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Massachusetts Department of Energy Resources

MASSACHUSETTS CLEAN ENERGY CENTER®

Environmental Justice Council Massachusetts Hydrogen Roadmap Briefing

May 9, 2024

Agenda

- Introduction and Objectives
- What is Hydrogen and Examples of Use
- Hydrogen in MA 2050 Climate Goals
- Future of Hydrogen in MA
- MA Hydrogen Roadmap
- Role of Stakeholders
- Clean Hydrogen Definition and Approach
- Hydrogen, Equity, and EJ Recommendations
- Next Steps

Objectives

- Introduce the concepts behind hydrogen for decarbonization
- Provide background on the MA Roadmap for hydrogen
- Solicit input on appropriate considerations for hydrogen equity and EJ strategy in the Roadmap

What is Hydrogen

1. Hydrogen is an **energy carrier** (not energy source)

2. Hydrogen has a high energy content and has the potential to emit no carbon emissions, which makes **hydrogen attractive as a clean energy solution, especially for hard-to-electrify sectors**

3. Hydrogen can be used as a **fuel, energy storage, or as feedstock**

4. The modes of **production, transport/storage, and use of hydrogen** impact the associated carbon emissions

Real world hydrogen applications in the U.S.

Photo Credit: UPS

Fuel cell delivery and parcel trucks starting deliveries in CA and NY

Photo Credit: FedEx

First fuel cell tow truck fleet at airport in Memphis

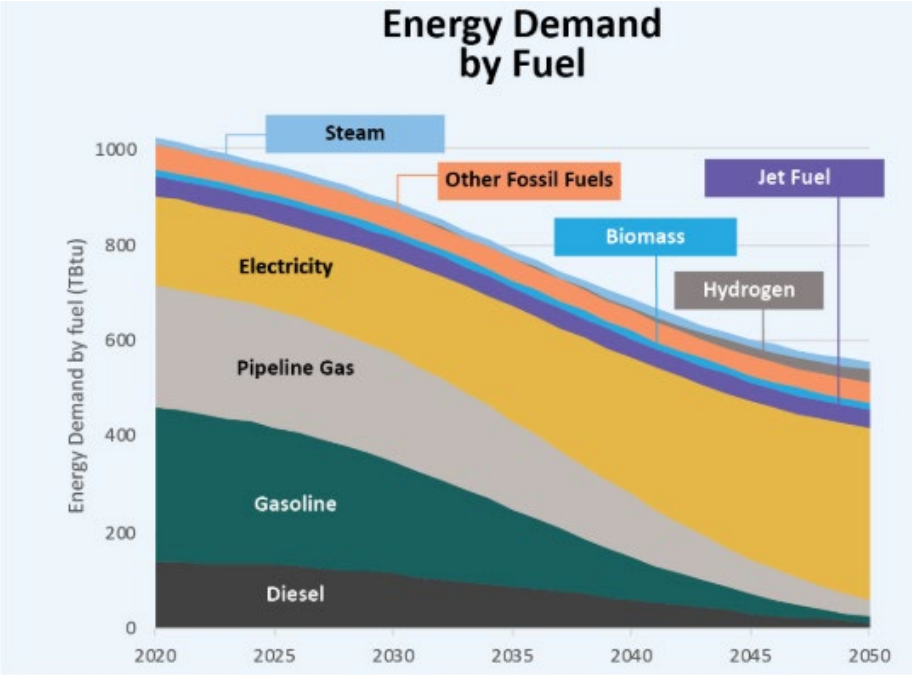
World's first fuel cell for maritime ports in Hawaii

Photo Credit: Sandia National Laboratories

Slide from DOE H2IQ Deck

Hydrogen and MA 2050 Climate Goals

- The 2050 Decarbonization Roadmap: Electrification is Massachusetts' primary decarbonization strategy
- Not all sectors or end uses are suitable candidates for electrification
- **Clean hydrogen will play a small, yet critical, role in MA achieving 2050 climate goals**



Massachusetts Decarbonization Roadmap, p24

Future of Hydrogen in MA

Clean hydrogen in MA will be used in:

- Targeted ways
- Alignment with our climate objectives
- Sectors that are otherwise difficult to decarbonize

How H2 to be Used in MA	Use Case / Application
• Fuel (combustion engine, turbines) • Fuel cell • Storage • Feedstock (potentially, but unlikely)	• Medium and heavy-duty vehicles • Specialty vehicles • Rail transport • Marine transport • Building back up power, combined heat and storage • Electricity generation and grid storage • Manufacturing and industrial processes • Aviation

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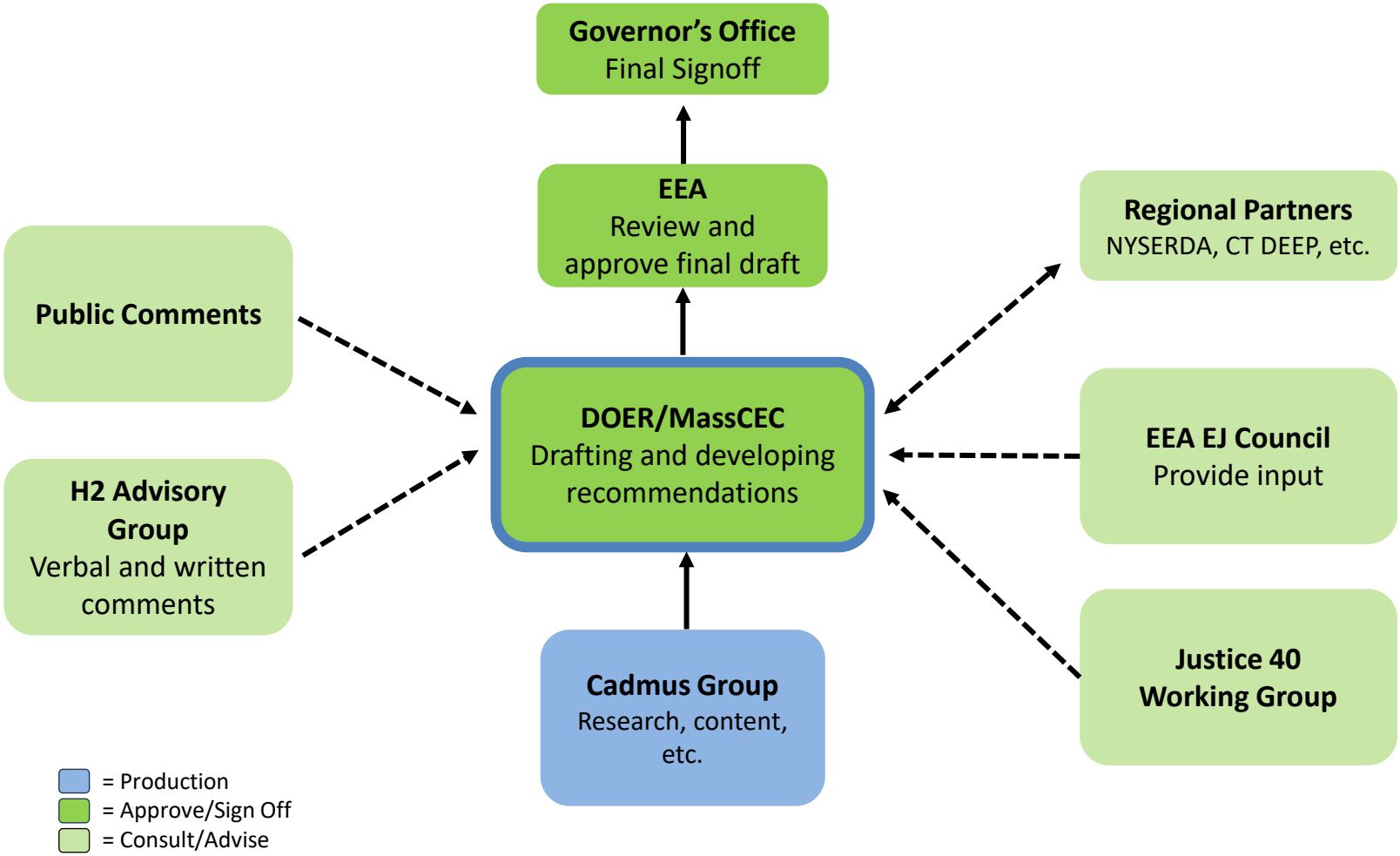
Massachusetts Hydrogen Roadmap

- **Provide strategic direction for hydrogen deployment and policy in MA**
  - Electrification is Massachusetts' primary decarbonization strategy
  - Hydrogen use will focus on hard-to-electrify sectors
  - The Roadmap will recommend specific actions Massachusetts should take, e.g., fund state projects, support private demonstration projects, modify existing policies to include hydrogen, etc.
- **Provide information to Stakeholders on the role of hydrogen**
  - How and why hydrogen is relevant in Massachusetts
  - Why further development and implementation in MA is necessary
  - Use cases for hydrogen that support decarbonization and benefit the MA economy and communities
- **Ensure that the benefits from clean hydrogen are distributed equitably, and that the Commonwealth's EJ principles are maintained**
  - Provide direction for workforce, safety, equity, environment, and community engagement

Role of Stakeholders in Roadmap Development



Clean Hydrogen Definition

- **Massachusetts Definition of Clean Hydrogen**
  - Potential options include:
    - Green hydrogen (produced using only renewable energy)
    - Any hydrogen produced that does not exceed a set carbon equivalency standard
    - Any hydrogen not from fossil fuel-based production, including carbon capture

- **Considerations**
  - The Massachusetts definition of clean hydrogen in the Roadmap will be a policy statement, not a regulatory definition that will be used for a specific use
  - U.S. Department of Energy uses a definition based on carbon intensity (kg of CO2 per kg of H2)
  - An IRS definition of clean hydrogen for the purposes of Federal tax credit eligibility (BIL Section 45V) will influence how MA industries will produce and use hydrogen
  - Other jurisdictions have set various standards
    - The European Union uses a Green Hydrogen Standard
    - Connecticut's standard is hydrogen produced from non-GHG emitting sources
    - New York's standard is electrolytic hydrogen from renewable sources
    - Washington State's standard excludes fossil fuel-based hydrogen, but allows hydrogen derived from biogas or biomass

Hydrogen, Equity, and Environmental Justice

What steps must MA take to ensure that clean hydrogen deployment in the state is equitable and achieves the environmental justice principles?

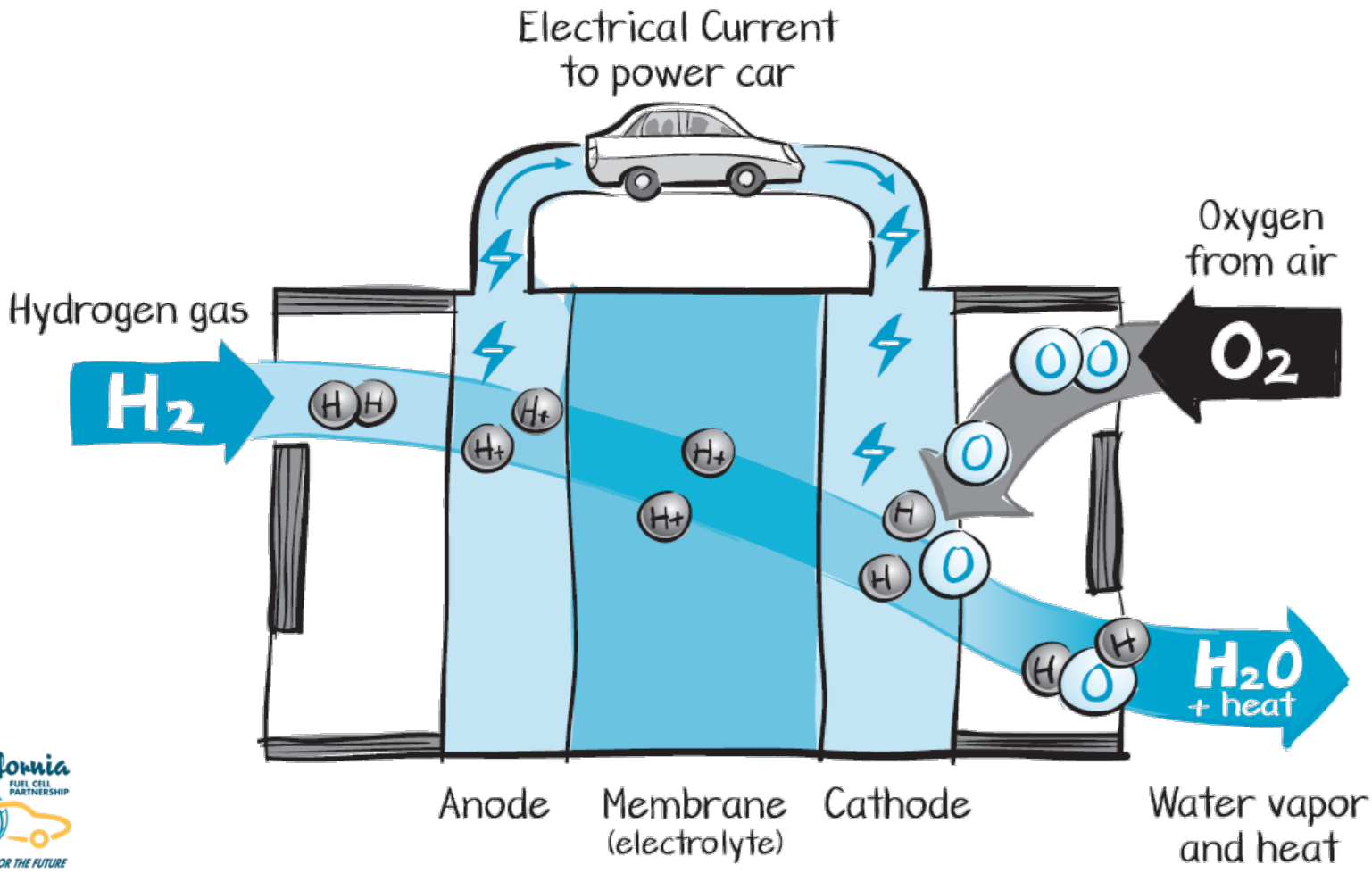
- Starting point for the discussion:
  - **Engagement**: Public outreach, education, and involvement
  - **Siting**: Community benefits (such as reductions in diesel emissions) need to be weighed against potential negative impacts on communities from facility siting
  - **Water**: The U.S. National Clean Hydrogen Roadmap identifies the need to conduct impact assessments of hydrogen technologies on regional water supplies as a medium-term (2026-2029) action to enabling a clean hydrogen economy; this should also be a key step for Massachusetts
  - **Safety:**
    - Hydrogen can be safely sited and managed using the National Fire Prevention Association code NFPA 2, which has been adopted by Massachusetts
    - Training for local building and fire officials will be part of the Roadmap recommendations
  - **State incentives:** Any state support or incentives for hydrogen production or uses must have clear requirements for community engagement, including Community Benefit Plans
  - **Additions, revisions, other considerations**

Next Steps

- Currently drafting the Roadmap, including developing the full EJ and Equity Strategy and Plan
- Incorporate EJ Council, Justice 40 Working Group input into Roadmap
- Incorporate upcoming advisory group meeting, focused on equity and environmental justice, into Roadmap
- Post Roadmap publication, the recommendations and strategies for H2 are implemented by the Commonwealth

What is a fuel cell?

Takes hydrogen in and puts electricity and water vapor out



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Slide from DOE H2IQ Deck

What is an Electrolyzer?

- **Electrolysis**: process that splits water into hydrogen and oxygen by using electricity
- **Electrolyzer**: the unit that this process occurs within
- Electrolyzers contain an anode, electrolyte (in the middle), and cathode

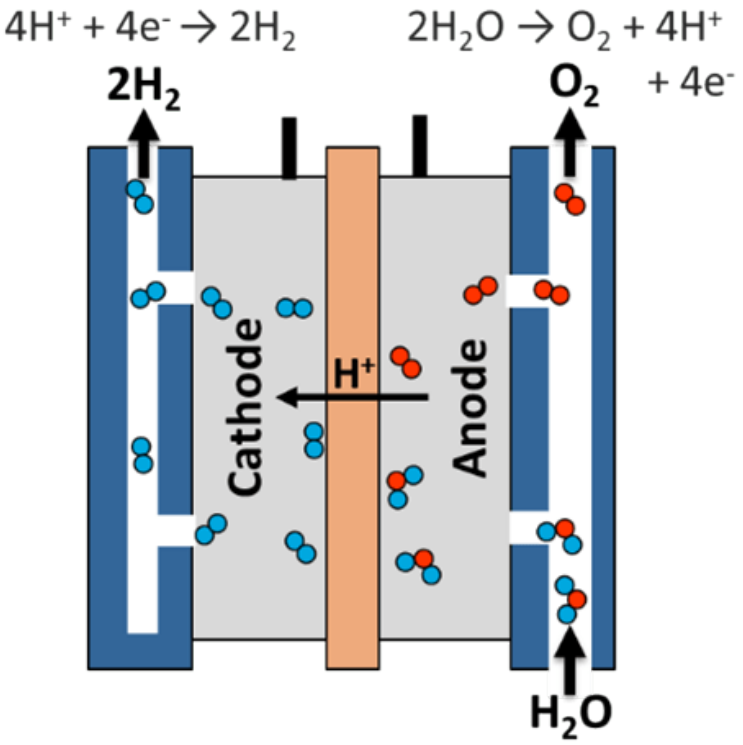

Image from DOE