Hydrogen development and standards harmonization

FCHEA
Fuel Cell & Hydrogen
Energy Association

About the Fuel Cell and Hydrogen Energy Association

- FCHEA represents over 70 leading companies and organizations that are advancing innovative, clean, safe, and reliable energy technologies.
- FCHEA drives support and provides a consistent industry voice to regulators and policymakers. Our educational efforts promote the environmental and economic benefits of fuel cell and hydrogen energy technologies.

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Our Members

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Johnson Matthey Fuel Cells the power within
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Nebraska Public Power District Always there when you need us
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NIKOLA
NISSAN GROUP OF NORTH AMERICA
NUVERA Making hydrogen make sense.
OFCC OHIO FUEL CELL COALITION
Parker

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PLUG POWER
POWERCELL
RENEWABLE INNOVATIONS
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Taylor-Wharton
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T.EN TECHNIP ENERGIES
TOYOTA
TRUE ZERO A FirstElement Fuel brand
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Interest in Hydrogen is Growing

Increased hydrogen activities on a regional, national, and international level.

Economic growth and employment

Resiliency and reliability

Reduction in local air pollutants

Reduction in greenhouse gases

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5 Uses of Hydrogen

Power generation and grid balancing

Centralized power (including storage) and distributed power (off-grid, backup power)

Hydrogen as an energy carrier and storage medium

Transportation fuel (including material handlings, light- and heavy- duty vehicles, captive fleets, rail)

Fuel for **residential and commercial buildings** (including blending into the gas grid, combined heat and power)

Fuel for **industry**

Feedstock for industry (ammonia, methanol, refineries, steel) and long-distance transport (aviation, marine)

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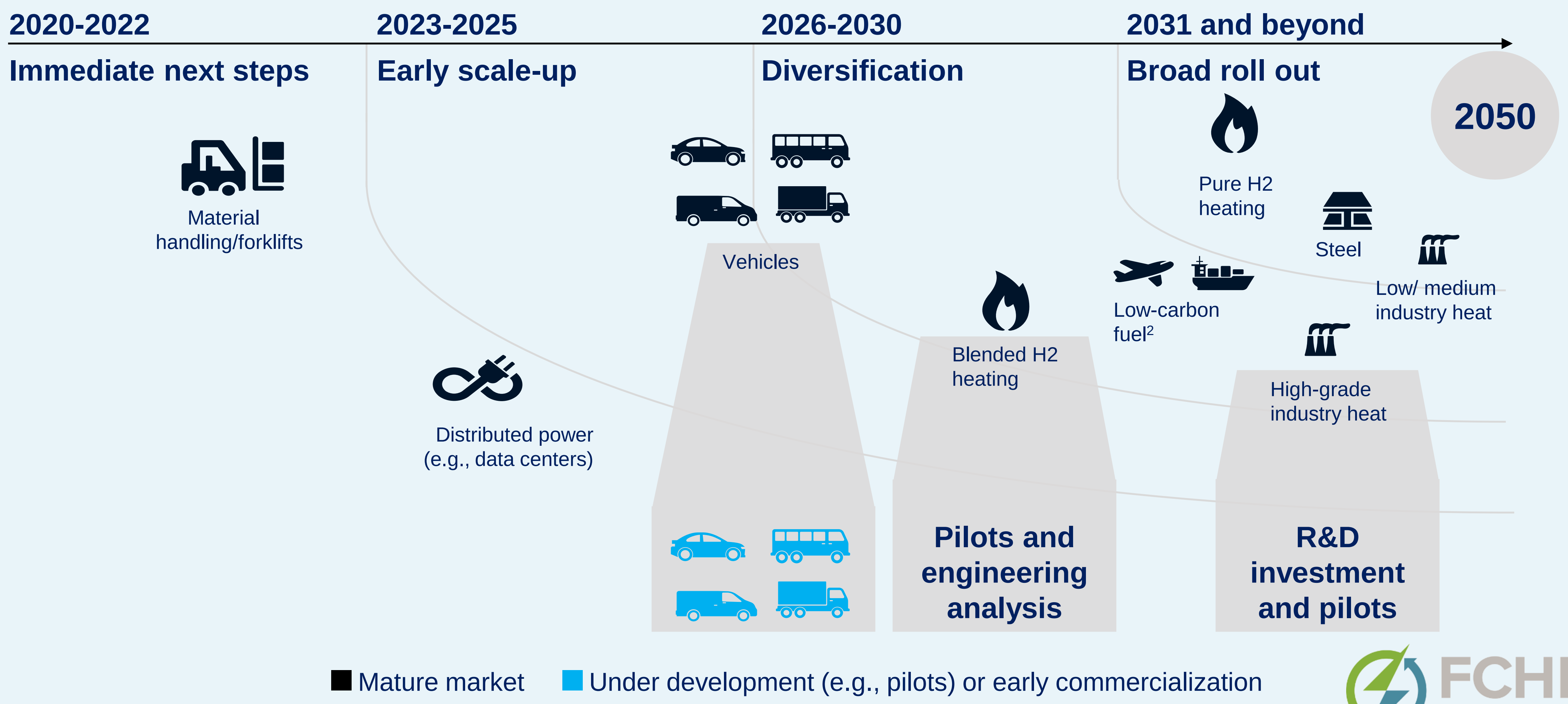
The roadmap describes 4 phases over the next decade to develop hydrogen across applications



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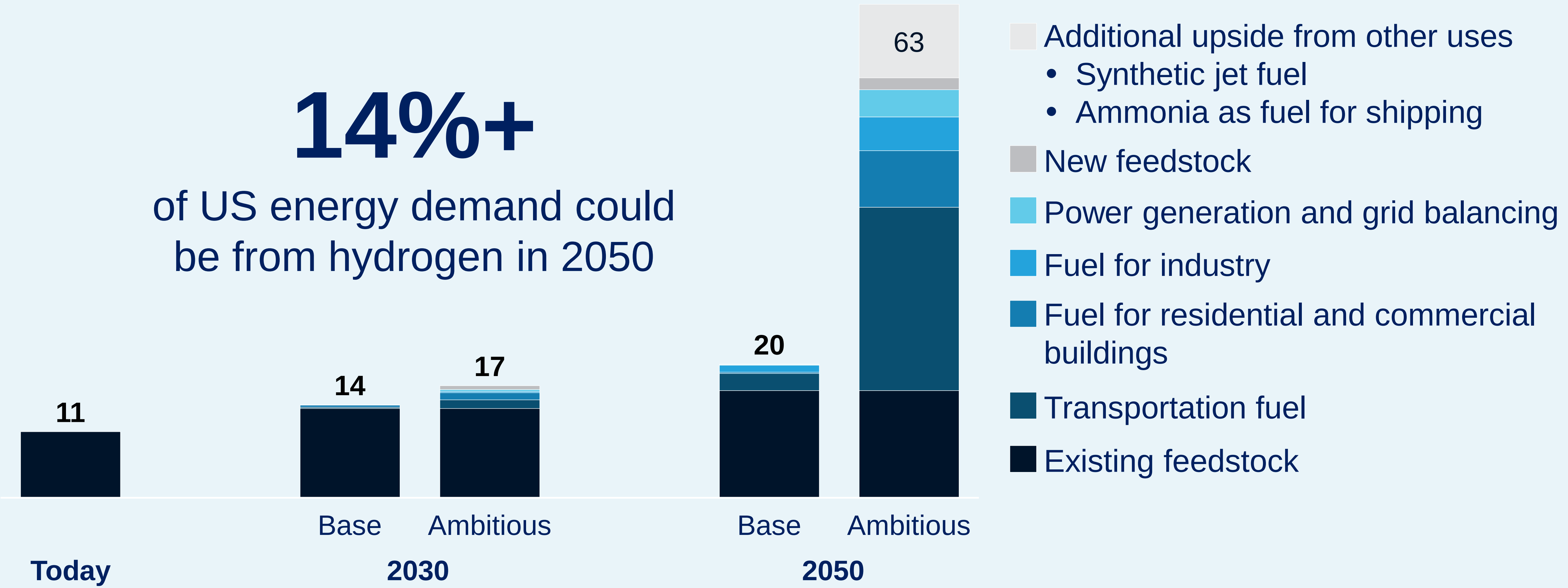
The road map lays out a high-growth pathway for hydrogen

Million metric tons per year

14%+

of US energy demand could be from hydrogen in 2050



1. Demand excluding feedstock, based on IEA final energy demand for the US
2. Assuming that 20% of jet fuel demand would be met from synthetic fuel and 20% of marine bunker fuel from ammonia
Note: Some numbers may not add up due to rounding

Scaling up Economic Opportunities: Investments and Jobs

Annual investment

$1bn	$2bn	$8bn
2022	**2025**	**2030**
Early scale-up	Diversification	Broad rollout

New jobs[1]

+50,000	+100,000	+500,000
2022	**2025**	**2030**
Early scale-up	Diversification	Broad rollout

1. Includes direct, indirect, and resulting jobs

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The US economy would benefit through emissions reduction, growth, jobs, & use of domestic energy resources

Hydrogen in the US could …

... Strengthen the US economy

~$750 bn

in revenue

3.4m

jobs

... Create a highly competitive source of domestically produced low-emission energy

~100%

domestically produced

... Provide significant environmental benefits and improve air quality

-16%

CO_2

-36%

NOx

In 2050

Note: Final energy demand excluding feedstock; share of abated CO^2 emissions relative to US emissions in 2050 as forecasted in the IEA Reference Technology Scenario; for NOx, for tailpipe emissions only, based on EPA current NOx emissions

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Engaging Industry

FCHEA hosts forums to identify R&D needs and provides a mechanism for input and feedback into DOE R&D plans and activities

- Conduct technical working groups focused on stationary fuel cell systems, transportation technologies, portable power applications, and others
- Direct participation in Technical Committees with opportunities for FCHEA members to review and comment on developing draft documents
- Direct participation in US TAG for ISO/TC 197 and IEC/TC 105 with opportunities to review and comment on developing draft documents
- Hosts monthly coordination calls with codes and standards development organizations representatives working on hydrogen activities

Sharing Industry Best Practices

Information-sharing of pre-competitive safety information

- Open discussions during meetings provide a mechanism for industry to contribute to developing requirements
- Discussions during monthly meetings of the National Hydrogen and Fuel Cell Codes & Standards Coordinating Committee (NHFCCSCC)
- Technical resources shared on www.hydrogenandfuelcellsafety.info
- RCS development updates shared on www.fuelcellstandards.com

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What are RCS?

- Regulations (Ex. GTR 13)
- Codes (Ex. NFPA 2, NFPA 55, building codes, fire codes, fuel gas codes)
- Standards
  - National examples: SAE J2600, CSA HGV 4.2, CGA G5, ASTM testing standards, etc.
  - International examples: IEC/TC 105 62282 series, ISO/TC 197 19880-X series, ISO/TC 22 SC 41 series, etc.
- How they Relate to Best Practices
  - Industry experiences and best practices
  - NASA experiences with hydrogen safety
  - Similar technologies, such as Natural Gas as starting points
  - New learnings incorporated in new and revised RCS

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Hydrogen Standards

Power generation and grid balancing

Standards: IEC/TC 105, ANSI/CSA 1, NFPA 853, NFPA 2, IEEE 1547, ASME PTC 50…

Transportation fuel

Standards: SAE standards and technical specifications, CSA HPIT 1 and HPIT 2, NFPA 2, GTR 13, ISO 19880 series…

Fuel for **industry**

Standards: CGA G5.3, SAE J2719, ISO 14687…

Feedstock for industry

Standards: AIR 6464, ASME B31.12…

Fuel for **residential and commercial buildings**

Standards: NFPA 850, NFPA 853, NFPA 2, others under development

FCHEA participation in developing RCS

– ISO/TC 197 – developing standards to support gaseous hydrogen refueling, as well as revisions to published standards

– IEC/TC 105 – fuel cell requirements with efforts to harmonize with national standards and international regulations

– CSA Fuel Cell Standards Committee – national standards and secretariat for the US TAG on IEC/TC 105

– NFPA - staff serves on the Technical Committee for NFPA 2 and acts as proponent for FCHEA member public input developed through our Hydrogen Codes Task Force

– SAE Fuel Cell Vehicle Safety Task Force and SAE Fuel Cell Standard Committee

– IEEE Interconnection standards

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How FCHEA Promotes Harmonization

- Industry can ensure best practices are incorporated into developing RCS
- Participation in FCHEA Working Groups allows businesses opportunities to be briefed on the RCS efforts of interest, weigh in on issues that arise, review documents, and develop industry positions on issues
- FCHEA participation in national and international standardization promotes harmonization
- FCHEA's Hydrogen and Fuel Cell Safety Report, Regulatory Matrix, and FuelCellStandards.com provide overview information making it easier for all interested parties to track and engage in key efforts

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Harmonizing Requirements

- National and International coordination
  - Significant progress: ISO/TC 197 WGs on hydrogen fueling stations and components
  - Launch of new subcommittee SC-1 to handle cross-cutting and integrated systems outside the normal scope of ISO/TC 197
  - CSA HGV standards were modelled on NGV standards
- Technical harmonization between national and international requirements
- Reference standards in U.S. Model Codes and Regulations

Challenges

Much work has been done to ensure timely codes and standards are in place for wide-scale adoption of fuel cells and hydrogen energy technologies. However, significant work remains to be done

- Harmonization of requirements between codes, standards, and regulations remains a priority
- National and International standards need to develop in a coordinated fashion to ensure they reflect the needs of industry and consistency with accepted practices
- Cross-cutting areas require hydrogen experts to work along-side experts from other fields: hydrogen for aviation, hydrogen locomotives, H2/NG-blends, hydrogen at scale
- U.S. adoption (with national deviations) for published International Standards
- U.S. Model Codes are analyzed and harmonized as applicable - References to recently published standards are added
- Regulations should be updated to reflect current codes and standards

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How to address RCS for Complex Systems?

- Standardization technical committees currently only cover defined technology scopes
- Hydrogen can be used in many technology sectors
- Developing the “Big Picture” shown earlier requires a coordinated approach
- ISO/TC 197 (Hydrogen Technologies) is creating a new Subcommittee to serve as a home for such collaborative work

What’s Next?

Policy

- Hydrogen is a versatile energy carrier that can enable deep decarburization across energy and industrial sectors
- Further policy support is underway to enable large-scale development and deployment of low-carbon hydrogen production and end-use

Regulations, Codes, & Standards

- Developing standards across sectors can be a challenge
- Harmonization of requirements
- Development and maintenance to reflect technological advances

Resources

FCHEA Resources

Association website
www.fchea.org

Hydrogen and Fuel Cell Safety Report
www.HydrogenAndFuelCellSafety.info

Searchable database of RCS
www.FuelCellStandards.com

Roadmap to a U.S. Hydrogen Economy
www.ushydrogenstudy.org

DOE Resources

Hydrogen and Fuel Cell Technologies Website
https://www.energy.gov/eere/fuelcells/hydrogen-and-fuel-cell-technologies-office

H2@Scale
https://www.energy.gov/eere/fuelcells/h2scale

H2Tools
www.H2Tools.org

HyRAM
https://energy.sandia.gov/programs/sustainable-transportation/hydrogen/hydrogen-safety-codes-and-standards/hydrogen-risk-assessment-model-hyram/

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Thank you.

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