Overview of Recent Hydrogen Policy Developments

Emily Beagle, PhD

UT Hydrogen Day

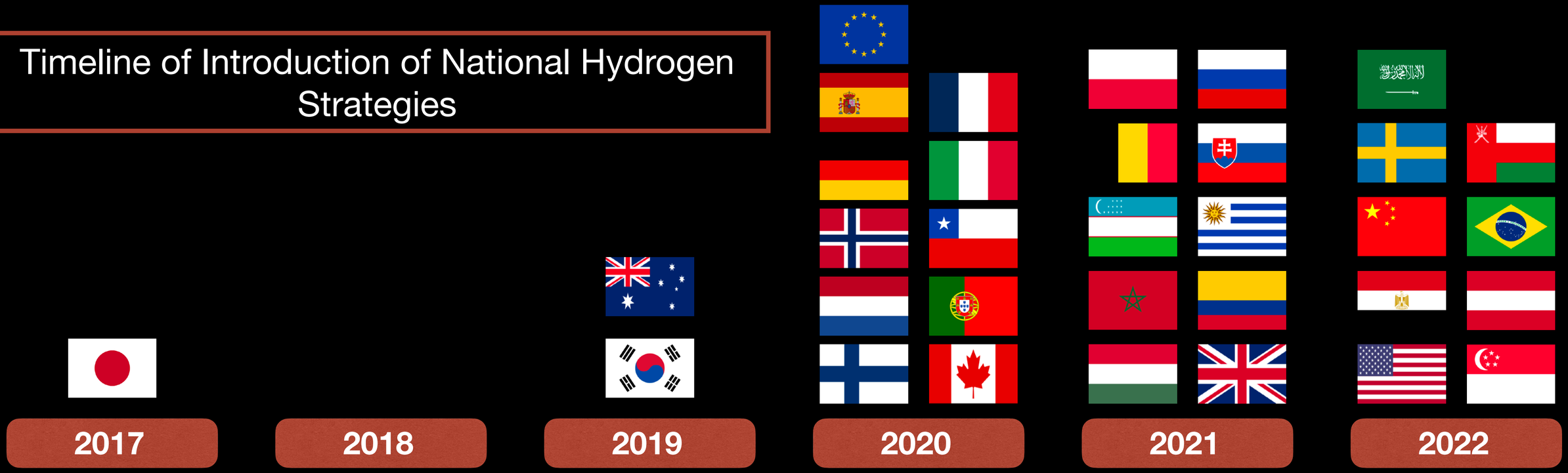
5 October 2023

Webber Energy Group

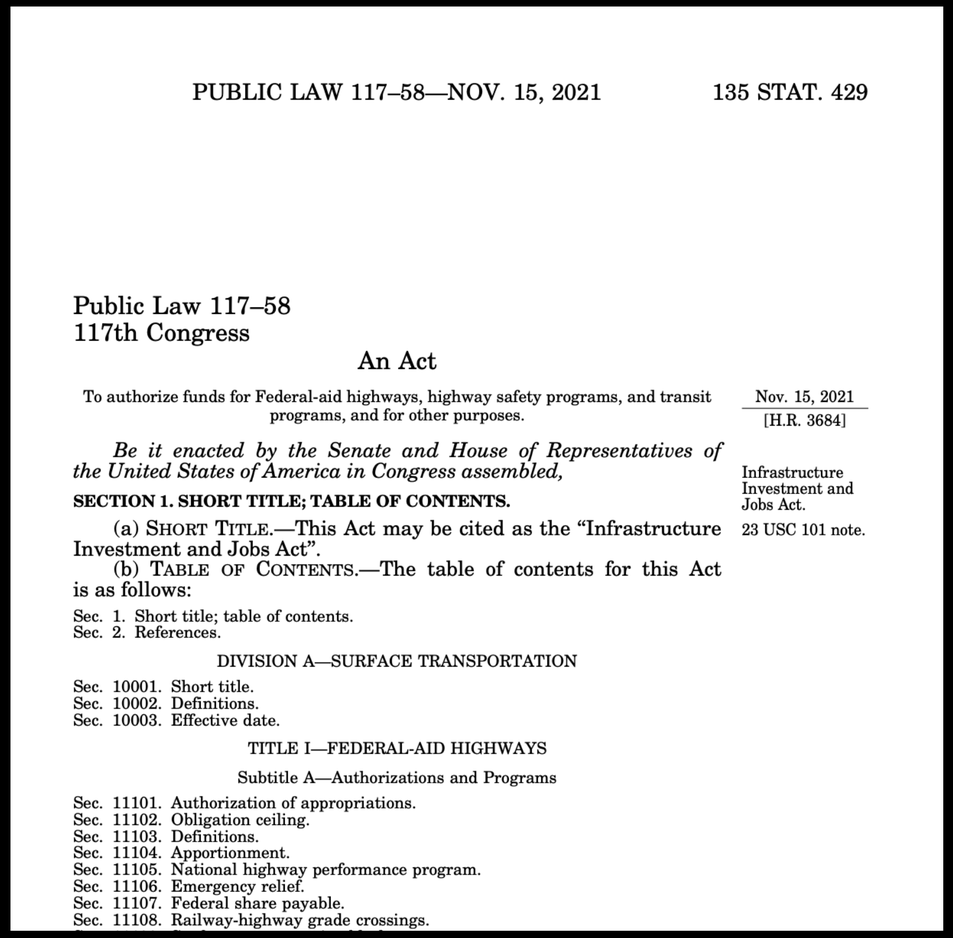
THE UNIVERSITY OF TEXAS AT AUSTIN

Recent years have seen significant international momentum to develop the hydrogen economy

Timeline of Introduction of National Hydrogen Strategies



The bipartisan *Infrastructure Investment and Jobs Act (IIJA or BIL)* delivers tens of billions of dollars for climate and energy



PUBLIC LAW 117–58—NOV. 15, 2021 135 STAT. 429

Public Law 117–58
117th Congress

An Act

To authorize funds for Federal-aid highways, highway safety programs, and transit programs, and for other purposes.

Nov. 15, 2021
[H.R. 3684]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Infrastructure Investment and Jobs Act.

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

23 USC 101 note.

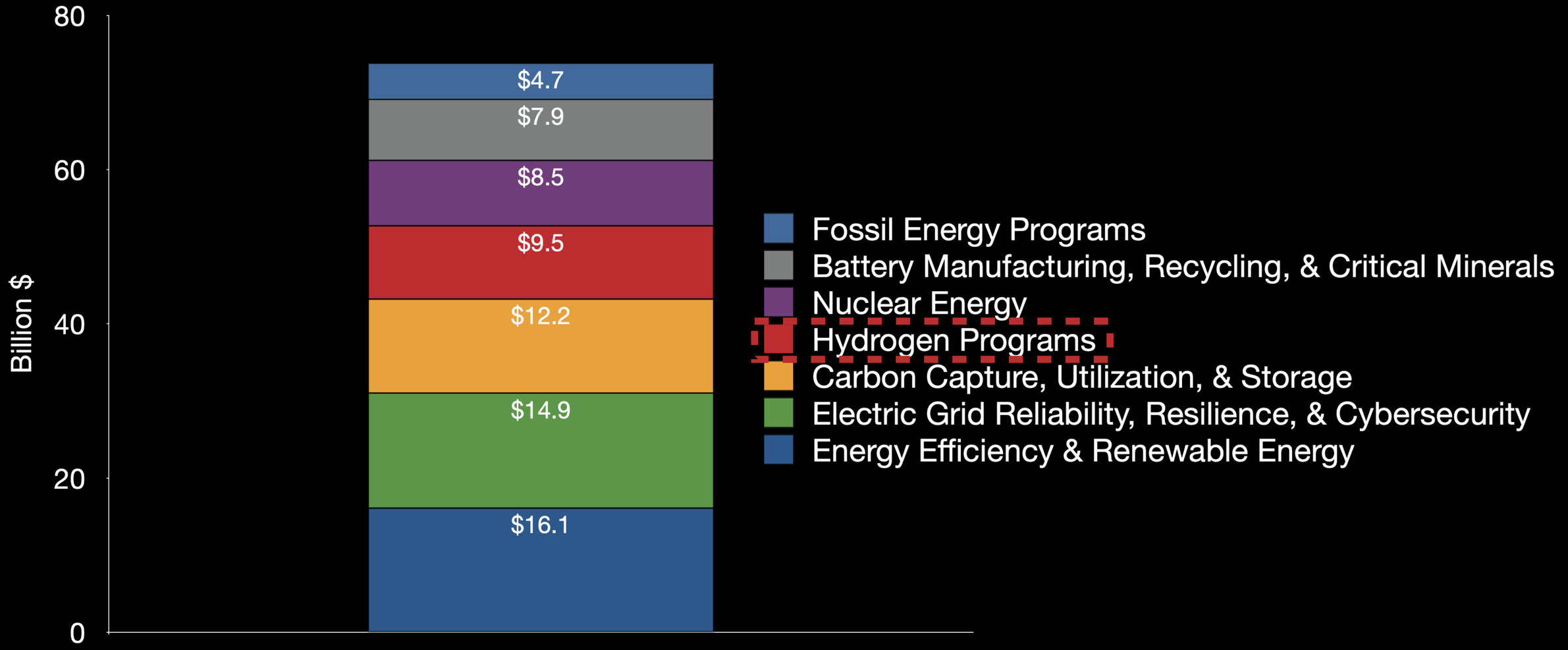
(a) SHORT TITLE.—This Act may be cited as the "Infrastructure Investment and Jobs Act".

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

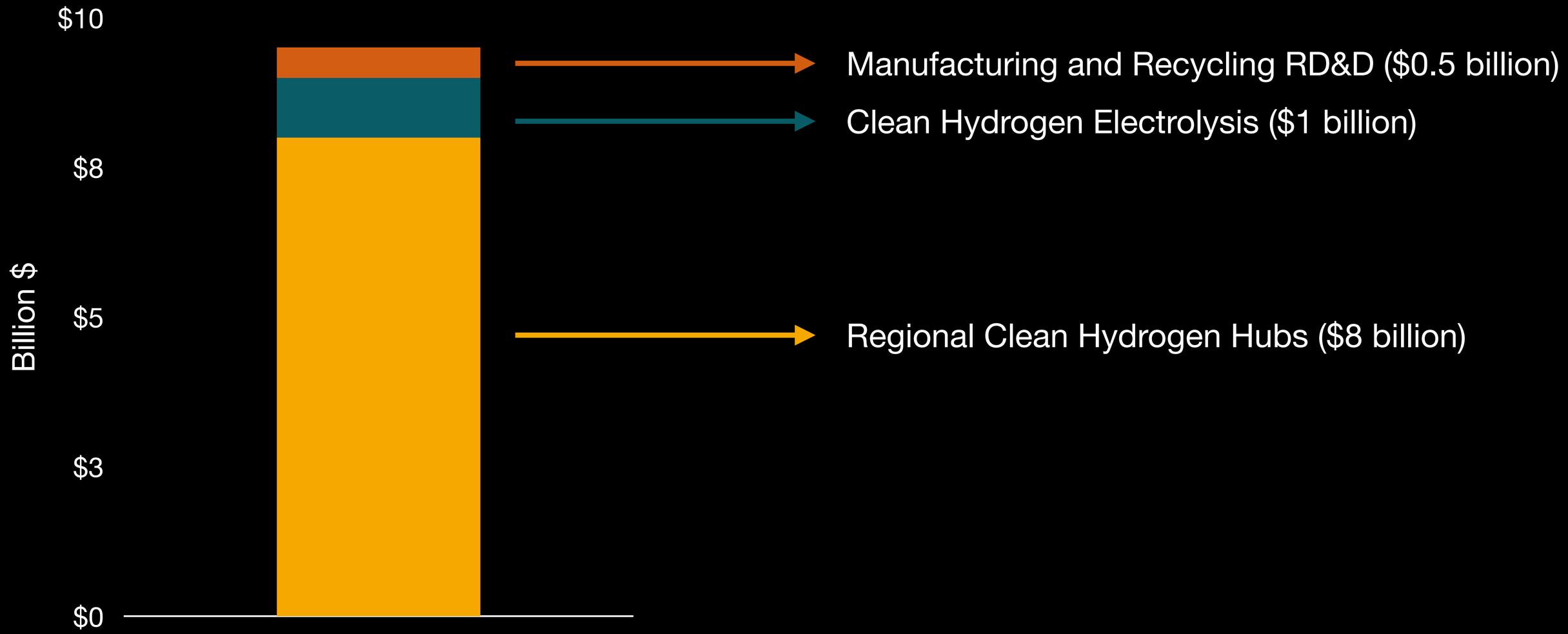
- Signed into law: November 2021
- Bipartisan: 69 - 30 in Senate; 228 - 206 in House

Bill text available here

The *Bipartisan Infrastructure Law* includes $9.5 billion for hydrogen programs



BIL hydrogen programs target early stage R&D through large-scale demonstration and hydrogen hubs



Regional Clean Hydrogen Hubs program ($8 billion) is currently in application phase and has specific requirements

Production

At least one from…

Renewable energy

Nuclear energy

Fossil fuels

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Nuclear energy

Fossil fuels

End Use

At least one in...

Residential and commercial heating

Electric power generation

Transportation

Industrial sector

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At least one from…

- Renewable energy
- Nuclear energy
- Fossil fuels

End Use

At least one in…

- Residential and commercial heating
- Electric power generation
- Transportation
- Industrial sector

Geography

Each in different regions of the US

At least two in…

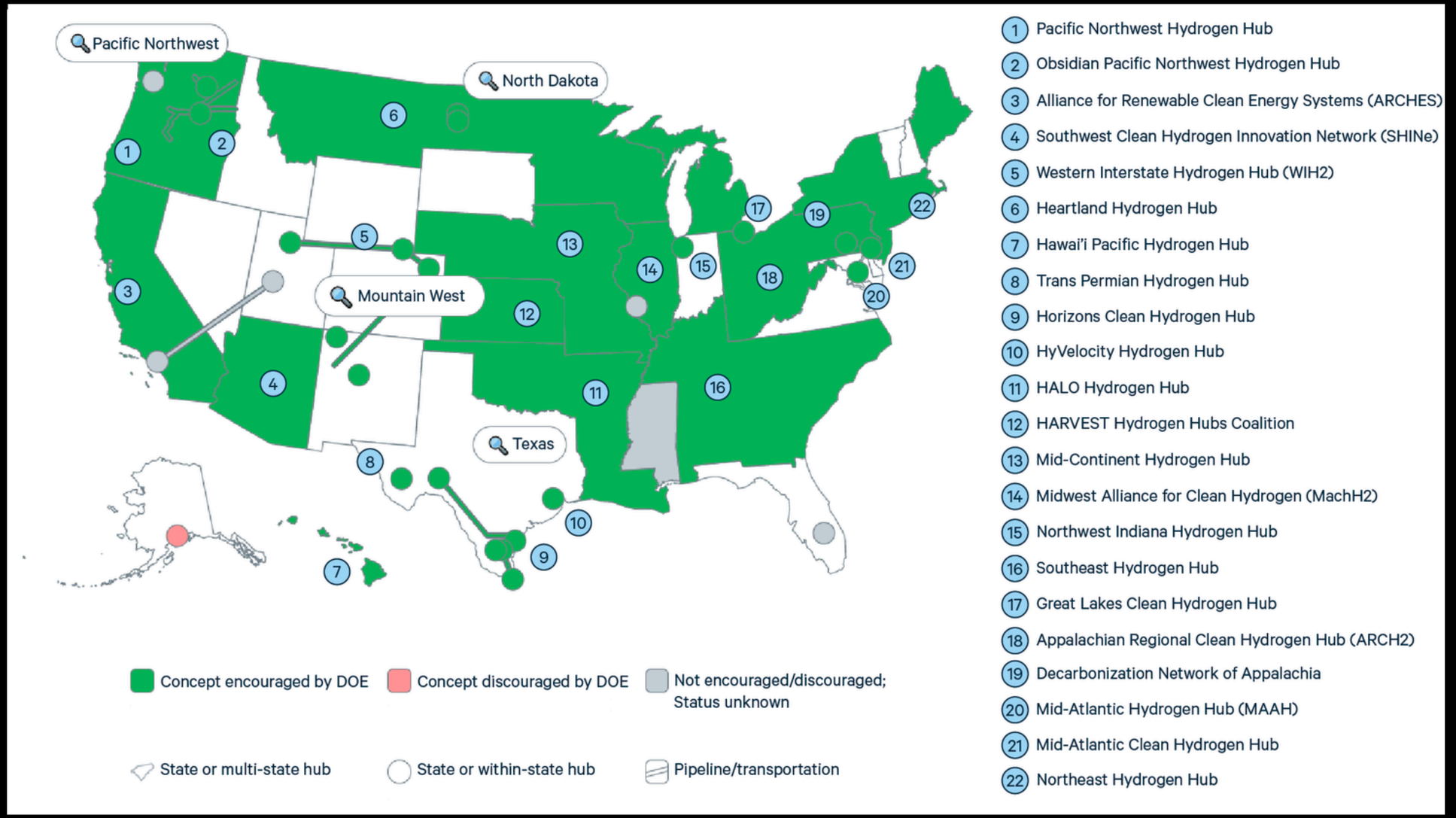
- Natural gas producing regions

Map of publicly known US hydrogen hub proposal locations

Concept papers submitted: **November 2022**

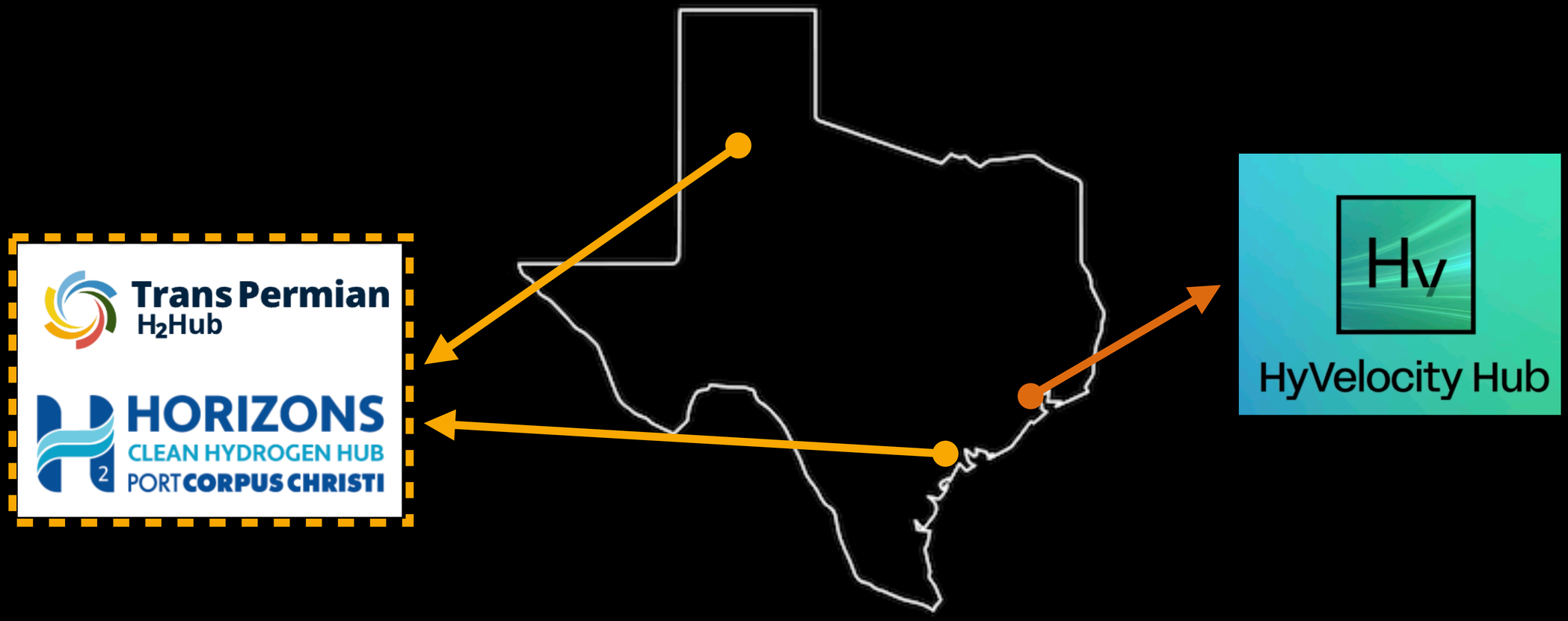
Initial proposals submitted: **April 7, 2023**

Project selection status: **ongoing - expected announcements Fall 2023**



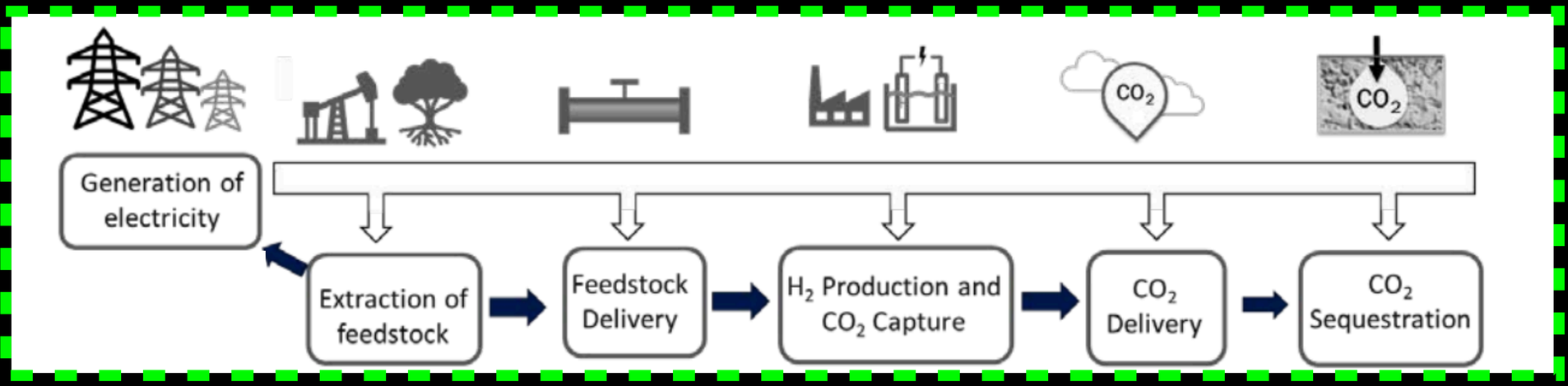
Map by: Resources for the Future

Texas is aiming to be a central location for regional clean hydrogen hub projects



The BIL also mandated establishment of a clean hydrogen production standard (CHPS) in the US

Well-to-gate system boundary for emissions considered in finalized CHPS guidance

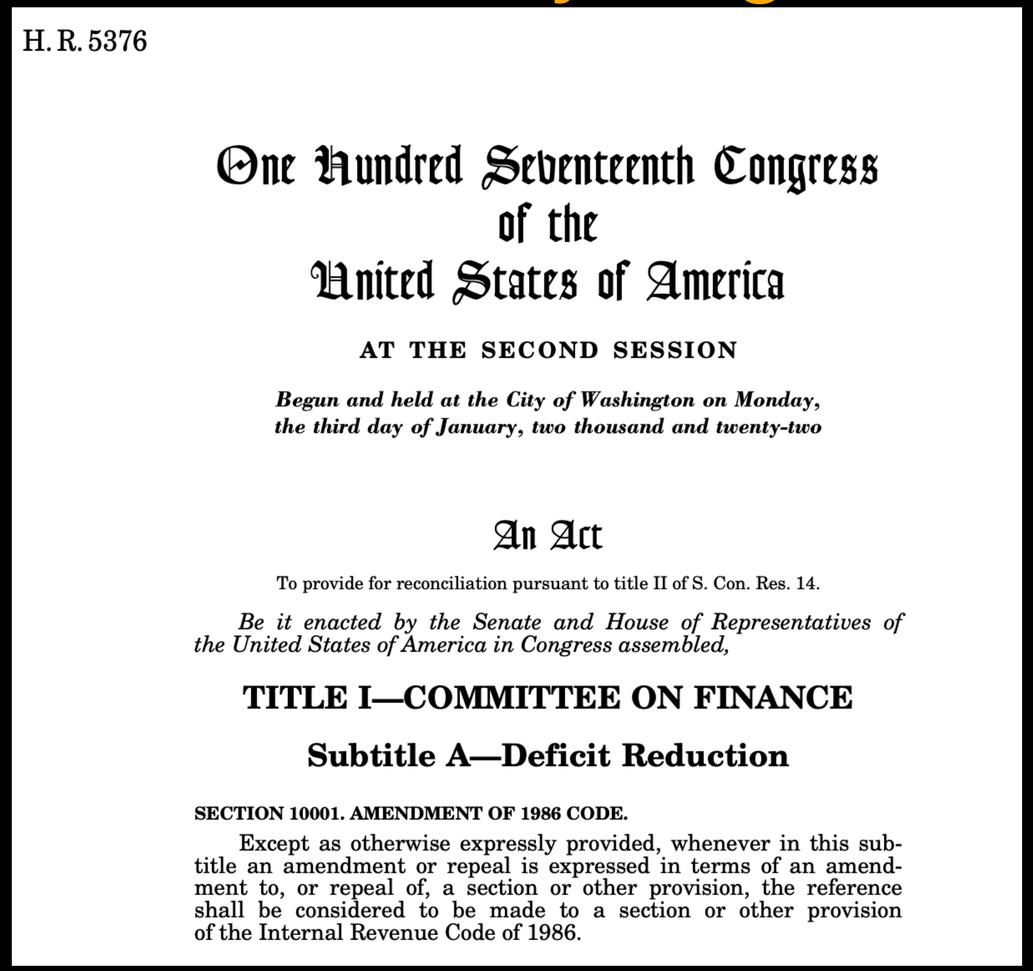


Finalized guidance:

<4 kg CO_{2e}/kg H_2
lifecycle emissions

Guidance document available here

The *Inflation Reduction Act* also included provisions for clean hydrogen



H. R. 5376

One Hundred Seventeenth Congress
of the
United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Monday, the third day of January, two thousand and twenty-two

An Act

To provide for reconciliation pursuant to title II of S. Con. Res. 14.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—COMMITTEE ON FINANCE

Subtitle A—Deficit Reduction

SECTION 10001. AMENDMENT OF 1986 CODE.

Except as otherwise expressly provided, whenever in this subtitle an amendment or repeal is expressed in terms of an amendment to, or repeal of, a section or other provision, the reference shall be considered to be made to a section or other provision of the Internal Revenue Code of 1986.

Bill text available here

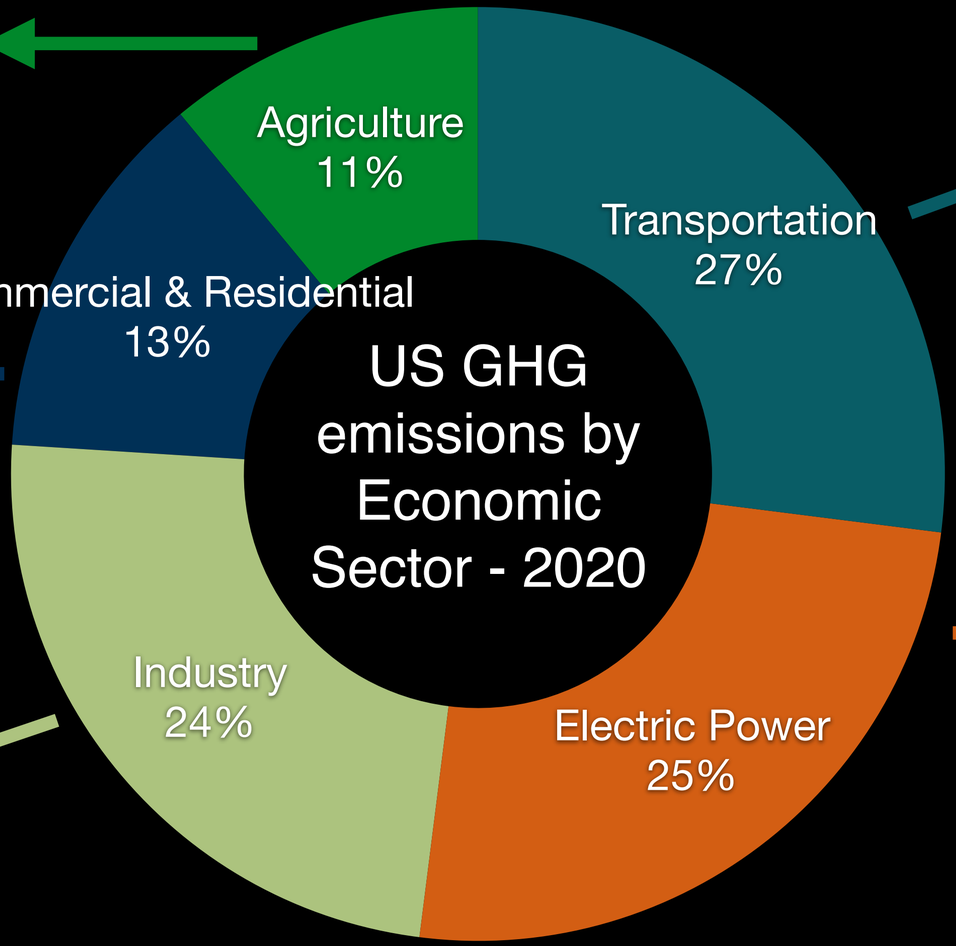
- Signed into law: August 2022
- Passed strictly on party lines (51-50 Senate; 220-207-4 House)
- Three main sections (not just a climate/energy bill)
  - 1) Climate and Energy
  - 2) Healthcare
  - 3) Tax Code Changes

The *IRA* strategically targets all sectors of the economy to reduce emissions

- Agriculture conservation investments
- National Forest fuel and restoration projects

- Energy efficient commercial building deduction
- Energy efficient home credit
- Electrification appliance credits

- CCUS 45Q Credit
- Clean hydrogen PTC
- Clean energy manufacturing investment credit

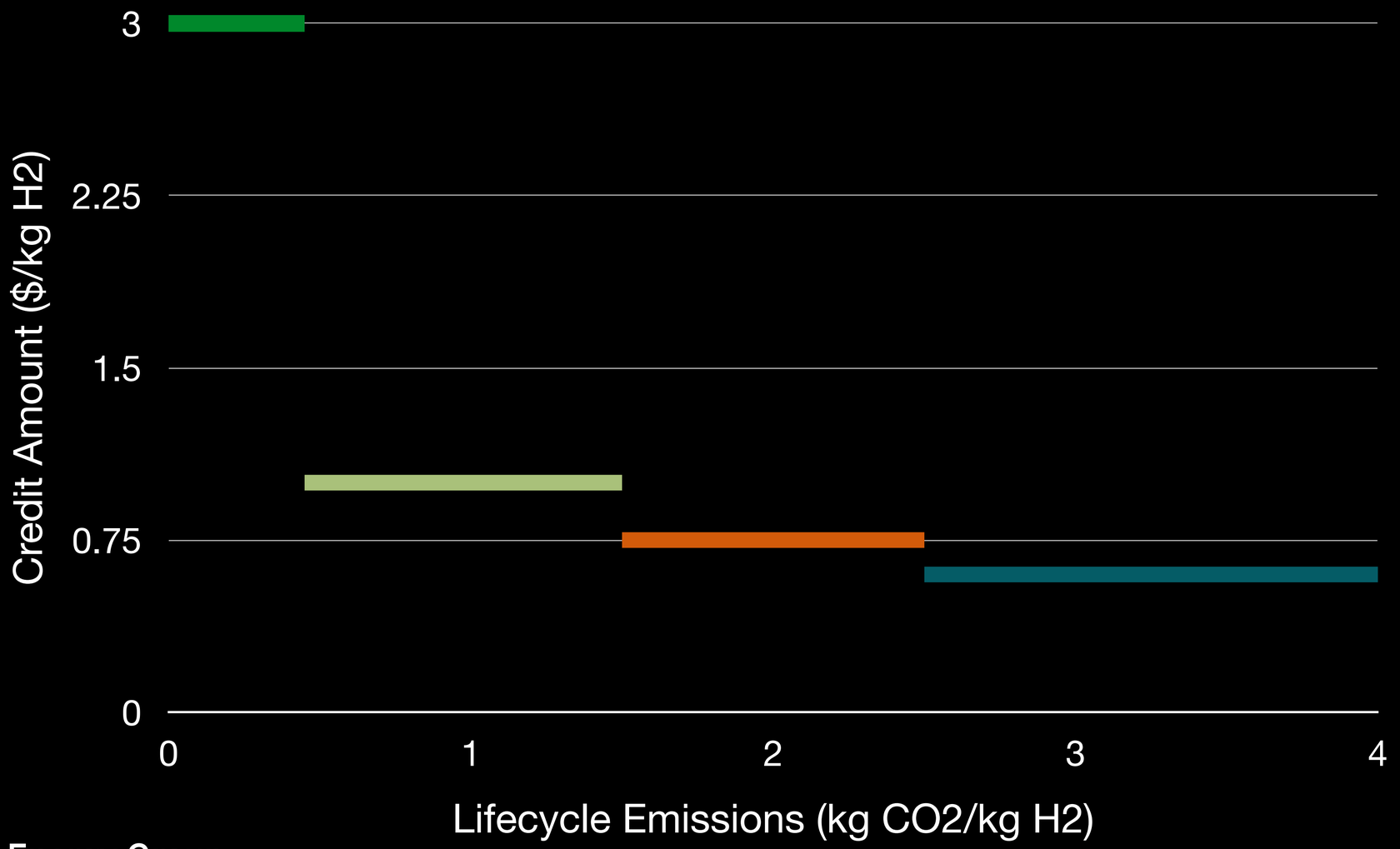


- Incentives for bio and alternative fuels
- Sustainable aviation fuel credit
- Clean vehicle credit

- Clean electricity production tax credit
- Clean electricity investment tax credit
- Transmission line grants

And many more…!

The new Clean Hydrogen Production Tax Credit in the *Inflation Reduction Act* could make clean hydrogen production competitive



*Includes full tax credit bonuses

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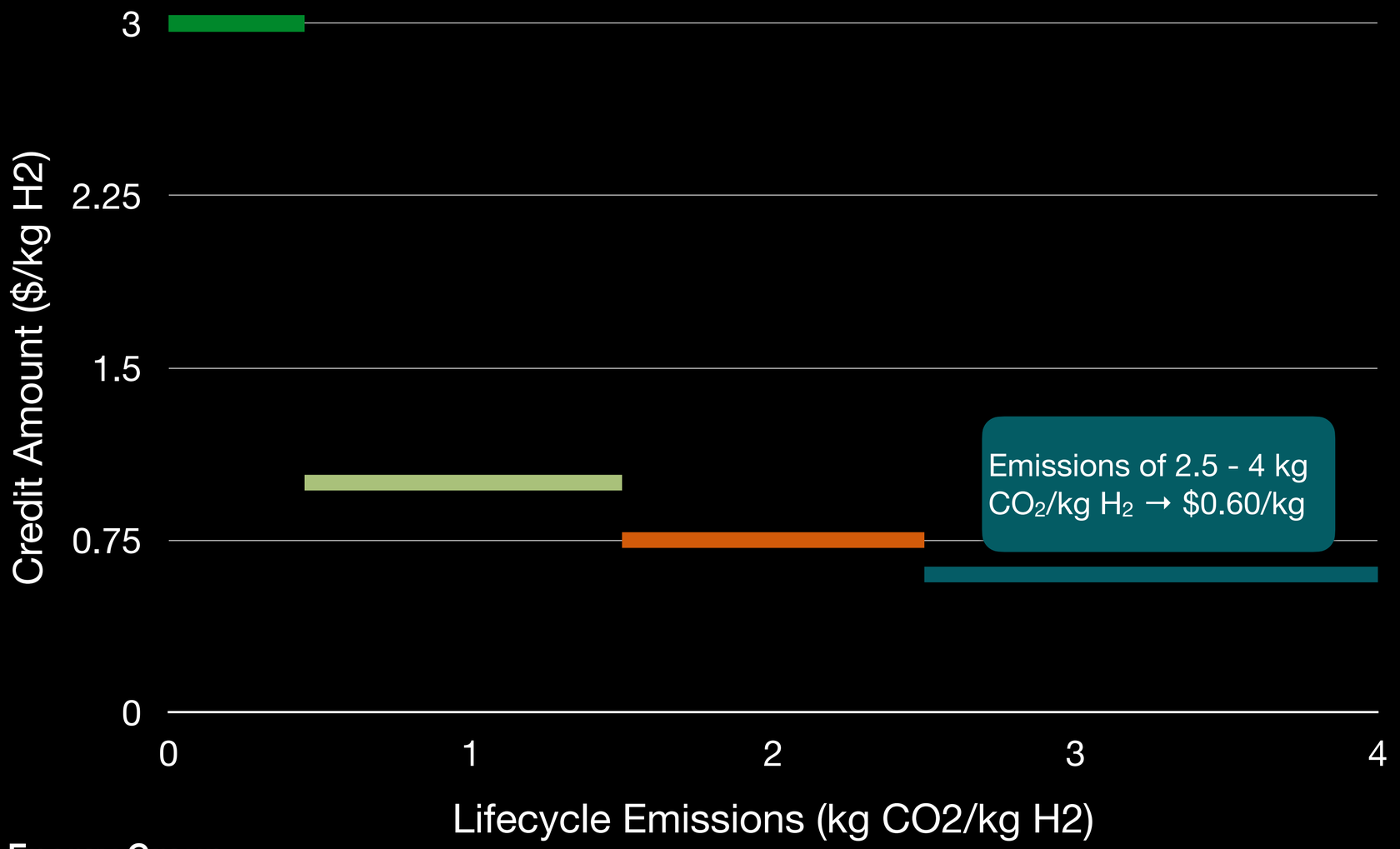

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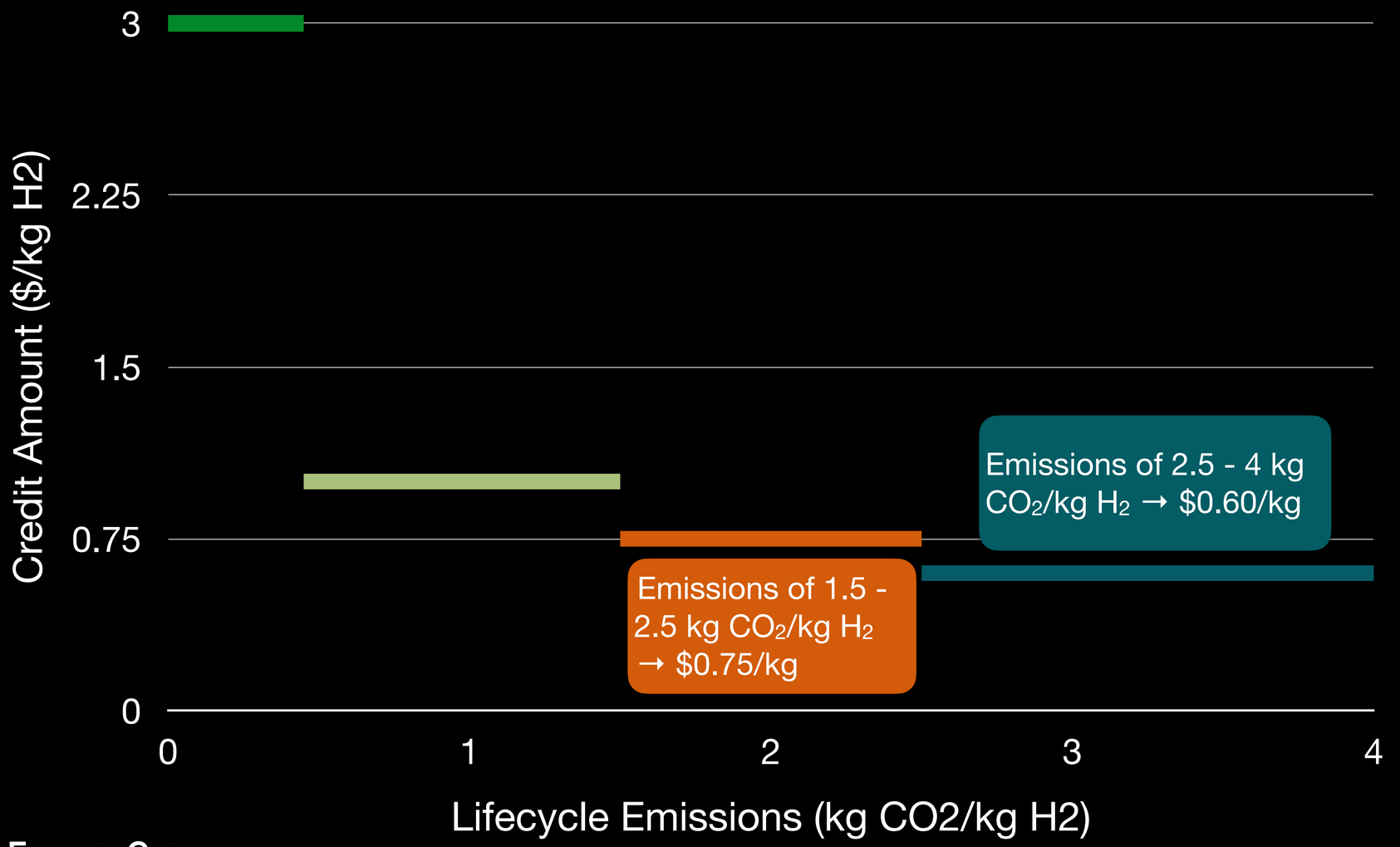

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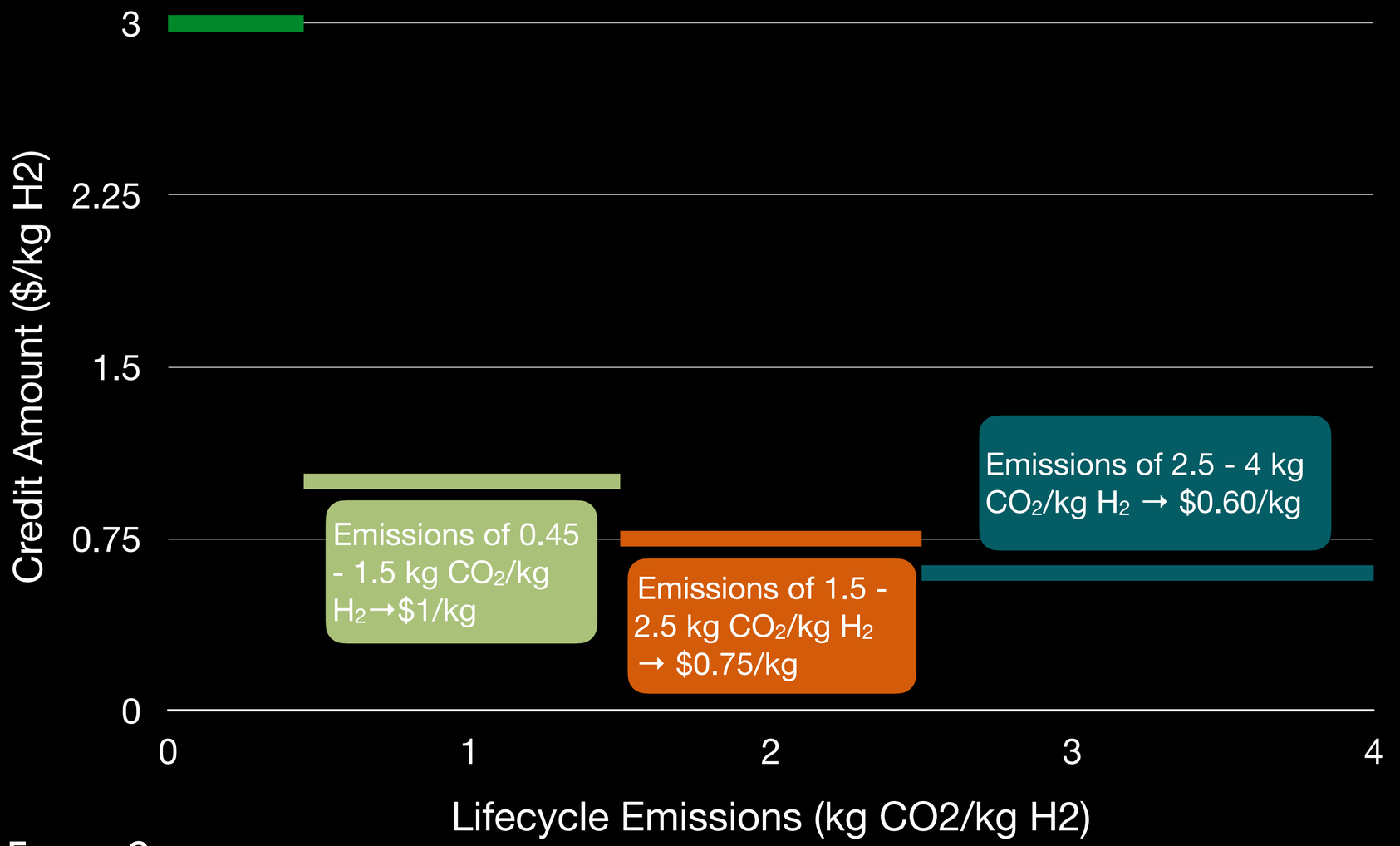

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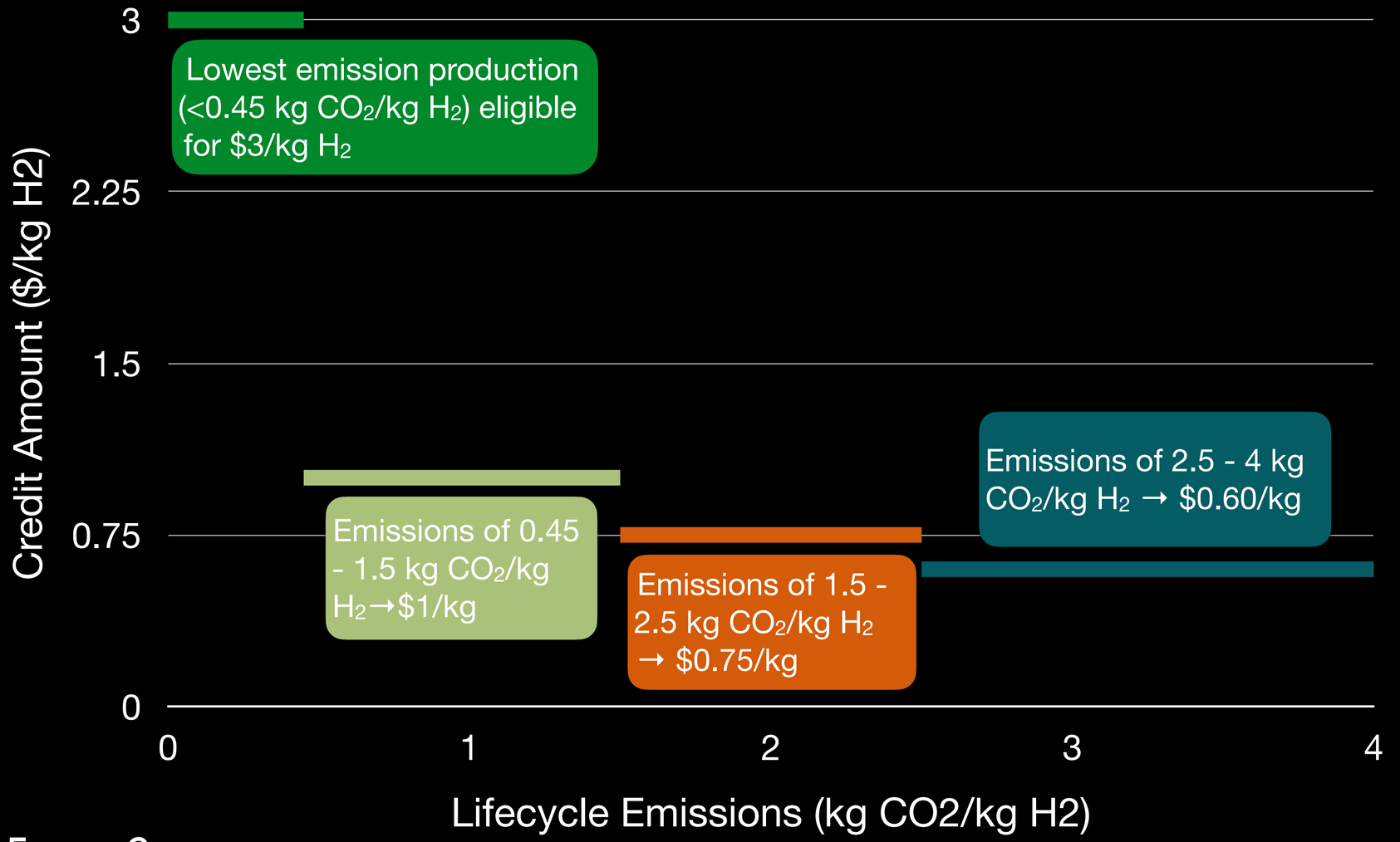

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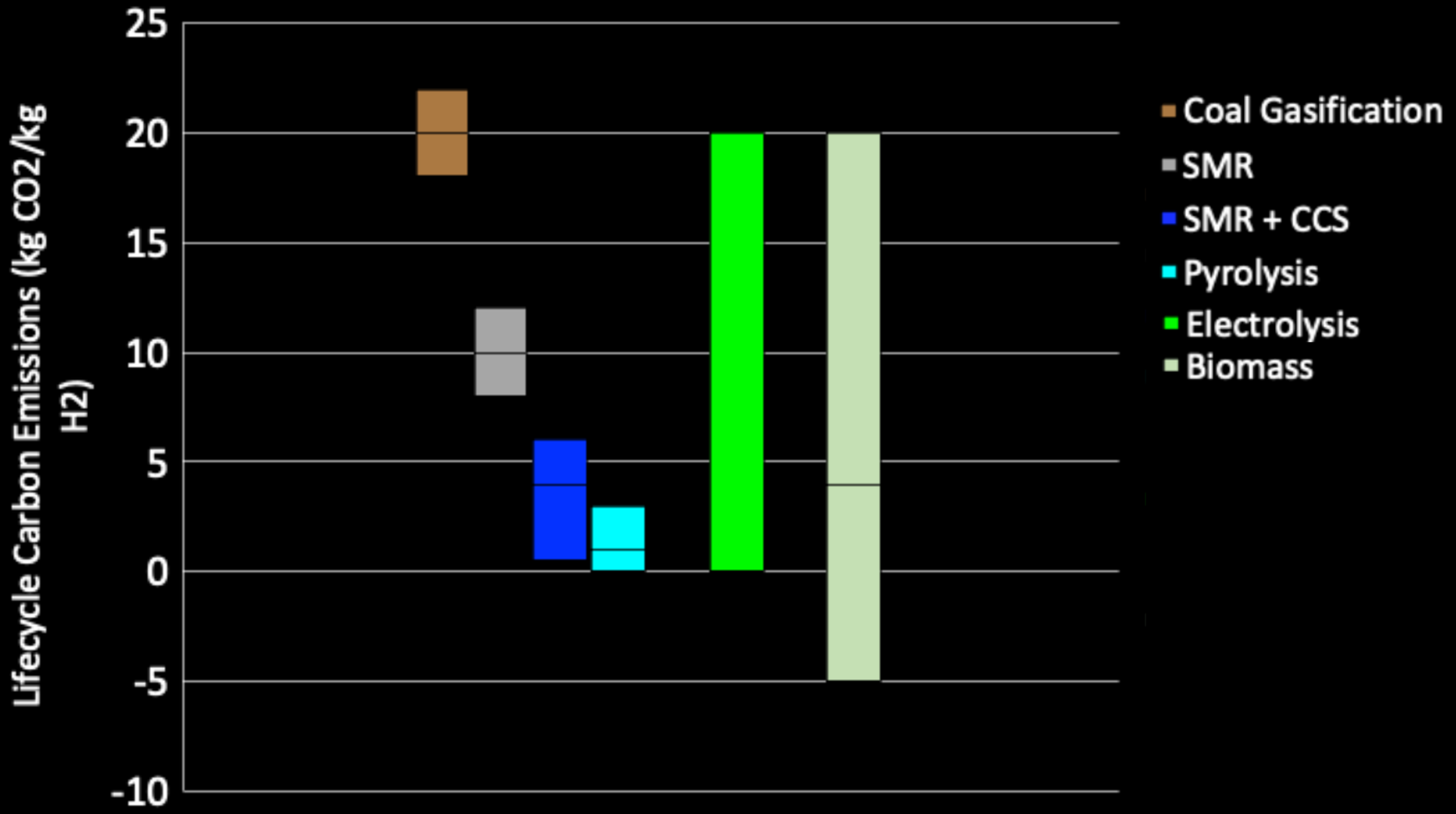
Carbon intensity of hydrogen production varies significantly even across similar pathways



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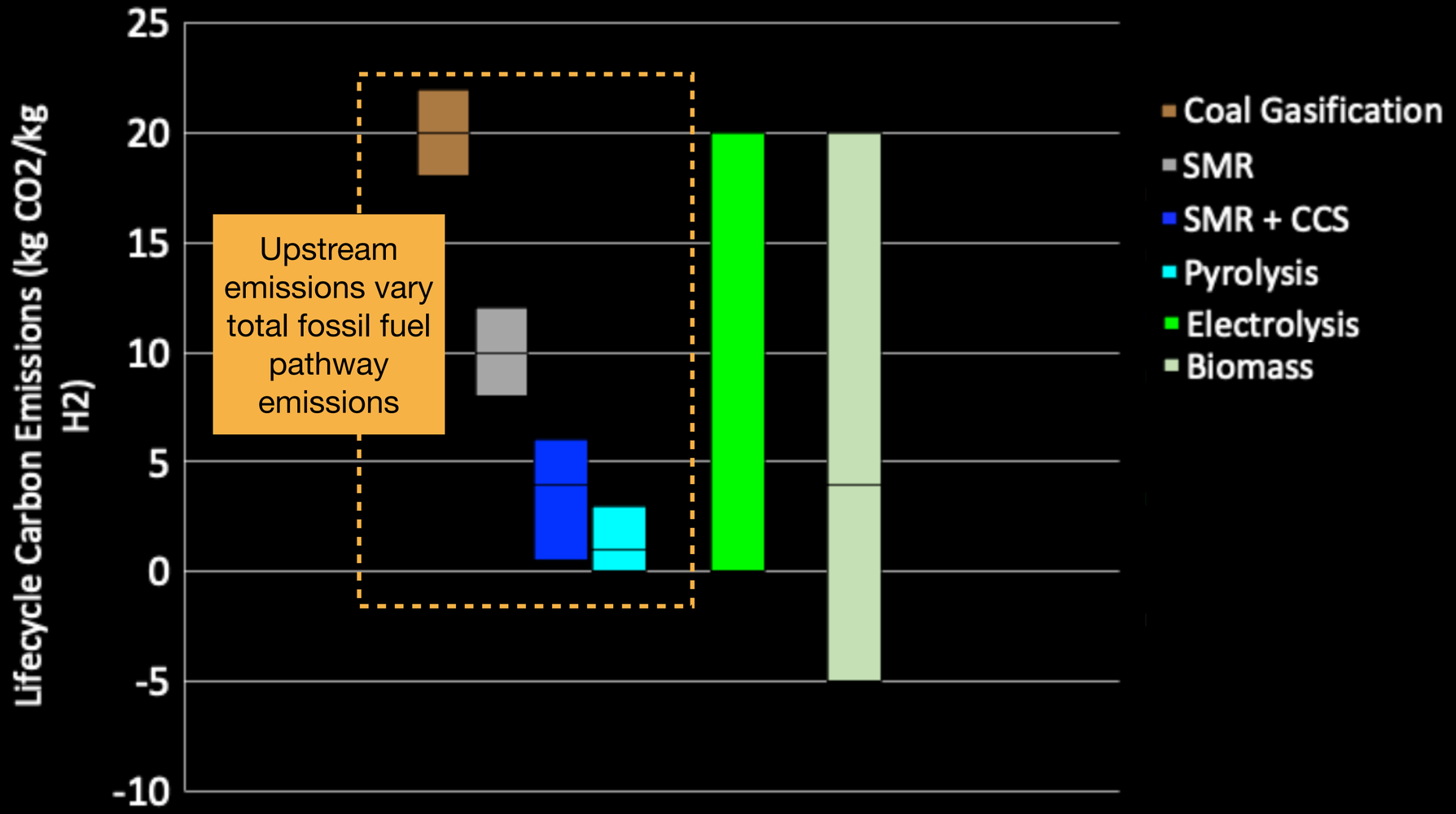

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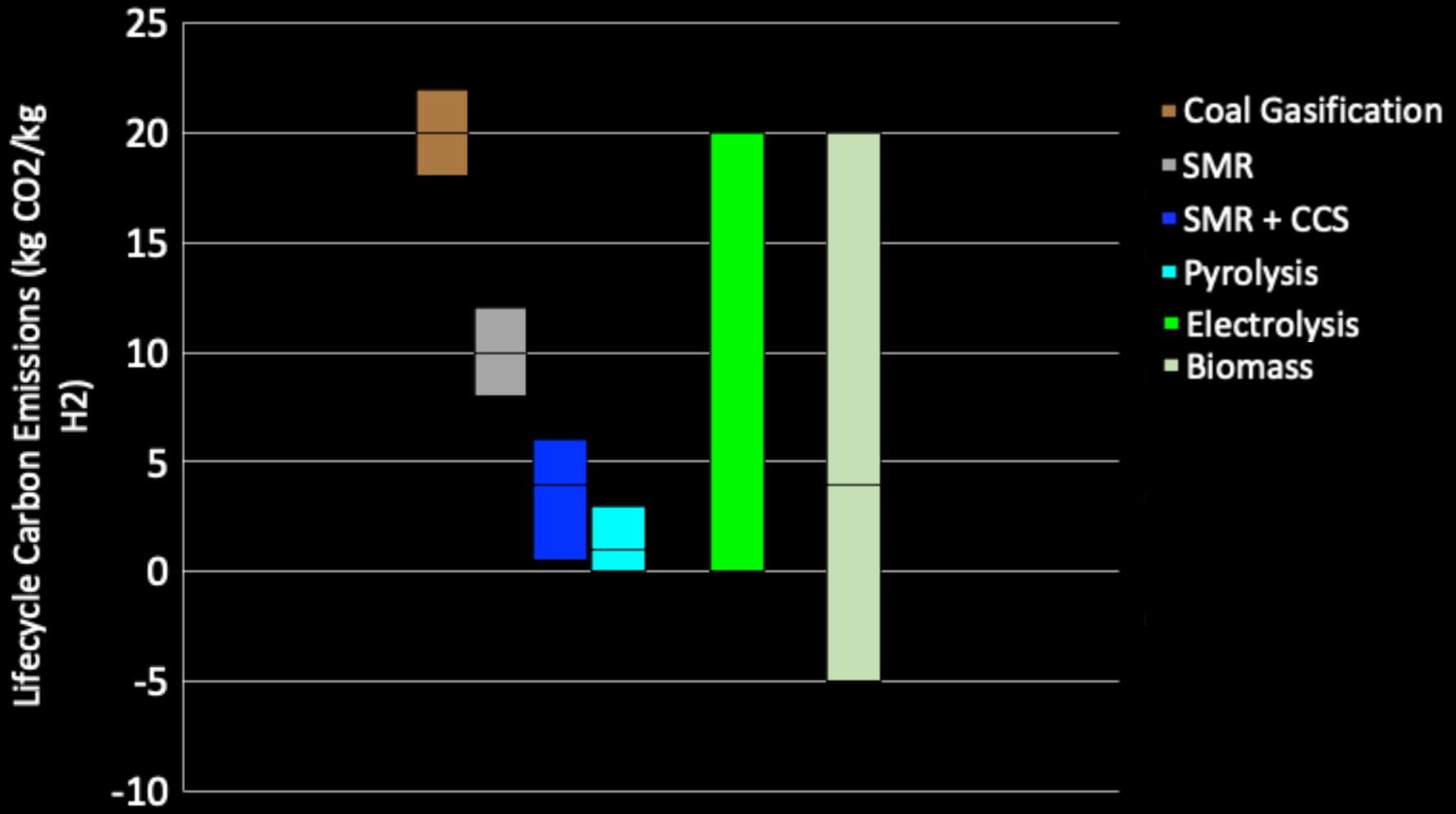

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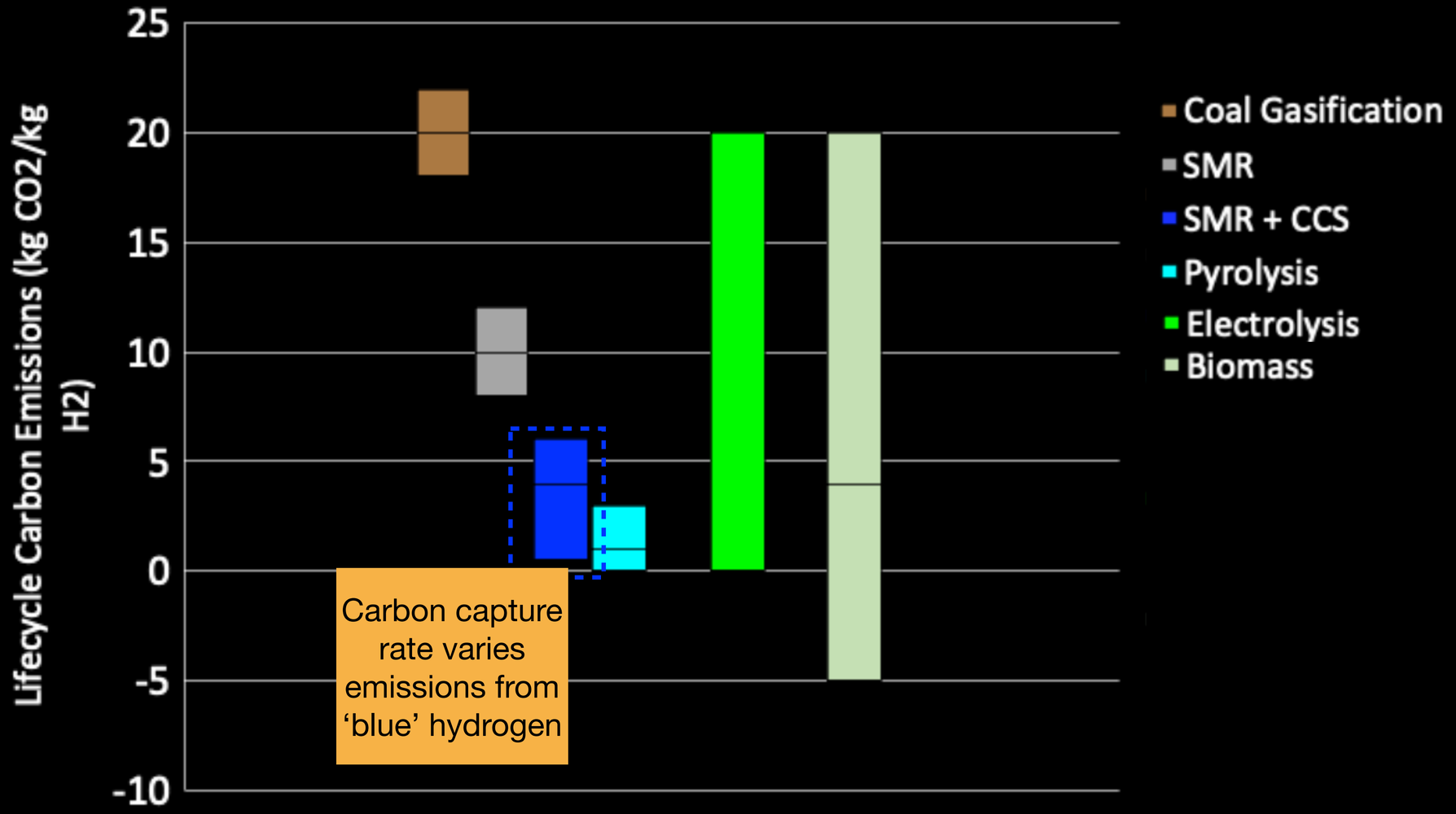

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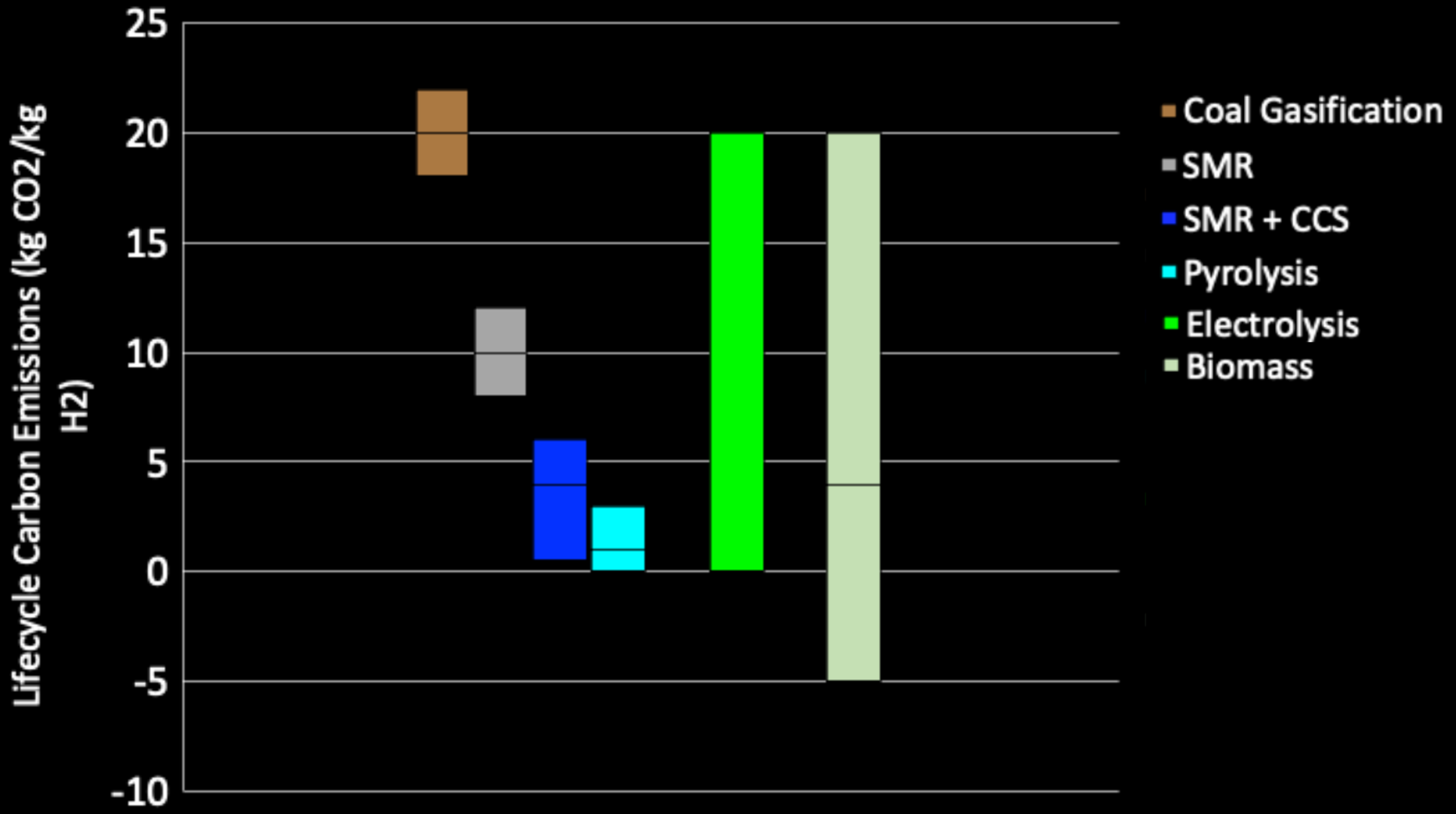

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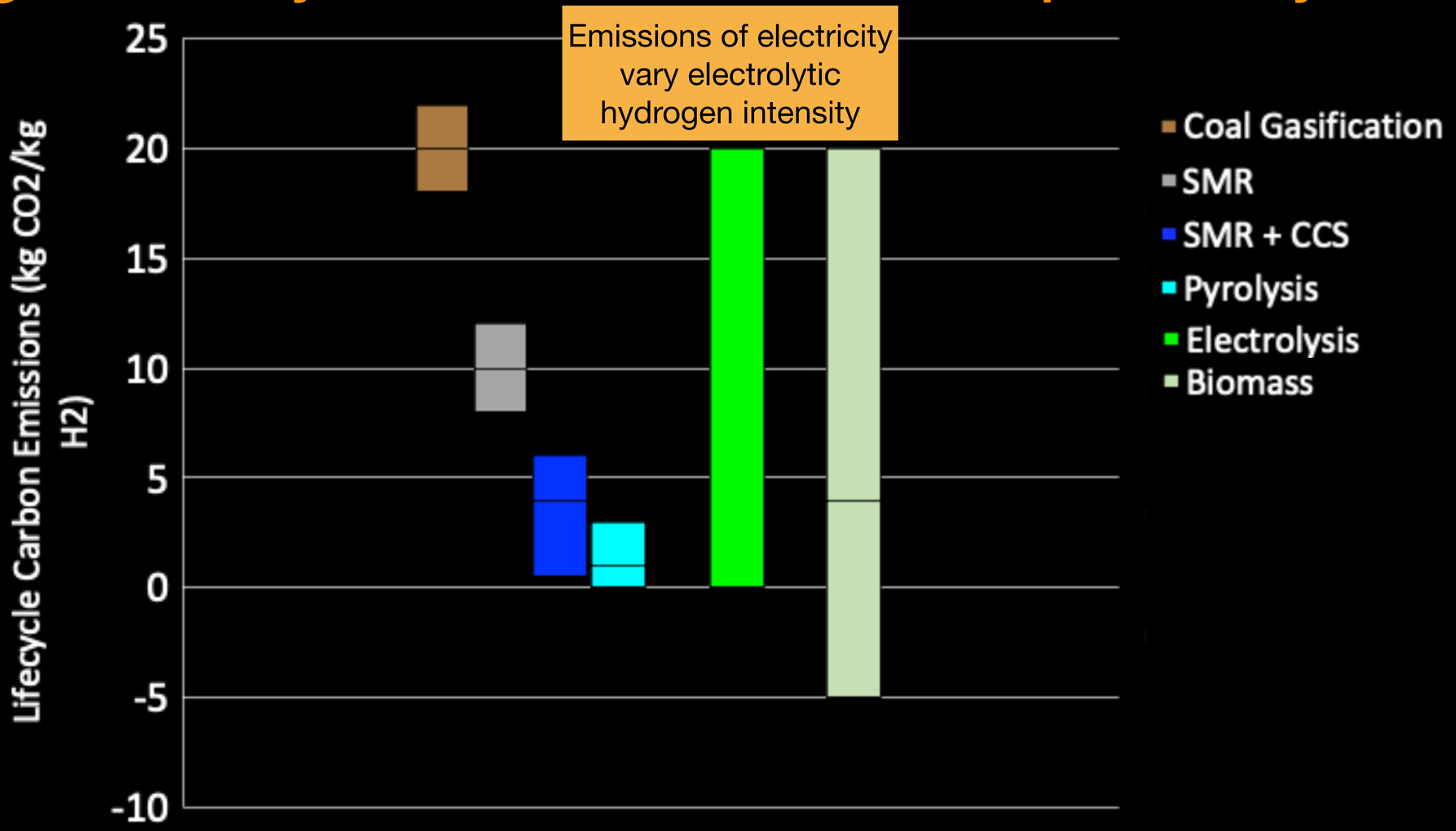

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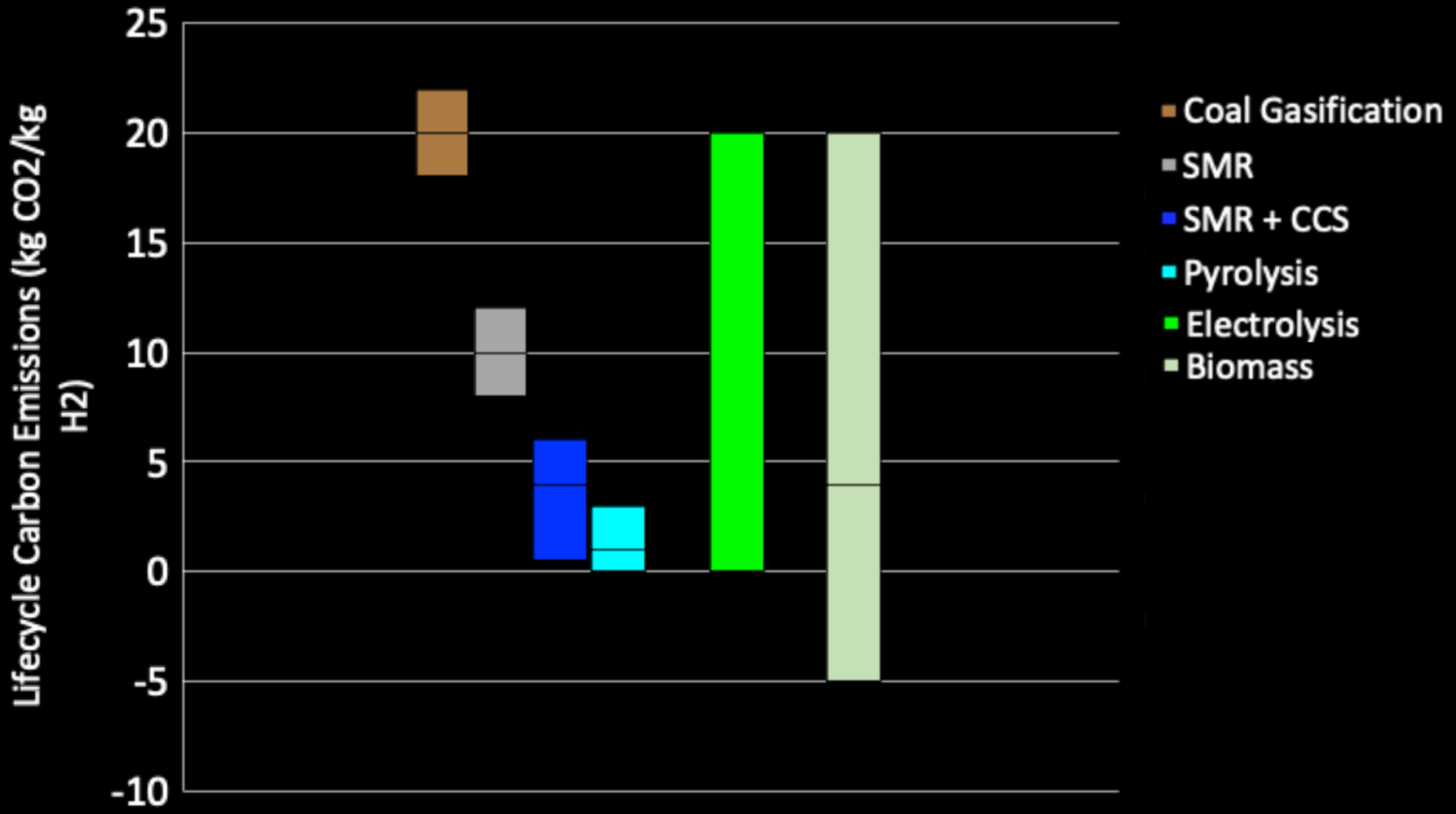

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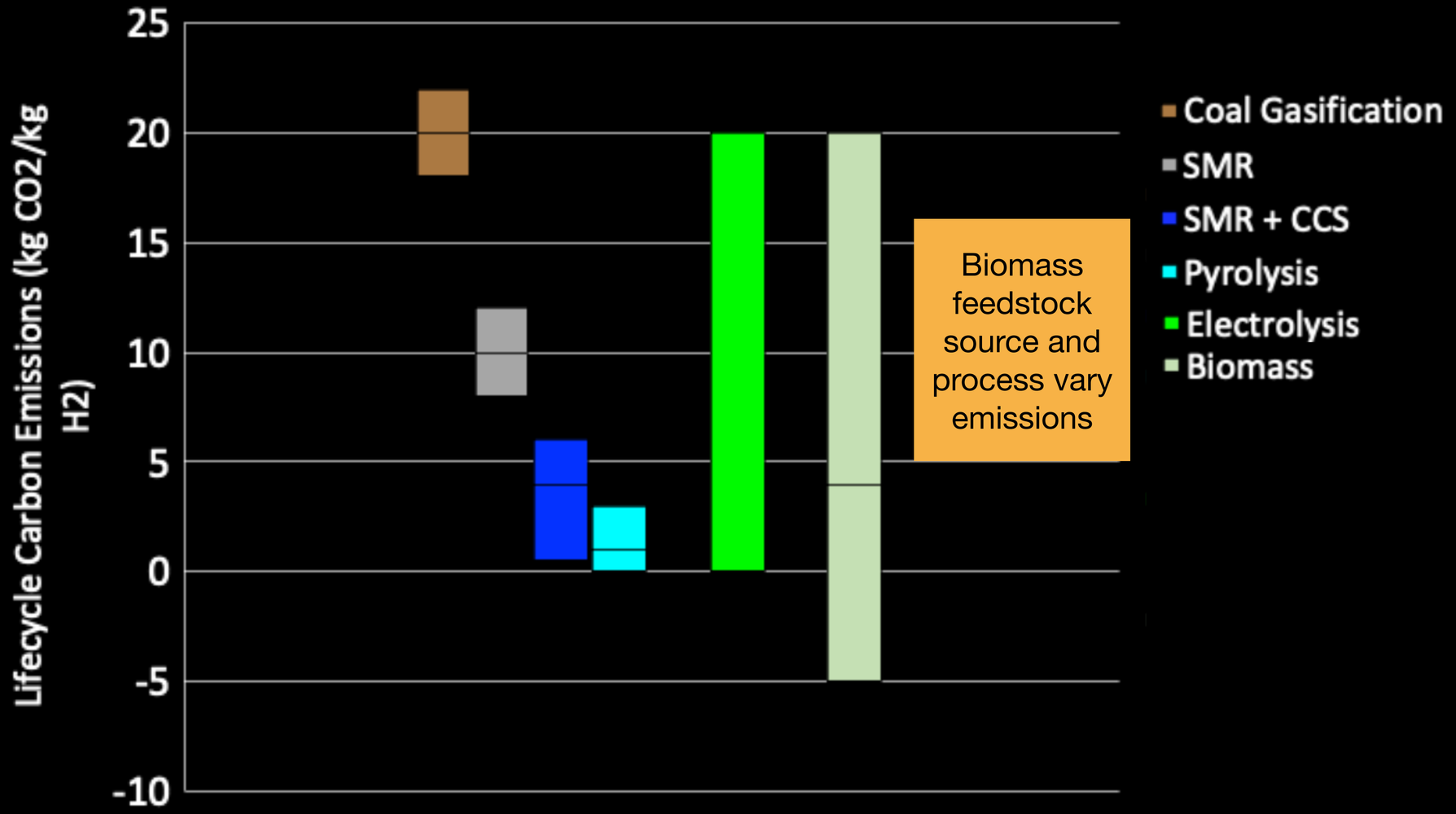

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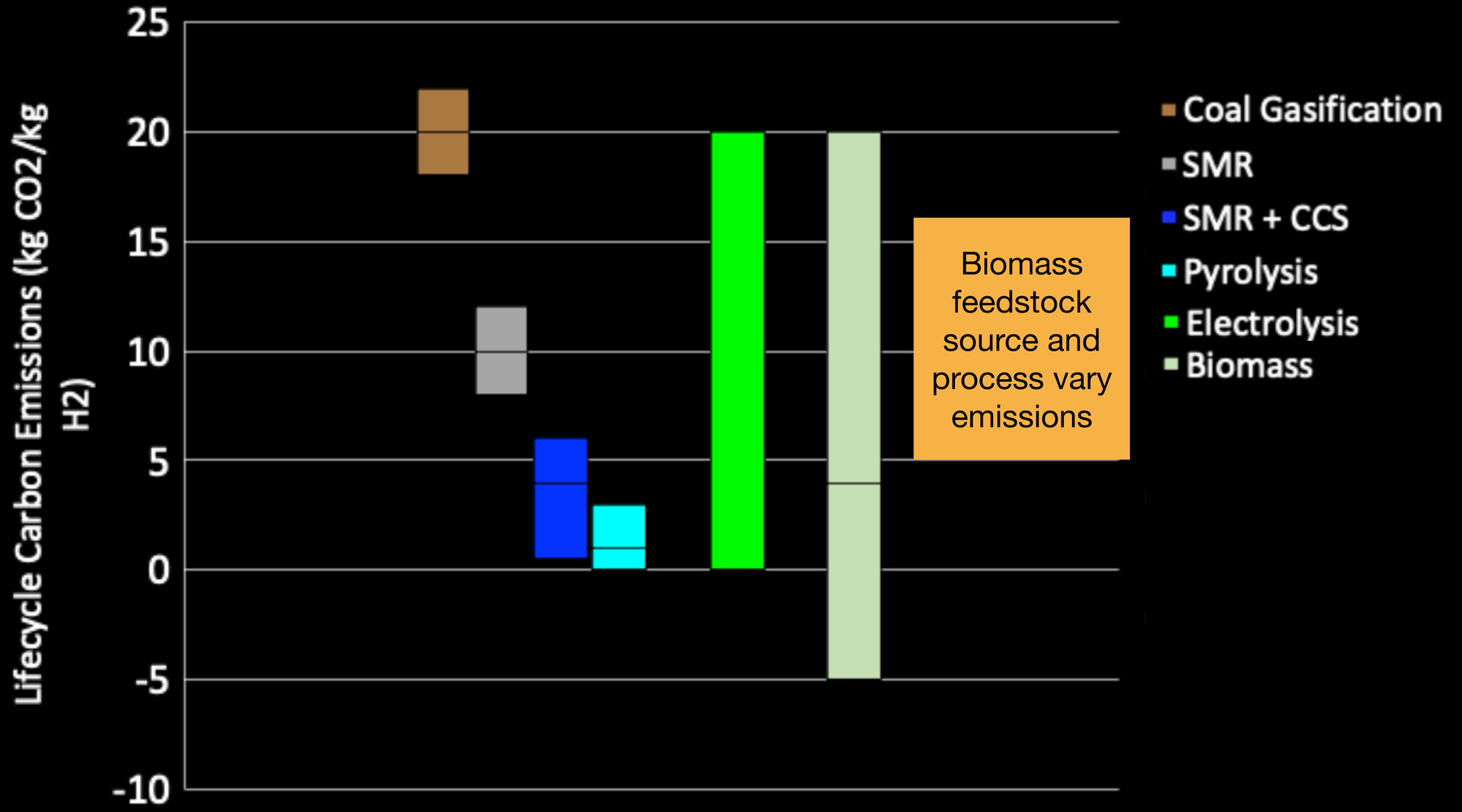
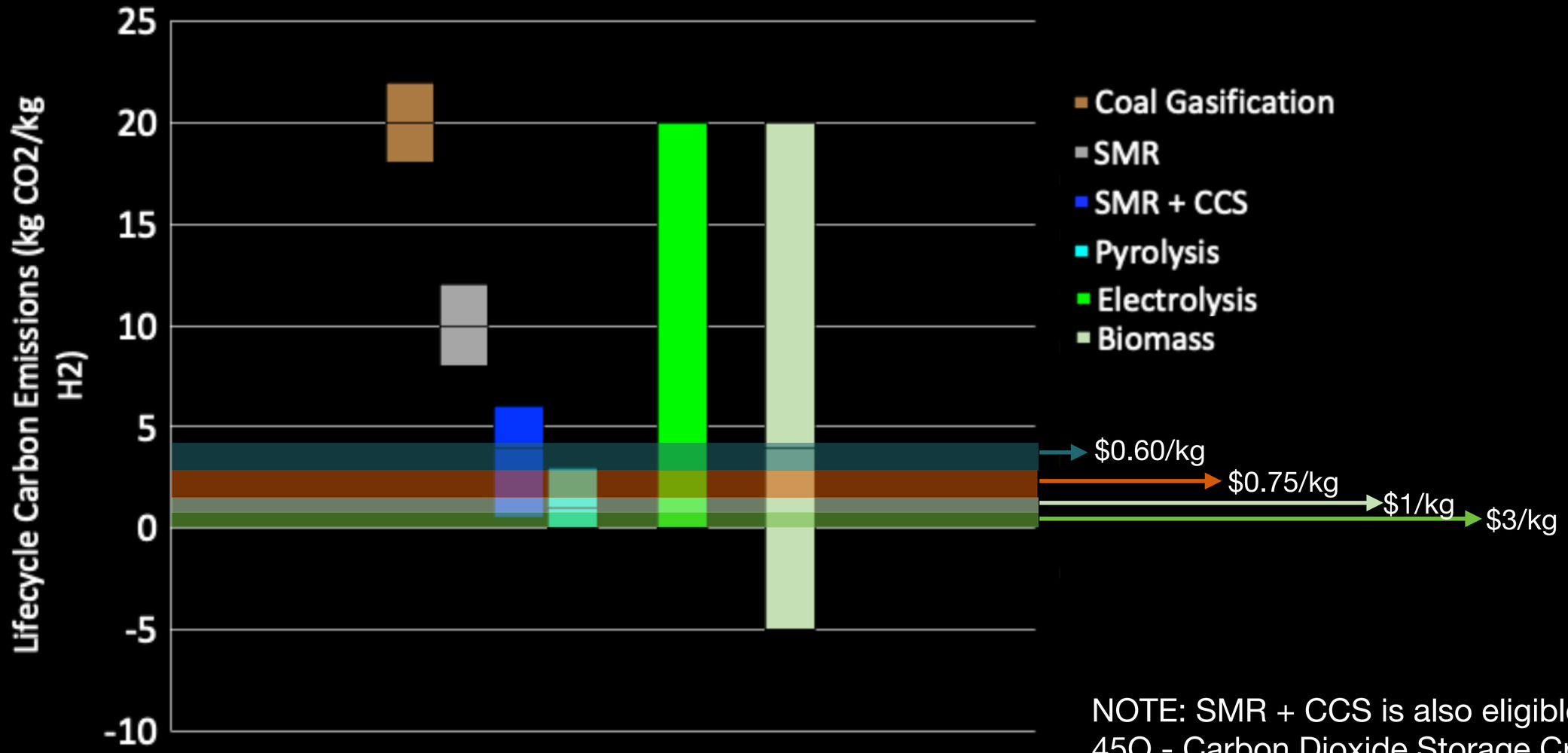


The same production pathway can have very different carbon intensity…

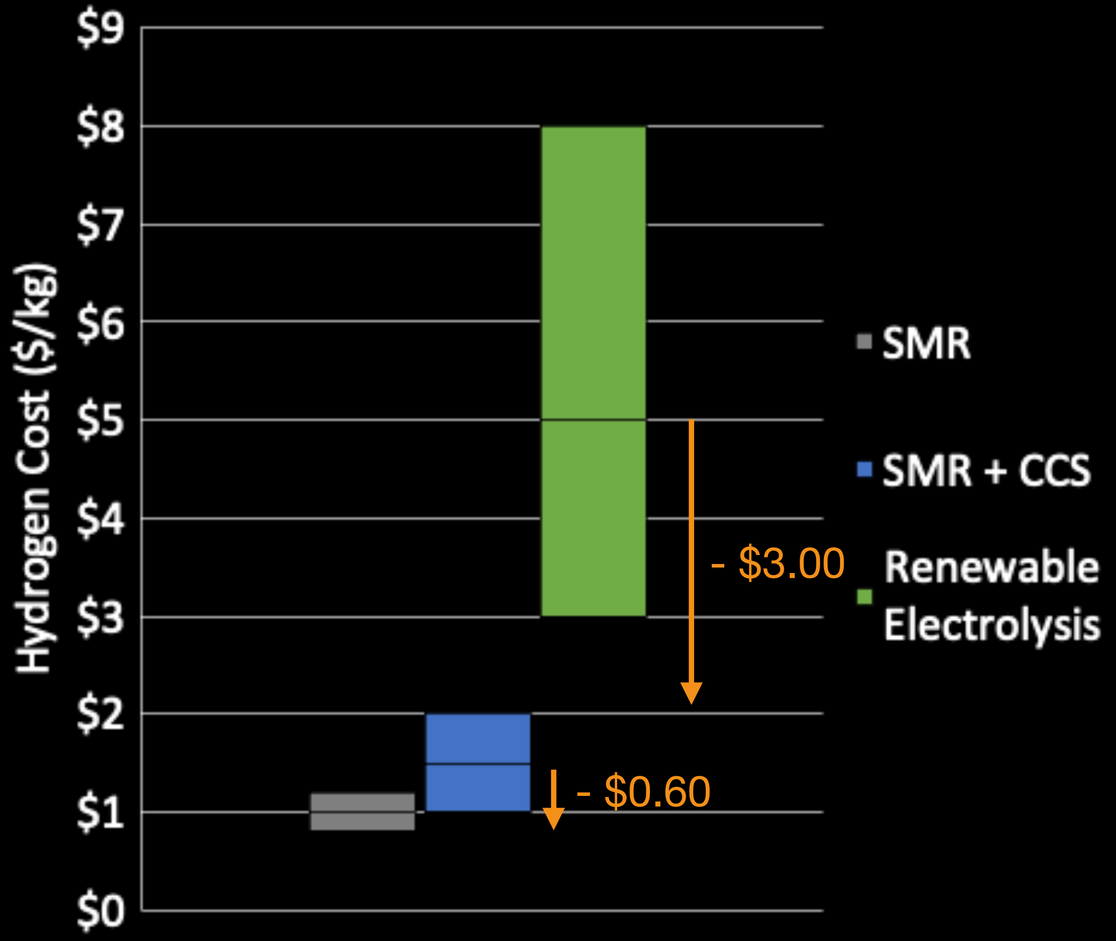
…carbon intensity defines greenhouse gas and climate impacts and credit eligibility

Carbon intensity of hydrogen production varies significantly even across similar pathways



NOTE: SMR + CCS is also eligible to take 45Q - Carbon Dioxide Storage Credit

Tax credit values are significant compared to current cost of clean hydrogen production



Life Cycle Emissions (kg CO_2/kg H_2)	PTC Value ($/kg H_2)
4.0 - 2.5	$0.60
2.5 - 1.5	$0.75
0.45 - 1.0	$1.00
< 0.45	$3.00

Specific guidance documents with the details of clean hydrogen tax credit requirements expected soon

- IRS expecting to release final guidance for the Clean Hydrogen Production Tax Credit from IRA in the next several months
- Remaining questions on details of implementation:
  - How will grid connected electrolyzers ‘count’ renewable energy?
  - How will the implemented standards compare to other international guidance?
  - How will renewable natural gas as a feedstock be counted?
  - And others

Two meaningful bills related to hydrogen were passed in the recent Texas legislative session

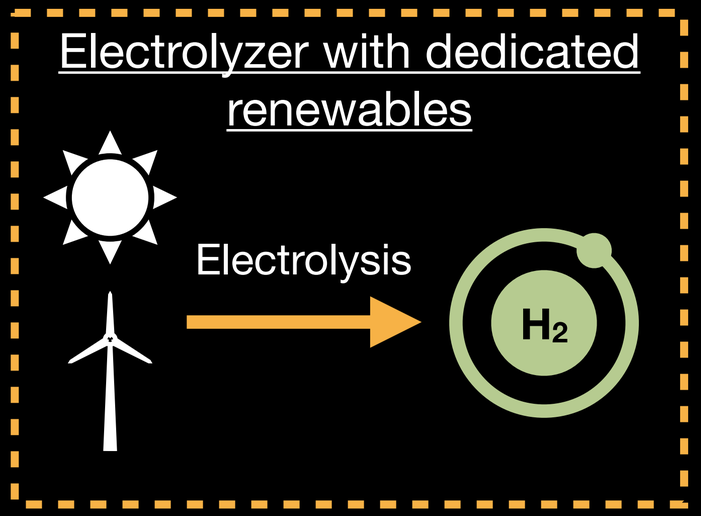
HB2847

- Provides the *Texas Railroad Commission* regulatory jurisdiction over hydrogen pipelines and underground storage facilities
- Establishes the Texas Hydrogen Policy Council, which will study the development of the hydrogen industry in Texas and make recommendations regarding oversight and regulations

HB4885

- Creates the Texas Hydrogen Infrastructure, Vehicle, and Equipment Grant Program administered by the *Texas Commission on Environmental Quality*
- Up to $8 million a year in grants for heavy duty trucks powered by hydrogen and their supporting fueling infrastructure

Grid-connected electrolyzer projects complicate the requirements of renewable hydrogen



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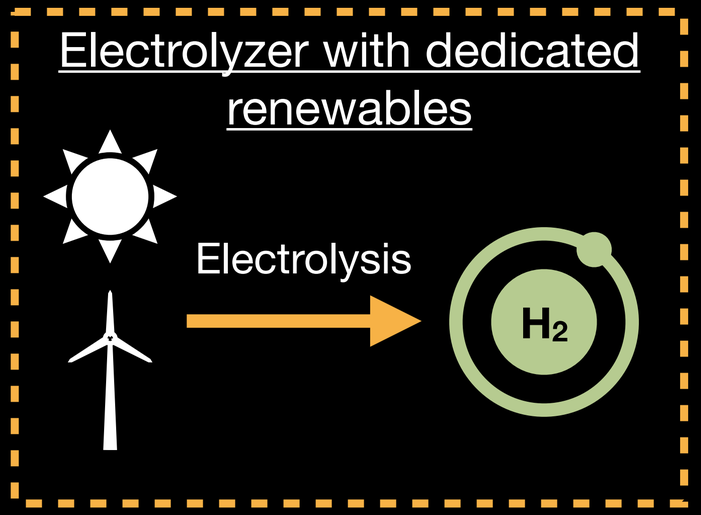
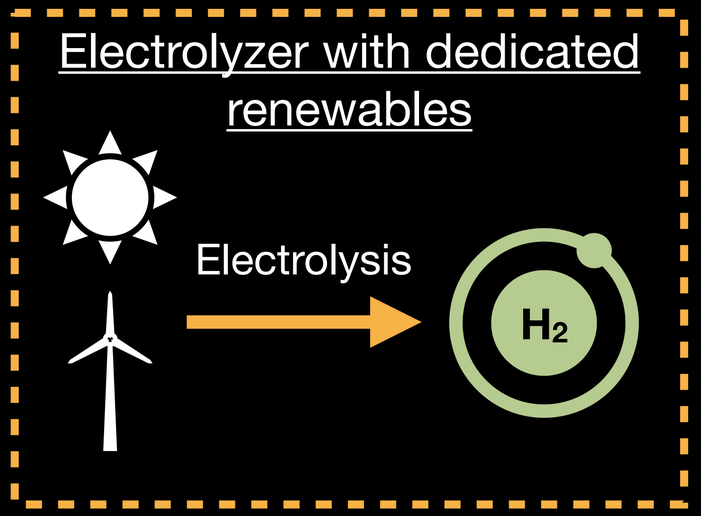
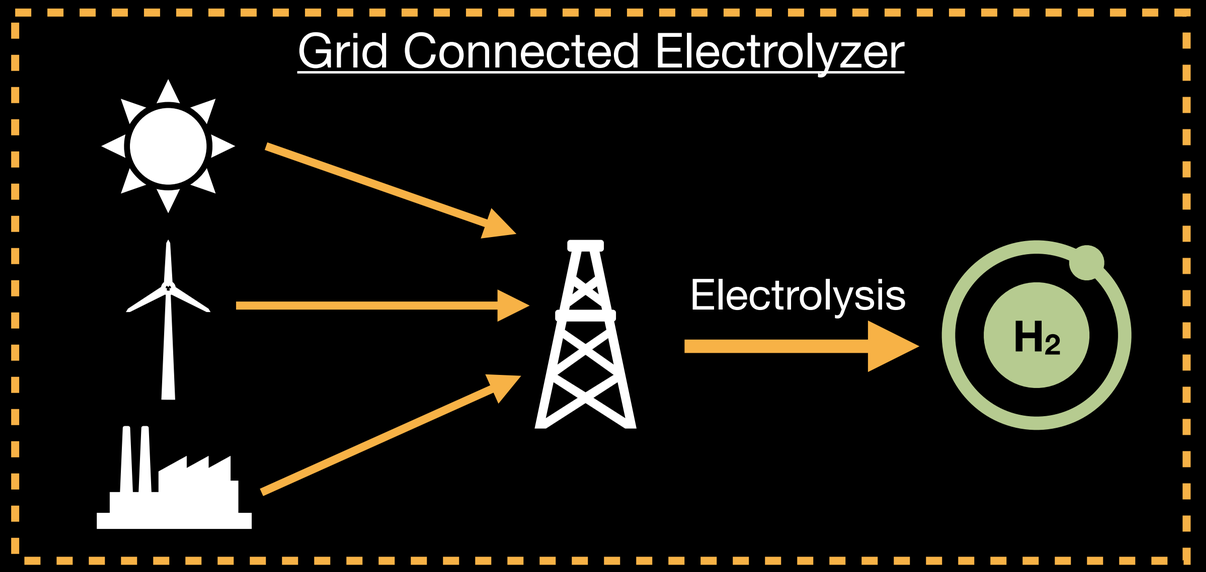


Technical Challenge
- impact of variable electricity input on electrolyzer performance and longevity

Economic Challenge
- low capacity factor and utilization yields high cost hydrogen

Grid-connected electrolyzer projects complicate the requirements of renewable hydrogen





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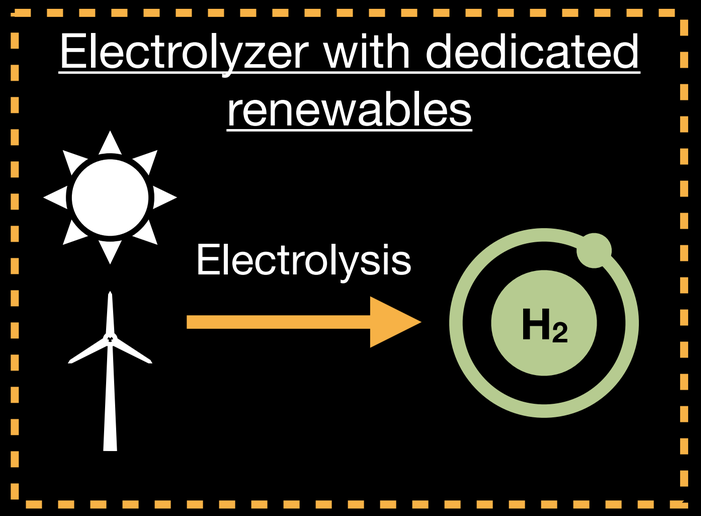

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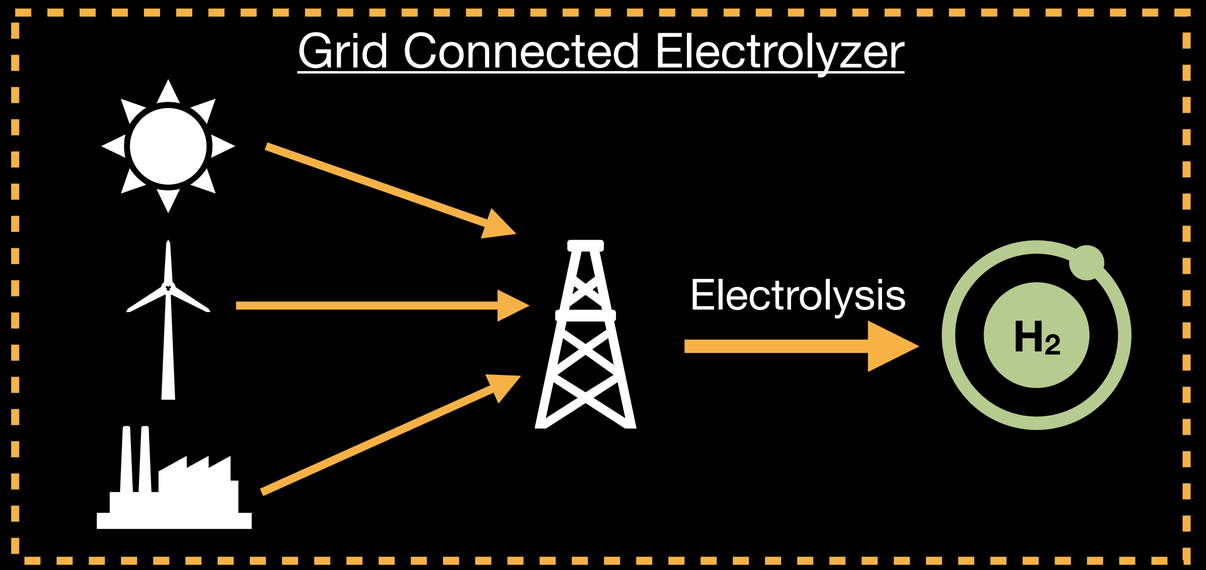


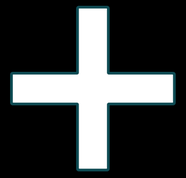
Technical Opportunities
- Power balancing and long duration energy storage for the grid

Economic Benefits
- High utilization yields lower cost hydrogen

Challenge: How do we show that the produced hydrogen is low-carbon?

The EU's framework for grid connected electrolyzers sets important standards for renewable electricity inputs

Additionality



Renewable generation added to system that would not have been built if not for the hydrogen project

The EU's framework for grid connected electrolyzers sets important standards for renewable electricity inputs

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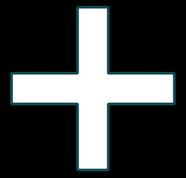

Renewable generation added to system that would not have been built if not for the hydrogen project

Temporal Matching

Electricity taken from the grid for hydrogen production must match time of renewable generation

The EU's framework for grid connected electrolyzers sets important standards for renewable electricity inputs

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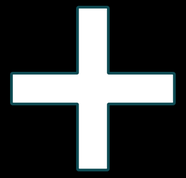

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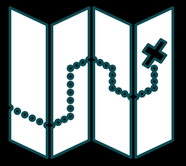
Geographic Matching



Renewable electricity installations must be in the same region as the hydrogen production

Fossil fuel generation pathways have options for tax credit selection

45Q Carbon Capture Tax Credit
- awarded per ton of CO_2 captured

45V Clean Hydrogen PTC
- awarded per ton of clean hydrogen produced
- varies based on carbon intensity

No Double Dipping → facilities must choose which of the two tax credits to take

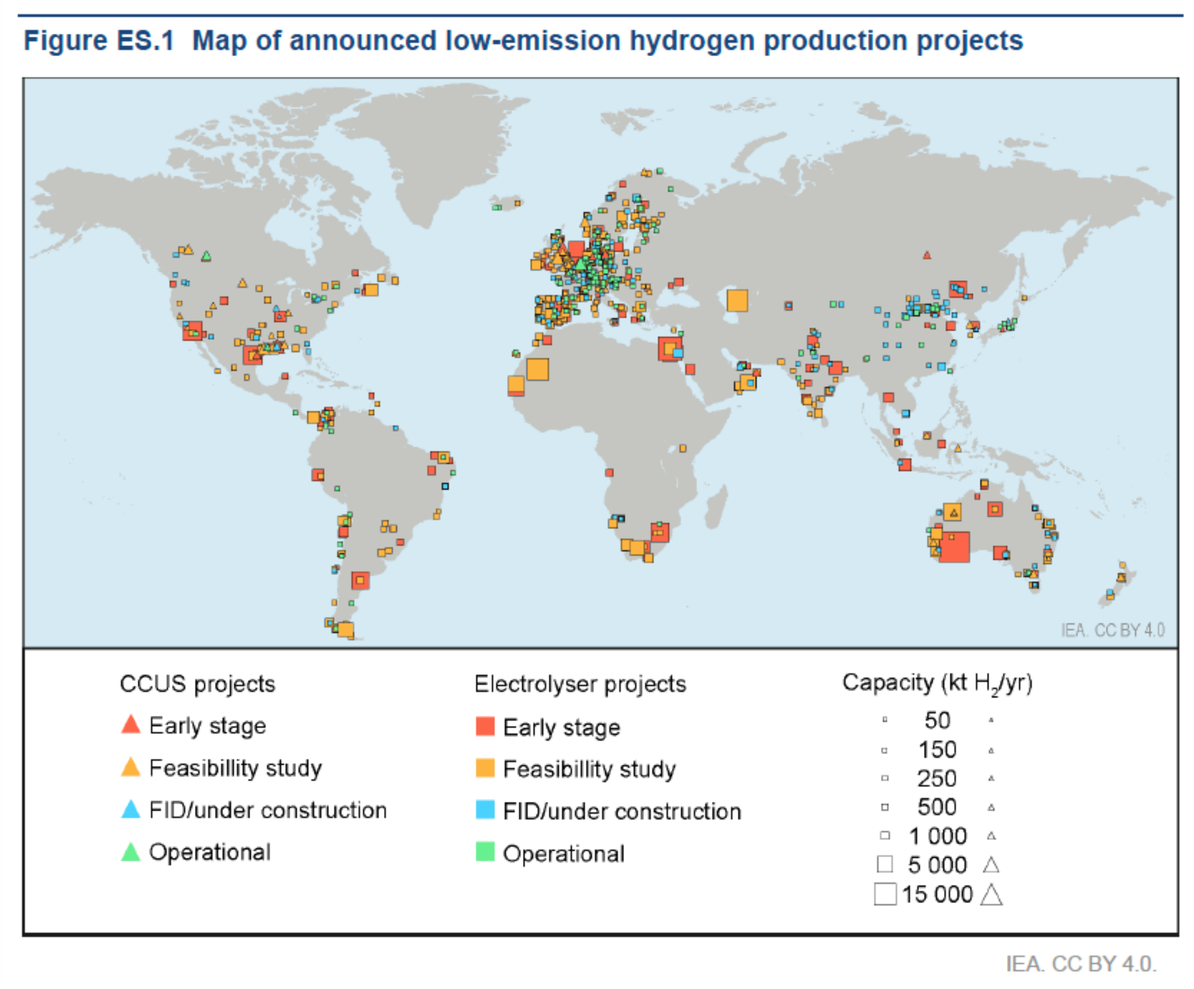
Tradeoffs for project economics
- More costly higher carbon capture rate equipment *might* push facility into higher tier of 45V credit
- Lower cost equipment might unlock enough of 45Q to make competitive

Policies should also ensure that novel hydrogen production technologies are not excluded

- Geologic hydrogen
- Methane pyrolysis
- And others

How do we ensure that new, and perhaps better, hydrogen pathways aren’t excluded from existing policies and standards?

Clean hydrogen project announcements are accelerating globally



Map from IEA Global Hydrogen Review 2023

By 2030, current proposed hydrogen projects would mean:

- **27 Mt** hydrogen production based on **electrolysis and low emission electricity**
- **10 Mt** hydrogen production based on **fossil fuels with carbon capture and storage**

Global hydrogen demand in 2022 was 95 Mt, of that 0.67 Mt (0.7%) was low-emission hydrogen

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THE UNIVERSITY OF TEXAS AT AUSTIN