

Hydrogen in Michigan

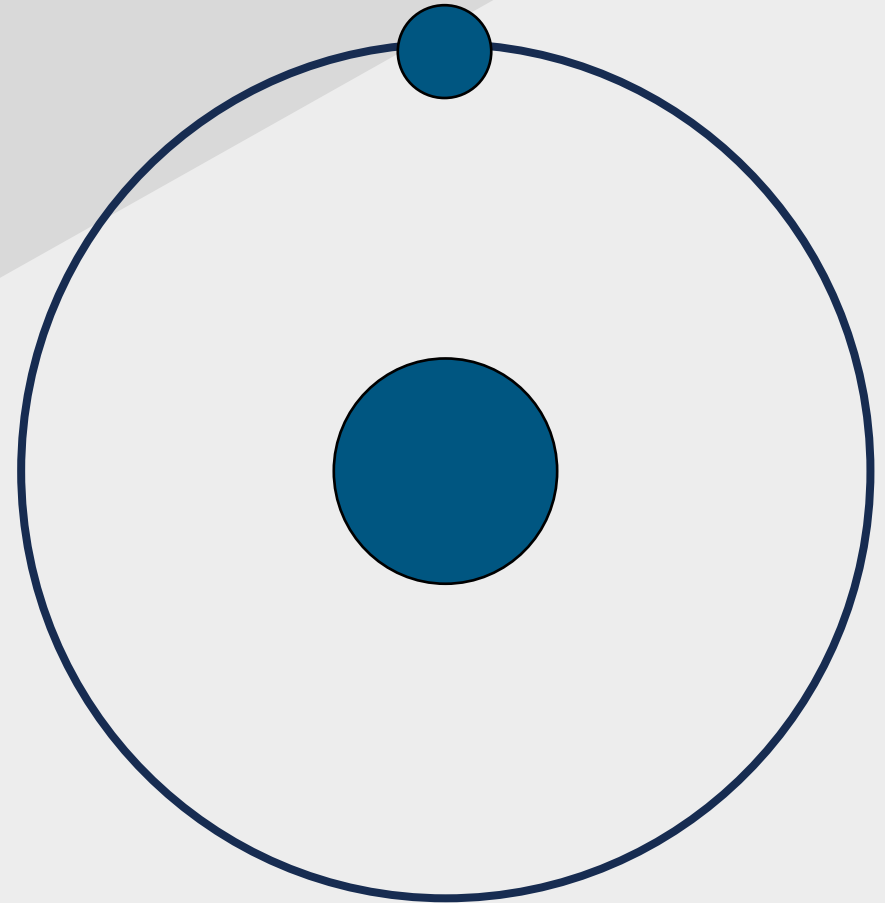
MI Hydrogen Seminar
12/1/2023



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Outline

- Michigan's Hydrogen Value Proposition
- Hydrogen in Michigan Today
- Vision for the Future
- State Actions
 - Partnerships/Planning
 - Funding Opportunities
 - Key Projects
- Work Still to be Done
- Questions?



Michigan's H2 Value Proposition

The Opportunity

- Accelerating Michigan's net-zero by 2050 pledge
- Reducing emissions in hard-to-abate sectors
- Creating high-paying, clean energy jobs
- Attracting new businesses to MI

Robust Demand Forecasts

- Potential estimated at roughly 500 kTPA total in 2035
- Leading Sectors by Demand
 - Trucking – 134 kTPA
 - Industry (Steel) – 159 kTPA
 - Power Generation – 120 kTPA

Economic and Environmental Impact

- Potential to abate more than 2.4 MTPA of CO2
- Potential to create ~6,500 – 8,400 jobs in Michigan

“The Midwest will continue leading the future of mobility and energy innovation and has enormous potential for transformative hydrogen investments”

- Governor Gretchen Whitmer

H2 in Michigan – What makes us unique

Geography

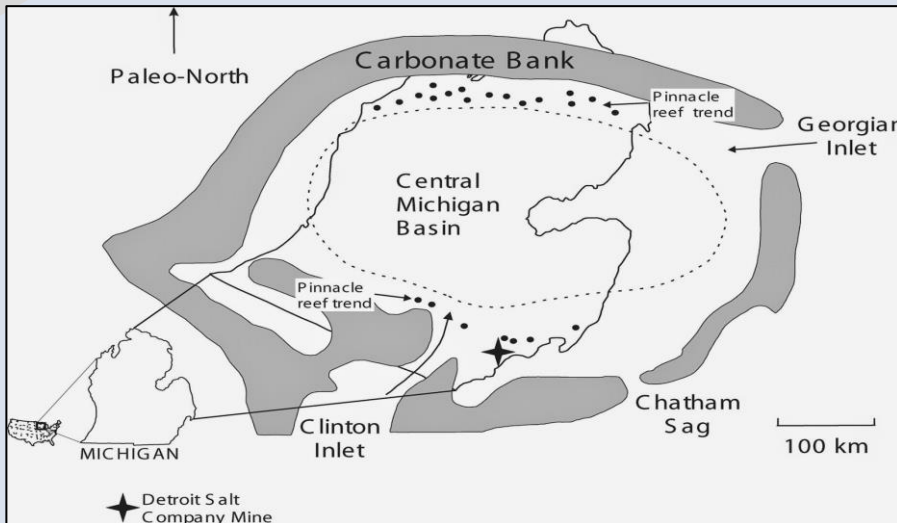
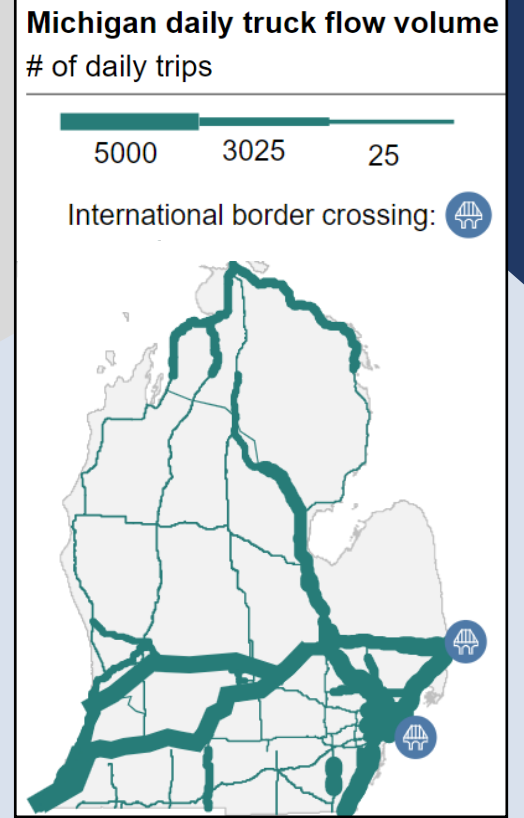
- Border Crossings – Unparalleled transportation decarbonization opportunity
- Potential for partnerships with neighboring states and Ontario
- The Great Lakes – Transportation and Fresh Water

Geology

- Bedded salt deposits – “natural” H2 potential and geologic storage

Industry/Research

- Strong manufacturing base
- Automotive Innovation
- Leading universities

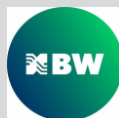


H2 in Michigan – Current Stakeholder Landscape

R&D and Facilitation



Technology



Government & Public Partnerships



Infrastructure



Industrial End-Use



H2 in Michigan – Looking ahead

Vision:

Support Michigan's decarbonization goals, enable equitable economic development, and create clean jobs by developing a robust hydrogen ecosystem and leveraging Michigan's industrial and transportation backbone



Robust hydrogen demand, driven by **transportation** and potential decarbonization of **industrial applications** (e.g., steel)



Potential to enable **pipeline** and **trucking and distribution networks** to support **low-cost H2 delivery** within Michigan and across the region



Opportunity for **cost-effective production of green (onshore wind) and pink (nuclear) hydrogen**, potentially helping to de-risk investments by end users

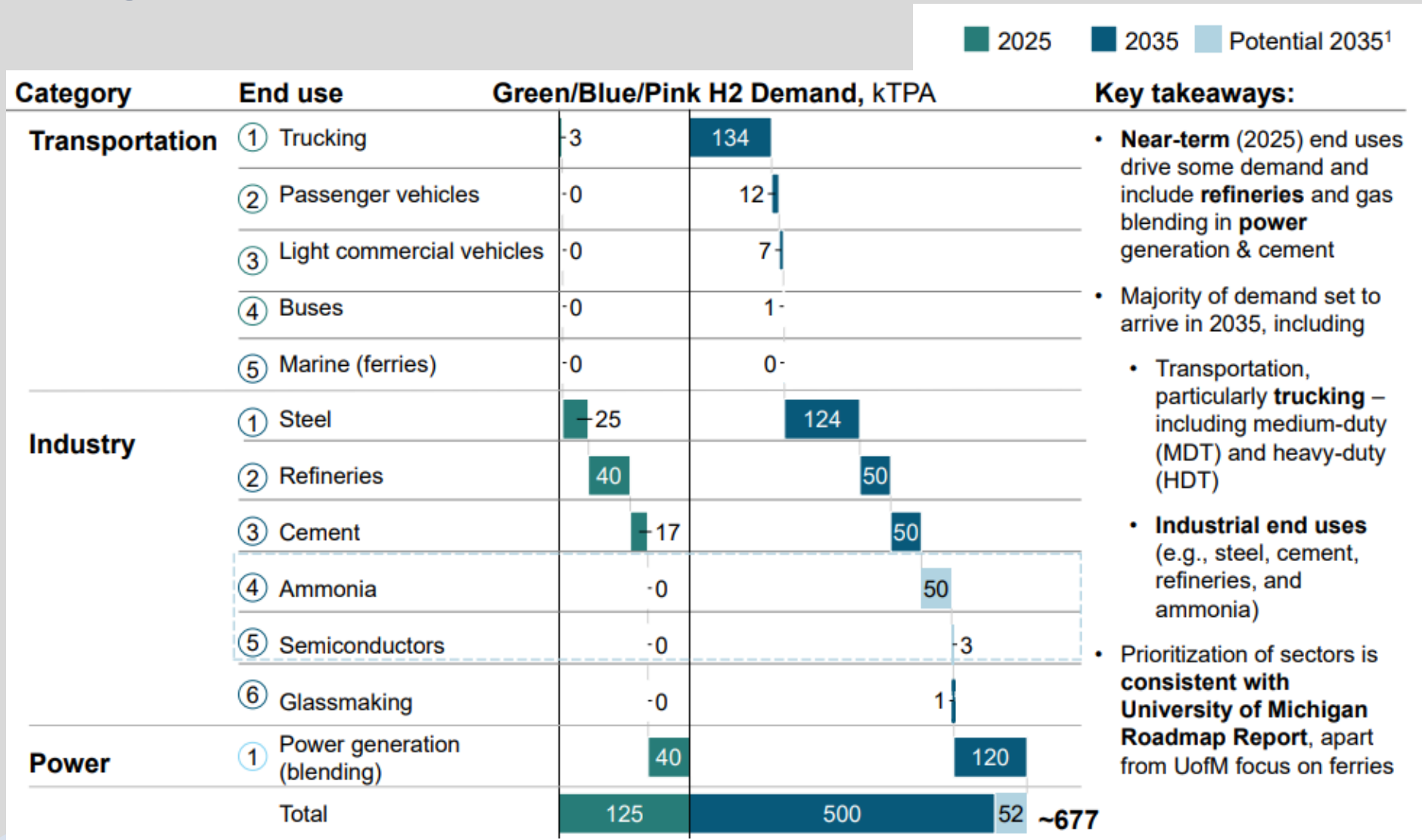


State commitment to supporting H2 investment through **incentives, technical assistance, supportive policy / permitting environment**, and investments in fueling infrastructure, like the **Truck Stop of the Future**

State commitment to spurring a robust hydrogen market, workforce, and supply chain through the 7-state **"M-H2 Coalition"**

State commitment to meeting **Justice40** goals

H2 in Michigan – Estimated Demand in 2035

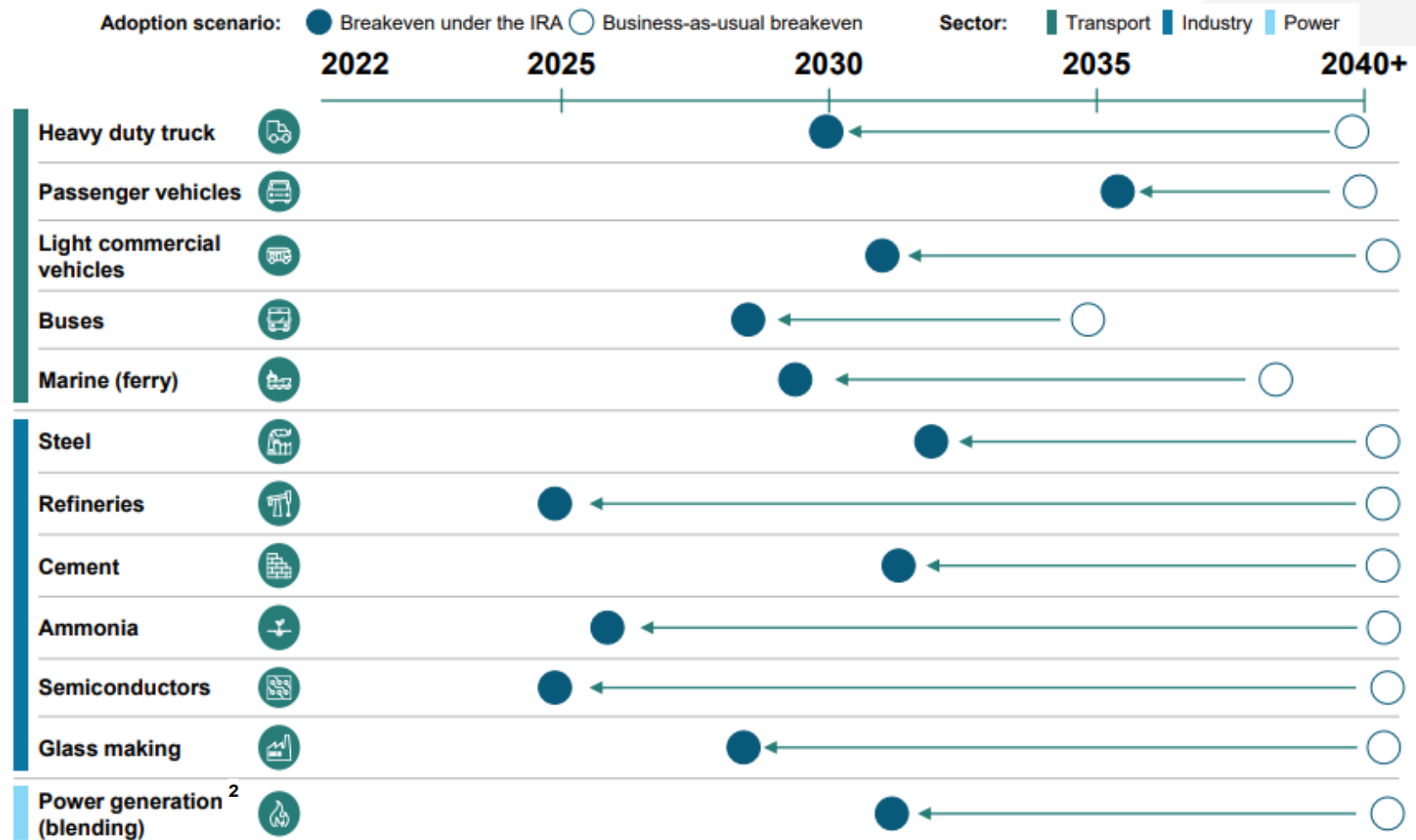


Key Assumptions/Sources

- Ammonia and Semiconductors – Assumes stakeholders execute on certain projects such as bringing an ammonia facility online in 2025 and the deployment of an average size, large wafer production line.
- Analysis does not include – Long-term investments (i.e. CHIPS funding for semiconductors), Greater region potential (i.e., ammonia production just outside of MI), Aviation demand, and Cargo Demand.
- Sources: McKinsey Global Energy Perspective 2022, McKinsey Hydrogen Insights, EPA Greenhouse Gas Reporting Program, EIA form 860, IHSM
- Trucking estimates based on 2,200-2,300 trucks deployed by 2035 with average daily consumption of 25 -35 kg/day per truck.

Impact of the IRA on Break-Even Year

Break-even timing for hydrogen vs. conventional alternative¹

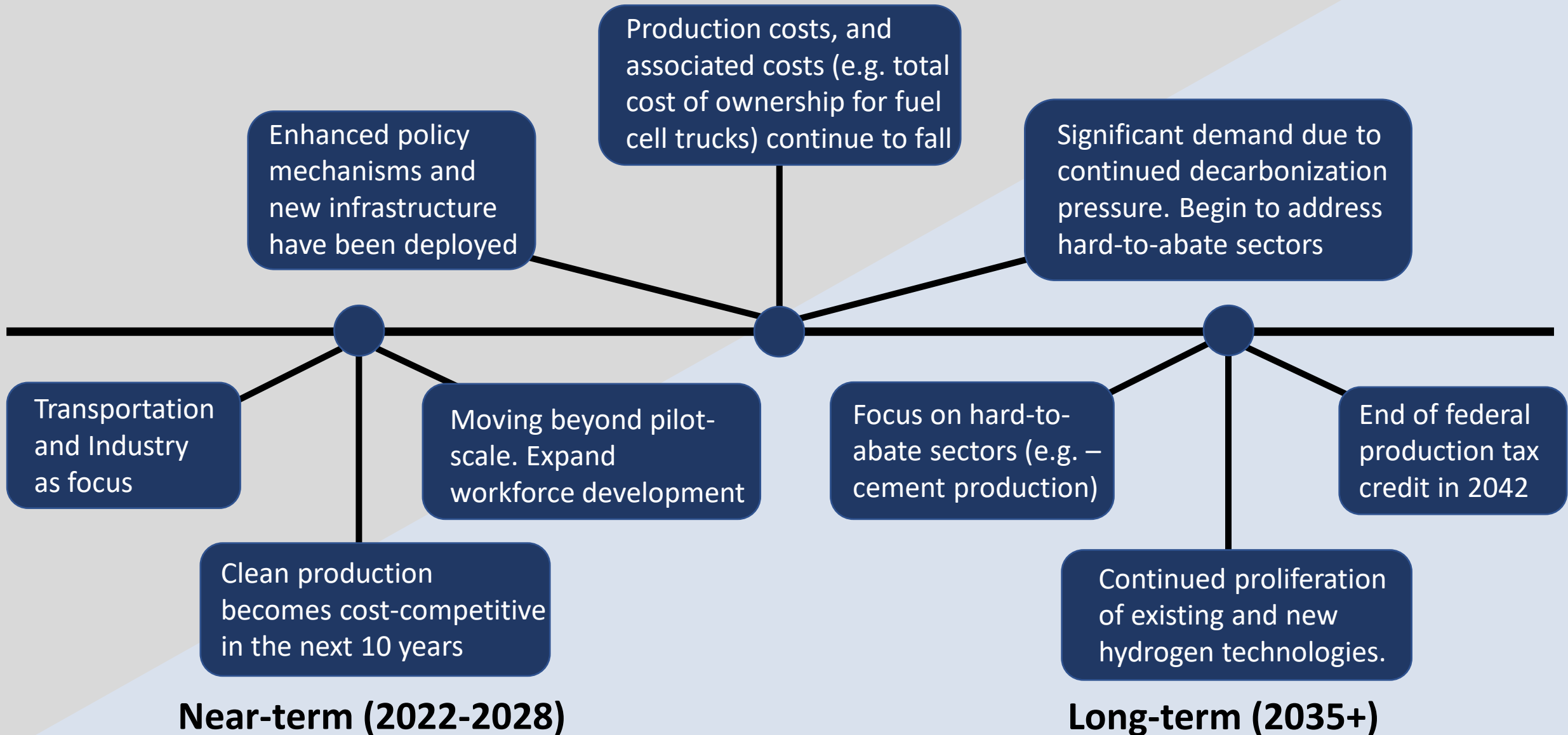


Key Assumptions/Sources

1. For transportation, the conventional fuel is diesel applications switching to fuel-cells; for steel, a blast furnace (BF-BOF) with hydrogen blending; cement is natural gas with hydrogen blending; refineries, glass making, ammonia and semiconductors replace grey hydrogen with low-carbon; power generation is natural gas with a 20% maximum hydrogen blend
2. H2 PTC from the inflation reduction act drives breakeven in next ~10 years, but renewables adoption and infrastructure concerns (embrittlement) around blending into natural gas pipelines may slow uptake
3. Sources: McKinsey Hydrogen Insights Cost Model

H2 in Michigan – Looking ahead

Medium-Term (2028-2035)



State Actions – Partnerships, Advocacy, Planning

7-State MOU



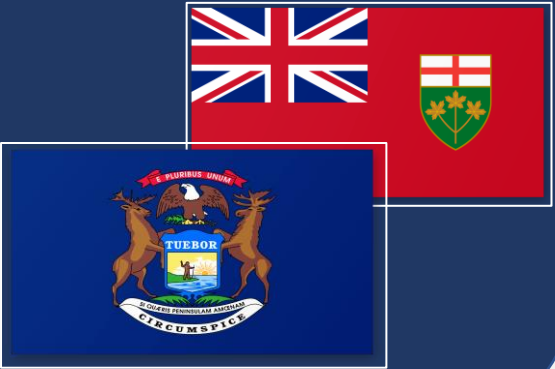
Stakeholder Engagement



Freight Planning



Cross-Border Cooperation



Michigan Council on Future Mobility



State Actions – Federal Funding

Priorities

Regional Clean Hydrogen Hubs

- Midwest Alliance for Clean Hydrogen
- ~100m for Michigan
- Significant Additional Private Investment
- Transportation Focus

Charging and Fueling Infrastructure Grants

- “NEVI Discretionary” Program
- Deploys Fueling/Charging Infrastructure
- Three new “H2-pending” routes as of 2023

Additional Opportunities

Clean Heavy-Duty Vehicle Rebate

- \$1 Billion in Funding from the IRA
- Intended for Fleet Conversion
- State/Local, Indian Tribes, Schools

IRA Hydrogen Tax Credits

- Introduces a PTC for Hydrogen
- Broadens Section 48 ITC to include H2
- Includes additional benefits

Funding to Advance the National Clean Hydrogen Strategy

- New NOI
- R&D focus – Transportation & more

Regional Clean H2 Hubs - Demand

- \$1B to support off take from H2 Hubs
- Transportation/Industry as key focus

Hydrogen Complementary Programs

- Due to its versatility, H2 projects will qualify for multiple other programs

State Actions – Key Projects



Truck Stop of the Future (EV and H2)

- Fueling stations and technology deployment platform
- MIO led project within MachH2
- Partner with ACM



Flint MTA Expansion

- H2 Buses for public transit
- Expansion of production and additional vehicles

American Center for Mobility

- Green H2 Production
- Freight Focus
- Partner with MIO



State Actions – Key Projects

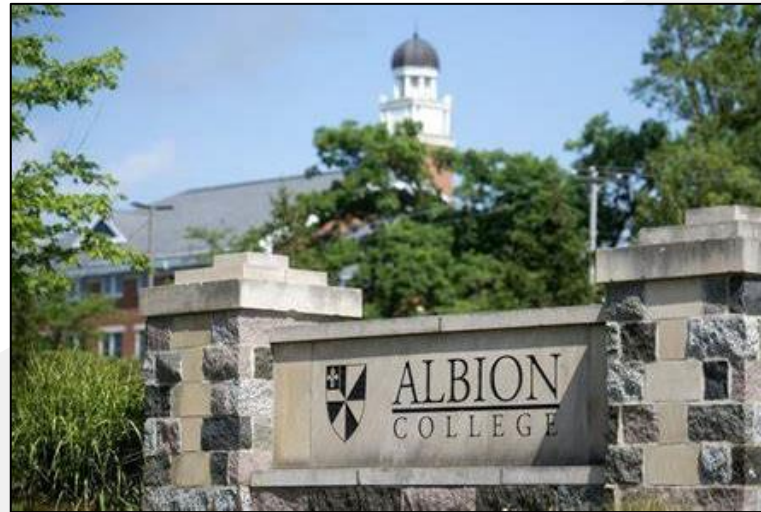


Geologic Storage

- Unique opportunity for Michigan
- Company conducting feasibility studies
- “Pipeline project” within MachH2

Albion Green Hydrogen

- Production and Energy
- Potential for transportation and supply



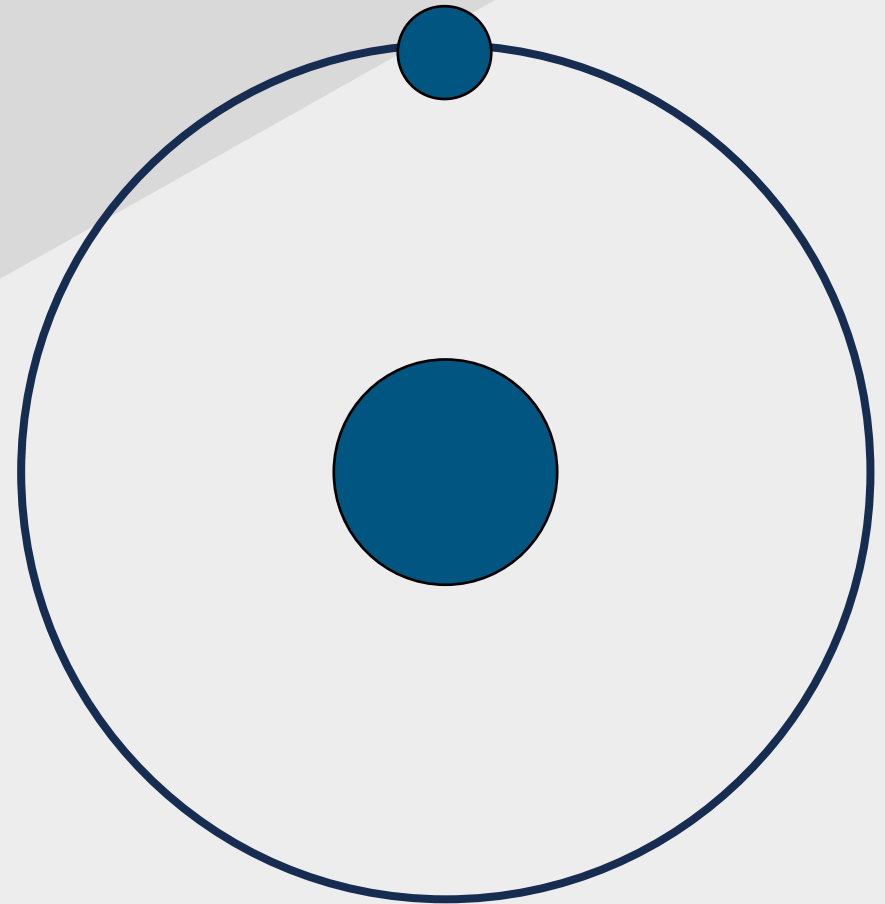
Industrial Decarbonization

- Green Steel
- Strong emissions reductions potential



More Work to be Done

- Planning to ensure supply meets demand
- Transportation of H2
 - (Safety / Complementary Interstate Policies)
- Safety Training – 1st responders
- Economics – quickest path to affordability
- Supply chain concerns
- Public education
- Workforce development



Questions

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