscola Complex, US". November 2023. Available at <https://www.offshore-technology.com/marketdata/cronus-chemicals-tuscola-complex-united-states/>

Ammonia is a chemical hydrogen carrier that can be used for long distance hydrogen transport or export markets.¹⁴ Ammonia can also be used directly as a carbon-free fuel. Although it is toxic, the use of ammonia has an excellent safety record. It can be stored in liquid form at 1MPa pressure or -33C. With volumetric energy density 70% larger than that of liquid hydrogen and gravimetric energy density equal to 17.65% of that of hydrogen, ammonia has 50% less storage and transportation cost than natural gas.¹⁵ The US has approximately 2,000 miles of domestic ammonia pipeline infrastructure of the DOE Commercial Liftoff Report, 2023) which along with the global transport infrastructure “can be used to export ammonia into countries that (A) lack natural gas resources and/or CO2 sequestration sites, or (B) lack an abundance of cost-effective renewable resources (e.g., Japan, South Korea), which could drive further growth in the U.S. ammonia production market.”¹⁶

The use of hydrogen as a fuel for transportation and freight/material handling is growing. There are over 60,000 hydrogen powered forklifts¹⁷, over 16,000 hydrogen powered fuel cell cars, and approximately 150 fuel cell buses in the U.S. More recently, hydrogen powered heavy duty and medium duty trucks are being deployed and the first hydrogen powered passenger train will begin operation in California in 2024. Clean hydrogen can also support the expansion of intermittent renewable power by providing a means for long-duration energy storage. Unlike battery storage, hydrogen can provide energy storage for months with no appreciable losses. Clean hydrogen production also offers flexibility and multiple revenue streams for all types of clean power generation including renewables, advanced nuclear, and other innovative technologies.

Recent Investments in the Hydrogen Economy

As noted above, on October 13, 2023 the Biden administration [announced](#) that seven regional clean hydrogen hubs were selected to receive \$7 billion in Bipartisan Infrastructure Law funding to accelerate the domestic production and market for low-cost, clean hydrogen. The seven selected regional clean hydrogen hubs are projected to catalyze more than \$40 billion in private investment and create tens of thousands of good-paying jobs – bringing the total public and private investment in hydrogen hubs to nearly \$50 billion. Roughly two-thirds of the funded hubs will include some level of electrolysis-based production. Collectively, the hubs aim to produce more than three million metric tons of clean hydrogen per year, thereby achieving nearly one third of the U.S. clean hydrogen production goal by 2030. Together, the seven Hydrogen Hubs estimate they could eliminate 25 million metric tons of CO2e GHG emissions from end uses each year—an amount roughly equivalent to combined annual emissions of over 5.5 million gasoline-powered cars. The nearly \$50 billion investment is one of the largest investments in clean manufacturing and jobs in history.

¹⁴ US Department of Energy. “Pathways to Commercial Liftoff: Clean Hydrogen.” March 2023. Available at <https://liftoff.energy.gov/wp-content/uploads/2023/05/20230523-Pathways-to-Commercial-Liftoff-Clean-Hydrogen.pdf>

¹⁵ US Department of Energy, Office of Energy Efficiency and Renewable Energy. “H2IQ Hour: Ammonia: From Fertilizer to Energy Carriers.” May 2021. Available at <https://www.energy.gov/eere/fuelcells/articles/h2iq-hour-ammonia-fertilizer-energy-carriers>

¹⁶ US Department of Energy. “Pathways to Commercial Liftoff: Clean Hydrogen.” March 2023. Available at <https://liftoff.energy.gov/wp-content/uploads/2023/05/20230523-Pathways-to-Commercial-Liftoff-Clean-Hydrogen.pdf>. See references xv, xvi and xvii in particular.

¹⁷ Business Research Insights. “Hydrogen Fuel Cell Forklift Market”. December 2023. Available at <https://www.businessresearchinsights.com/market-reports/hydrogen-fuel-cell-forklift-market-109245>

As noted above, one of these Hubs, the Midwest Alliance for Clean Hydrogen (MachH2), will operate in a key U.S. industrial and transportation corridor encompassing Illinois, Indiana, and Michigan. The Hub will enable emission reductions for applications associated with steel and glass production, power generation, refining, heavy-duty transportation, and sustainable aviation fuel. The MachH2 Hub plans to produce hydrogen by leveraging diverse and abundant energy sources, including renewable power such as wind and solar power, natural gas with CCS, and nuclear power. The Midwest Hydrogen Hub anticipates creating 12,100 construction jobs and 1,500 permanent jobs.

The momentum for hydrogen continues to accelerate globally with more than 1,040 projects with announced investments of \$320 Billion through 2030. The hydrogen project pipeline is growing across all stages of maturity, with 30% to 40% growth in announced planning, advanced planning, and committed, indicating a healthy project funnel. However, investment decisions are lagging with only 10% of investment volumes having passed financial investment decision. However, 795 of the projects are scheduled to commission by 2030. Hydrogen production and supply accounts for about two thirds of the announced investments, with a total of 38 million metric tons of clean hydrogen production announced through Europe and North America together accounting for nearly 60% of the total volumes.¹⁸

Job Creation Opportunities

Widespread hydrogen adoption could greatly expand the growth of the green job market with 90,000 to 110,000 jobs created by 2030 and up to 675,000 new jobs created by 2050¹⁹. These jobs will primarily be associated with manufacturing hydrogen production and utilization equipment along with construction, operation and maintenance of the various systems required for a prosperous hydrogen economy.²⁰

Illinois employed 296,326 energy workers statewide in 2022, representing 3.6 percent of all U.S. energy jobs. Therefore, if the projections above are accurate and Illinois' share of this growth is proportional, the state could gain 3,200 to 4,000 new jobs by 2030 and 24,000 by 2050. Some hydrogen jobs will likely displace jobs in multiple traditional fossil fuel-based applications. A significant shift towards a hydrogen economy will require numerous types of occupations, experience, and skills necessary to construct, maintain, and operate the various systems that produce, transport, store and utilize hydrogen. Examples include pipefitters, welders, electrical workers, machinists, and assembly technicians for electrolyzers and fuel cells. It is estimated that MachH2 projects alone would create 13,600 direct jobs—12,100 in construction and 1,500 permanent jobs.²¹ Given Illinois' labor market

¹⁸ Hydrogen Council. "Hydrogen Insights 2023". May 2023. Available at <https://hydrogencouncil.com/en/hydrogen-insights-2023/>

¹⁹ US Department of Energy, Office of Energy Efficiency and Renewable Energy. Hydrogen Program Materials. Available at https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/doe_h2_program.pdf

²⁰ US Department of Energy, Office of Energy Efficiency and Renewable Energy. Hydrogen Program Materials. Available at https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/doe_h2_program.pdf

²¹ The White House. "Biden-Harris Administration Announces Regional Clean Hydrogen Hubs to Drive Clean Manufacturing and Jobs". October 2023. Available at <https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/13/biden-harris-administration-announces-regional-clean-hydrogen-hubs-to-drive-clean-manufacturing-and-jobs/>

structure and the state's longstanding support for union-friendly policies, it seems likely that these positions would be part of a unionized workforce or feature strong labor protection requirements.

Many technical occupations will require associate degrees, long-term on-the-job training, or trade certifications, including scientists, engineers, chemists, managers, technicians, all of which pay higher than US average wages. The hydrogen economy is a realistic target industry for job creation in most regions and states. The wide variety of entry points to the hydrogen economy makes this market easier to penetrate if Illinois can market its strengths in high-tech, research, credit and non-credit education, manufacturing, IT, and energy.

Many displaced workers from coal mining and coal fueled power plants may possess skills suitable for the jobs that a prosperous hydrogen economy could create. They have considerable experience working with hazards associated with the energy sector and the steps required to safely work with these resources, including explosive gas monitoring and mitigation, utilizing appropriate personal protective equipment, and lockout/tagout procedures. Additionally, they frequently have experience dealing with other common industrial work features such as shift work.

Hydrogen-related jobs could develop across a continuum of employment, skills, responsibilities, and earnings. Skills for many of these jobs may align with the vehicle manufacturing and service sectors. However, though related to other energy sector jobs as noted above, many of these jobs do not currently exist and may not have occupational titles defined in federal and state government occupational handbooks and employment guides. States may need to develop training curricula to enable this rapidly growing sector of the US economy and labor market to have a sufficient supply of trained and qualified employees.

Hydrogen market expansion has the potential to drive new enterprise creation, including opportunities to support enterprise creation in minority-, women-, veteran-owned or other disadvantaged businesses, and Minority Serving institutions. Constructing and maintaining industrial hydrogen clusters can have a much larger impact than a single plant. In communities where fossil fuel tax revenues might decline, developing a clean hydrogen economy could replace lost revenue and protect jobs.

The HEFT recommends the following:

Strong labor standards including, but not limited to prevailing wage, responsible bidder and project labor agreements for the construction and maintenance phases of hydrogen facilities will help to ensure the hydrogen sector will ease the workforce transition from fossil fuel enterprises. Also, labor neutrality requirements for ongoing operations of hydrogen facilities will pave the way for quality union jobs well into the future. Training and placement opportunities such as registered apprenticeships will attract the skilled workers required and draw new workers to the field and to the locations where they are needed.

Training for new skills may nonetheless be needed across a wide spectrum of industries. Some changes in skills are relatively well defined, but potential changes remain difficult to forecast since many of the technologies are still evolving. Some job tasks, titles, and industry-recognized credentials currently remain unknown, and thus identification of training needs requires interactive research combined with job definition. Science and engineering education needs to change to prepare students for hydrogen

careers, and university and workforce training and education need to be assessed to understand where opportunities lie and what additional curricula may be needed. Workforce training and education programs at community colleges include connections to workforce partners in communities and the K-12 system through career exploration and dual credit courses. Community colleges, technical schools, colleges, and universities need to be evaluated to determine how well they are preparing the workforce for the emerging hydrogen economy and labor market. These organizations are historical and reliable providers of academic and career advising, career exploration and planning, and wraparound support services that ensure student success.

Partnerships should be formed with workforce training and education providers and unions in locally defined networks to address pre-apprenticeship, apprenticeship, entry-level, intermediate, and mid-level access to construction employment opportunities. Similar partnerships with local workforce boards, industry initiatives, and higher education institutions could be formed to tap into existing programs for off-the-shelf training, work-based and experiential learning, and training of the trainer programs for trade, technical and operational positions. Career pathway programs could be deployed to develop and implement comprehensive educational and worker training modules. Connection to the K-12 education system would be helpful to ensure that current and future employment needs are met in a comprehensive manner that provides union workers and non-union workers viable career options. STEM programs and academies offered through K-12 and community colleges should include the spectrum of renewable energy sources in the state with career exploration activities.

It is important to develop training for first responders, especially the fire service, regarding all the potential uses and storage methods mentioned above. Expanded hydrogen use can present new challenges to the fire service that could result in injuries and fatalities if not approached properly and safely. The Illinois Fire Service Institute would be the best resource to provide this training for Illinois firefighters. Additional training should be available to fire inspectors and building officials for plan reviews and code enforcement. The Office of the Illinois State Fire Marshal could host these programs, but there are also fire inspector and building code official organizations throughout the state that could play a role as well. In addition, it will be important to ensure that first responders have the necessary equipment to meet any hydrogen-related emergencies.

Hydrogen GHG Emissions (or Carbon Intensity) by Source

Hydrogen can be produced using a variety of conversion processes, some of which are cleaner than others in terms of their carbon intensity (CI) on the life cycle basis from resource extraction to hydrogen production with different energy resources.

- NG SMR (Grey) hydrogen is currently the most common form and is generated from natural gas, or methane, through a process called “steam methane reforming.” CO₂ is emitted from this process as the natural gas reforms. Currently, steam reforming provides the lowest cost hydrogen. The CI of this hydrogen source is around 10 kg of CO₂e per kg of hydrogen.
- NG ATR or SMR (Blue) hydrogen with CCS is also produced through steam reforming, the first with POX. In both cases and with CO₂ emissions are from SMR captured and sequestered. About 80-90% of the CO₂ is captured can potentially be utilized as a feedstock for chemical

products or stored geologically in salt caverns or saline aquifers. The CI of this hydrogen production is usually below 4 kg of CO₂e per kg of hydrogen.

- Low-carbon hydrogen is produced using renewable (Green) and nuclear (Pink) energy sources to power a process called electrolysis to split water into two hydrogen atoms and one oxygen atom. No CO₂ is emitted with this process. On the life cycle basis, this hydrogen production with no- or low-carbon electricity such as wind power, solar power, and nuclear power can have CI below 0.45 kg of CO₂e per kg of hydrogen.
- Emerging (Turquoise) hydrogen production technologies include methane pyrolysis and geologic hydrogen. Instead of generating CO₂ as a byproduct, methane pyrolysis produces solid carbon that can be used as a feedstock in tire manufacturing or as a soil amendment. Geologic hydrogen is to recover hydrogen stored in certain geologic formations. These hydrogen technologies usually have low CI.
- In addition to the processes described above, hydrogen can also be produced using biomass via gasification as a feedstock. Depending on the source of the biomass and whether carbon capture and storage technologies are used, hydrogen produced with this method can have very low emissions and – under certain conditions – be carbon negative.

Note that Hydrogen “colors” are a common shorthand to characterize the production method, but they do not necessarily provide clear insight on GHG emissions which depend on site-specific factors. A more precise means is to utilize a lifecycle analysis approach to calculate the impact from energy source through production method to end use. Tools such as Argonne’s GREET and other models can be used for these assessments. Carbon intensity estimates provided above should be considered a rough guide.

The IRA provides incentives ranging from \$0.6 to \$3 per kg of hydrogen produced, depending on life-cycle CI, labor employment, and regional locations of individual hydrogen projects. This will incentivize a variety of hydrogen projects with low CIs. In addition, the California Low-Carbon Fuel Standard and similar standards in the state of Oregon and Washington provide additional incentives for hydrogen use in the transportation sector. Use of clean hydrogen in sustainable aviation fuel production is indirectly incentivized with incentives available at the federal level and several states.

Illinois’ Existing Infrastructure Supports Opportunities in Hydrogen

Illinois is uniquely positioned to stimulate the state’s economic growth by leading the Midwest in deployment of a prosperous hydrogen economy. The state possesses the human capital required to develop and deploy the needed technology through its top public and private research universities and Argonne National Laboratory. The state’s manufacturing base could rapidly adapt to manufacturing products for hydrogen and fuel cell technologies. Illinois is also well positioned to utilize hydrogen to reduce CO₂ emissions in the hard-to-electrify transportation sectors and industrial/manufacturing sectors. Illinois and the Midwest offers opportunities for synergies between energy and water resources because certain hydrogen production technologies require water resources that are relatively abundant in the state.

Several Illinois cities possess major rail, trucking, and maritime trade corridors with 200 million tons of cargo shipped annually. Illinois is positioned at the heart of the U.S. interstate system, with the third most extensive network of interstate highways. Major East-West interstate highways include I90, I80, I94, I74, I72, I70, and I64. Major North-South interstate highways include I57, I55, I24, and I39. Chicago is a major transportation hub for rail, maritime, and aviation applications. Most freight shipments by

Illinois businesses (73 percent) are carried to their destination via truck. Illinois truck shipments were valued at \$779.7 billion in 2020 and are projected to exceed \$889 billion by 2025; \$1.1 trillion by 2035 and \$1.2 trillion by 2040.²²

Railroads play an important role in Illinois's economy. There are currently 55 freight railroads operating 6,712 miles of track in Illinois.²³ Nearly 1,300 trains pass through the region daily (500 freight and 800 passenger & commuter). Every day, one-fourth of the nation's freight rail traffic is heading to, from, or through Chicago (about 37,500 railcars). Nearly half of all containers offloaded at coastal seaports are offloaded at the major rail yards in and surrounding Chicago²⁴, including the CenterPoint Intermodal Center in Elwood, which is the largest inland port in the U.S. Many of these rail yards are located in environmental non-attainment areas as well as disadvantaged and marginalized communities. The six Class I railroads that operate in Illinois are considering all options for decarbonizing their operations including hydrogen-fuel cell locomotives. The two major US locomotive manufacturers, Wabtec and Progress Rail, have projects underway to develop a hydrogen-fuel cell locomotive for mainline freight operations.

One hundred and forty-five truck stops are located throughout Illinois along the major highways.²⁵ A growing market for trucking is transporting goods to and from the inland ports and major rail yards throughout Illinois. Locating the initial hydrogen refueling stations at or near the ports and rail yards could help accelerate the transition to hydrogen fuel cell trucks. Given that many of the inland ports and major rail yards are located in environmental non-attainment areas or disadvantaged and marginalized communities, replacing diesel fuel and the corresponding diesel engine technology with hydrogen and fuel cell technology will not only reduce CO₂ emissions but also eliminate other pollutants including NO_x, SO_x, and particulate matter that cause serious health issues. Delivering hydrogen by truck will most likely represent major means for hydrogen distribution in the near- and mid-term for distributed end-uses such as transportation. Potential hydrogen applications in the power and industrial sectors such as the petroleum refinery industry and steel industry will require considerably larger volumes of hydrogen than transportation applications and are more likely to be co-located or connected via a pipeline leading to lower delivery costs.

As Illinois transitions to a decarbonized economy, the role of pipelines will also transform. While pipelines currently transport natural gas and petroleum products, in a future sustainable energy system, existing or new hydrogen pipelines, after they get certified for hydrogen compatibility, could also transport hydrogen to users such as producers of ammonia and sustainable aviation fuels. Additionally, pipelines could be used to transport CO₂ captured during NG SMR or ATR hydrogen production to injection wells for carbon capture and sequestration and to end users for use as chemical feedstock.

²² American Road & Transportation Builders Association. "The 2015 U.S. Transportation Construction Industry Profile." Available at https://www.artba.org/wp-content/uploads/2016/08/econ_profile_2015_Illinois.pdf

²³ Illinois Department of Transportation. "Illinois 2023 State Freight Plan. July 2023. Available at https://idot.illinois.gov/content/dam/soi/en/web/idot/documents/transportation-system/reports/opp/freight/illinois-2023-state-freight-plan_20230731_updated20231020.pdf

²⁴ Chicago Region Environmental and Transportation Efficiency (CREATE). "Impact on Rail Industry". Available at <https://www.createprogram.org/impact-on-rail-industry/>

²⁵ Illinois Department of Transportation. "Illinois 2023 State Freight Plan. July 2023. Available at https://idot.illinois.gov/content/dam/soi/en/web/idot/documents/transportation-system/reports/opp/freight/illinois-2023-state-freight-plan_20230731_updated20231020.pdf

Illinois is also home to geology in certain parts of the State that is suitable for the storage of CO₂. The ADM plant in Decatur is home to a Class VI CO₂ storage well, which has stored well over a million tons of CO₂ over the last decade. Illinois has not sought primacy on siting of CO₂ injection wells, so permitting of such wells is done through U.S. EPA. Siting of pipelines to transport CO₂ is under authority of the Illinois Commerce Commission.

Risk Profile and Safety

With proper handling and controls, hydrogen can be as safe as, or safer than, other fuels we use today. Safety considerations associated with handling hydrogen include fire, explosion, asphyxiation and if liquefied, cryogenic burns. Hydrogen has a long history of safe use in the petrochemical and ammonia industries. An understanding of hydrogen properties, proper safety precautions and engineering controls, and established rules, regulations, and standards are the keys to this successful track record. As the use of hydrogen and fuel cell systems expands, existing codes and standards may need to be updated and new ones created to provide the information to safely build, maintain, and operate hydrogen and fuel cell systems and facilities, to ensure uniformity of safety requirements, and to assure local code officials and safety inspectors that sufficient safety standards have been met.

As companies consider where to implement their various hydrogen projects, they will give preference to states that offer straightforward and expedient guidance with respect to codes, standards, laws, and regulations required to safely produce, transport, store, and utilize hydrogen. For Illinois to be competitive with respect to attracting hydrogen projects and the companies that will implement them, the State will need to proactively address the necessary codes, standards, and regulations required for safe development and operation. Additionally, these aspects of the hydrogen regulatory environment must be assigned to appropriate regulatory agencies that will expeditiously deal with the various permits, inspections and other actions required.

The National Fire Protection Association, The International Code Council and the State of [California](#) have developed and implemented considerable hydrogen codes, standards, laws, and regulations, many of which have strong applicability to Illinois to the extent that any existing State and local law needs to be clarified, improved, supplemented or standardized. An excellent resource is the [Center for Hydrogen Safety](#) which is a global non-profit organization dedicated to promoting hydrogen safety and best practices worldwide for the safe handling and use of hydrogen across applications in the energy transition. Additionally, [DOE](#) offers considerable guidance regarding these aspects.

The HEFT recommends the following:

For Illinois to be competitive with respect to attracting hydrogen projects and the companies that will implement them, the State should review existing hydrogen safety and operational codes and proactively address any potential changes needed to codes, standards, and regulations required for safe development and operation. Additionally, these aspects of the hydrogen regulatory environment must be assigned to appropriate regulatory agencies that will expeditiously deal with the various permits, inspections and other actions required.

Current and Projected Hydrogen Production & Usage in Illinois

Production

Current hydrogen producers that are operating in Illinois include Air Liquide and Invenergy. Invenergy's Sauk Valley Hydrogen pilot project using onsite solar is under construction and is planned for Q1 2024 operation. Invenergy's project focuses on supporting local truck and bus fleets as they look to pilot and grow their fleet of hydrogen vehicles. Air Liquide and American Petroleum Institute are also exploring opportunities to use biogas, captured and upgraded from municipal solid waste and agricultural waste, also called "RNG," to produce hydrogen. Air Liquide recently opened a renewable natural gas plant near Rockford.

Champaign-Urbana MTD has already integrated hydrogen energy with the utilization of solar-powered electrolysis into their fleet of public transportation buses. Their fleet includes 118 buses, two of which are currently 60-foot hydrogen fuel cell. By 2024 they will have replaced 10 buses with 40-foot hydrogen fuel cell buses – at that time they will have 12 total hydrogen fuel cell buses. The onsite hydrogen station and solar array are expected to produce enough hydrogen for about 12 buses. So, MTD will need hydrogen delivery for any additional hydrogen buses after the first 12 buses. [MTD's fleet replacement plan](#) shows 65-70 hydrogen fuel cell buses by 2040.²⁶

Other producers, such as Constellation, Mitsubishi, GEVO, and Ameren hope to develop projects to produce or use hydrogen in Illinois and have already begun development in other states. Areas of interest include Grundy and Will County, as well as Joliet. Mitsubishi is interested in locations close to existing users in the oil refinery and chemical sectors, and are looking to increase production of hydrogen from renewable and nuclear power sources. Constellation is focused on hydrogen produced via electrolysis using nuclear power and is interested in customers that could co-locate near hydrogen production facilities. Constellation is currently planning to open a hydrogen production facility in Illinois. Generally, companies looking to expand production are exploring all production methodologies and claim that economic feasibility will be the determinative factor in choosing a production method.

Current hydrogen users in Illinois include four refineries: the Lemont Refinery operated by Citgo, the ExxonMobil Joliet Refinery operated by ExxonMobil, the Robinson Refinery operated by Marathon Oil, and the Wood River Refinery operated jointly by Phillips 66 and Cenovus Energy.

However, many end users in long-haul truck, aviation, marine, rail, ammonia production, and long-duration energy storage are interested in hydrogen as a decarbonized option. Aviation is likely not expected to use hydrogen directly until 2045; however, incentives and market trends encourage the production of sustainable aviation fuels (SAFs) from biomass which requires hydrogen as a one of the feedstocks for the process. For ground transportation, distribution and refueling infrastructure must be developed for long-haul trucks so that fuel cell trucks may refuel as needed. Yet hydrogen producers cite a lack of end users as a barrier to investing in the distribution and refueling infrastructure.

Current estimates from the Champaign-Urbana MTD put a hydrogen fuel-cell heavy-duty vehicle at about twice the cost of a diesel or hybrid truck, if the hydrogen is produced from on-site solar. Current average costs (based on recent MTD orders and/or the 2023 American Public Transportation Association

²⁶ Private communication with Champaign-Urbana MTD External Affairs Director

vehicle database) for 40-foot transit vehicles built in 2021 or later are: fuel cell: \$1,290,000; diesel electric hybrid: \$808,000; diesel: \$554,000.²⁷

However, total cost of ownership considering fuel, maintenance, and refuel/charging times must all be considered. For example, Foothill Transit in Pomona Valley, California, has spoken extensively of their past experience with battery-electric buses and their subsequent shift toward purchasing a large number of hydrogen fuel cell buses moving forward. Flint Mass Transit in Michigan has operated fuel cell buses since 2012 and is expanding their fleet as a member of the MachH2 hydrogen hub.

In the electric power generating sector, there is potential for clean hydrogen to serve a load-balancing function for the electric grid. Illinois is currently exploring potential battery storage policies, but the state may also need longer-duration energy storage options, as most batteries cannot hold more than 10 hours of generation energy. When produced via renewable electricity that would otherwise be curtailed for reliability purposes, clean hydrogen could provide a decarbonized energy storage option. The stored hydrogen can then be used to generate electricity using fuel cells or combustion turbines when needed. Ameren Illinois has begun looking into hydrogen to address potential peaks in electric load.

Storage/delivery/transport – current practices & potential options

Today most of the hydrogen consumed in Illinois is consumed on the same site at which it is produced, so distribution of the hydrogen is locally on-site and not regulated by the state. The lack of storage and distribution options has been cited by potential end users as a major barrier to entering the Illinois market. Storage options include geologic storage in underground formations or unused mines, an approach currently being investigated by the State Geological Survey and GTI Energy, and above-ground tanks holding gaseous or liquid hydrogen similar to how natural gas is stored today. Other potential storage options include below ground pipe networks, liquid organic hydrogen carrier technologies (LOHC), methanol, NH₃ and metal hydrides.

In the transportation sector, storage will likely be distributed to end users, with onsite hydrogen storage tanks holding small volumes of hydrogen in order to serve a specific set of customers or users. This will be analogous to the onsite diesel storage tanks found at truck stops and gas stations and is similar to sites already operating in California.²⁸

Hydrogen may be transported via pipelines or trucks²⁹. Today there are over 1600 miles of hydrogen pipelines in the US³⁰ with the largest pipeline, 1200 miles, serving the petrochemical industries between Houston and Baton Rouge. There is a 30-mile pipeline serving steel and various other industries along northern Indiana's lakefront industrial region. In order for today's natural gas pipelines to transport

²⁷ Private communication with Champaign-Urbana MTD External Affairs Director

²⁸ California Energy Commission. "Hydrogen Refueling Stations in California". Available at <https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/hydrogen-refueling>

²⁹ US DRIVE. "Hydrogen Delivery Technical Team Roadmap". July 2017. Available at: <https://www.energy.gov/eere/vehicles/articles/us-drive-hydrogen-delivery-technical-team-roadmap>

³⁰ US Department of Energy, Hydrogen and Fuel Cell Technologies Office. "Hydrogen Pipelines". Available at: <https://www.energy.gov/eere/fuelcells/hydrogen-pipelines>

hydrogen, they need to be assessed for hydrogen compatibility, and the science and engineering to do this evaluation is available.³¹

Hydrogen Incentive Law

On July 25, 2023, Governor Pritzker signed into law the Hydrogen Fuel Replacement Tax Act (“HFRT Act”).³² The HFRT Act establishes a tax credit of \$1 per kilogram of “qualifying hydrogen” used by the eligible taxpayer in the preceding year, with an additional \$0.15 per kilogram available for qualifying hydrogen use that meets two energy equity provisions.³³ First, that the project workforce associated with the project meets the Minimum Equity Standard established by the Illinois Power Agency Act.³⁴ Second, that at least 40% of the benefits of the qualifying hydrogen use are received by the equity investment eligible communities. The tax credit is non-refundable, meaning the taxpayer may not receive a tax credit in excess of their tax liability for the previous year. The HFRT Act authorizes tax credits totaling up to \$10 million per year and directs that up to 90% of the credits shall be prioritized to taxpayers that participate in a Hydrogen Hub awarded by US DOE or taxpayers that purchase hydrogen from a participant in that Hydrogen Hub.³⁵

Clean Hydrogen Incentives in the Inflation Reduction Act (IRA)

The 2022 IRA contains the Hydrogen Production Tax Credit (45V) providing a tax credit ranging from \$0.60 to \$3 per kg of hydrogen produced.³⁶ The applicable credit level depends on the carbon intensity of the hydrogen and whether regional and labor requirements are met. Many of the hydrogen production options summarized in this report could qualify for the production tax credit. Together with the Illinois state tax incentive, these incentives can help companies develop clean hydrogen projects in Illinois. Without access to these tax credits, clean hydrogen projects are not likely to economically feasible to pursue.

On December 22, 2023, the U.S. Treasury and IRS released proposed regulations regarding the production tax credit (PTC) for hydrogen under section 45V of the Internal Revenue Code. In addition to setting credit and emissions levels, the proposed guidance also sets forth on lifecycle greenhouse gas emissions, time matching of energy attributes, and whether clean energy sources to produce hydrogen must be additional or existing generation facilities. The proposed regulations are subject to a comment period. These regulations, if finalized, may have a significant impact on how hydrogen is produced. As part of the proposed regulation for 45V, the U.S. Department of Energy released a GREET version – 45VH2-GREET – to use for estimating CI of hydrogen production pathways.³⁷
<https://www.energy.gov/eere/greet>.

³¹ Sandia National Laboratories. “Materials Compatibility”. Available at <https://energy.sandia.gov/programs/sustainable-transportation/hydrogen/materials-compatibility/>

³² Cohane, Krista A., “Illinois Enacts Hydrogen Fuel Replacement Tax Credit,” *Reuters* (Aug. 1, 2023), available at <https://tax.thomsonreuters.com/news/illinois-enacts-hydrogen-fuel-replacement-tax-credit>.

³³ P.A. 103-0268, Illinois General Assembly (2023).

³⁴ 20 ILCS 3855/1-75(c-10).

³⁵ P.A. 103-0268, Illinois General Assembly (2023).

³⁶ *Inflation Reduction Act of 2022*, H.R. 5376, 117th Cong. (the Act) § 13204.

³⁷ US Department of Energy, Office of Energy Efficiency and Renewable Energy. Available at <https://www.energy.gov/eere/greet>

MachH2 Hydrogen Hub

As noted earlier in the report, the US Department of Energy has announced that MachH2 will be one of seven Regional Clean Hydrogen Hubs receiving roughly \$1B apiece in funding. These hubs are intended to accelerate the commercial-scale deployment of low-cost, clean hydrogen. MachH2 is a multistate Midwestern alliance, based in the Midwest with potential projects across Illinois, Indiana, Michigan, and Wisconsin, including carbon-free energy producers, national labs, leading universities, hydrogen technology providers, diverse hydrogen end users across sectors and environmental justice organizations. MachH2 is intended to produce tens of thousands of metric tons of clean hydrogen per year and promote commercially scalable projects for end users across diverse sectors.

On May 23, 2023, the U.S. EPA issued new source performance standards for new and existing coal and gas-fired power plants, commonly known as section 111(b) and(d) regulations. EPA has received comments on the proposed standard and is now finalizing the regulations. If the final version is similar to the draft, hydrogen usage in the State could be affected. The rules as drafted provide that certain coal and gas-fired plants may utilize clean hydrogen to reduce their greenhouse gas emissions. Alternatively, carbon capture and storage may be utilized. In either case, additional infrastructure for hydrogen production (including through CCS) may be needed. States will be required to demonstrate to US EPA how they will comply with the new regulations. Illinois' use of hydrogen or carbon capture may be influenced by the CEJA provisions dealing with coal and gas fired power plants. The EPA section 111 rules will likely be the subject of a federal court case.

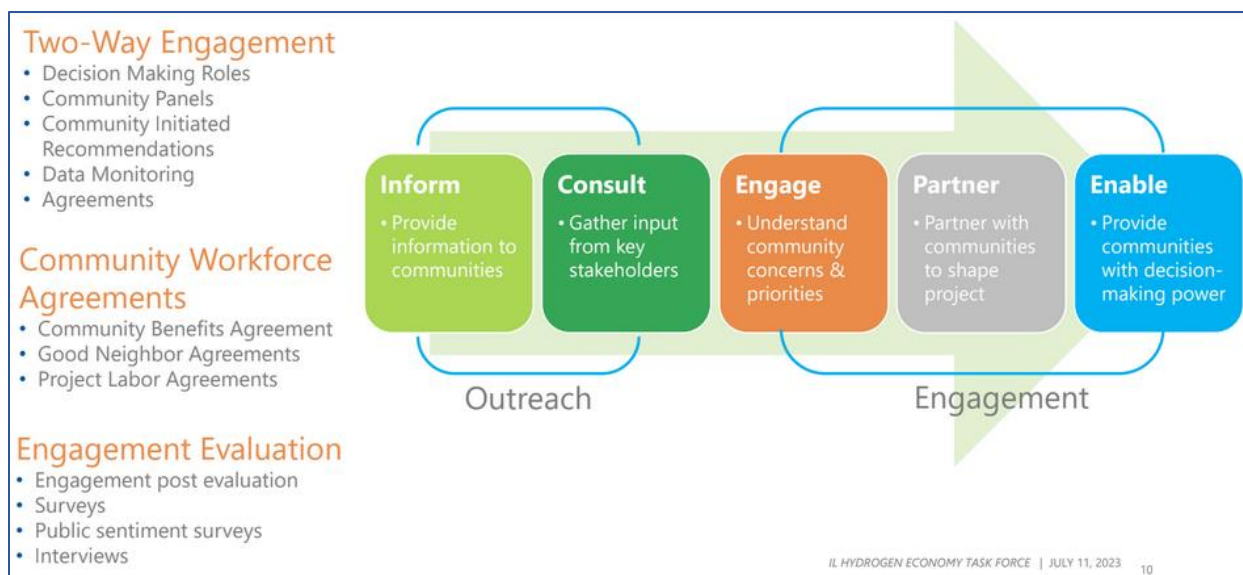
Environmental Justice

The Bipartisan Infrastructure Law and the Inflation Reduction Act have established requirements for robust and meaningful engagement with disadvantaged communities as criteria for initial and ongoing federal funding³⁸. The Department of Energy (DOE) describes the Community Benefits Plan process as having four elements:

- Justice 40 provisions, requiring that 40% of the benefits flow to disadvantaged communities
- Diversity, Equity, Inclusion and Access, including access to wealth-building opportunities
- Good Jobs, for creating and retaining quality jobs and attracting and retaining skilled workers
- Workforce and Community Agreements, where meaningful engagement with communities and labor result in formal agreements

These requirements are part of DOE's hydrogen hub award process, which Task Force learned about in July, 2023; below is an infographic on the process.

³⁸ US Department of Energy. "Community Benefits Plans Webinar Series: CBP 101 Webinar". Available at <https://www.energy.gov/infrastructure/about-community-benefits-plans>



Successful engagement with environmental justice communities depends on identifying, informing, and empowering impacted people and communities. Per the Illinois Environmental Protection Agency (IEPA), environmental justice includes “meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” Illinois EPA has an Environmental Justice Policy (details at <https://epa.illinois.gov/topics/environmental-justice/ej-policy.html>) and processes to identify and strengthen people’s involvement in decisions.

The intent is to engage people early in the process of developing hydrogen projects, not as an afterthought, or as a checklist item. The new hydrogen hub development provides an opportunity to build equity and preclude disparities from the very start.

The recommendations for educating communities about the safety, science and impact of hydrogen will help inform and empower environmental justice communities.

Meaningful, ongoing engagement with communities that are overburdened and concerned by the added environmental burdens that hydrogen projects could bring to them are key to ensuring that Environmental Justice goals are met. Given the very limited information that currently exists on where and how hydrogen may be deployed in Illinois, it will be critical to have early and ongoing engagement around community concerns that arise as specific policies, proposals, and projects are considered.


Community Benefits Plans Webinar Series: CBP 101 Webinar


Watch later Share

How is DOE addressing workforce and equity goals in funding opportunities?

Prioritize benefits to disadvantaged communities

Equitable access to wealth building opportunities

Good jobs and career-track training

Impacted workers and communities have a voice throughout the process

MORE VIDEOS




4:00 / 56:37 • Intro

The general public, local officials, and policymakers still lack education on the potential benefits and potential impacts of hydrogen production and use in their communities. Project sponsors and government agencies should develop clear, culturally appropriate, accurate resources to communicate these impacts so that communities can make informed decisions about potential projects in their areas. These resources should help communities understand environmental impacts, community safety, zoning and land use needs, workforce and first responder education and training needs.

Hydrogen project development should include a community benefits plan, developed in consultation with environmental justice communities. The US Department of Energy's Guidance for Creating a Community Benefits Plan for the Regional Clean Hydrogen Hubs should serve as a template for community benefit planning processes.

Future Areas of Inquiry

As noted in the beginning of this report, the HETF is slated to continue its work through June of 2026. Ample scope remains for further inquiry, in part due to the sheer complexity, scope and scale of potential impacts of the shift towards the hydrogen economy (as suggested by the contents of this report), and in part because many important drivers remain in flux.

For example, what projects will MachH2 launch, and what impacts will result? How successful will the U.S. Department of Energy be in meeting its goal of reducing the cost of clean hydrogen by 80% to \$1 per 1 kilogram in 1 decade? In December 2023, US DOE released draft rules on how energy companies

can access billions in hydrogen incentives.³⁹ While various stakeholders reacted positively or negatively, it is not yet clear what the full implications will be, especially with respect to using nuclear power to produce hydrogen.

Specific topics that may warrant additional exploration include:

- Should Illinois government establish a central point of contact for regulatory and/or business development issues pertaining to hydrogen-relative initiatives?
- How aggressive should Illinois be in pursuing hydrogen projects, and how should the state structure incentives?
- How should workforce development priorities be adapted to align with development of hydrogen projects?
- What steps are needed to ensure that hydrogen projects and initiatives meet environmental justice goals? How do we ensure that community outreach is sufficiently proactive?
- What is the technical and economic potential for hydrogen storage in Illinois? Is establishing geologic storage alternatives for hydrogen feasible in Illinois?
- Should Illinois explore adoption of a low carbon fuel standard (LCFS), a market mechanism to tighten allowable vehicle emissions over time while allowing clean fuels producers to earn credits?

³⁹ Gardner, Timothy. "US unveils clean hydrogen plan, nuclear power role uncertain". Reuters (December 22, 2023), available at <https://www.reuters.com/sustainability/climate-energy/us-unveils-clean-hydrogen-plan-nuclear-power-role-uncertain-2023-12-22/>.

Appendix 1: HETF 2023 Recommendations

- 1. *Strong labor standards including, but not limited to prevailing wage, responsible bidder and project labor agreements for the construction and maintenance phases of hydrogen facilities will help to ensure the hydrogen sector will ease the workforce transition from fossil fuel enterprises. Also, labor neutrality requirements for ongoing operations of hydrogen facilities will pave the way for quality union jobs well into the future. Training and placement opportunities such as registered apprenticeships will attract the skilled workers required and draw new workers to the field and to the locations where they are needed.***
- 2. *For Illinois to be competitive with respect to attracting hydrogen projects and the companies that will implement them, the State should review existing hydrogen safety and operational codes and proactively address any potential changes needed to codes, standards, and regulations required for safe development and operation. Additionally, these aspects of the hydrogen regulatory environment must be assigned to appropriate regulatory agencies that will expeditiously deal with the various permits, inspections and other actions required.***

Appendix 2: HETF 2023 Meeting Minutes

The following pages show approved minutes from all HETF meetings during CY 2023. Agenda and minutes from HETF meetings can also be found on the HETF web page, housed on the DCEO web site at: <https://dceo.illinois.gov/events/hydrogen-economy-task-force.html>



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

State of Illinois Hydrogen Economy Task Force January 13, 2023 9:00am – 11:00am Minutes

Location:

Virtual

WebEx Video Conference

Join link: <https://illinois.webex.com/illinois/j.php?MTID=ma31e5ddf9be72038eda894ddc62598f6>

Meeting number (access code): 2452 854 0585

Meeting password: vQtFU2t6hr3

Join by phone

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002 US Toll

Agenda:

I. Call to Order – Senator Ellman - Chair.

- a) The meeting was called to order by Senator Rezin on behalf of Senator Ellman at 9:02 am.
- b) Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: Yes

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin: No

Chad Kruse: Yes

Dan LeFevers: Yes

George Letavish: No

Carly McCrory-McKay: Yes

Dulce Ortiz: No

Chad Parker: Yes

Sen. Sue Rezin: Yes

Dr. Petros Sofronis: Yes
Catherine Stashak: Yes
Michael Wang: Yes
Rep. Keith Wheeler: No
Michael Woods: Yes
Dana Wynn: Yes
Carrie Zalewski: Yes

There were 19 of 23 appointed members present at the time of the roll call. Quorum was established (13 of 23).

II. Review of 11/29/22 Meeting Minutes

Draft minutes had been circulated to the task force prior to the meeting, including revisions proposed by Michael Woods and Dr. Petros Sofronis.

Carly McCrory-McKay made a motion to approve the November 23rd minutes, and the motion was seconded by Michael Wang. The vote was conducted by roll call with all members present voting "Yes" to adopting the minutes as revised.

III. 2023 Meeting Schedule

Senator Ellman opened the discussion of setting the 2023 meeting schedule, suggesting that meeting every two months was appropriate. After a discussion regarding the best day of week and best time of day for task force meetings, Senator Ellman suggested meeting at 8:30 the first Tuesday of every odd month (March, May, etc.). This was agreed to by members present in a voice vote, with no members opposing.

IV. Task Force Member Training

Task Force members were reminded of ethics and Open Meetings Act training requirements. The ethics training required of all state employees satisfied the former requirement. Members facing difficulties in completing either of the requirements were asked to reach out to Senator Ellman or John O'Conner.

V. MacH2 Presentation

Colleen Wright, Erik Larson, John Holladay, and Stacey Halliday made a presentation to the task force on behalf of the Midwestern Alliance of Clean Hydrogen (MacH2). The presenters discussed the challenges and promise of investing in Illinois' Hydrogen economy. Specific points of emphasis included the importance of attracting a DOE hydrogen hub, MacH2's ongoing efforts and approach, and how the HETF can help make the hydrogen economy vision a reality in Illinois.

The MacH2 team noted the potential for adoption of hydrogen-based technologies to generate economic growth and jobs while decarbonizing the economy, allowing the state to better meet climate goals. However, significant barriers remain, including the cost of hydrogen and the infrastructure needs associated with connecting hydrogen suppliers with end users. The team noted that attracting a portion of DOE's expected \$7 billion investment in regional hubs for hydrogen would be a huge lift for the region.

The team cited Illinois' ample supply of carbon-free nuclear energy as a strategic asset for the MacH2 proposal. MacH2 is among the 33 "concepts" that DOE is encouraging to proceed. MacH2's project would ultimately produce an estimated 100,000 metric tons of hydrogen and bring benefits to local communities, including promoting environmental

justice for communities that have been historically disadvantaged. MacH2 is currently evaluating potential projects' alignment with their vision and the priorities of the US DOE.

The presenters noted that the HETF could provide a significant boost to MacH2's by promoting incentives and grants. This would help the group to leverage greater impacts and make establishment of a midwestern hub more attractive to DOE.

The presentation sparked questions from task force members, resulting in a several discussions. These includes supply chain challenges, approaches to understanding and addressing environmental justice concerns, and the relationship between biofuels and hydrogen-based technologies.

VI. Federal Grant Opportunities

John O'Conner briefly noted two NOIs issued by the US Department of Energy in December: one pertaining to the First Phase of \$1.5 Billion in BIL-Funded Programs for Electrolysis, Manufacturing, and Recycling and another regarding funding in support of the hydrogen shot goal. He indicated he would send an email to task force members including the links from the US DOE announcement.

VII. Task Force Working Groups

Senator Ellman summarized the proposed working group structure she had circulated to the task force prior to the meeting. This structure specified four working groups and summarized the subject matter to be addressed by each. The proposed working groups included 1) Regulatory/Safety, 2) Workforce/Entrepreneurship/Education, 3) Communities, Environmental Justice, and 4) Commerce Development and Investment.

Dr. Sofronis recommended adding a fifth working group to assess the potential scope for interstate coordination. Senator Ellman agreed with this recommendation. Patrick Devaney suggested explicit consideration of labor standards by the Workforce/Entrepreneurship/Education working group. There was also a short discussion of whether to establish an additional working group to address basic science. After a short discussion, it was agreed that this topic was beyond the scope of the task force.

John O'Conner indicated that he would circulate a revised version of the working group structure to task force members, asking members to identify which working groups, if any, they wish to participate in. This information will be shared prior to the March meeting, during which the task force is expected to formally establish the working groups and their respective memberships. The task force was reminded that Open Meetings Act requirements will apply to any working group with more than six members.

VIII. Close

Senator Ellman adjourned the meeting at 11:00 a.m.



**Illinois
Department of Commerce
& Economic Opportunity**

JB Pritzker, Governor

**State of Illinois
Hydrogen Economy Task Force
March 7, 2023
8:30am – 10:30am
Minutes**

Location:

Virtual

WebEx Video Conference

Join link: <https://illinois.webex.com/illinois/j.php?MTID=ma31e5ddf9be72038eda894ddc62598f6>

Meeting number (access code): 2452 854 0585

Meeting password: vQtFU2t6hr3

Join by phone

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002 US Toll

Agenda:

I. Call to Order – Senator Laura Ellman, HETF Chair.

a) The meeting was called to order by Senator Ellman at 8:32 am.

b) Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: Yes

Haley Hoke: Yes

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin: Yes

Chad Kruse: Yes

Dan LeFevers: Yes

George Letavish: No

Carly McCrory-McKay: No

Dulce Ortiz: Yes

Chad Parker: Yes

Sen. Sue Rezin: Yes

Dr. Petros Sofronis: No
 Catherine Stashak: Yes
 Michael Wang: Yes
 Michael Woods: Yes
 Dana Wynn: Yes
 Carrie Zalewski: Yes

There were 19 of 22 appointed members present at the time of the roll call. Quorum was established (13 of 22).

II. Review of 1/13/2023 Meeting Minutes

Draft minutes had been circulated to the task force prior to the meeting. Representative Costa-Howard moved to accept the minutes and Senator Rezin seconded. Motion passed unanimously.

III. Establishment of Working Groups

The HETF agreed to establish the following working groups, in accordance with discussions at the January meeting. These group will meet to research pertinent issues and present findings during future HETF meetings.

It was noted that the Commerce Development and Investment Working group, due to its size, must adhere to the open meetings act. Meeting for the group will be posted on the HETF site on DCEO's web page.

Regulatory/ Safety	Workforce/ Entrepreneurship/ Education	Communities, Environmental Justice	Commerce Development and Investment	Interstate Coordination
Catherine Stashak	Dana Wynn	Dana Wynn	Rep. Terra Costa Howard	Jon Horek
Patrick Evans	Michael Woods	Chad Kruse	Michael Wang	Dr. Petros Sofronis
Carrie Zalewski	Rep. Terra Costa Howard	Elizabeth Irvin	Pat Devaney	Sarah Duffy
Sarah Duffy	Carly McCrory- McKay	Sen. Laura Ellman	Dr. Petros Sofronis	Sen. Laura Ellman
Daniel Lefevers	Pat Devaney	Dulce Ortiz	Patrick Evans	
			Sarah Duffy	
			James Hoyt	

IV. Roundtable Presentations

Four sets of guests participated in a roundtable discussion of market conditions and the usage of hydrogen in Illinois. Each set of panelists delivered a prepared slide deck, but also engaged with HETF members by answering questions.

- Messer/Avina

Michael Guth from Messer America and Vishal Shah from Avina launched the roundtable by discussing their joint efforts to promote green hydrogen production in Illinois.

The companies are currently developing a project in Illinois that will initially produce 15 tons/day of green hydrogen. The plant could ultimately be scaled up to produce 100 tons/day. They see this as a 1st wave of projects, bringing hydrogen supply to meet demand, and as an opportunity to facilitate decarbonization.

Regarding demand for hydrogen, Messer and Avina anticipate a significant increase in demand from the mass transit and heavy transportation sectors over the next 5-10 years as these agencies/companies gain experience and familiarity with the technology. Fuel switching of a myriad of applications from natural gas to hydrogen represents a large opportunity but will likely play out over a longer time frame.

Other market opportunities include using hydrogen in producing fertilizers, powering industrial and logistics equipment (e.g., forklifts) and producing power (primary or backup) for the electricity grid.

- **Hydrogen Fuel Cell Partnership**

Keith Malone presented on behalf of the Hydrogen Fuel Cell Partnership, a nationally focused nonprofit organization based in California.

Mr. Malone discussed private sector efforts to produce zero-emission vehicles using both hydrogen fuel cell and electric battery technologies. Both technologies feature distinct opportunities and challenges. He noted that fuel cells vehicles provide viable alternatives to internal combustion for nearly all market segments, and that more manufacturers are entering this space.

He noted that transit – buses in particular – represent the “canaries in the coal mine” as hydrogen fuel cell technologies are tested and refined. Buses are expected to be workhorses that offering durability and availability. Transit agencies are also more than willing to share their experiences and lessons learned with sister agencies across the country.

When asked about notable barriers to employment of hydrogen technologies, especially in the heavy-duty transportation sector, Mr. Malone noted that market participants are looking for short term and long term policy signals from government. Examples include incentives but also facilitation and provision of infrastructure development, such as fueling stations.

Mr. Malone also noted the importance of developing hydrogen mobility across the country. Absent a network of infrastructure, including strategic fueling access, development of this sector will be inherently limited. This effort is in its earliest stages.

- **Nikola Motors**

Philippe Gerretsen spoke on behalf of Nikola Motors, a maker of heavy-duty trucks using both hydrogen fuel cell and electric battery technologies. Nikola is looking for solutions to the chicken & egg problem of ensuring that charging and refueling infrastructure is robust enough to facilitate development of the market for zero-emission trucks.

Nikola's new vehicles, including fuel cell prototypes, have been well received by customers in terms of performance and reliability. Battery electric will offer ranges of up to 330 miles while fuel cell trucks will have a range upwards of 500 miles. Refueling and recharging infrastructure remains a challenge, as does the price premium for their vehicles under current fuel costs as these trucks cost roughly twice as much as the diesel equivalent.

Mr. Gerretsen noted that current hydrogen prices are roughly \$27/kg, which is roughly equivalent to the same price per gallon for gasoline. Nikola is seeking partnerships with fuel suppliers to bring prices down while keeping carbon intensity down and is also seeking to develop fueling stations.

Nikola recommends an array of incentives to jump-start the market for heavy-duty zero-emission vehicles in Illinois. This includes financial incentives and sales tax exemptions for consumers and an exemption from weight limits. Nikola also recommends aggressive steps to promote infrastructure development and permitting, and adoption of a low carbon emissions standard. The company asserts that incentives comparable to those in California will be necessary to encourage trucking companies to make the substantial investment necessary to buy these trucks.

- Clean Jobs Coalition

A panel of speakers from the Clean Jobs Coalition offered a different perspective and what could be considered a counterpoint to the tenor of the prior presentations. These speakers included Lauren Piette from Earth Justice, Pete Budden from the Natural Resources Defense Council, and Dulce Ortiz from Clean Power Lake County.

The Clean Jobs Coalition contends that hydrogen use can be employed to promote a cleaner, more equitable future, but only if the transition is handled correctly. Guard rails must be in place to ensure that the transition does not cause more harm than good.

The coalition offered the following principles governing use of hydrogen technologies:

- ☐ Must reduce net emissions. For example, producers should not use existing zero-carbon generation to produce hydrogen.
- ☐ Must prioritize green (and only green) hydrogen. Using fossil fuels to produce hydrogen could easily raise net emissions and prove wasteful.
- ☐ Use only to displace fossil hydrogen and in hard-to-electrify uses/sectors. Examples of the latter could include steel productions, and long-haul aviation and marine shipping.
- ☐ Protect interests of environmental justice communities. Hydrogen projects should bring benefits and do no harm to host environmental justice communities, and should only be undertaken after meaningful engagement and collaboration.

The coalition contends that electrification should generally remain the priority. Hydrogen is generally ill-suited for fueling power plants, heating and cooking usage in buildings, passenger vehicles, and most transit and heavy trucking uses.

- Final Note on Roundtable Discussion: Meeting participants touched on a number of topics that – through questions to speakers and through the meeting's chat – that will require more attention and more time from the task force to adequately address going forward. These included:
 - o How can we best balance efficiency with system functionality and resilience?

- o What are the implications of hourly matching vs annual matching, or some intermediate alternative?
- o Would it be appropriate to phase in standards for green hydrogen production, or should they be implemented immediately given the substantial federal incentives available?

V. Close

Senator Ellman adjourned the meeting at 10:45 a.m.



**Illinois
Department of Commerce
& Economic Opportunity**

JB Pritzker, Governor

**Agenda
Hydrogen Economy Task Force
May 2, 2023
8:30am – 10:30am**

Location: Virtual WebEx Video Conference

Join Link:

Meeting Number (access code): 2467 314 7251

Meeting Password: FAwUWC9S2Z6

Join by phone:

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002

Join from a video system or application:

Agenda:

- I. Call to Order – Senator Laura Ellman, Chair
- II. Roll Call of Membership
- III. Review of 3/7/23 Meeting Minutes
- IV. Brief Status Reports from Working Groups
 - a. Regulatory/ Safety
 - b. Workforce/ Entrepreneurship/ Education
 - c. Communities, Environmental Justice
 - d. Commerce Development and Investment
 - e. Interstate Coordination
- V. Primer on the Electric Grid (Presenter: Dr. George Gross, University of Illinois College of Engineering)
- VI. Primer on Illinois' Electricity Market/Regulatory Structure (Presenter: Carrie Zalewski, Illinois Commerce Commission)
- VII. Primer on Illinois' Integration of Renewable Energy (Presenter: Sarah Duffy, Illinois Power Agency)
- VIII. Integrating Hydrogen Production with the Electric Grid (Presenter: Ben King, Rhodium Group)
- IX. Adjournment

Materials:

- I. 3/7/2023 Minutes



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

State of Illinois Hydrogen Economy Task Force July 11, 2023 8:30am – 10:30am Minutes

Location:

Virtual

WebEx Video Conference

Join link:

<https://illinois.webex.com/illinois/j.php?MTID=m95aaac240bd9928ea3d804e5c6304f13>

Meeting number (access code): 2467 314 7251

Meeting password: FAwUWC9S2Z6

Join by phone

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002 US Toll

Agenda:

I. Call to Order – Senator Laura Ellman, HETF Chair.

a) The meeting was called to order by Senator Ellman at 8:32 am.

b) Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: No

Haley Hoke: Yes

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin: Yes

Chad Kruse: Yes

Dan LeFevers: Yes

George Letavish: Yes

Carly McCrory-McKay: No

Dulce Ortiz: Yes

Chad Parker: No

Sen. Sue Rezin: Yes

Doug Scott: Yes
Dr. Petros Sofronis: No
Catherine Stashak: Yes
Michael Wang: No
Michael Woods: Yes
Dana Wynn: Yes

There were 17 of 22 appointed members present at the time of the roll call. Quorum was established.

II. Review of 5/2/2023 Meeting Minutes

Draft minutes had been circulated to the task force prior to the meeting. Patrick Devaney moved to accept the minutes and George Letavish seconded. Motion passed unanimously.

III. Brief Discussion Regarding Development of Recommendations for HETF Report

Senator Ellman noted that the HETF is responsible for submitting a report to the General Assembly in December. The working groups will need to contribute to this effort by providing draft recommendations and proposals between now and December.

Elements of each working group's research findings would be part of this plan. This could include identifying barriers to implementing a hydrogen hub and other facets of the hydrogen economy.

IV. Brief Status Reports from Working Groups

a. Regulatory/ Safety

Daniel LeFevers indicated that working group met on June 30th and listened to a presentation by Tony Lindsay of GTA energy on "hydrogen 101" and safety. Hydrogen presents a different risk profile from other fuels. As hydrogen is deployed in the state, it would be useful to have a means for educating users, local fire marshals and first responders in areas where new hydrogen activities are going to be evolving.

b. Workforce/ Entrepreneurship/ Education

Dana Wynn noted that the working group discussed mapping out relevant workforce training resources. A proposal was submitted to present at a forum for community college CTE administrators and to talk about the task force and issues surrounding the use of hydrogen.

c. Communities, Environmental Justice

Dana Wynn noted that the working group has been discussing how best to identify environmental justice communities and the issues that must be considered. This group has spent much of its recent effort arranging for this meeting's panel discussion.

d. Commerce Development and Investment

Rep. Terra Costa Howard shared that this working group has begun to draft a report including the uses of hydrogen and in the investment in the U.S. They have been listening to various presentations to get a better understanding of how companies in Illinois and nationally are currently using hydrogen

e. Interstate Coordination

Jon Horek noted that this group is serving as a conduit for working groups to surrounding states. The group has established ties with Minnesota and still working on Wisconsin and Indiana to establish where they are with hydrogen. If other working groups would benefit from conducting outreach with other state, the Interstate Coordination group will be pleased to assist.

VI. Panel on Hydrogen and Environmental Justice

a. Chris Pressnall, Illinois Environmental Protection Agency

Chris Pressnall presented a broad overview of environmental justice. It requires just and equitable distribution of environmental benefits and harms over time. Environmental justice can be seen as enhanced public outreach (more developed) and cumulative impacts. IEPA EJ start GIS mapping tools. USCPA has a revamped EJ screen which is now more user friendly. Anyone developing hydrogen needs to be aware that there are tools available online.

b. Lauren Piette, Earth Justice

This presentation focused on minimizing risks and maximizing environmental justice in a hydrogen economy. Hydrogen projects must never add to burdens in environmental justice communities, benefit environmental justice communities, and environmental justice communities must have meaningful say in decisions about hydrogen projects impacting their communities. The risks of a hydrogen economy include more health-harming air pollution, safety hazards, extending the life of fossil fuels infrastructure and delaying electrification, and climate impacts. It is essential to have adequate and strong regulations in place at the outset to avoid the serious safety risks that could come from transporting, storing and using hydrogen. Illinois hydrogen can benefit all communities, but guardrails are necessary to ensure that this does not increase the risks.

c. Elizabeth Kocs, GTI Energy

This presentation discussed Community Benefits Plans (CBP). There are four sections to CBP: Workforce and Community Agreements looks at how someone is engaging with communities and what the communities really look like. Advancing DEIA is focusing on what a company has done or plans to do in their strategies in an effort to achieve more and create an inclusive brand. Good Jobs is focusing on what is being done about jobs and economic development as well as the importance of investing in the American workforce to retraining and attracting future workforce to new technology. Lastly, Justice40 focuses on disadvantages communities and how the benefits should be flowing to them. All four components of the CBP require an update at the end of each phase.

VII. Adjournment

Senator Ellman adjourned the meeting at 10:32 a.m.



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

State of Illinois Hydrogen Economy Task Force September 5, 2023 9:00am – 11:00am Minutes

Location:

Virtual
WebEx Video Conference
Join link:
<https://illinois.webex.com/illinois/j.php?MTID=me199d2489f5936663f13a54d76a6820a>
Meeting number (access code): 2634 547 9840
Meeting password: F3mdCK9hMy3
Join by phone
+1-312-535-8110 United States Toll (Chicago)
+1-415-655-0002 US Toll

Agenda:

- I. Call to Order – Senator Laura Ellman, HETF Chair.
 - a) The meeting was called to order by Senator Ellman at 9:03 am.
 - b) Roll Call of Membership
 - Rep. Terra Costa Howard: Yes
 - Patrick Devaney: Yes
 - Sarah Duffy: Yes
 - Sen. Laura Ellman: Yes
 - Patrick Evans: Yes
 - Rep. Bradley Fritts: No
 - Haley Hoke: Yes
 - Jon Horek: Yes
 - Jim Hoyt: No
 - Elizabeth Irvin: Yes
 - Dan LeFevers: Yes
 - George Letavish: Yes
 - Carly McCrory-McKay: No
 - Dulce Ortiz: Yes
 - Chad Parker: No

Sen. Sue Rezin: Yes
Doug Scott: Yes
Dr. Petros Sofronis: No
Catherine Stashak: No
Michael Wang: No
Michael Woods: Yes
Dana Wynn: Yes

There were 15 of 22 appointed members present at the time of the roll call. Quorum was established.

II. Review of 9/5/2023 Meeting Minutes

Draft minutes had been circulated to the task force prior to the meeting. Patrick Devaney moved to accept the minutes and Doug Scott seconded. Motion passed unanimously.

III. Brief Discussion Regarding Development of Recommendations for HETF Report

Senator Ellman noted that the HETF is responsible for submitting a report to the General Assembly in December. The working groups will need to contribute to this effort by providing draft recommendations and proposals between now and December.

Elements of each working group's research findings would be part of this plan. This could include identifying barriers to implementing a hydrogen hub and other facets of the hydrogen economy.

IV. Brief Status Reports from Working Groups

a. Regulatory/ Safety

Daniel LeFevers discussed the need to ensure that new hydrogen users and developers are well informed as hydrogen usage expands. The State should provide support so that local first responders/fire marshals can receive accurate and timely information on hydrogen usage and best practices, and also receive training on the unique properties of hydrogen. He also went on to list some key questions for regulators.

b. Workforce/ Entrepreneurship/ Education

Pat Devaney shared that his working group has met with people in the production and distribution of hydrogen and users of hydrogen. From those meeting they have learned that most of the education comes from the venders themselves and there is no standardized curriculum. After touring a few facilities that work with hydrogen they have learned that there is a need for a trained workforce that have the technical skills of working in this industry. It will be important to create an educational curriculum for community colleges/universities that would provide better training.

c. Communities, Environmental Justice

Dana Wynn noted that the working group has agreed that the education component needs to include something available for the general public, local officials, and policy makers that communicates the benefits and possible impacts on their communities. They believe that having a community benefits plan in Illinois and all EJ communities where hydrogen projects are being proposed should be part of the project development.

d. Commerce Development and Investment

Rep. Terra Costa Howard shared that this working group has been meeting with individuals and companies in the industry and have reported that they see a lot of cross over between education and workforce development along with the industrial development. A recommendation that they hope to be making is to push for labor standards as new jobs are created.

VI. V. Preparing Annual Report

a. Scope/contents of report

Going forward, representatives from the working groups, working in groups of fewer than six members to avoid OMA violations, should continue discussions on the contents and structure of the report.

b. Process/timetable for approving work products and recommendations for report.

The Task Force agreed to add an extra meeting in October to accelerate development of the report.

VII. Adjournment

Senator Ellman adjourned the meeting at 10:39 a.m.



**Illinois
Department of Commerce
& Economic Opportunity**

JB Pritzker, Governor

**State of Illinois
Hydrogen Economy Task Force
October 10, 2023
8:30am – 10:30am Minutes**

Location:

Virtual

WebEx Video Conference

Join link:

<https://illinois.webex.com/illinois/j.php?MTID=me199d2489f5936663f13a54d76a6820a>

Meeting number (access code): 2634 547 9840

Meeting password: F3mdCK9hMy3

Join by phone

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002 US Toll

Join from a video system or application

Dial 26345479840@illinois.webex.com

You can also dial 173.243.2.68 and enter your meeting number.

Agenda:

I. Call to Order – Senator Laura Ellman, HETF Chair.

a) The meeting was called to order by Senator Ellman at 8:35 am.

b) Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: No

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: Yes

Bradley Fritz: No

Haley Hoke: No

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin: Yes

Dan LeFevers: No

George Letavish: Yes

Carly McCrory-McKay: Yes

Dulce Ortiz: No

Chad Parker: Yes

Sen. Sue Rezin: Yes
Doug Scott: Yes
Dr. Petros Sofronis: No
Catherine Stashak: Yes
Michael Wang: yes
Michael Woods: Yes
Dana Wynn: No

There were 16 of 22 appointed members present at the time of the roll call. Quorum was established.

II. Review of 9/5/2023 Meeting Minutes

Draft minutes had been circulated to the task force prior to the meeting. Rep. Terra Costa Howard moved to accept the minutes and Michael Woods seconded. Motion passed unanimously.

III. Status Reports from Working Groups (Including discussion of work products and potential recommendations)

a. Regulatory/ Safety

Catherine Stashak shared how the expanded use of hydrogen in Illinois will naturally bring up issues for state regulation, but codes and standards already exist for these areas. They have discussed talking to other states that already have a large use of hydrogen. One of their recommendations is that they adopt one code throughout the state of Illinois, For example, the hydrogen technologies code or international fire code. A community should be able to adapt their own code catered to specifically to their needs. It is also important to get first responders and local code officials involved in training. She also recommended that they provide townhalls for the public to start educating the citizens early on hydrogen and ease some of the nerves that it could bring.

b. Workforce/ Entrepreneurship/ Education

Dana Wynn shared that her working group has met with employers and learned that they are going to have some identified training and certifications within the hydrogen field. They are going to be working with the climate works group apprenticeship program to help facilitate this training. It was recommended to them that they establish a community college advisory committee to partner with.

VI. V. Preparing Annual Report

a. Scope/contents of report

Several HETF members are working on a draft of the annual report due in December. Anyone in the task force who wishes to participate in the process should let Senator Ellman and John O'Conner know. The tentative outline of the report is as follows:

- Intro/Purpose of the HETF
- The basics of Hydrogen
- Current and Projected Hydrogen Production and Usage in Illinois
- Hydrogen Policy: Transitional Issues, Pressure Points and Competing Objectives
- Specific Recommendations- TBD
- Attachments

b. What to expect coming up.

We would like to have a draft of material in place by the next meeting on November 7, 2023. The primary goals will be to provide a solid fact base for the audience (which will include members of the General Assembly and other stakeholders) and to provide a stronger understanding of the tradeoffs associated with various policy options. Any definitive policy recommendation would require approval of the HETF membership.

VII. Adjournment

Senator Ellman adjourned the meeting at 9:11 a.m.



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

Agenda **Hydrogen Economy Task Force** **November 7, 2023** **8:30am – 10:30am**

Location: Virtual WebEx Video Conference

Join Link:

<https://illinois.webex.com/illinois/j.php?MTID=m95aaac240bd9928ea3d804e5c6304f13>

Meeting Number (access code): 2467 314 7251

Meeting Password: FAwUWC9S2Z6

Join by phone:

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002

Join from a video system or application:

Dial 24673147251@illinois.webex.com

You can also dial 173.243.2.68 and enter your meeting number.

Agenda:

- I. Call to Order – Senator Laura Ellman, Chair
- II. Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: Yes

Kyle Freeman: Yes

Rep. Bradley Fritz: Yes

Haley Hoke: No

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin: Yes

Laura Roche: Yes

Dan LeFevers: Yes

George Letavish: Yes

Carly McCrory-McKay: No

Dulce Ortiz: Yes

Chad Parker: Yes

Sen. Sue Rezin: Yes

Doug Scott: No

Dr. Petros Sofronis: No

Catherine Stashak: Yes
Michael Wang: yes
Michael Woods: Yes
Dana Wynn: Yes

III. Review of 10/10/2023 Meeting Minutes

IV. Status Reports from Working Groups (Including discussion of work products and potential recommendations)

a. Regulatory/ Safety

Dan LeFevers shared that he wants to add more ways to identify and provide education for local fire marshals and others into the report and focus more on issues around policy and carbon intensity. The overall life cycle analysis in the carbon intensity should be focused on more as opposed to color. Laura Ellman agreed and added there should be a section within the report about carbon intensity throughout the life cycle. Sarah Duffy also is in favor of moving away from colors and wants to name the generation sources.

b. Workforce/ Entrepreneurship/ Education

Dana Wynn shared that they have identified the community colleges and universities in the system having the resources to support services available for students looking to transition into jobs in the renewable sector. Job growth in the sector needs to focus on skilled laborers in construction, maintenance and operations phases that are going to include degrees, on the job training, and certifications. Pat Devaney added that in the report there is a reference to creating labor standards around the development of hydrogen at all levels, so adding language that would name what the labor standards are is needed. This could include, if subsidies change to state policy are provided, project labor agreements and prevailing wage in the construction phase. There should also be labor neutrality to make sure when transitioning from fossil to new technologies that are carbon, free like hydrogen, the same type of job is being created that already exist in the fossil industry.

c. Communities, Environmental Justice

This working group talked about creating clear, culturally appropriate resources for educating communities regarding issues like displaced workers from the fossil fuel and oil refining industries and guiding workers to support resources like patterning with community colleges. They also added that after attending forums for hydrogen, the community colleges present expressed interest in creating an advisory committee regarding renewable energy including hydrogen.

d. Commerce Development and Investment

Joe Giatras shared that this working group had added all the information they have gathered from their individual report and transferred it to the draft of the final report. No other updates from this working group.

e. Interstate Coordination

Sarah Duffy shared that they had reached out to Wisconsin a few months ago but have not heard anything back. Companies in the MachH2 consortium across multiple states are engaging in coordination. No other updates from this working group.

V. Annual Report Discussion

a. Current Draft

i. Provide feedback contributions or new submissions by November 15th. This includes any edits or new sections.

b. Filling in gaps

- i. Various members spoke on issues surrounding development of the annual report due December 1st. If there are conflicts within the report, conflicts should be resolved by spelling out the challenges on specific issues and providing information to those who are reading the report by building consensus and providing an understanding for it. The goals should also be well articulated and there should be lay out for what some of the different positions are and the principals that the state has identified within the report.
 - c. Process for proposing/adopting formal recommendation.
 - i. Clear recommendations supported by consensus and following from the work of the task force would be valuable to include into the report.
- VI. Future Meeting Schedule
- a. Report due December 1st. Next meeting is scheduled Tuesday the 21st. If there is no quorum on that first Tuesday, then Tuesday the 28th will be scheduled.
- VII. Adjournment
- a. Meeting adjourned at 9:26 a.m.



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

Minutes Hydrogen Economy Task Force November 21, 2023 8:30am – 10:30am

Location: Virtual WebEx Video Conference

Join Link:

<https://illinois.webex.com/illinois/j.php?MTID=m95aaac240bd9928ea3d804e5c6304f13>

Meeting Number (access code): 2634 893 9362

Meeting Password: ZchFmPq5R32

Join by phone:

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002

Join from a video system or application:

Dial 24648939362@illinois.webex.com

You can also dial 173.243.2.68 and enter your meeting number.

Agenda:

- I. Call to Order at 8:34 a.m. – Senator Laura Ellman, Chair
- II. Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: Yes

Kyle Freeman: Yes

Bradley Fritz: Yes

Jon Horek: No

Jim Hoyt: Yes

Elizabeth Irvin: Yes

Laura Roche: Yes

Dan LeFevers: Yes

George Letavish: No

Carly McCrory-McKay: No

Dulce Ortiz: Yes

Chad Parker: Yes

Sen. Sue Rezin: Yes

Doug Scott: Yes

Dr. Petros Sofronis: Yes

Catherine Stashak: Yes

Michael Wang: Yes
Michael Woods: No
Dana Wynn: No

III. Review of 11/7/2023 Meeting Minutes

Sarah Duffy offered a correction to draft minutes for the November 7th meeting. Senator Ellman moved to accept as corrected and Doug Scott seconded. Motion passed by voice vote.

IV. Annual Report Discussion

Members engaged in a wide-ranging discussion of the draft annual report which had been circulated to members and other participants before the meeting. Notable elements of the discussion and takeaways include the following:

- a. Representative Costa Howard noted that working groups should be in an agreement with relevant content in the report. Recommendations should be included for which there is a clear consensus.
- b. Patrick Devaney noted several issues regarding the current language in the report. First, he advocated for additional language regarding labor standards and labor neutrality requirements for ongoing operations of hydrogen facilities. Second, he suggested that an existing statement regarding the risks of carbon sequestration is a debatable opinion that likely lacks consensus support and should be excluded from the report. Third, he noted that recommendations regarding issues such as how to treat additionality are controversial and probably lack sufficient support to warrant inclusion in the report.
- c. Dr. Wang initiated a discussion of how different hydrogen production methods and their associated “color” designations should be discussed. There is some support for removing the color designations altogether as misleading or at least better framing the discussion of colors and their associated carbon intensities.
- d. Following up on an earlier point, Jim Hoyt added that carbon capture exists in Illinois and could serve as viable option or a bridge to other long term viable options.
- e. Sarah Duffy suggested that the report needs to have better citations and references to document projections on job creation, cost estimates, etc.
- f. Doug Scott added that the report might want to mention that there is a multi-state MOU on building out the hydrogen economy that could be good as background and structure. On the CCS topic, if the last sentences on health and safety threats is left in, it needs to be expanded more. He also noted that there is not a lot in the report on the agriculture uses, as ammonia is a good hydrogen storage component. He also noted that additionality and the 24/7 matching is being evaluated at the federal level.
- g. Dulce Ortiz added she finds the placeholder on the accommodations on the environmental justice problematic due to the lack of effort to meet with environmental justice leaders in the state of Illinois. She also added that policy makers working on hydrogen should be more aware of and coordinating with other regulatory processes regarding carbon capture. She also wants to see an effort to properly assess the impact of refueling stations located in EJ communities. Lastly, noting language pertaining the fuel cell buses, she wants to add language about the advantages of battery electric buses.
- h. Sarah Duffy noted there are no commercially running examples of CCS on fossil fuel fired plants. Also, she does not know if there are enough evidence to support the claim that the majority of the hydrogen hub production would be electrolysis. Dr. Sofronis acknowledged that the proportion hydrogen production through the hubs is

unknowable, it is reasonable to project, based on what we do know about their plans, that a majority will come from electrolysis.

- i. Dan LaFevers noted the distinction between carbon capture and sequestration. There are several capture technologies out there that work though they are expensive. The DOE is not funding capture of CO₂ on SMRs.
- j. Jim Hoyt noted that in the case the intent of the report is to fully lay out the economics of everything, then there should be more added to the economics of making hydrogen and all potential uses.
- k. Chad Parker advocated caution on specifically stating how carbon capture is used. There are other ways of reducing the carbon intensity that some might not be aware of at this time.
- l. Dr. Petros Sofronis noted that CCS and CCUS are part of the DOE's vision and are happening in the country right now. Stakeholders should be made aware.
- m. Representative Costa Howard added that this report needs to be guided by the statute. She wants to make clear that emotional comments and opinions should not be included in this report.
- n. Senator Rezin noted that EJ communities should have a say on pending projects. She also wants to add that the report should be sticking to legislative intent of the task force.

Senator Ellman suggested that completing the report by the December 1 deadline is not realistic, but that the HETF should endeavor to complete the report during the month of December.

IV. Adjournment

- a. Meeting adjourned at 9:56 a.m.



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

Agenda

Hydrogen Economy Task Force

December 5, 2023

8:30am – 10:30am

Location: Virtual WebEx Video Conference

Join Link:

<https://illinois.webex.com/illinois/j.php?MTID=m8c122a366043561ae45f20b0ec0d47f7>

Meeting Number (access code): 2634 893 9361

Meeting Password: ZchFmPq5R32

Join by phone:

+1-312-535-8110 United States Toll (Chicago)

+1-415-655-0002

Join from a video system or application:

Dial 24648939361@illinois.webex.com

You can also dial 173.243.2.68 and enter your meeting number.

Agenda:

- I. Call to Order at 8:39 a.m. Rep. Terra Costa Howard
- II. Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: No

Sen. Laura Ellman: No

Patrick Evans: Yes

Kyle Freeman: Yes

Bradley Fritz: Yes

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin:

Laura Roche: Yes

Dan LeFevers: Yes

George Letavish: No

Carly McCrory-McKay: No

Dulce Ortiz: Yes

Chad Parker: No

Sen. Sue Rezin: Yes

Doug Scott: Yes

Dr. Petros Sofronis: Yes
Catherine Stashak: Yes
Michael Wang: Yes
Michael Woods: No
Dana Wynn: No

III. Review of 11/7/2023 Meeting Minutes

- a) Minutes from the 11/7 meeting were adopted as corrected. Moved by Sen. Ellman, seconded by Dan LeFevers and approved by voice vote.

IV. Annual Report Discussion

- a) Dan LaFevers added some language about ATR for auto thermal reforming. This technology should be mentioned because it is most likely going to be making the new hydrogen moving forward. He also covered carbon intensity in a new paragraph for the report.
- b) Jon Horek added that he and Dan came up with some revised language regarding hydrogen colors versus carbon intensity. He recommended moving material from the related footnote into the body of the report..
- c) Rep. Terra Costa Howard noted that the original deadline of December 1st is not going to be met and the governor's office has been notified of this. She included that the new deadline for new material or specific recommendation is going to be the 12th of December. The next meeting is projected to be the 19th of December to have a final discussion. Lasty, there will be a meeting in January, most likely on the 9th, to vote in the final language and adopt the report.
- d) Doug Scott added that there is a placeholder for the governance section at the end of the report so there will need to be some information provided for that section by next Tuesday (12/12).
- e) Rep. Terra Costa Howard also noted that the report needs to reflect content developed/presented in meetings of the full task force and working groups. Talking point not supported by evidence should be excluded.

V. Adjournment

- i. Jim Hoyt moved to adjourn and Bradley Fritz seconded. Meeting adjourned at 8:55 a.m.



Illinois Department of Commerce & Economic Opportunity

JB Pritzker, Governor

Agenda

Hydrogen Economy Task Force
December 19, 2023
8:30am – 10:30am

Location: Virtual WebEx Video Conference

Join Link:

<https://illinois.webex.com/illinois/j.php?MTID=m8c122a366043561ae45f20b0ec0d47f7>

Meeting Number (access code): 2634 893 9361

Meeting Password: ZchFmPq5R32

Join by phone:

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Agenda:

- I. Call to Order at 8:33 a.m. Rep. Terra Costa Howard
- II. Roll Call of Membership

Rep. Terra Costa Howard: Yes

Patrick Devaney: Yes

Sarah Duffy: Yes

Sen. Laura Ellman: Yes

Patrick Evans: No

Kyle Freeman: Yes

Bradley Fritz: No

Jon Horek: Yes

Jim Hoyt: Yes

Elizabeth Irvin: No

Dan LeFevers: Yes

George Letavish: Yes

Carly McCrory-McKay: No

Dulce Ortiz: No

Chad Parker: Yes

Sen. Sue Rezin: Yes

Laura Roche: Yes

Doug Scott: Yes

Dr. Petros Sofronis: Yes
Catherine Stashak: Yes
Michael Wang: No
Michael Woods: Yes
Dana Wynn: Yes

III. Review of 11/7/2023 Meeting Minutes

There was a motion to adopt the previous minutes as corrected. Sen. Laura Ellman motioned to move the new adopted minutes. Dan LaFevers seconded it.

IV. Discussion of the Draft Report with any Recommendations.

Task Force members discussed efforts to review any outstanding items from the report, review potential recommendations and provide feedback enabling task force review and for a final approval by the January 9th meeting.

It was noted that Patrick Evans and Dulce Ortiz had had previously offered recommendations. Sara Duffy has suggested edits to Patrick's proposal on the applicability of existing laws in light of fact that the Regulatory/Safety working group has not specifically examined these laws. Since Patrick was unable to attend the meeting, it was suggested that the matter be discussed off-line.

John Horek proposed a notion for supporting a low carbon fuels standard, noting that the entire west coast, including California, Oregon, and Washington, has developed low carbon fuel standards. His recommendation is that the appropriate state agency should be tasked with reviewing the goals and implementation of the West Coast CFS markets and see how that can help Illinois meet its own transportation decarbonization goals. Senator Sue Rezin advised that the report's language should be cautious when suggesting and advised against using words like "adopt" in order to avoid giving the impression that they are fully committed to adopting this kind of language from the West Coast. This is a subject that likely warrants HETF attention in 2024.

The regulatory and safety working groups has suggestions regarding training for first responders and community leaders. There are educational requirements related to the fire service. Training should be provided for the fire service, fire inspectors, and building officials. Catherine Stashak has contacted the Illinois fire institute and they are interested in becoming involved.

Petros Sofronis recommended that the State explore how community colleges can educate the younger generations for the future workforce. He also recommended reaching out to high schools. Dana Wynn added that some of the recommendations on how the community college programs are developed are based on what the employer partners provide to the advisory committee in the development of those programs.

Sen. Laura Ellman recommended that there should be an acknowledgement of the federal incentives that are available, but nothing should be recommended until those incentives are finalized. A conclusion should be added that addresses the activities to date, noting that the HETF will continue its work through the middle of 2026. It was also recommended that within the conclusion there should be a short section listing out future topics to be discussed. Doug Scott recommended that the section 111 regulations for US EPA be add to the conclusion because it specifically mentions hydrogen as compliance mechanisms for coal and gas plans.

It was recommended to include in the education section of the report, outreach to community leaders, the public, and EJ communities, to inform them about the nature of hydrogen and to raise awareness about its potential risks and hazards as well as informing them of potential benefits.

Sarah Duffy noted previous discussions on the potential for an office on hydrogen, or at least identifying government entities would serve as appropriate points of contact.

Doug Scott also discussed adding how CCS comes into play when discussing hydrogen. What it is doing in Illinois and what kind of role it might play going forward. ?

Dan LaFevers also added that there are 17 companies nationally that are funding the effort that is looking at the opportunities across the country for hydrogen storage in specific areas in the regions.

DCEO staff will use feedback from participants to construct a narrative and recommendations for the report. This will be issued sometime between the 26th and 29th. The next meeting scheduled for January 9th, will have the goal of approving the draft for publication.

V. Adjournment

i.Meeting adjourned at 9:24 a.m.