



H₂
HYDROGEN

MIDWEST HYDROGEN CENTER OF EXCELLENCE
OHIO CLEAN HYDROGEN HUB ALLIANCE

The Energy of Tomorrow driving economic growth and innovation Today

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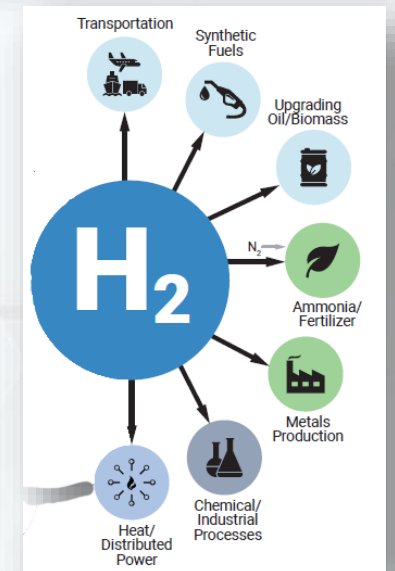


MIDWEST HYDROGEN CENTER OF EXCELLENCE OHIO CLEAN HYDROGEN HUB ALLIANCE

The Energy of Tomorrow driving economic growth and innovation Today

Agenda

-  Introduction
-  Ohio Clean Energy Hub Alliance
-  Hydrogen Hub Concept
-  The Ohio Advantage
-  Potential Economic Impacts
-  DOE Application Process
-  Next Steps





OHIO CLEAN HYDROGEN HUB ALLIANCE

The Energy of Tomorrow driving economic growth and innovation Today

The Ohio Clean Hydrogen Hub Alliance is a powerful broad-based coalition formed to wage an aggressive, multi-faceted campaign to convince the federal government to site a Clean Hydrogen Hub in the state.

Founding Partners



**Dominion
Energy[®]**

**THE MIDWEST HYDROGEN
CENTER OF EXCELLENCE**

A Key Initiative of the Renewable Hydrogen Fuel Cell Collaborative



Levin.

THE MAXINE GOODMAN LEVIN
COLLEGE OF URBAN AFFAIRS

Bipartisan Infrastructure Act solidifies clean hydrogen's status as an essential component of the nation's long-term energy strategy.

The Bipartisan Infrastructure Investment and Recovery Act appropriates \$8,000,000,000 for the formation of at least four “clean hydrogen hubs” (CHH) across the United States.

Clean hydrogen hubs are regions where various users of hydrogen across industrial, transport and energy markets are co-located. ... Hubs also facilitate opportunities for sectors to innovate and collaborate, while developing the workforce and skills needed to support a future hydrogen industry.

Clean Hydrogen: Hydrogen produced with a carbon intensity less than or equal to 2 kg of CO₂ per kg of hydrogen produced.

Key CHH Requirements under the Act

Feedstock Diversity: At least one hub must demonstrate the production of clean hydrogen from fossil fuels, one from renewable energy, and one from nuclear energy.

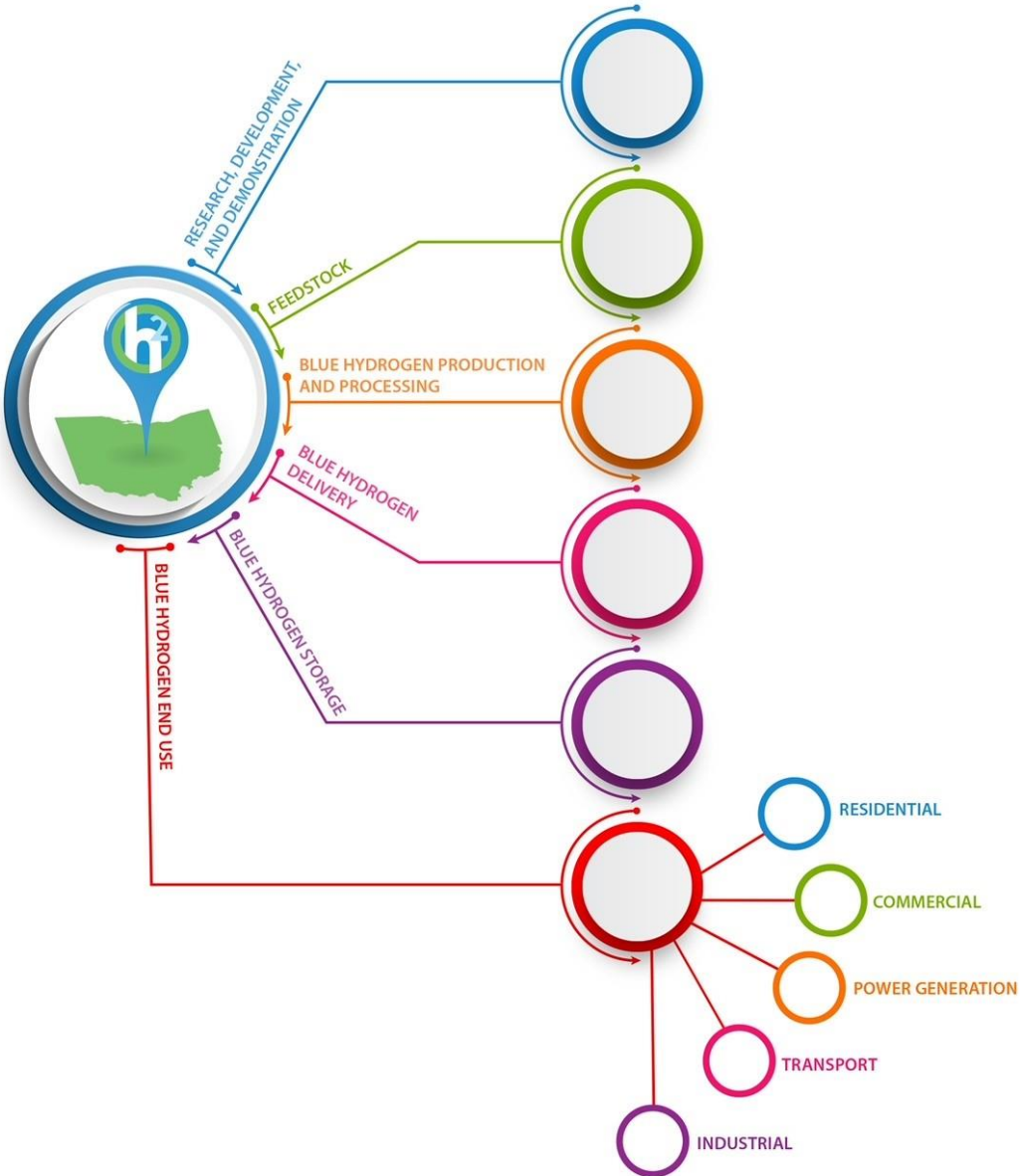
End Use Diversity: At least one hub must demonstrate the end-use of clean hydrogen in the electric power generation sector, one in the industrial sector, one in the residential and commercial heating sector, and one in the transportation sector

Two hubs must be located in regions of the country that possess the greatest natural gas resources

Priority will be given to hubs that are likely to create opportunities for skilled training and long-term employment to the greatest number of residents of the region.



Elements of a Clean Hydrogen Hub



Clean Hydrogen Hub will generate billions of dollars in investment and economic activity in Ohio



Positions Ohio as a world leader in public and private sector clean energy, zero-emission R&D



Create and preserve thousands of good-paying jobs across broad industry sectors



Maximize use of Ohio's bountiful natural gas resources and infrastructure



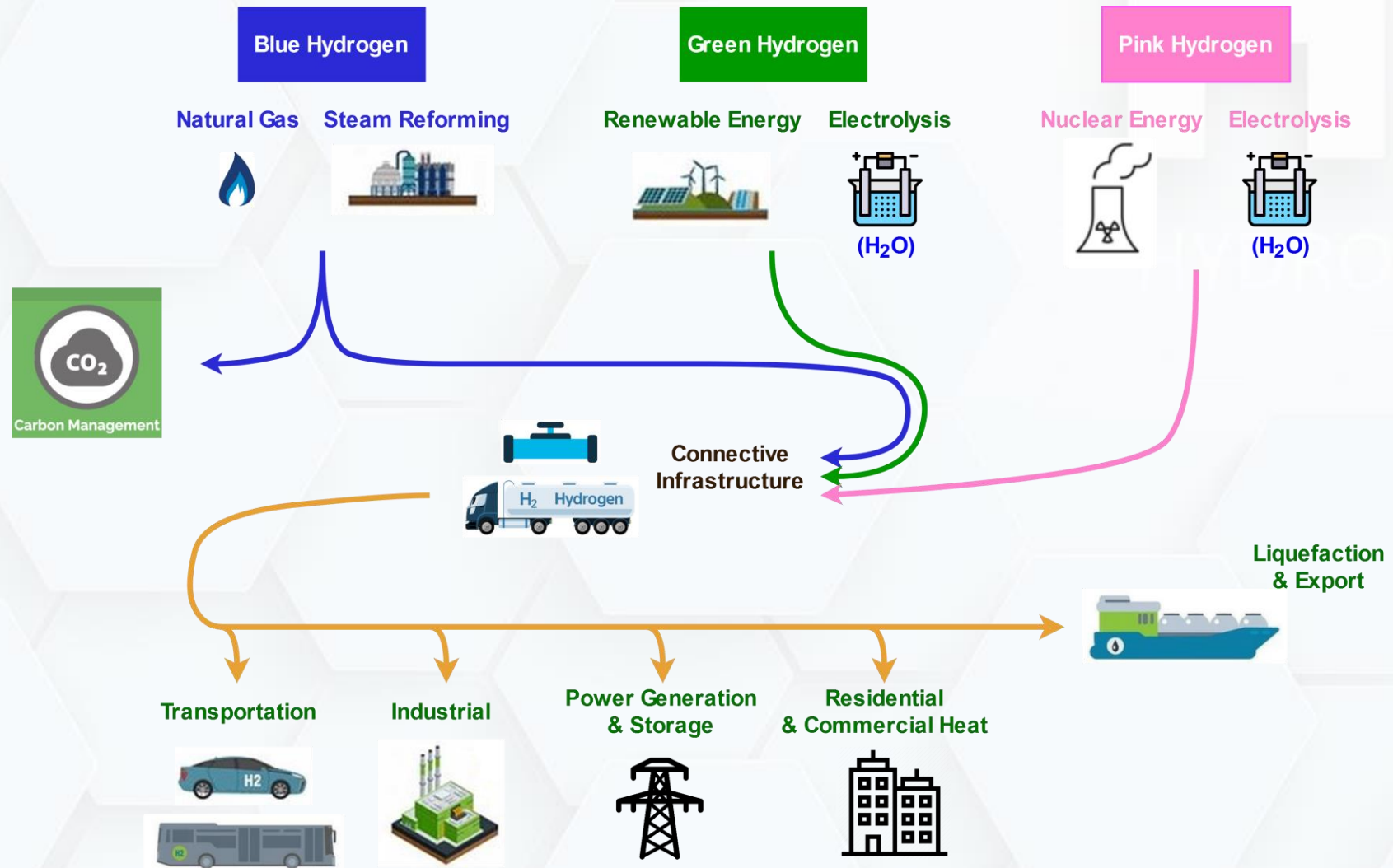
Enable existing companies, including steelmakers, refineries, chemical producers, and paper mills to meet their net-zero carbon goals



Make Ohio a "go-to" state for new businesses searching for safe, affordable ways to reduce their carbon footprint



Clean hydrogen will supercharge Ohio's economy in the 21st Century...



The Ohio Advantage

Competition for CHH funding will be fierce. West Virginia, North Dakota, New Mexico, and Texas and other states are expected to bid for the billions of dollars at stake. Ohio's advantage: we check all the boxes established for CHH siting in the Infrastructure Act...

✓ Located in largest US natural gas basin

- ✓ 30-50 year supply of low-cost feedstock
- ✓ Geologic storage
- ✓ Existing natural gas infrastructure

✓ Manufacturing capacity

- ✓ Steel,
- ✓ Automotive,
- ✓ Glass,
- ✓ Chemicals
- ✓ Wood and paper processing



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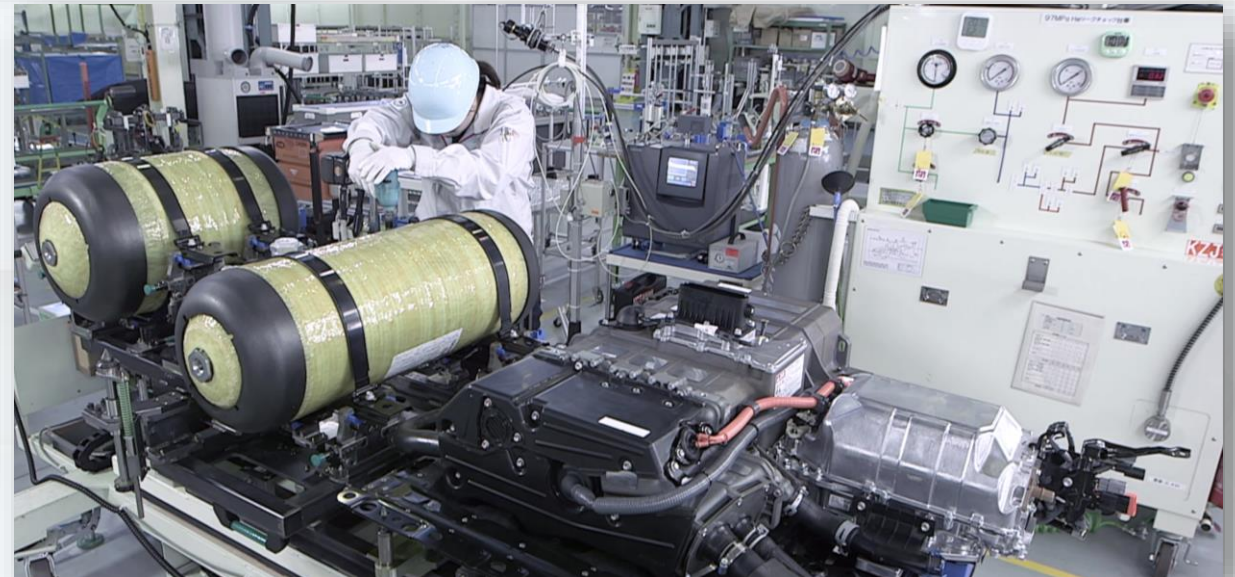
- ✓ Workforce Capacity
- ✓ Emerging H2 Markets
 - ✓ Established leader in industrial use
 - ✓ Early leader in transportation
 - ✓ Power generation in development
- ✓ Carbon Use and Sequestration Options
- ✓ University Research
- ✓ Bipartisan support for H2 Economy transition
 - ✓ Senators Portman & Brown advocated and voted for CHH funding



Potential Economic Impact of Transition to H₂ Economy

Year	U.S. Jobs	Ohio's Projected Share*
2030	700,00	35,000
2050	3,400,000	170,000

Source: <https://www.fchea.org/us-hydrogen-study>



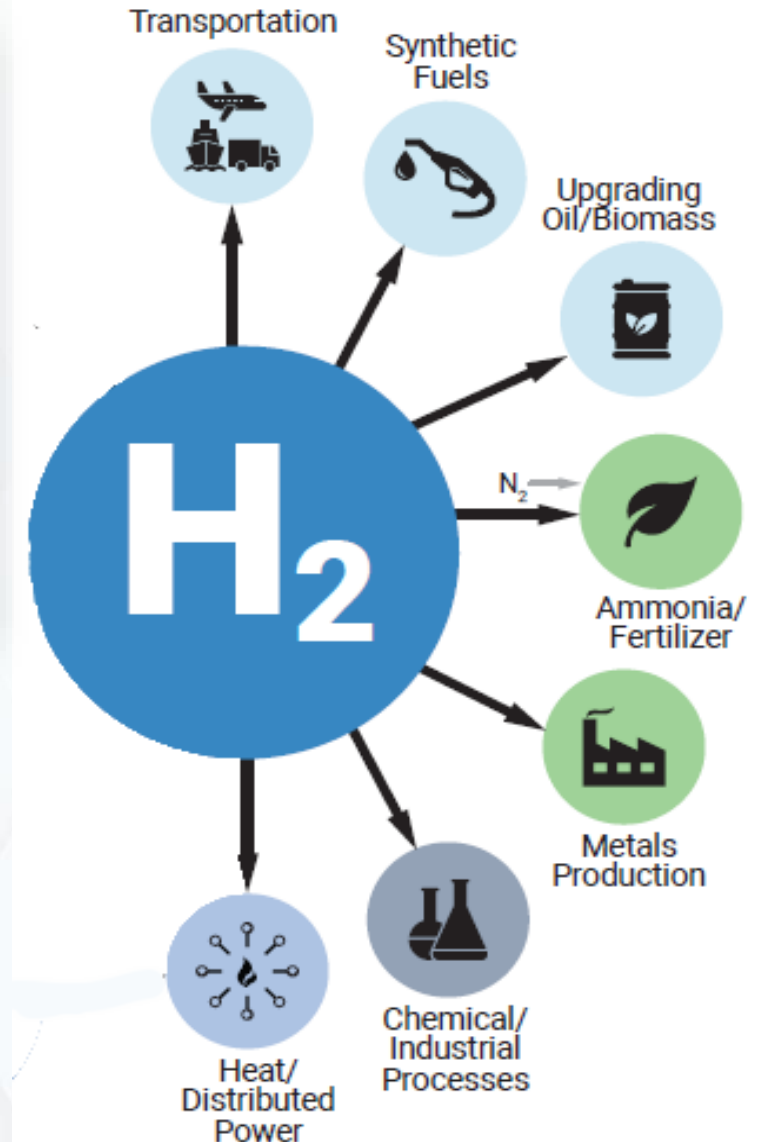
*Based on Ohio's approximate 5% national manufacturing share.
McKinsey & Co. Report on H₂ Economy Job Creation/Retention January 2021

Ohio-based Clean Hydrogen Hub will fuel business growth and job creation in a broad range of industries

Hydrogen based steel processes and carbon capture and storage are among the more promising and sustainable technologies currently being developed. As we build momentum toward our ambitious goal targeting net-zero carbon emissions by 2050, the opportunity to explore the potential for a hydrogen hub in this region...is cause for optimism. Richard Fruehauf, Senior Vice President, Chief Strategy & Sustainability Officer, United States Steel



Ohio has...the proudest history and the best manufacturing talent in the country. We have the history of the workers... the passion... the innovation. And we certainly have the physical capital. We have the factories. We have the space ready to be retooled and repurposed. We just need the investment. Sen. Sherrod Brown



MHCoE Projections for Ohio Hydrogen Markets 2030-2050

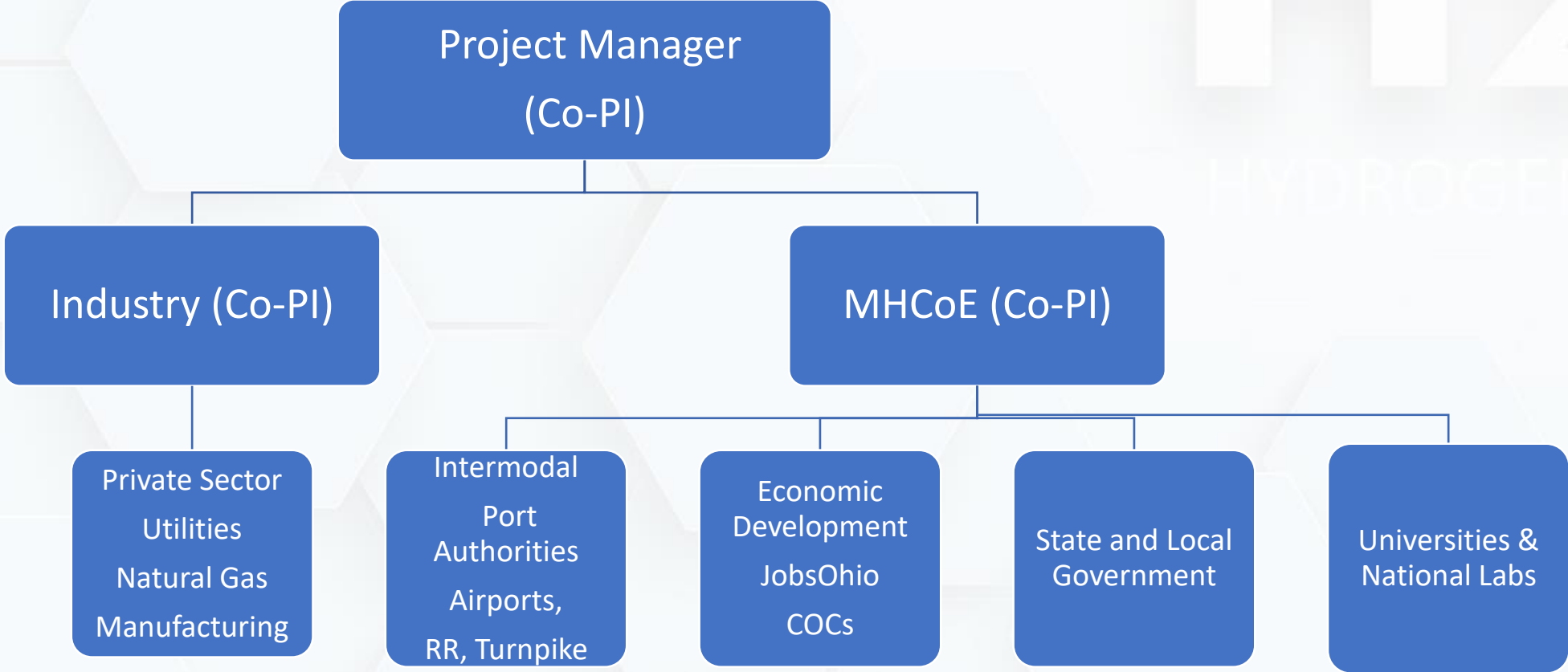
		2030	2040	2050
Hydrogen Consumption	Power generation	31,100	88,400	251,200
	FCEVs	2,900	35,400	430,600
	Forklifts	4,700	8,400	12,700
	Oil refining	188,700	202,400	217,000
	Metal refining	23,900	96,600	391,000
	Ammonia production	114,200	119,600	125,400
	Biofuels	400	7,900	148,000
	Synthetic hydrocarbons	63,600	85,800	397,700
	Other Mfg. markets	8,100	9,100	10,300
	Total Consumption	437,600	653,600	1,983,900
Hydrogen Production	Electrolysis via Nuclear Power	9,300	50,700	59,600
	Electrolysis via Renewable Sources	65,310	78,980	94,334
	Natural Gas (SMR)	362,990	523,920	1,829,966

*Assumes Ohio will not be a zero-emission vehicle state.
Assumes repurposing 15% of nuclear and renewable power for hydrogen.*



Example Application Structure

DoE FOA to be issued by May 15, 2022, awards by Nov. 2022. Recipient has five years to complete work.





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Visit OH2hub.org to join the OH2 Alliance. Together we will make Ohio a leader in the development and deployment of clean hydrogen, the energy source that will power America and the world in the 21st Century.

