

## California's decarbonization targets and beyond: Decentralized Waste to Hydrogen solutions

# California Target

Renewable electricity  
electrolysis and conventional  
biofuels are fully carbon  
neutral.

**Good !!**

Hydrogen (or Power) from  
Biomass and Waste:  
Effectively remove carbon  
from the atmosphere by  
combining conversion stations  
with CCS technology.

**Much better !!**

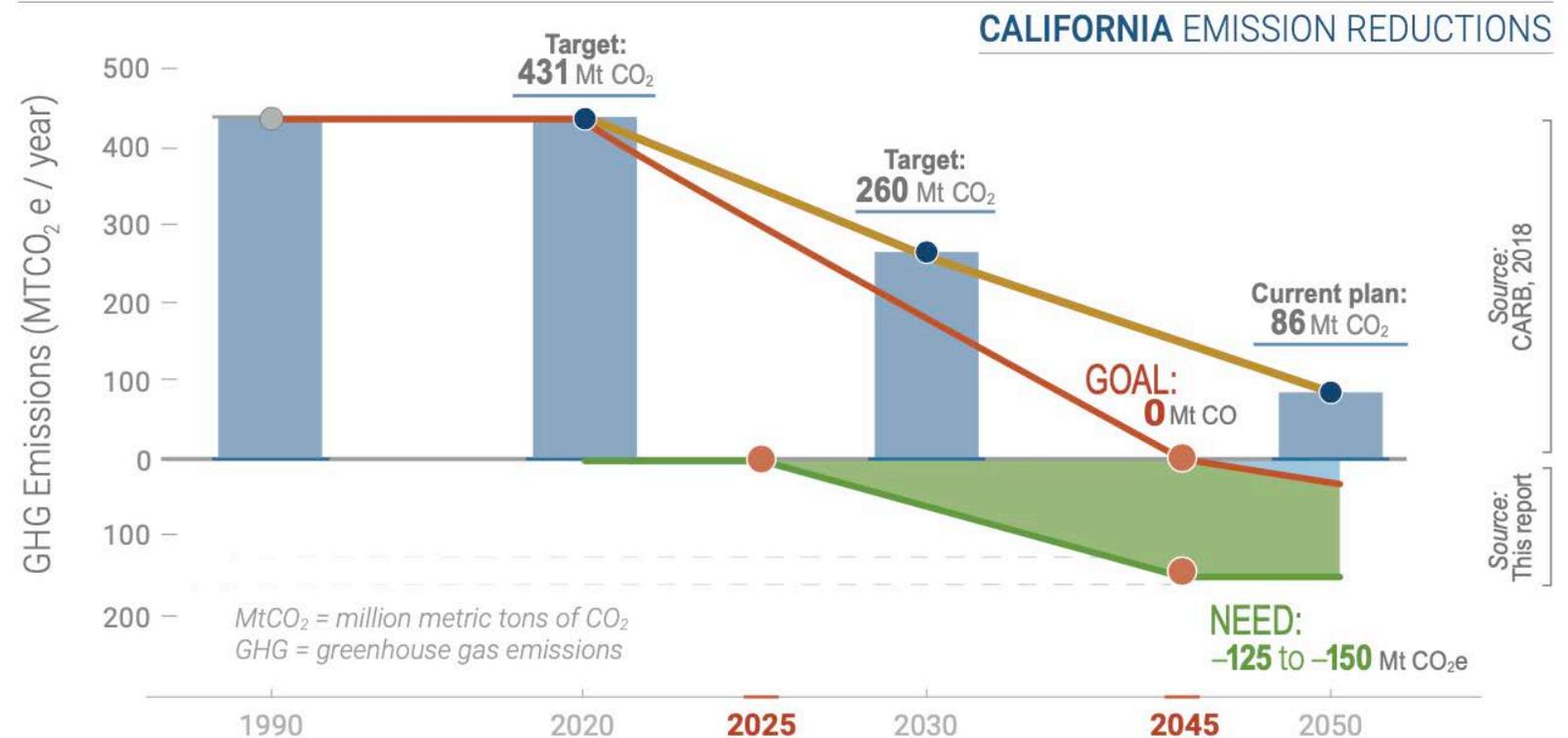


Figure ES-1. Goals of California's emissions plan extrapolated to 2045 (CARB, 2017) with negative emissions estimates from this report.

- Landfilled MSW: 40 MMT
- Crop residue: 9 MMT
- But also:
  - 170 million trees
  - Other dry biomass
  - Non-recycled plastic and paper
  - Upcoming bioplastics

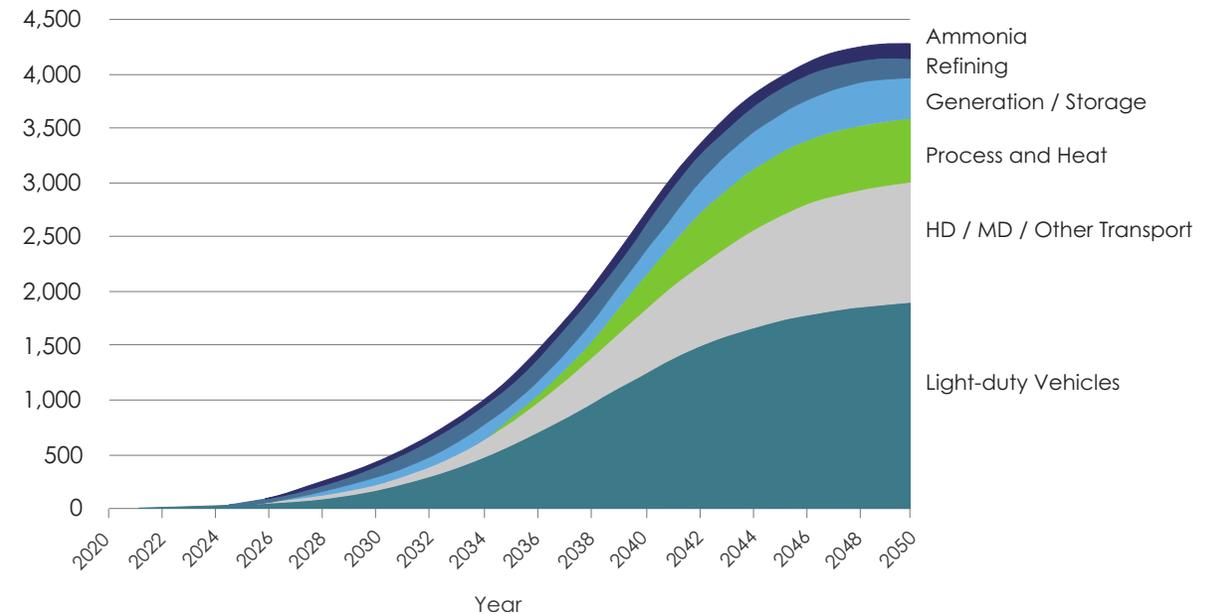


# ... and hydrogen is coming

## Not “if”, but “when”

- California expected to reach 500,000 T H<sub>2</sub> demand by 2030, 4 MT in 2050
- Public transportation projects, automotive manufacturers, heavy duty vehicles...

MILLION KILOGRAMS H<sub>2</sub> DEMAND



# Renewable hydrogen production pathways

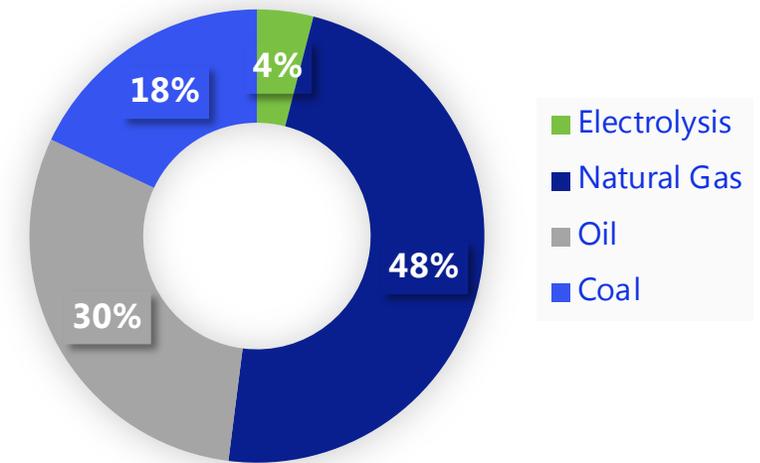
## Current world production: 50 M Tons per year

- Mostly used for crude oil refining or ammonia production
- Overwhelmingly fossil source  
(not unlike the power that charges our “clean” BEVs)

## Electrolysis powered by renewables

- The most widely acknowledged  $\text{RH}_2$  production solution
- A long road, just to cover the current production needs.
  - Need to reach a higher RE ratio
  - Cover added demand from BEV
  - Then produce hydrogen for the clean transportation needs ?

Hydrogen Production Source (Mt)



# Biomass: the third pathway

- **Billion-Ton Report - U.S. DoE & Oak Ridge National Lab**
  - Paves the way for hydrogen production:
    - 1 billion ton biomass = 50 M tons H<sub>2</sub>,
    - 50 M tons of H<sub>2</sub> contains enough energy to replace 90% of U.S. annual gas consumption of 3.4 billion barrels
- **What about California:**
  - 49 MMT MSW and Crop is 2.5 MT H<sub>2</sub>
  - 63% of the expected H<sub>2</sub> demand in 2050
  - 66 MT biogenic CO<sub>2</sub> out of our atmosphere per year

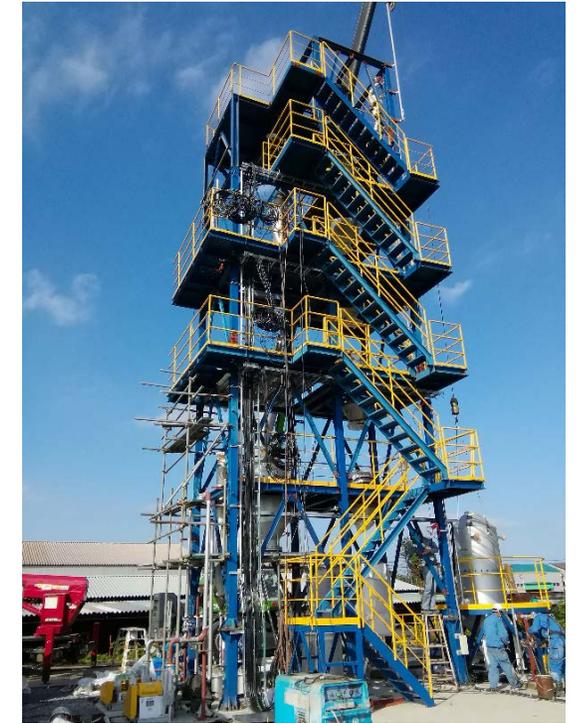
## Improving Waste management, producing clean Hydrogen

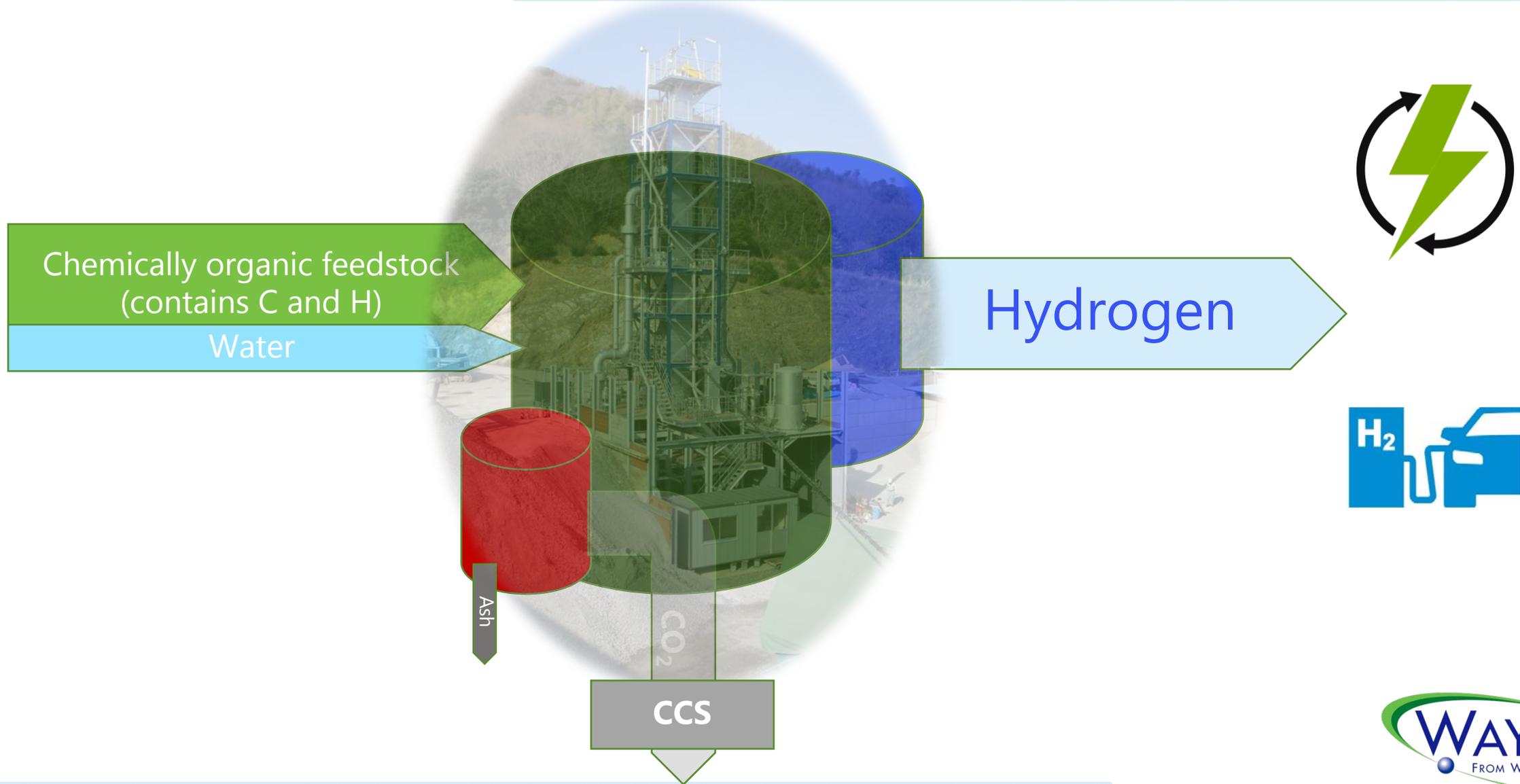
- Predictable, continuous and creatively solve another major environmental issue
- Small size distributed systems improve waste logistics and provide a clean decentralized conversion of waste to energy.
- Cleaner than incineration, addresses landfill diversion mandates



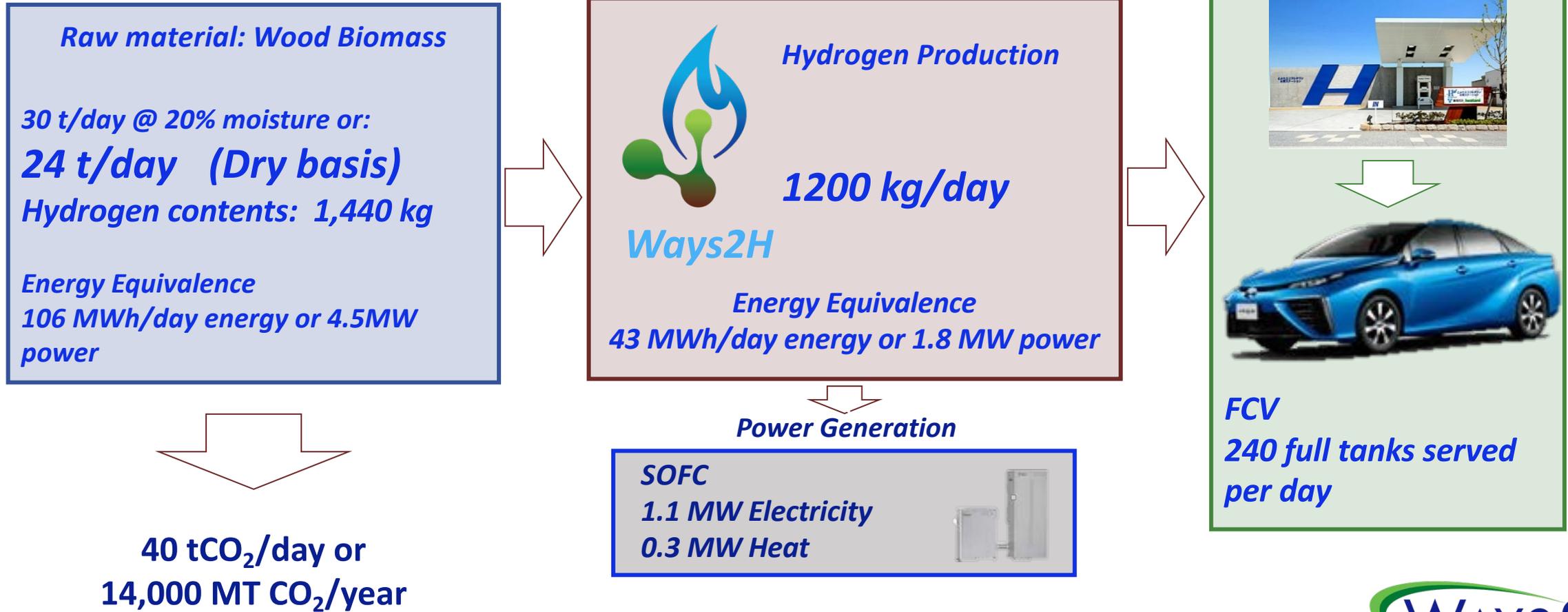
## Our solution, engineered, refined and enhanced in Japan

- Developed by Japan Blue Energy Co.
- Organic waste, including plastics, into hydrogen
- Over 16 years development, 3 generations of test size units built, tested and enhanced
- 4th generation currently in operation in Joso, Japan, treating sewage sludge and other waste streams
- Small to medium size, truly decentralized solutions to optimize feedstock or hydrogen logistics
  - 1 t/day capacity transportable solution
  - Stationary 24 t/day standard design.





# Project Case Study: 2 Output Options



## Ways2H systems produce renewable hydrogen from waste biomass

- Engineering
- Construction
- Commercial Development
- Joint venture: Clean Energy Enterprises & Japan Blue Energy Co.
- Headquarters in Long Beach, CA

## Decentralized energy production

- 8 to 48 tons/day waste processing
- 300 KW to 2 MW power stations, 300 kg to 2 tons H<sub>2</sub>/day

## Systems available now





**For additional information  
please contact:**

Jean-Louis Kindler, CEO  
+1 (562) 414-4151  
[jkindler@ways2h.com](mailto:jkindler@ways2h.com)