

GREEN HYDROGEN: CLEANER AND ZERO EMISSION FUEL
FOR A SUSTAINABLE GREEN ECONOMY

Green Hydrogen:

Today's Status and Tomorrow's Challenges

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Green Hydrogen: *Today's Status and Tomorrow's Challenges*

“United vision and long-term ambition for hydrogen to foster the clean energy transition for a better, more resilient future”

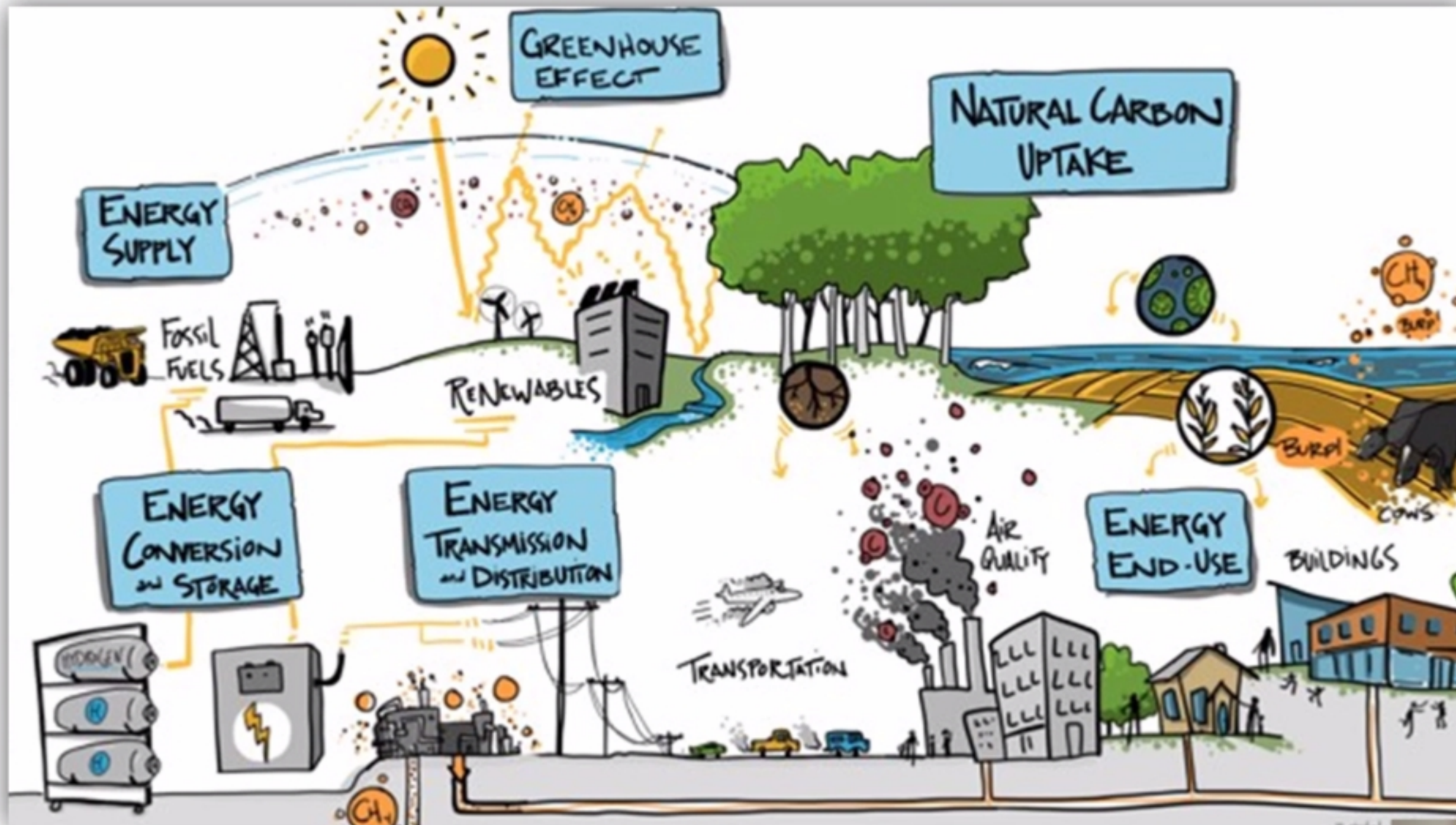
HYDROGEN COUNCIL



HYDROGEN COUNCIL LOOKS TO THE FUTURE



Green Hydrogen: *Today's Status and Tomorrow's Challenges*



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GREEN HYDROGEN is hydrogen
produced by splitting water
from electrolysis using *excess*
renewable electricity



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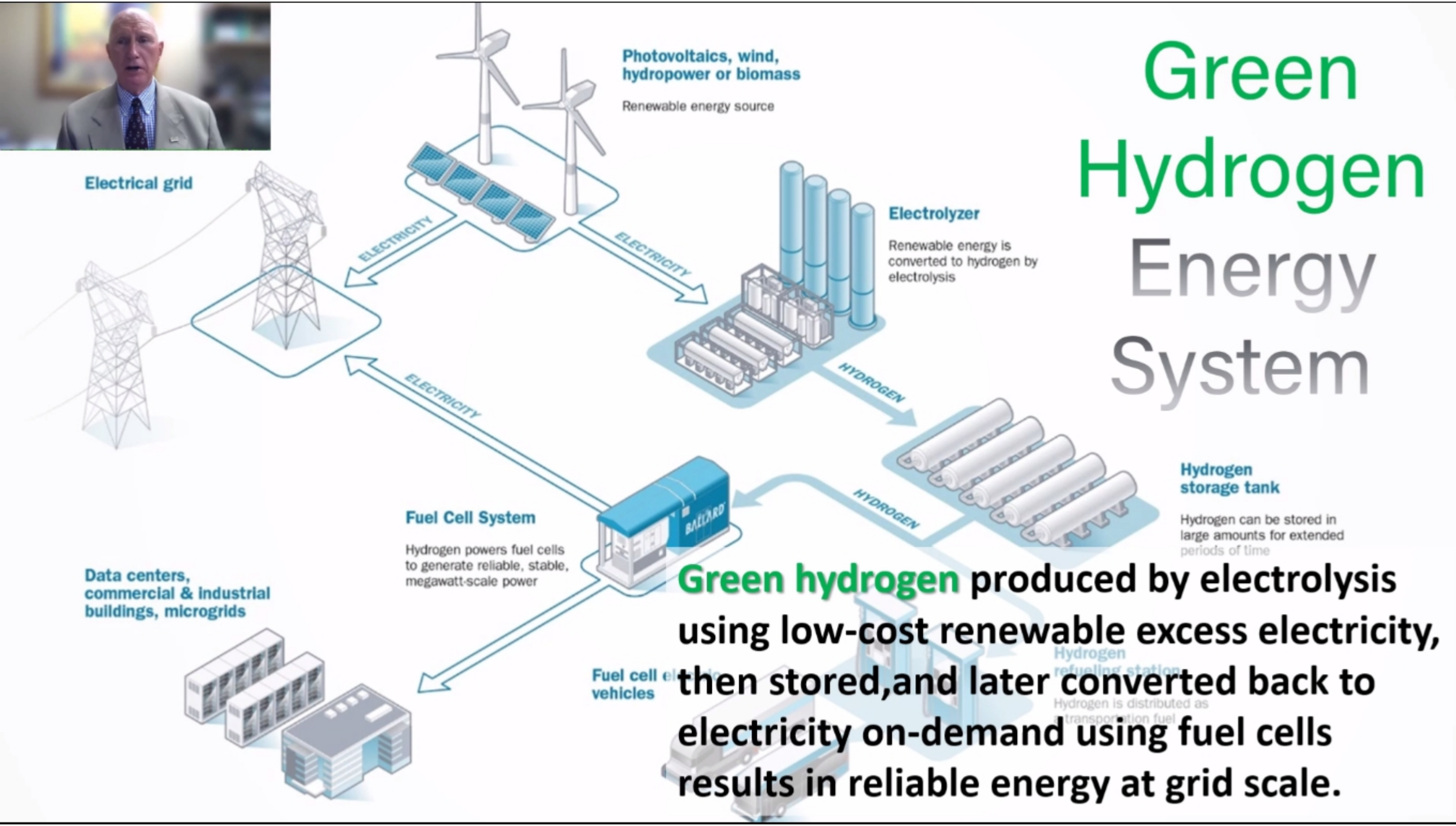
Green Hydrogen is Key to Decarbonizing Major Sectors of our Economy

- 1. Integration of renewable energy systems*
- 2. Distribute energy across sectors: Sector Coupling*
- 3. Increase energy system resilience*
- 4. Decarbonize transport*
- 5. Decarbonize industry*
- 6. Decarbonize building heating*



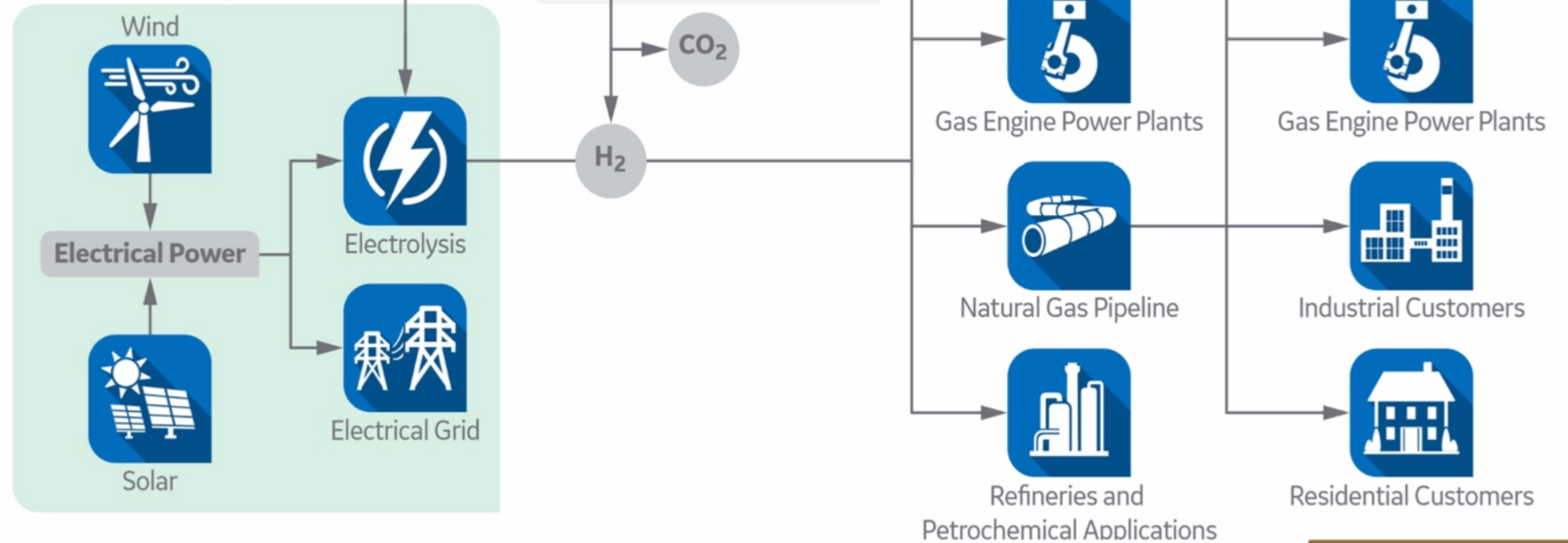


Green Hydrogen Energy System



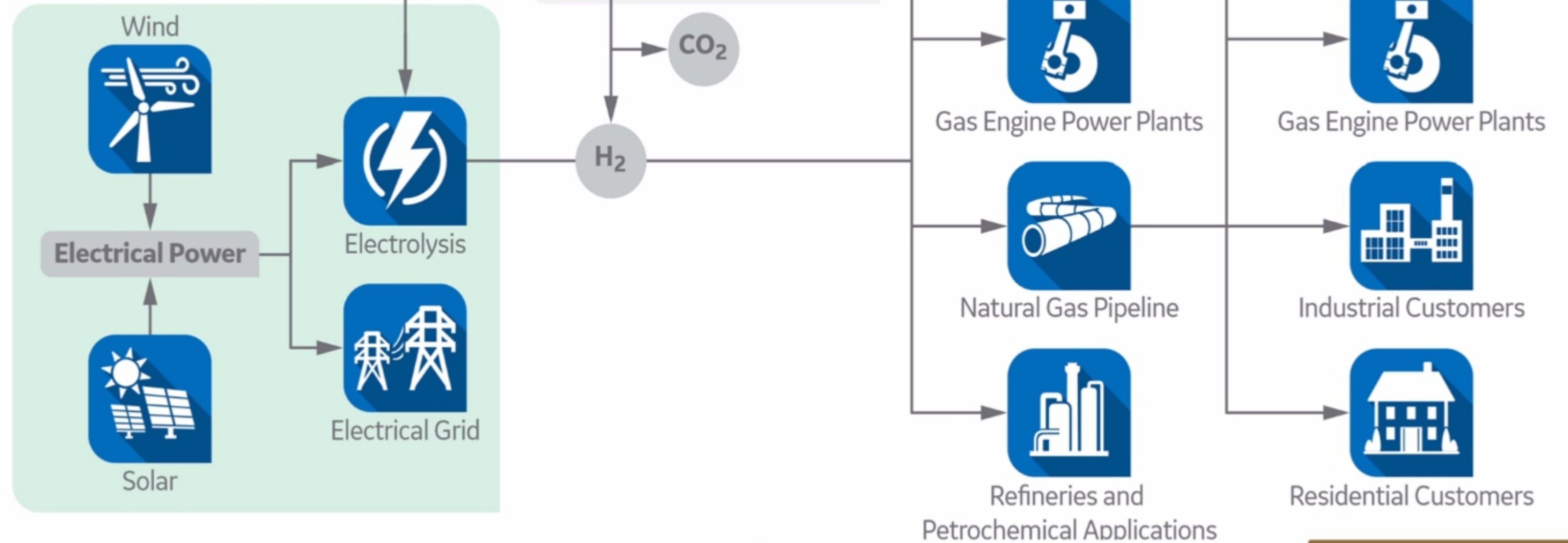


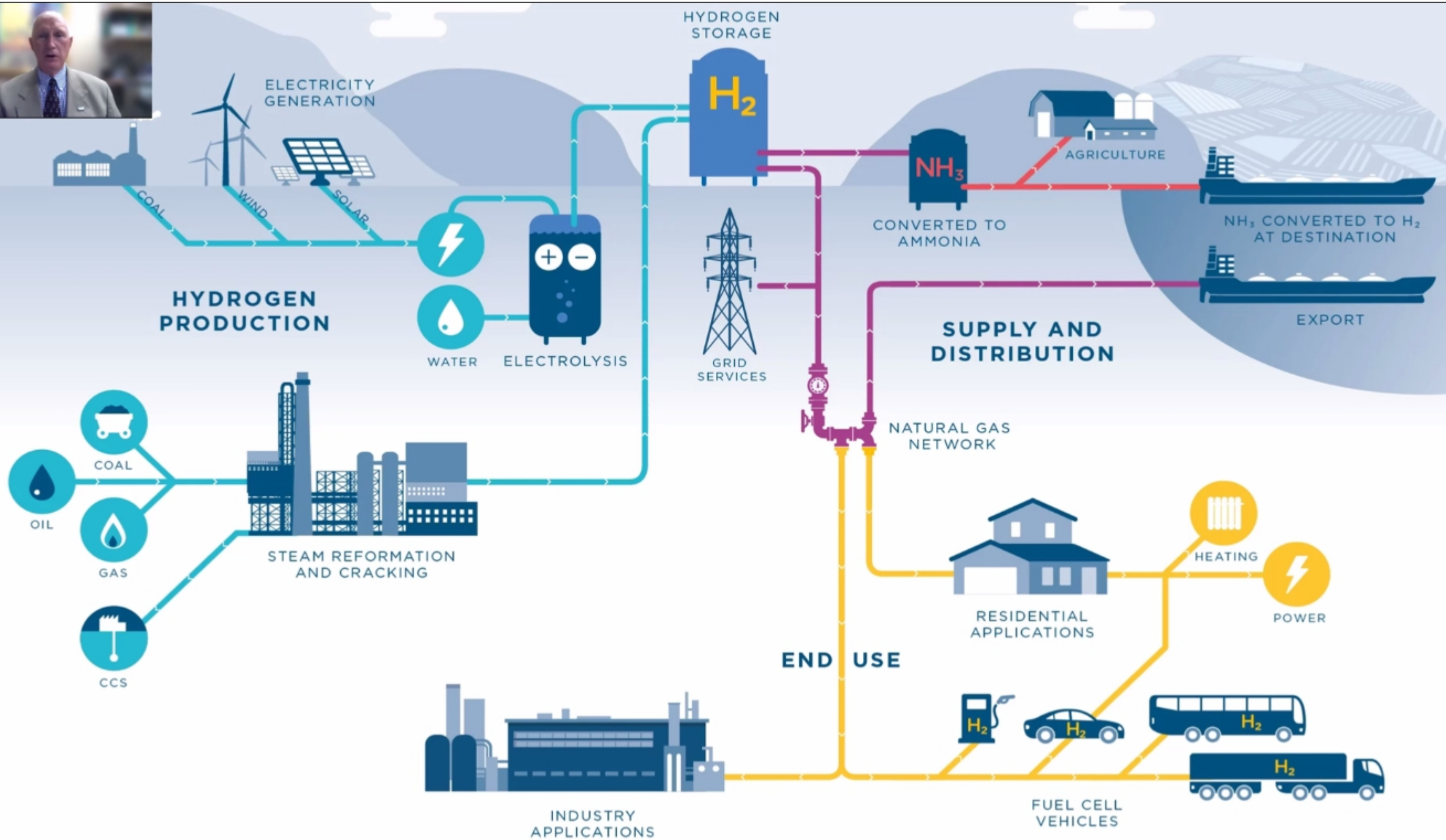
"Green Hydrogen"

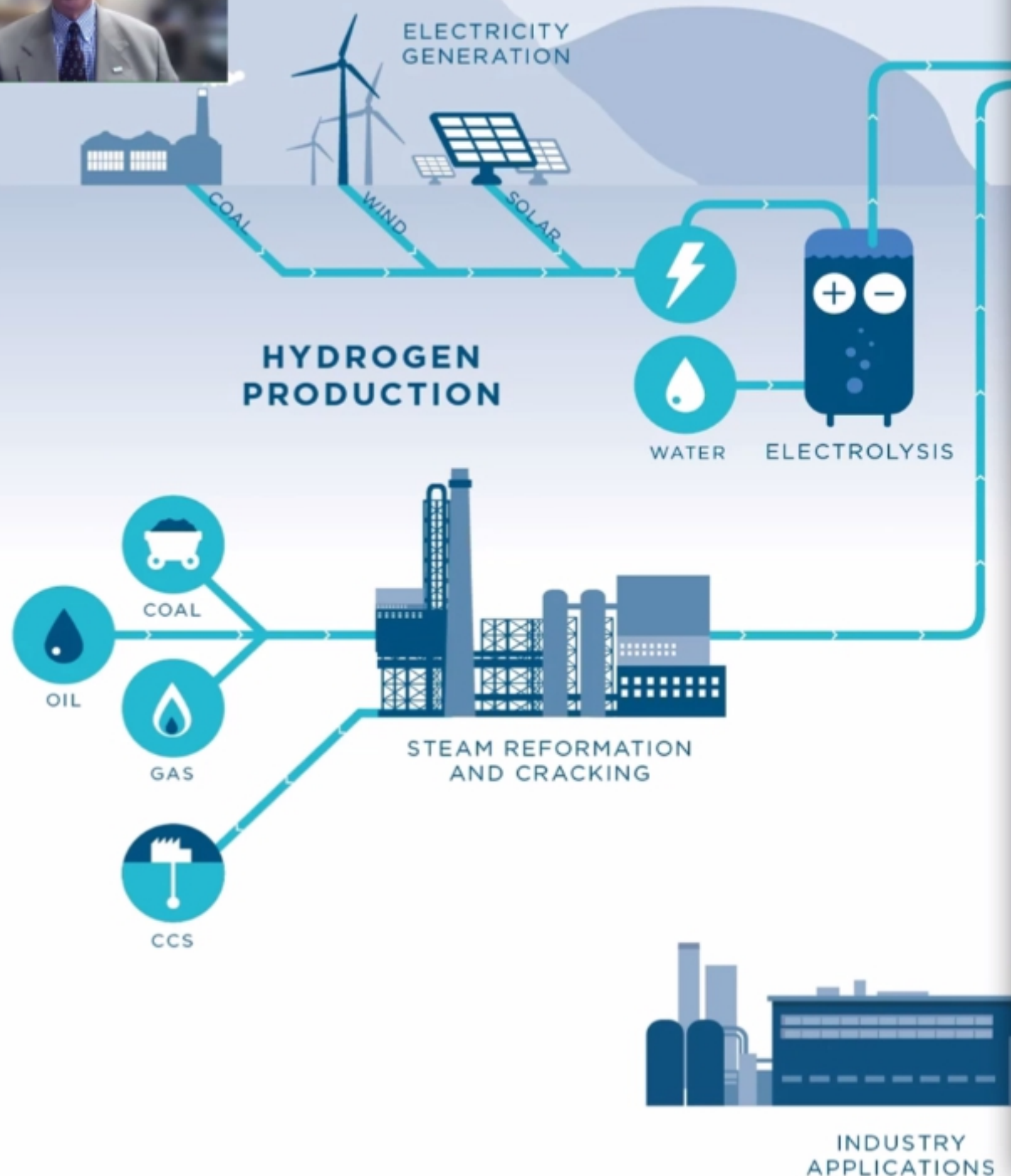




"Green Hydrogen"







‘Blue’ Hydrogen production

Hydrogen today is predominantly made by conventional SMR of natural gas - as of 2018, around 95% of global hydrogen produced from fossil fuels by steam reforming natural gas.

To be “blue”, carbon emitting hydrogen production must be coupled with Carbon Capture and Storage (CCS) to capture CO₂ from the fluegas.

The CCS process can double the overall cost of the plant. Generally seen as:

- more scalable as the industry expands
- easier to supply to industrial clusters that need to decarbonise quickly

‘Green’ Hydrogen production

Today, worldwide electrolyser capacity is 20-25GW.

There are two main types of electrolyzers:

- alkaline electrolysis cells (AEC) – been available for many years, based on current technology generally lower CAPEX but higher OPEX cost than PEMs
- polymer electrolyte membrane (PEM)

Energy vector

Hydrogen can be used to store and move renewable energy production from where it can be generated at very low cost to demand centres where it can be monetised – to overcome intermittency and excess supply of renewable power generation

Blending with the grid

Hydrogen can be blended with natural gas and transported on national gas grids

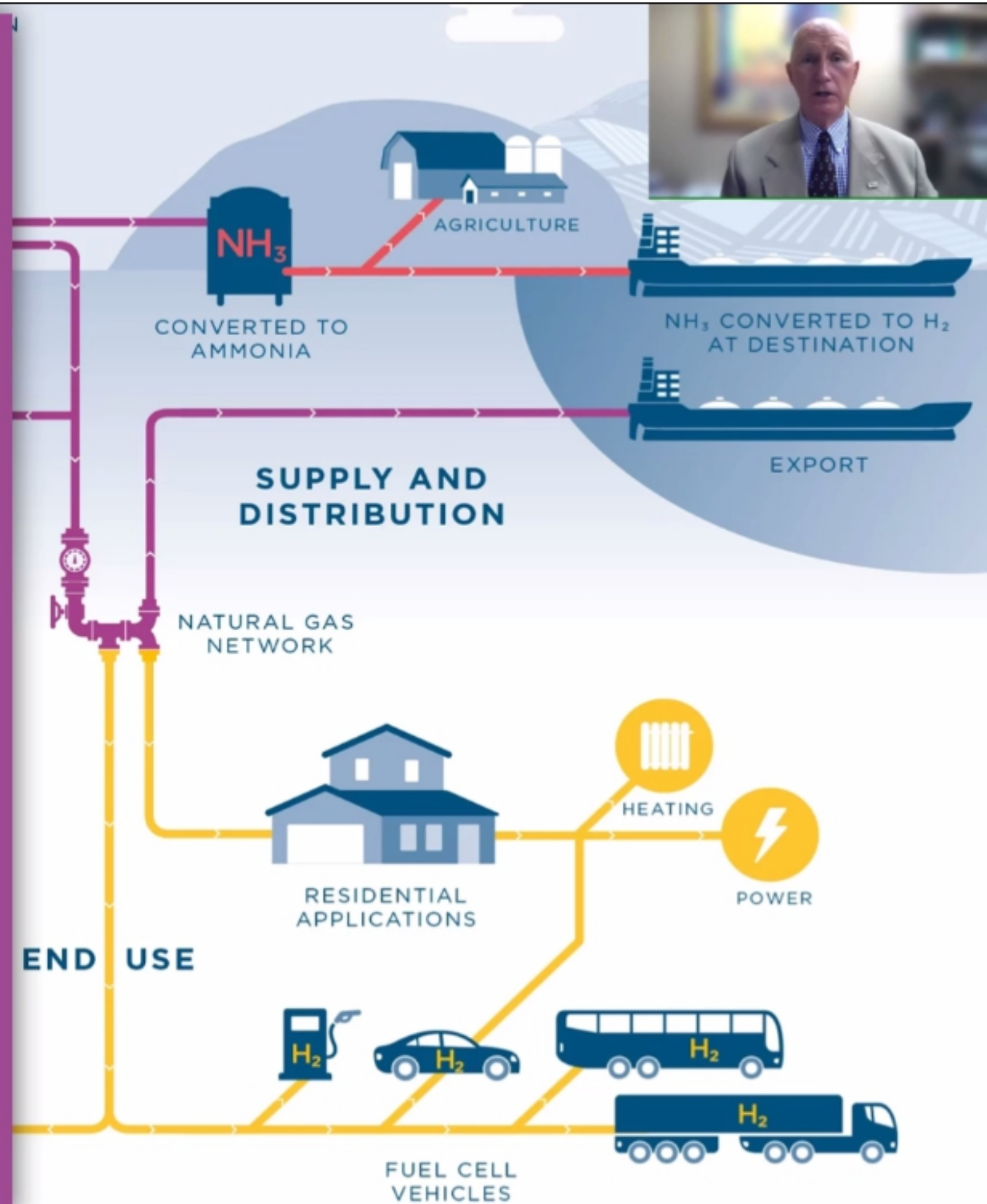
- there are existing infrastructure and markets to facilitate this
- hydrogen has 1/3 of thermal value so costs involved in switching equipment and reinforcing infrastructure

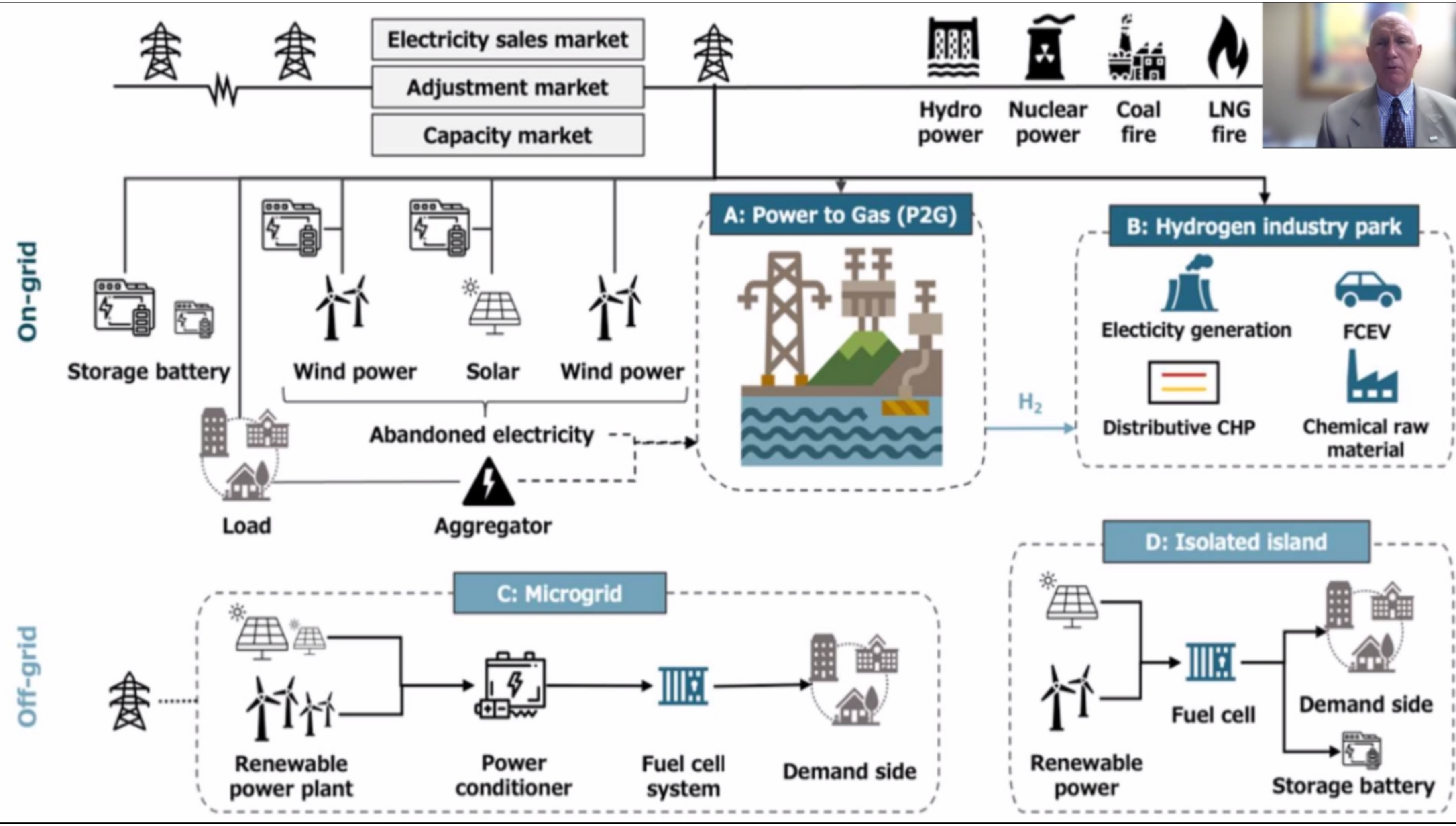
Ammonia conversion

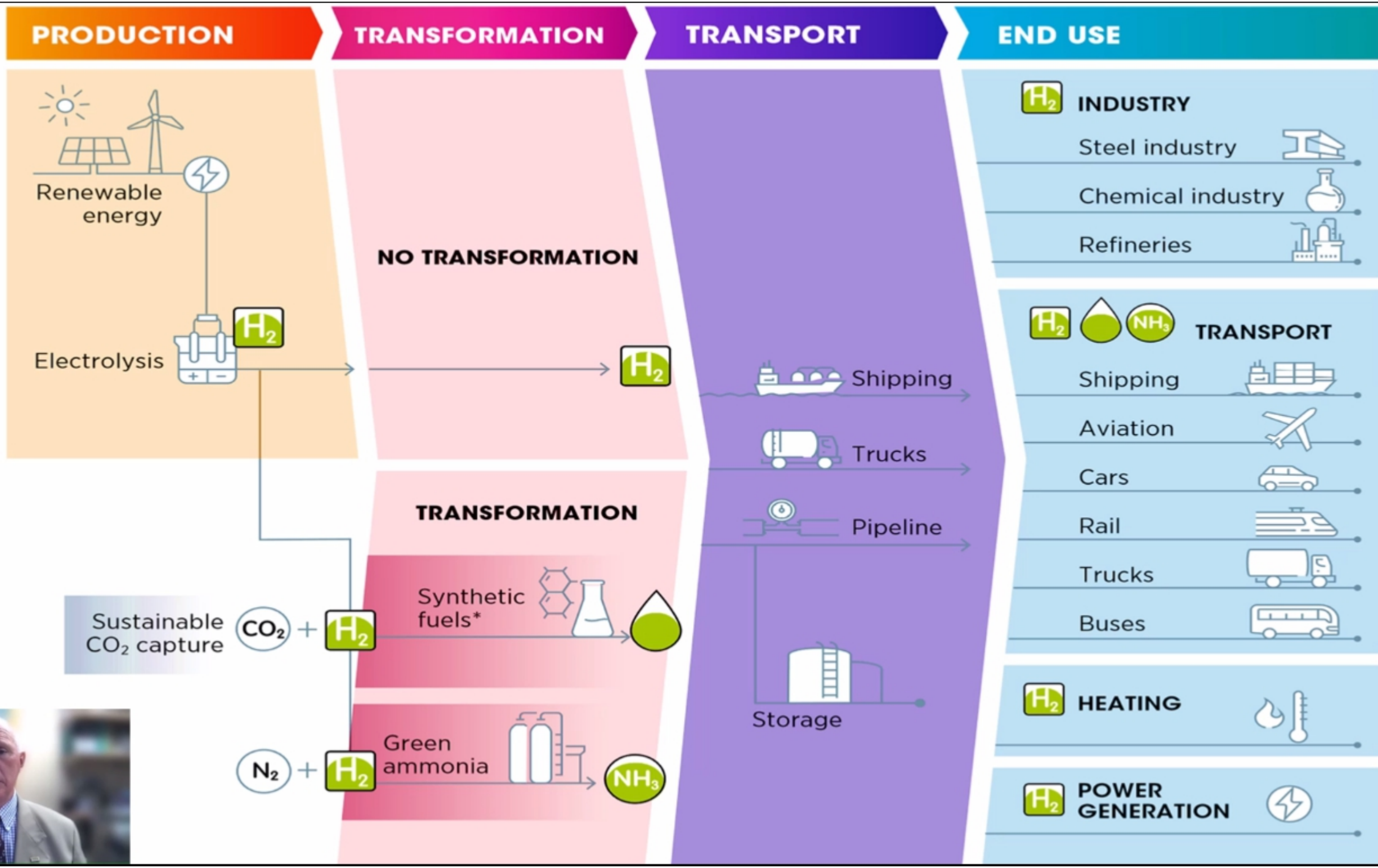
Hydrogen can also be converted to ammonia for distribution, then converted back to hydrogen at destination

Dedicated hydrogen networks

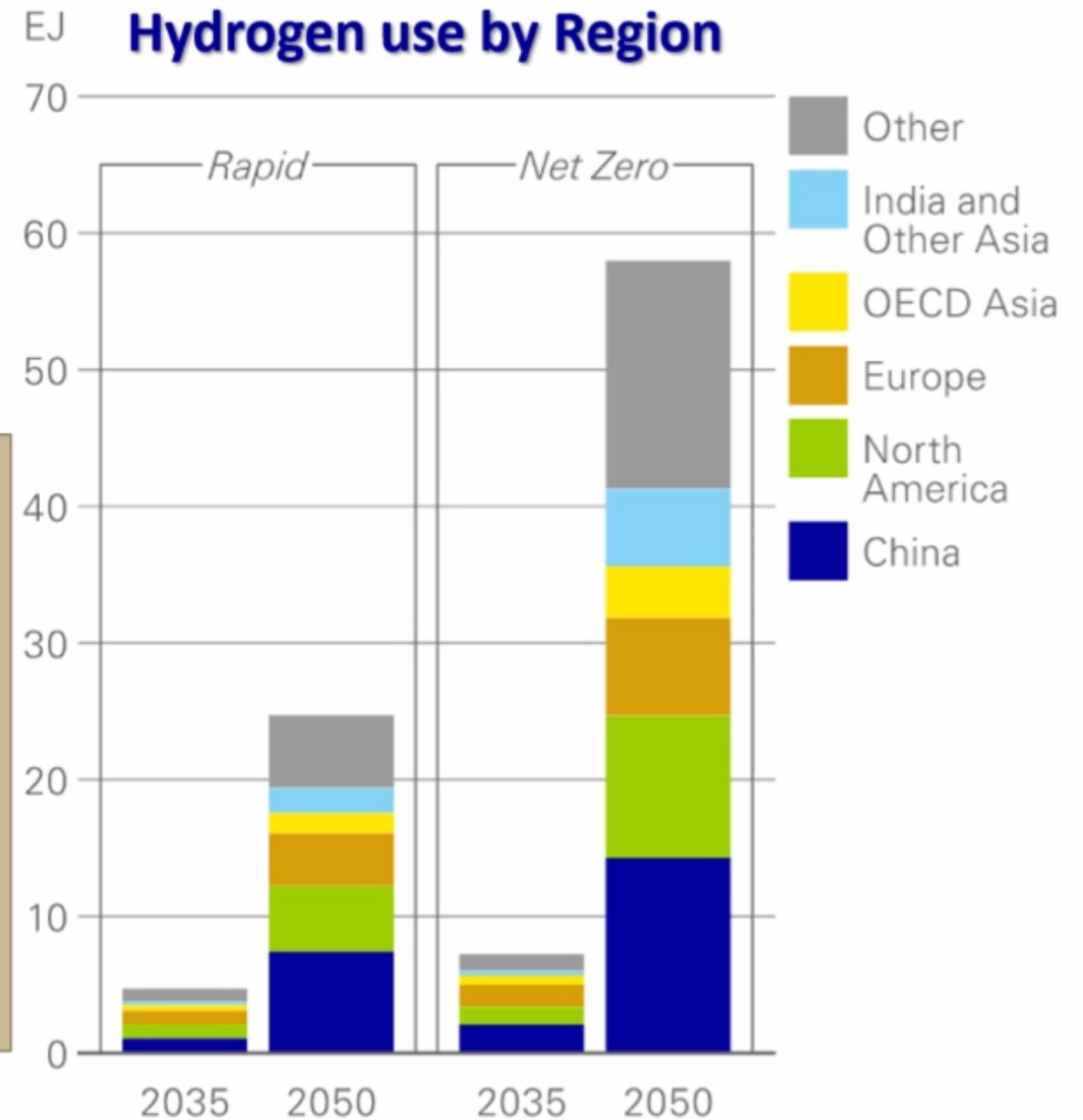
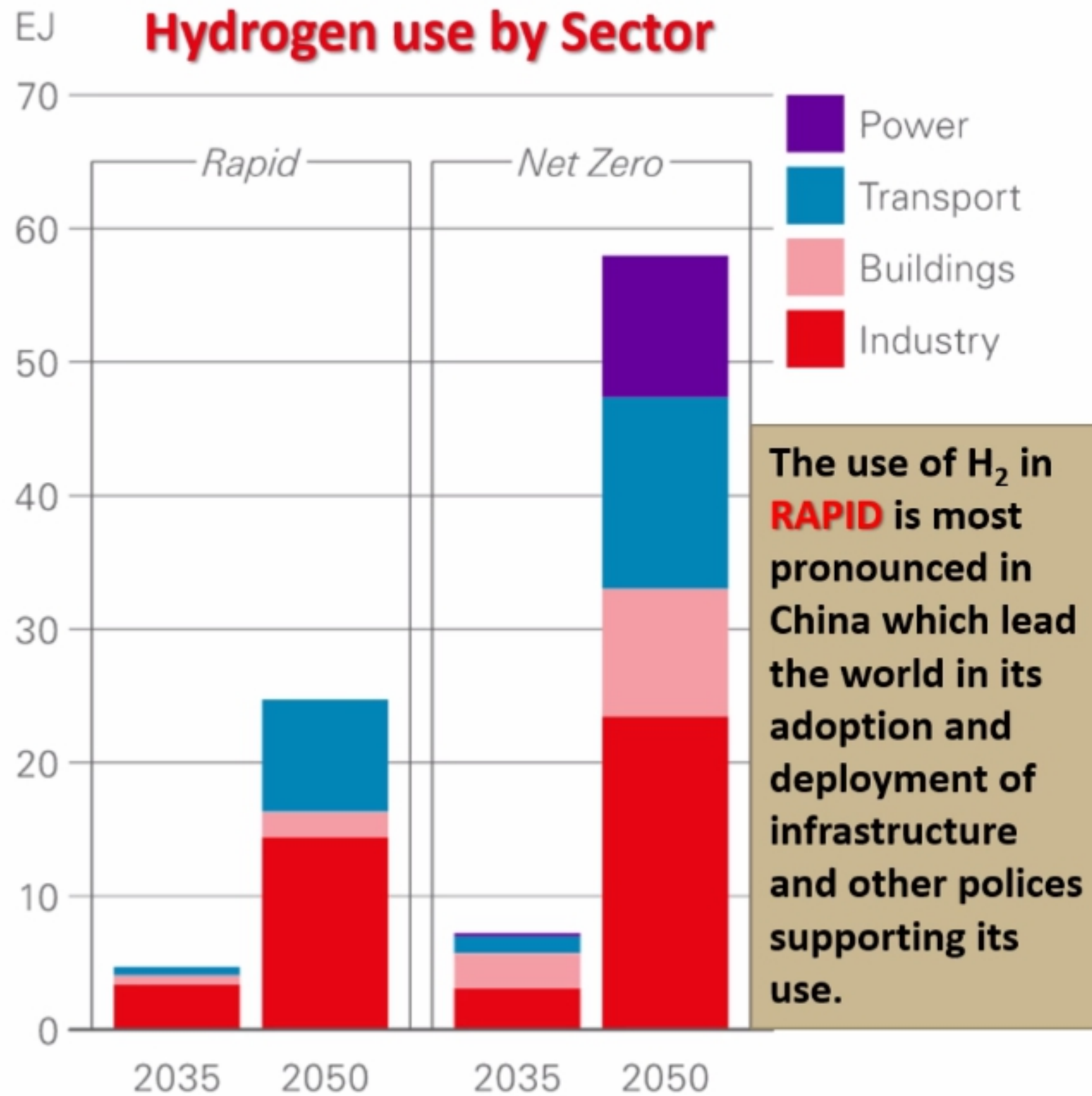
Government support will be required to build dedicated hydrogen networks.



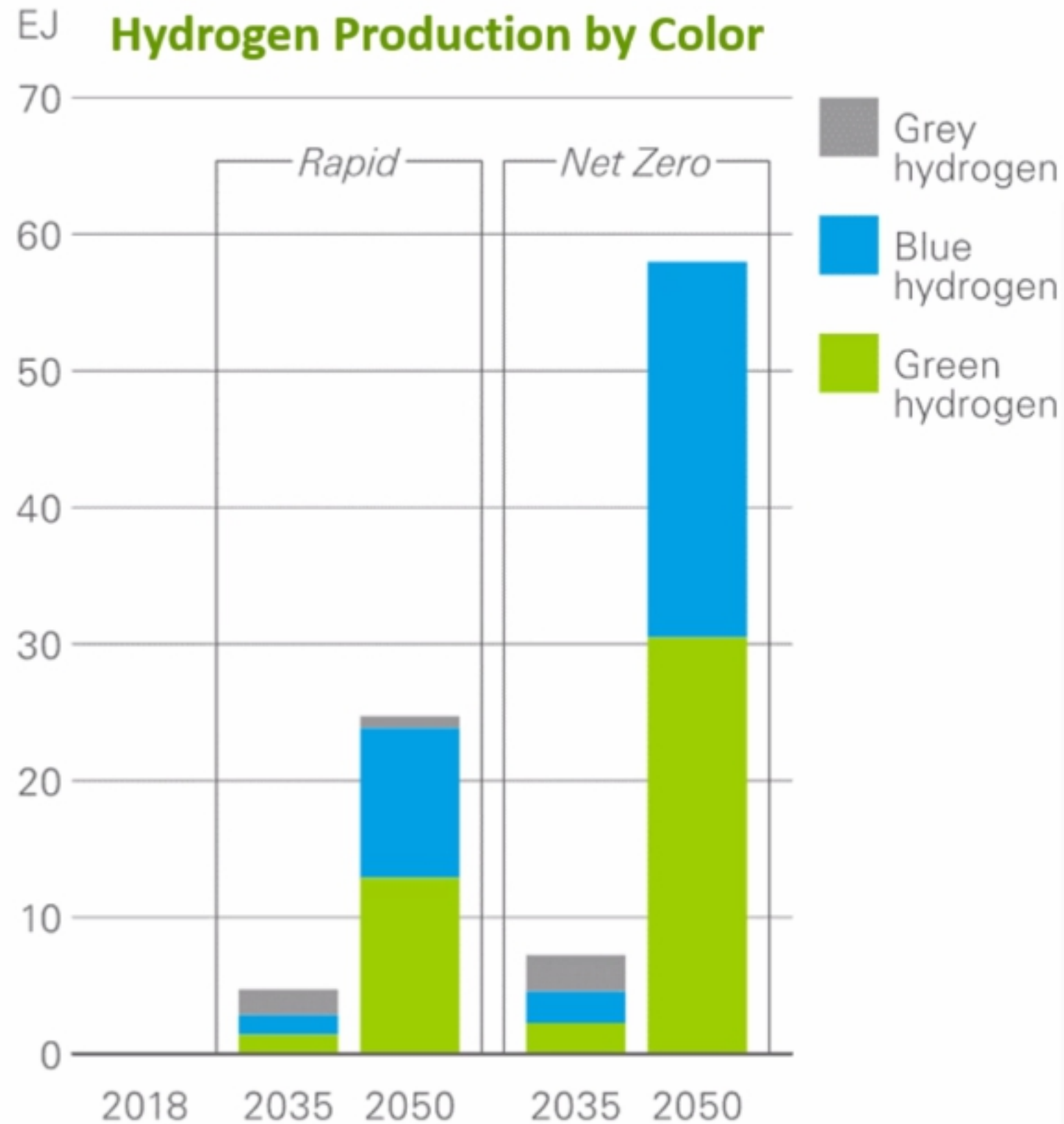




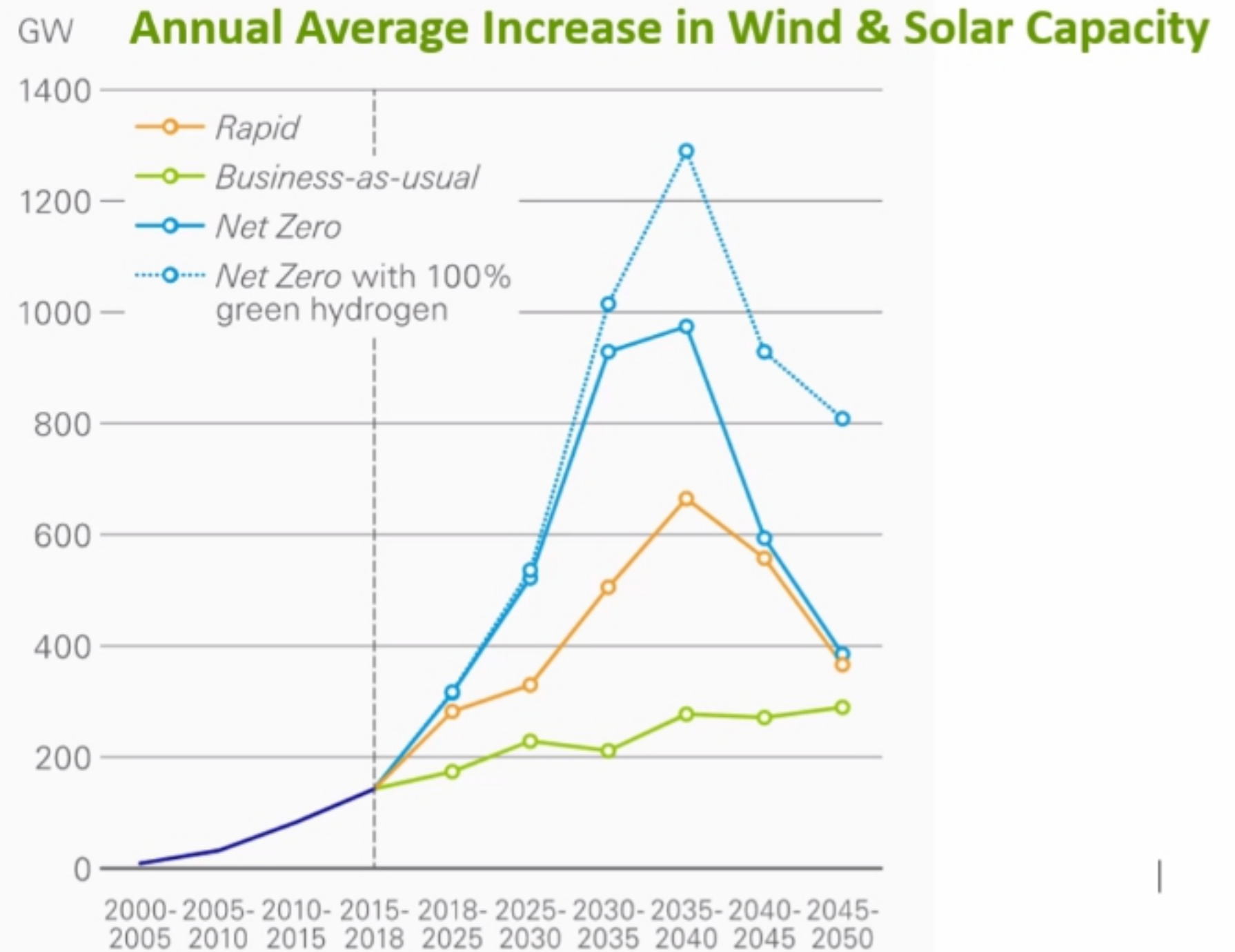
Scaling Up – *How do we get there?*



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By 2050, over 95% of hydrogen in Rapid and Net Zero comes from green and blue hydrogen in more or less equal amounts.



Green Hydrogen is reshaping our World



Is Green Hydrogen reshaping the rule of the game?

When and where could Green Hydrogen
become cheaper than blue hydrogen?

Source: *Green Hydrogen to Start Undercutting Blue by Mid-2020s,
Bloomberg New Energy Finance, London*



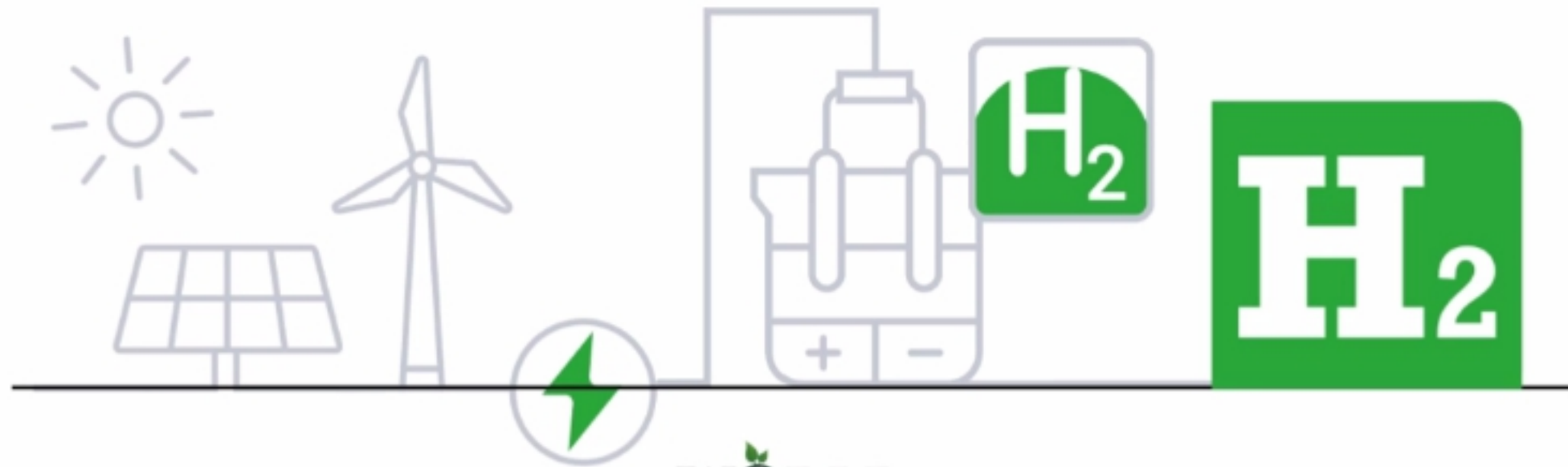
***Green Hydrogen** is reshaping our World*



Changing Role of **Green Hydrogen** in Today's World

Geopolitics and Geoeconomics loom large in Today's World.

The current events will continue to establish new global relationships facilitating policies for energy transitions.



Challenges of the Energy Trilemma



SUSTAINABILITY
SECURITY
AFFORDABILITY

Green Hydrogen is reshaping our World

Thank you

