Hydrogen Webinar Series

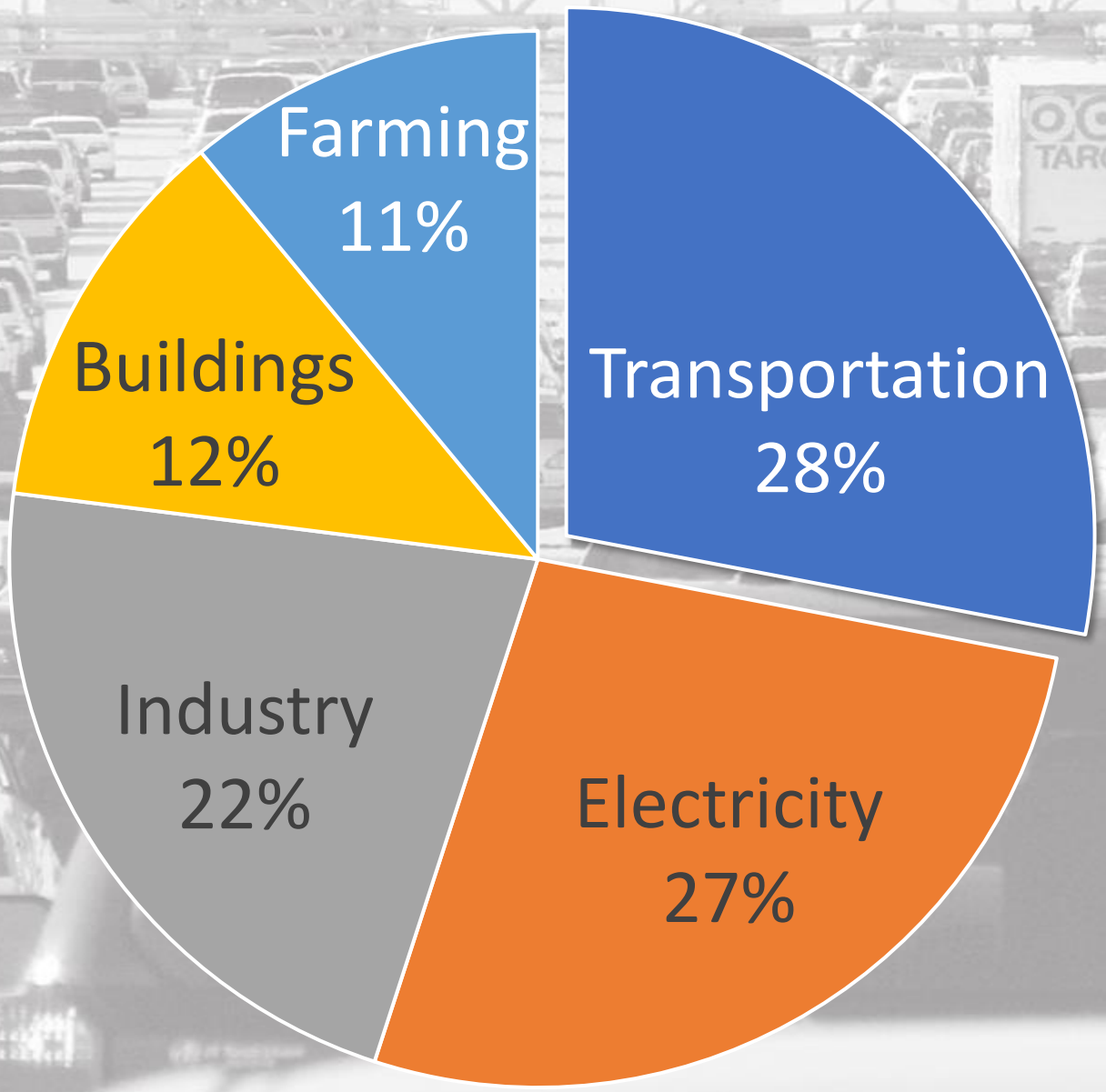
Clean Hydrogen for Sustainable Transportation

H2P H2 POWER
ON-DEMAND HYDROGEN MADE EASY

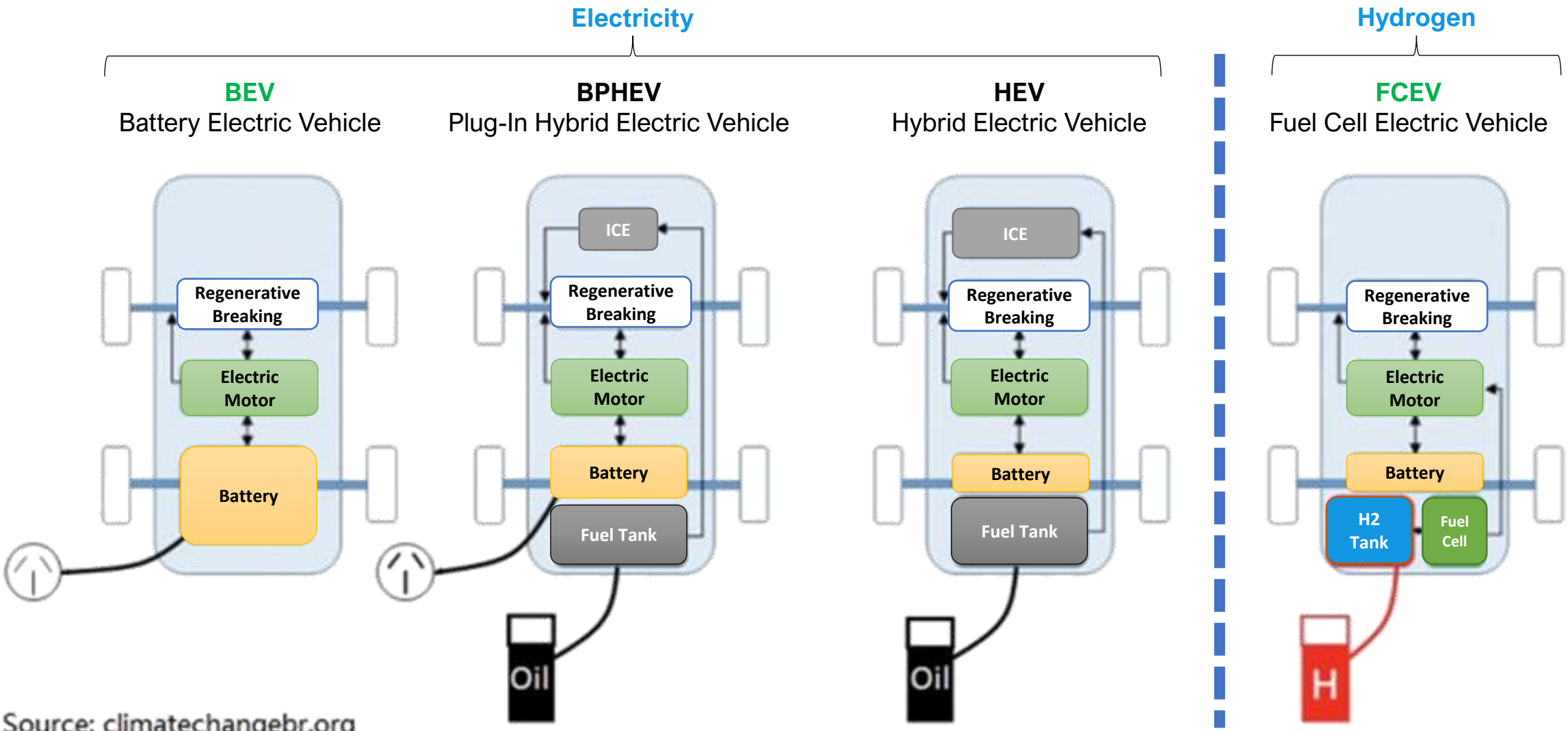
April 6th, 2023

CO2 =
Global Warming

U.S. Greenhouse Gas Emissions in 2018



What is clean transportation?



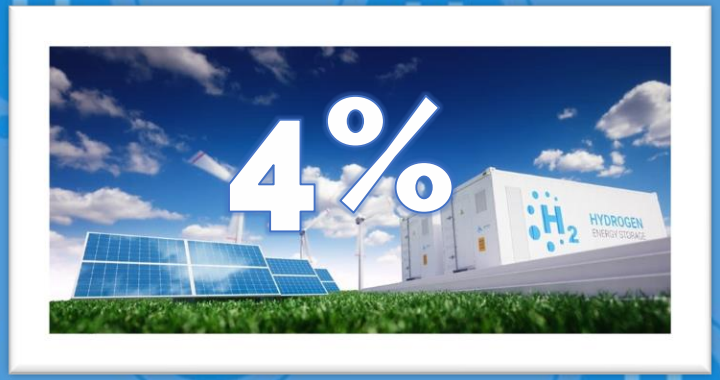
Source: climatechangebr.org

The hydrogen sources today

Natural Gas Conversion

7kg of CO_2 per kg of hydrogen
Cheap

Electrolysis

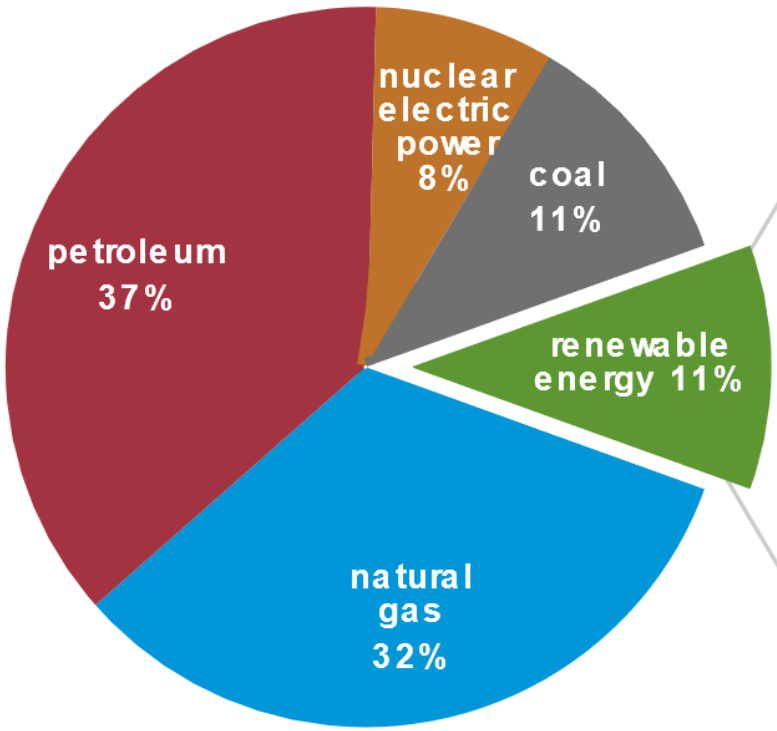


No CO_2 emissions
Expensive
55kWh per kg of hydrogen

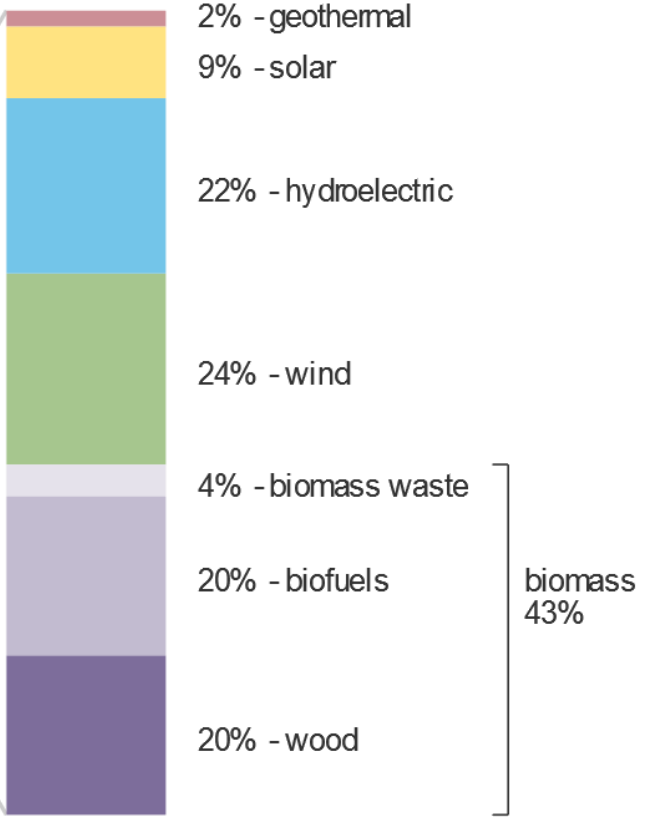
Clean transportation requires clean energy

U.S. primary energy consumption by energy source, 2019

total = 100.2 quadrillion British thermal units (Btu)



total = 11.4 quadrillion Btu



Coal: 820g CO_2 per kWh
(World Nuclear Association)

Clean energy
(<50g CO2 per kWh)

CO2 emissions
(>250g CO_2 per kWh)

Note: Sum of components may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2020, preliminary data

A large market

"From a $170 Billion market in 2021, to 225 Billion by 2030"

ResearchAndMarkets.com, Dublin, Ireland, August 2022

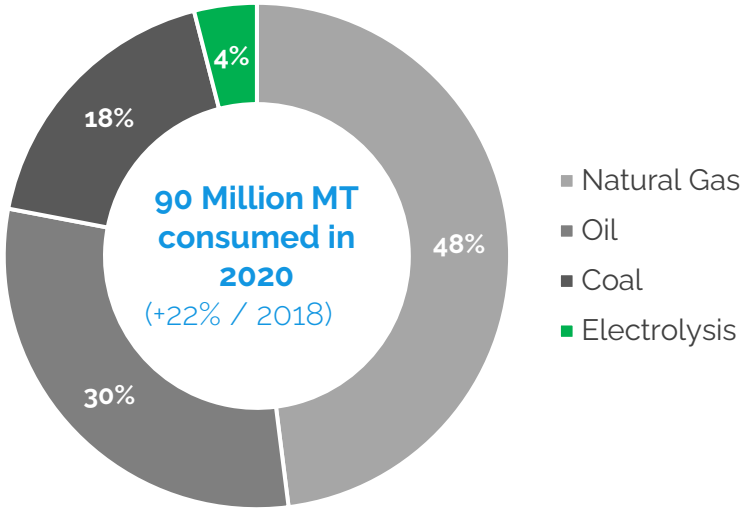
Current capacities well below stated ambitions for electrolysis:

2,7 GW in 2025 > **40 GW** in 2030

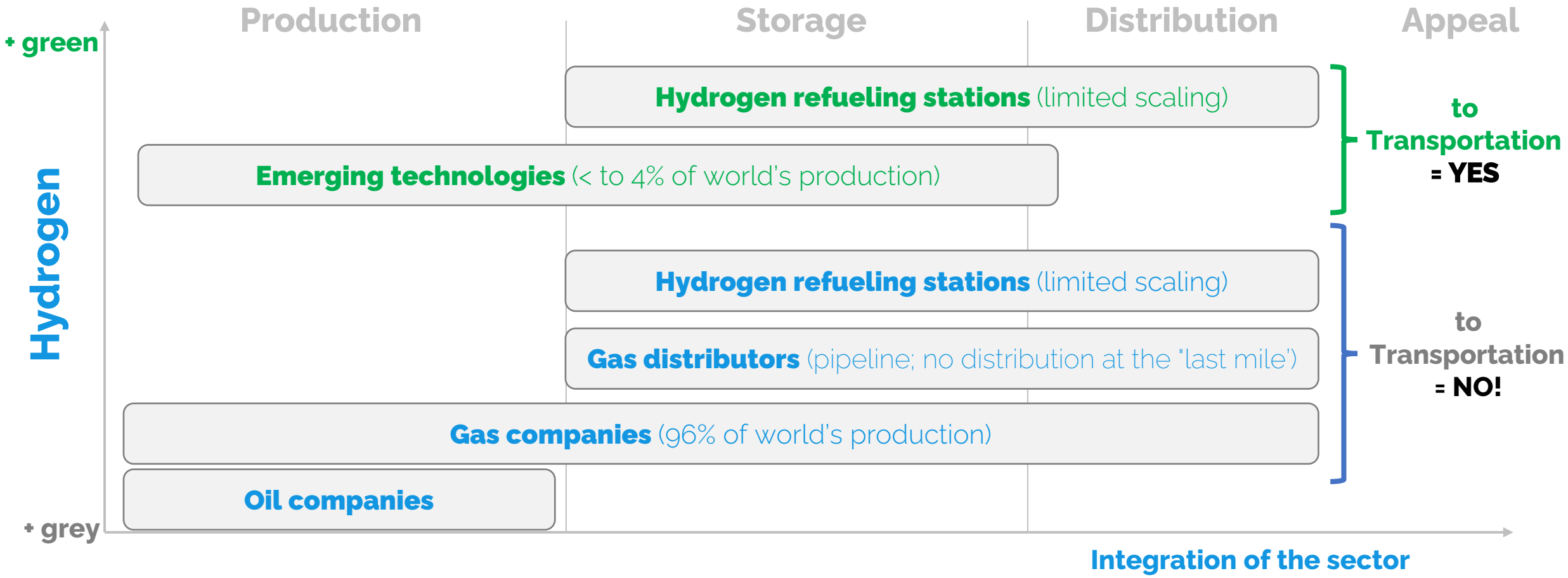
Estimated European production capacity

European production capacity target

Hydrogen Production



A slow transition to green hydrogen



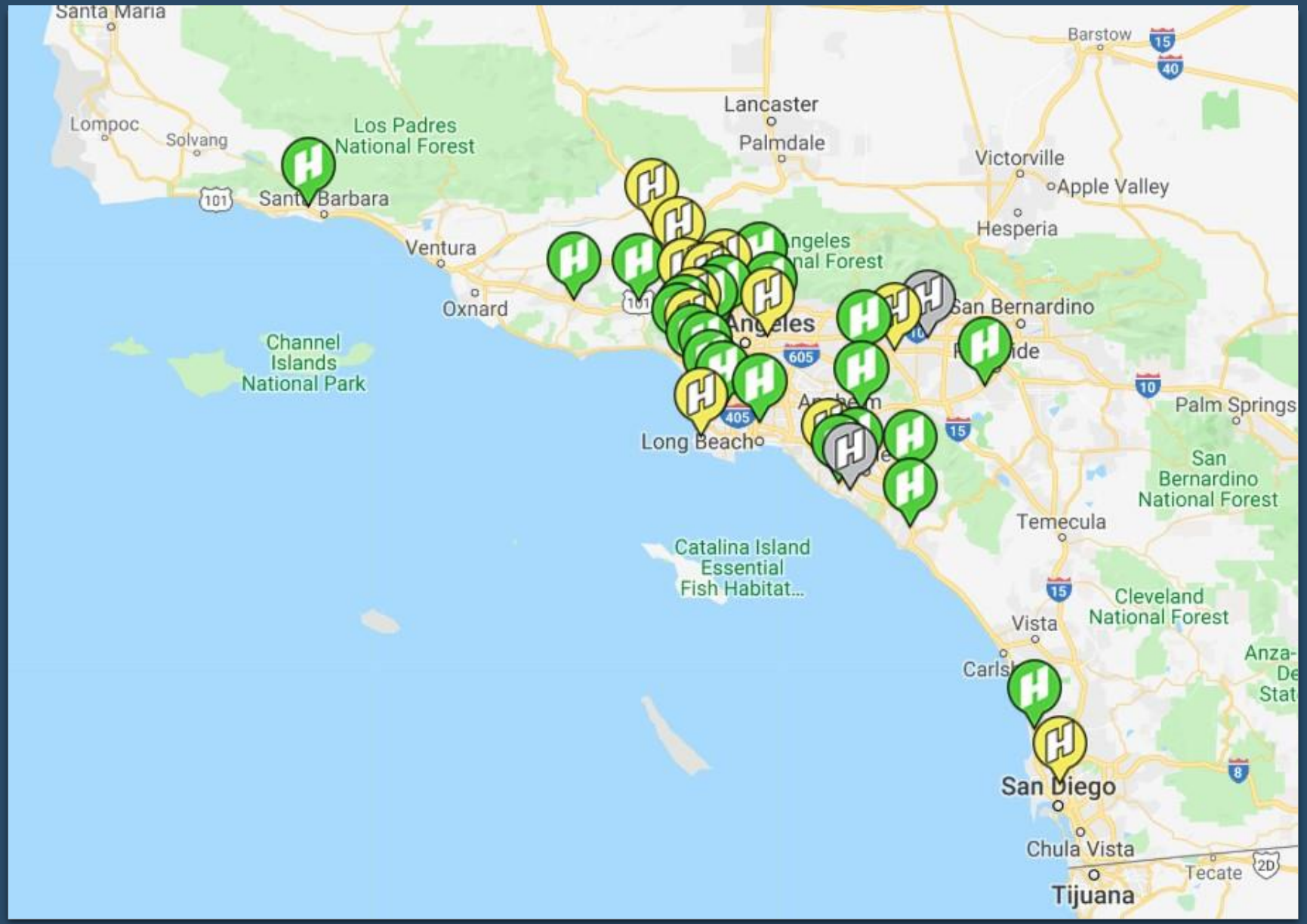
Controlled by century-old technologies

Electrolysis

Linde
AIR PRODUCTS
Cummins
McPhy Driving clean energy forward
Air Liquide
nel
gen-hy
SIEMENS
John Cockerill
sunfire

New technologies

IONMR INNOVATIONS
CPH2 CLEAN POWER HYDROGEN
NEXCERIS where energy meets environment
TOPSOE
H2PRO

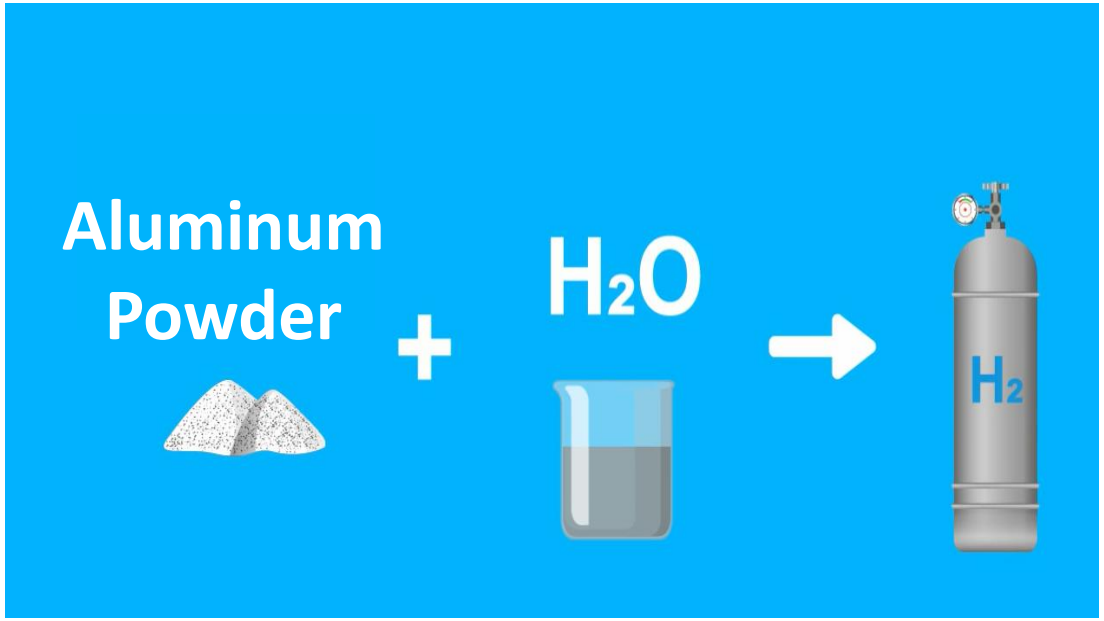


Result:
54 HRS
15,000 FCEVs
1 state!

www.statista.com/statistics/1026719/number-of-hydrogen-fuel-stations-by-country/

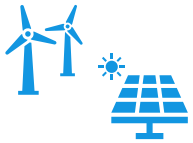
A manufacturing boom on hold, worldwide!

Solution: H2 Power's technology

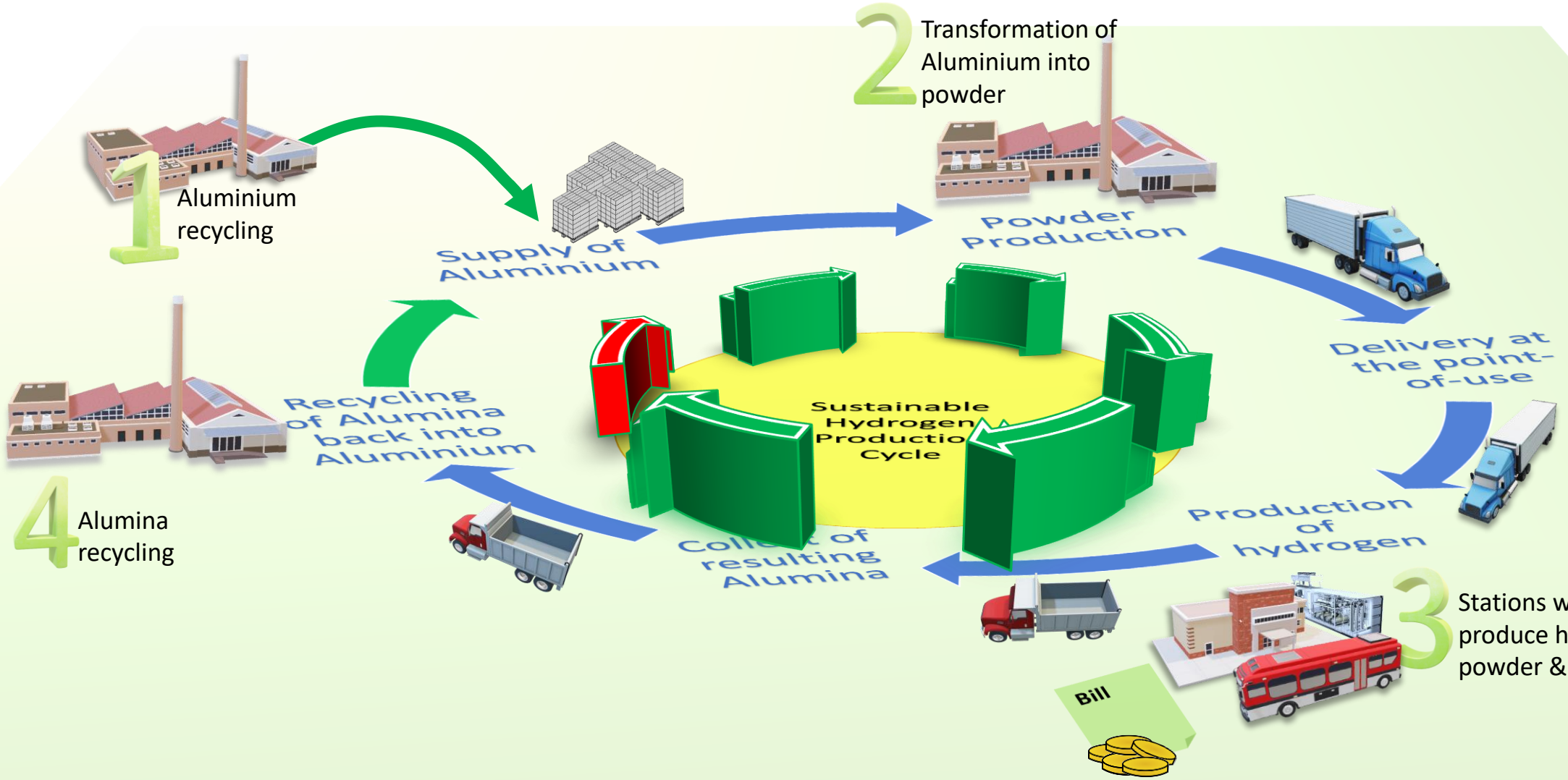


No electricity; no CO2; no chemicals

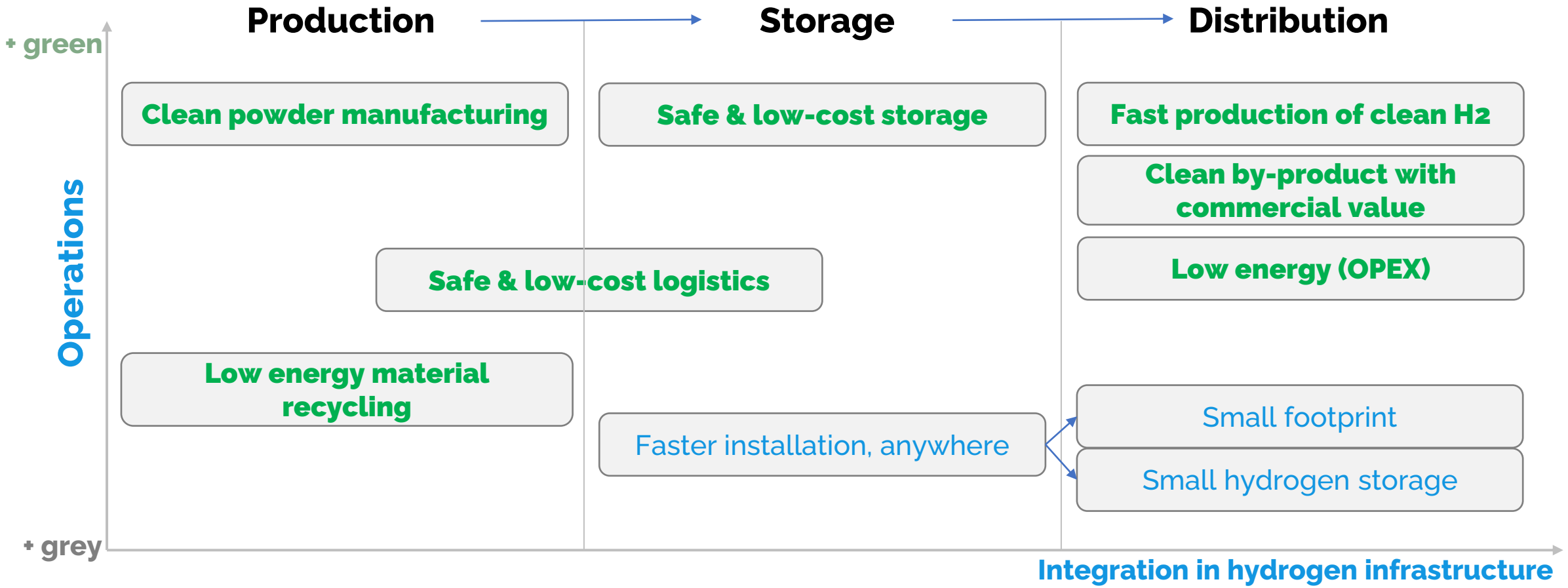
Key advantage: produces more energy than it consumes

Production of 1 kgH2	Energy consummed	Energy returned	Yield
 Electrolysis	**55 kWh**	**33 kWh**	**- 22 kWh** - 40%
Aluminum **100% recycled** H2 Power	**6,6 kWh**	**33 kWh**	**26,4 kWh** +400%
Aluminum **80% recycled 20% primary** H2 Power	**31,3 kWh**	**33 kWh**	**1,72 kWh** +5,4%
Aluminum **100% primary** H2 Power	**130 kWh**	**33 kWh**	**- 130 kWh** - 75%

A game changer!



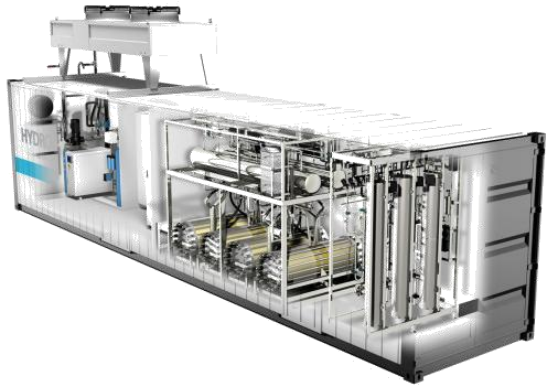
Efficient all the way



H2 Power's products

1) Aluminum-based Powder

2) Mixing equipment*



*Products under development. This picture is purely indicative and does not represent the actual products.

1,2 tons of powder

M200w : 120 kgH2 / day

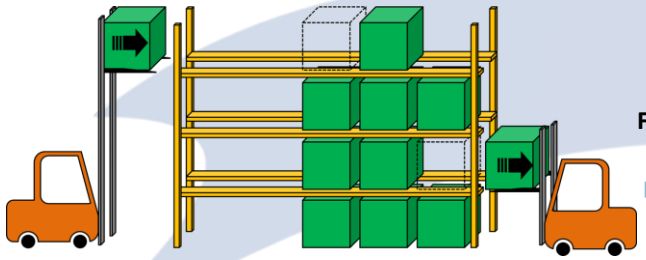
4 tons of powder

M400 : 400 kgH2 / day

16 tons of powder

M1600 : 1600 kgH2 / day

Simplifying refueling stations



H2P Powder onsite storage

Feed to H2P mixer

H2P mixer

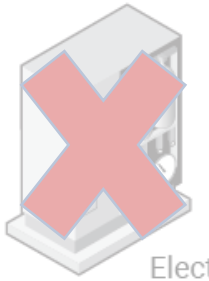
local water supply

local power supply

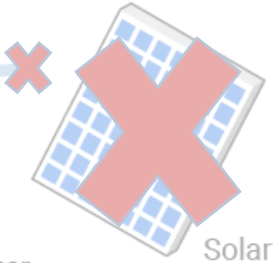
Hydrogen

H2 Power system

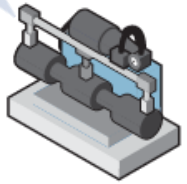
Existing stations



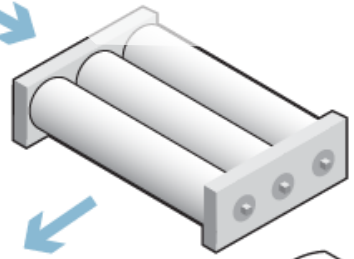
Electrolyzer



Solar



Compressor



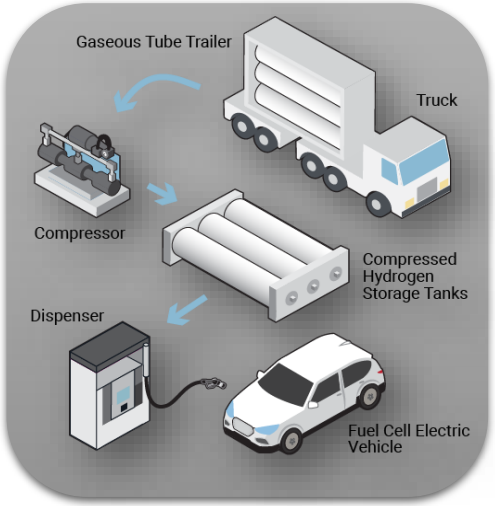
Compressed Hydrogen Storage Tanks

Dispenser

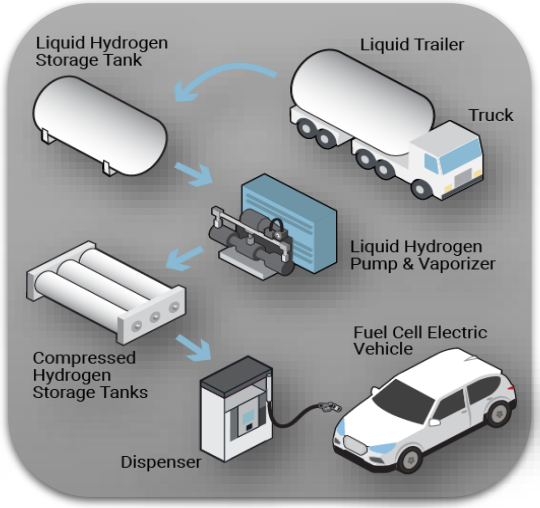
Fuel Cell Electric Vehicle

A competitive first application

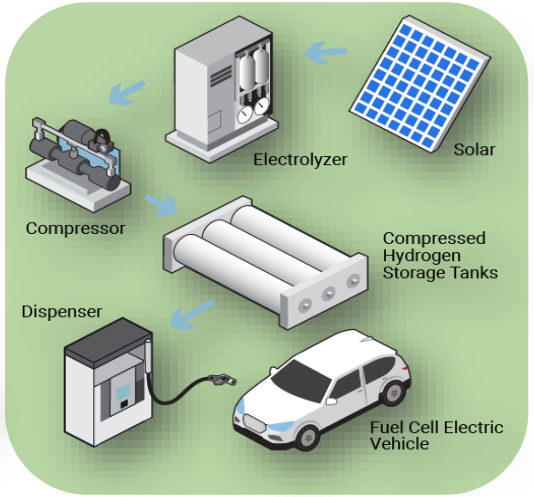
Gaseous Delivery*



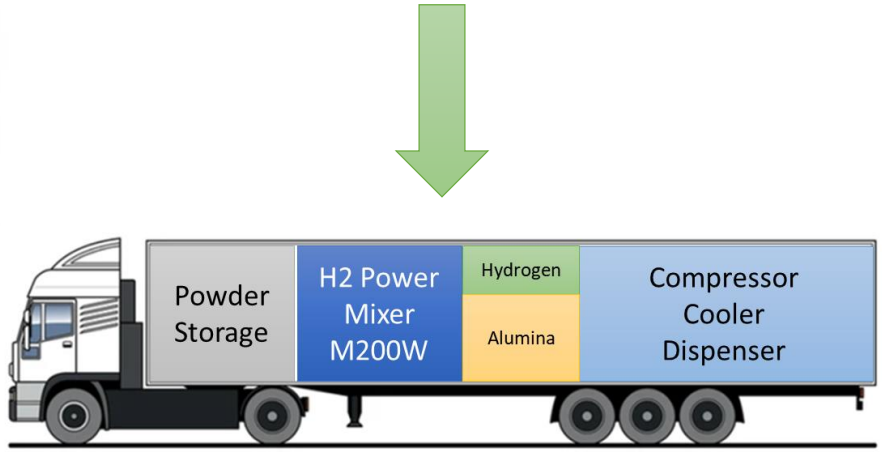
Liquid Delivery*



Onsite Production* Electrolysis



Onsite Production H2 Power



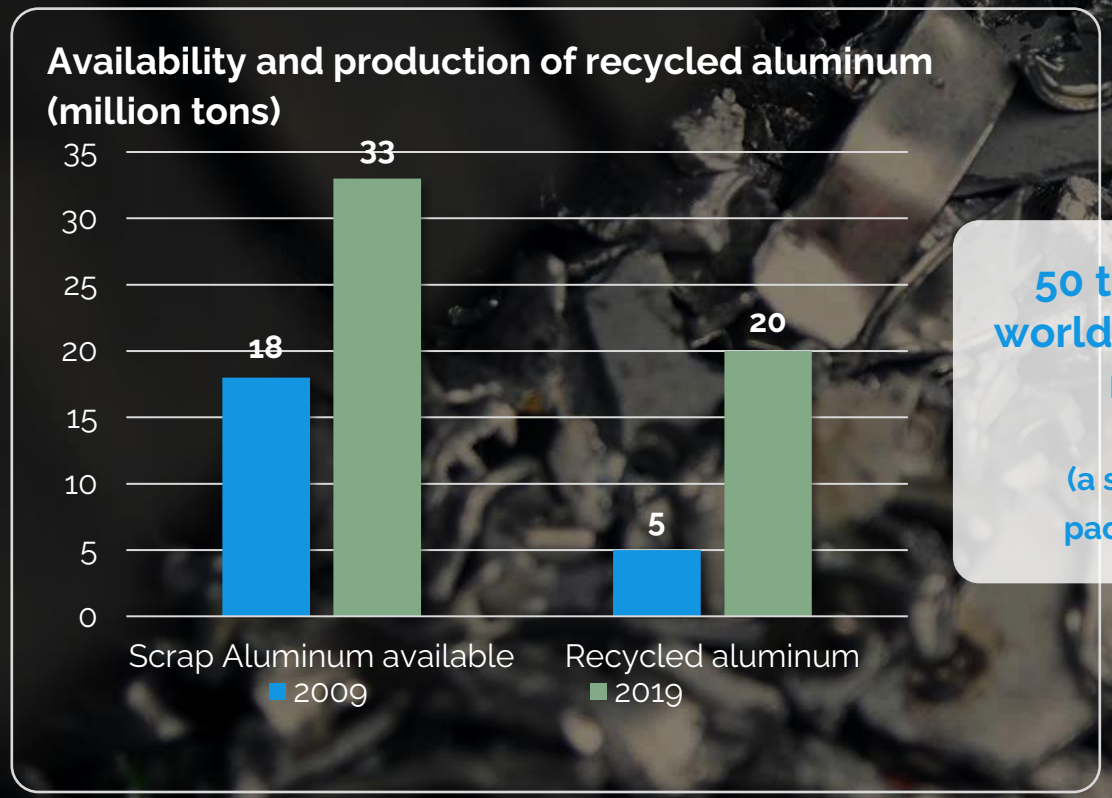
CAPEX: $2 million*	$2.8 million*	$3.2 million*	$1.5 million
180 kgH2/day	350 kgH2/day	120 kgH2/day	**120 kgH2/day**
Build: 18 to 24 months	18 to 24 months	18 to 24+ months	**1 day**
>= 12,000 sq. ft.	>= 12,000 sq. ft.	>= 12,000 sq. ft. + land for solar/wind farm	**+/- 1,000 sq. ft.**
$15 -21/kgH2**	$15 - 21/kgH2**	$15 - 25/kgH2**	**$18 - 20/kgH2**

*Source: Hydrogen Fuel Cell Partnership, www.h2stationmaps.com/costs-and-financing

**Source: 11/2022, www.hydrogeninsight.com

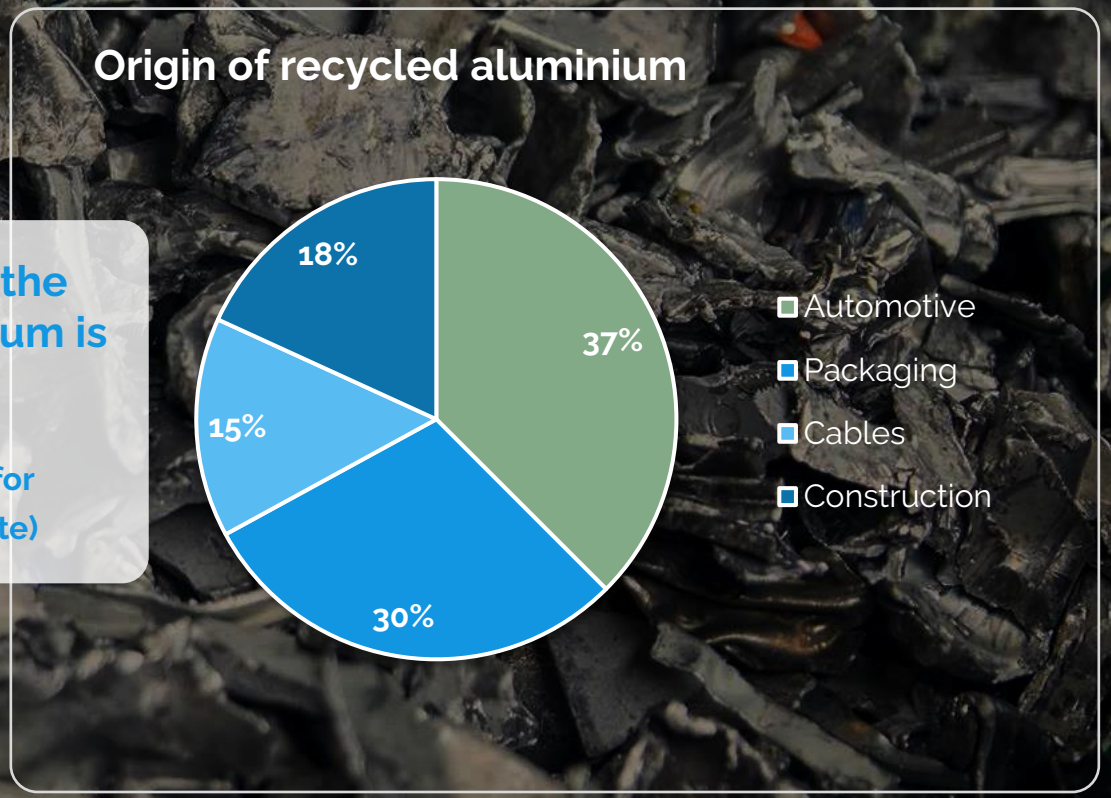
No shortage of raw material

- Plenty of recyclable aluminum available
- Tin, poorly recycled: 33% worldwide (22% in the US)



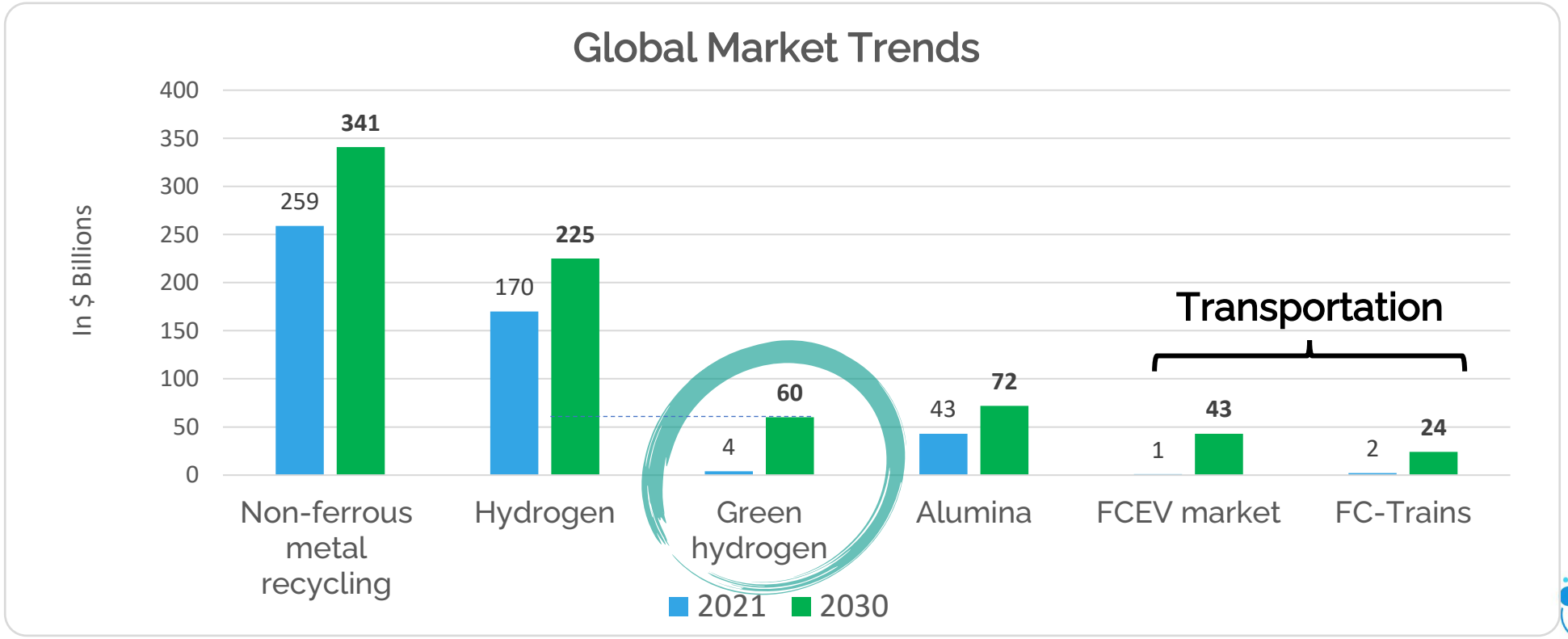
50 to 60% of the world's aluminum is recycled

(a small share for packaging waste)



Optimistic market forecasts

- Green hydrogen +1,500% by 2030
- Worldwide new business opportunities



Takeaways:

- **Reduction of CO_2 emission is necessary**
- **Not all hydrogen sources are equal:**
  - Energy balance
  - CO_2 emissions
- **2030 will be a milestone:**
  - EU: 55% less emissions, all vehicles (100%,2035)
  - US: 50% of no-emission vehicles sold
- **Transition = new business opportunities**
- **Beware of disinformation/greenwashing**
- **Hydrogen will only grow**
- **EV and FCEV will become mainstream**

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H2 Power is looking for partners to accelerate its development around the world

We bring a new path to clean hydrogen for transportation.

Fabrice Bonvoisin | CEO | fbonvoisin@h2psolutions.com

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Thank you!

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