



Earth, Energy, Environment

Colorado Fuel Cell Center



Low-carbon electricity, green hydrogen, and industrial decarbonization

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American Chamber of Commerce Peru

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We wish to store solar and wind power for years

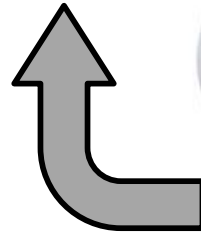


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**Peru's largest battery
Chilca BESS System
31 MW-hr
Charged in ~ 3 hrs**

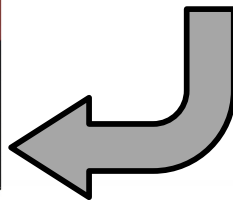


**Charged in
8 milliseconds!**

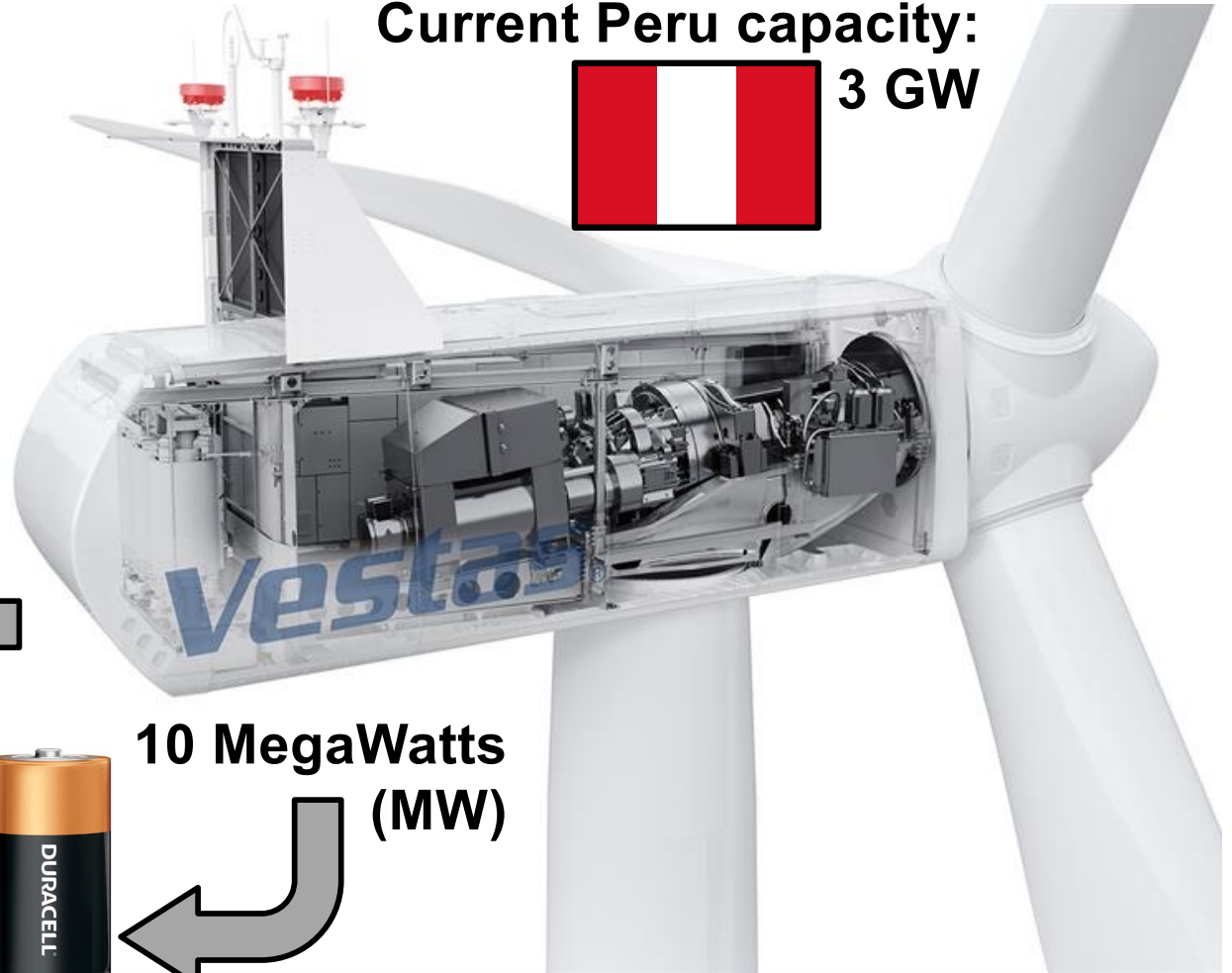


12 Watt hours

**10 MegaWatts
(MW)**



**Current Peru capacity:
3 GW**

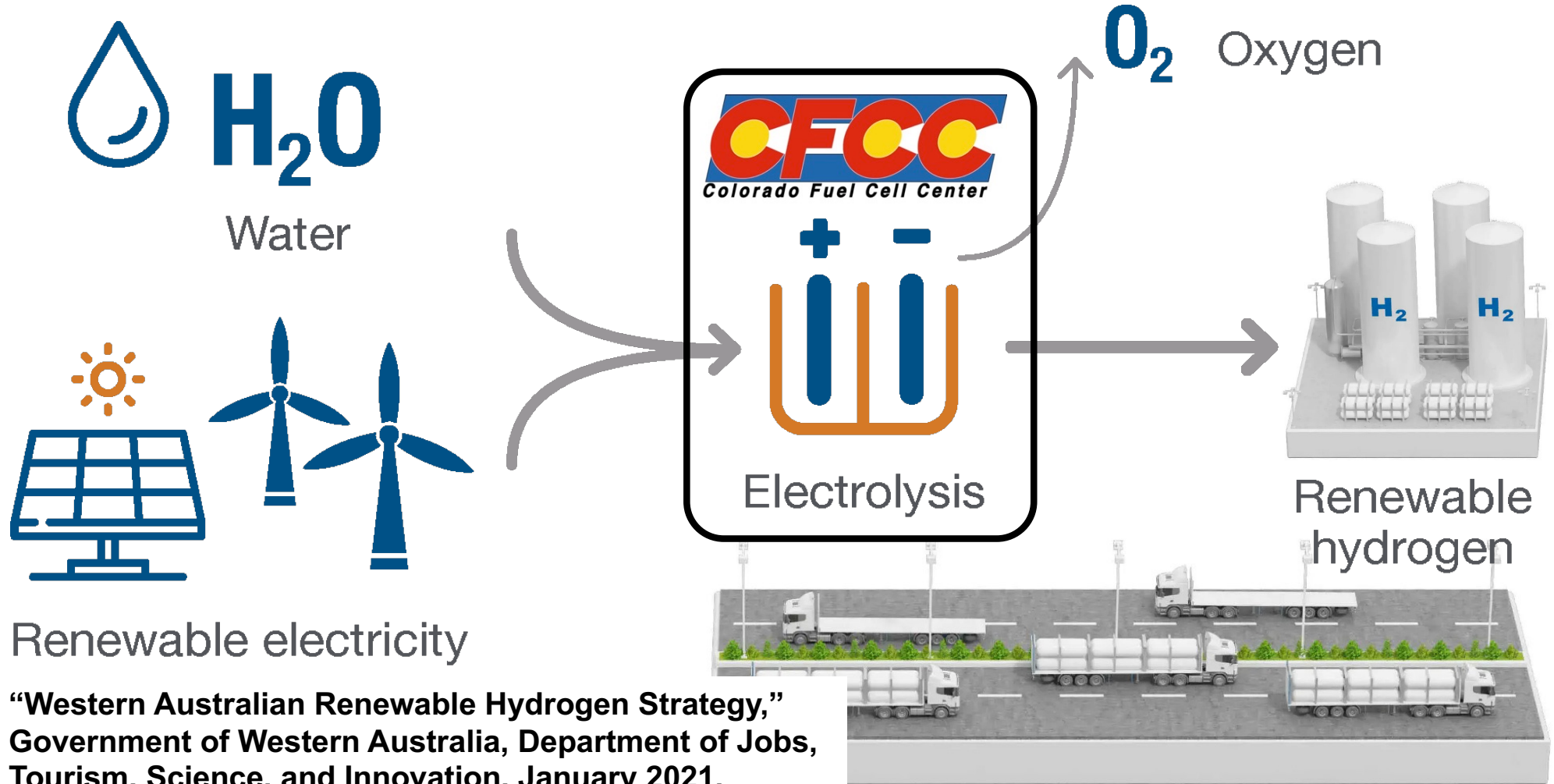


We build “Electrolyzers”, or “Flow Batteries”, turn green electricity into green hydrogen



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“Western Australian Renewable Hydrogen Strategy,”
Government of Western Australia, Department of Jobs,
Tourism, Science, and Innovation, January 2021.

Australia's Fortescue Metals Group seeks to be the Green H₂ Supplier to all of Asia; 15 MT by 2030



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Chairman Andrew Forrest



China boasts the world's largest electrolyzer: 260 MW of power makes 150 MW of H₂



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World's largest electrolyzer, Sinopec's 260 MW Kuqa facility



- Electrolyzers produced in China
 - Tech issues reducing productivity
 - Operating at 1/3rd scale
- Alkaline electrolyzers
 - “Low temperature” technology, ~ 90 °C
- Efficiency ~ 60%
- Commissioned 2023

Solid-oxide electrolyzers produce H₂ at much higher efficiency than more well-established technology



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World's largest solid-oxide electrolyzer, NASA's Ames Research Ctr



- **Manufactured by Bloom Energy**
- **Earlier stage of technological development**
- **Efficiency ~ 80%**
- **Many orders on hand!**

Mines has been advancing solid-oxide fuel cells manufactured by Ceres Power, Ltd (UK), expanding to electrolyzers

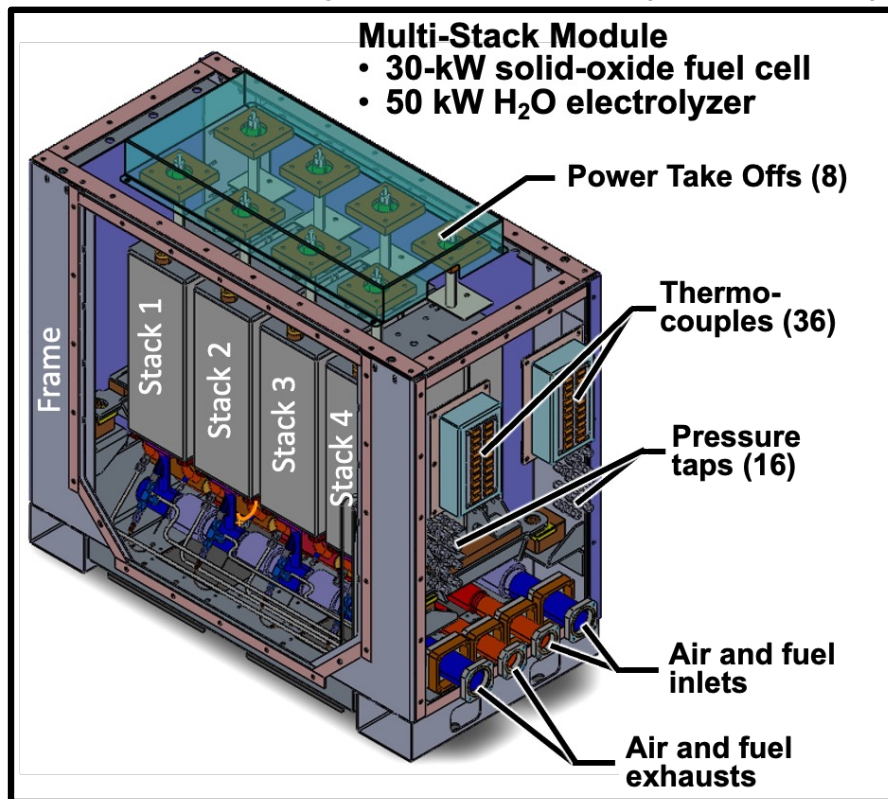


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Multi-stack module featuring four (4) 5-kW SOFC stacks supplied by Ceres Power Ltd. (Horsham, UK)

Research Engineer Chris Chmura preparing 25 kW_e multi-stack module for operation

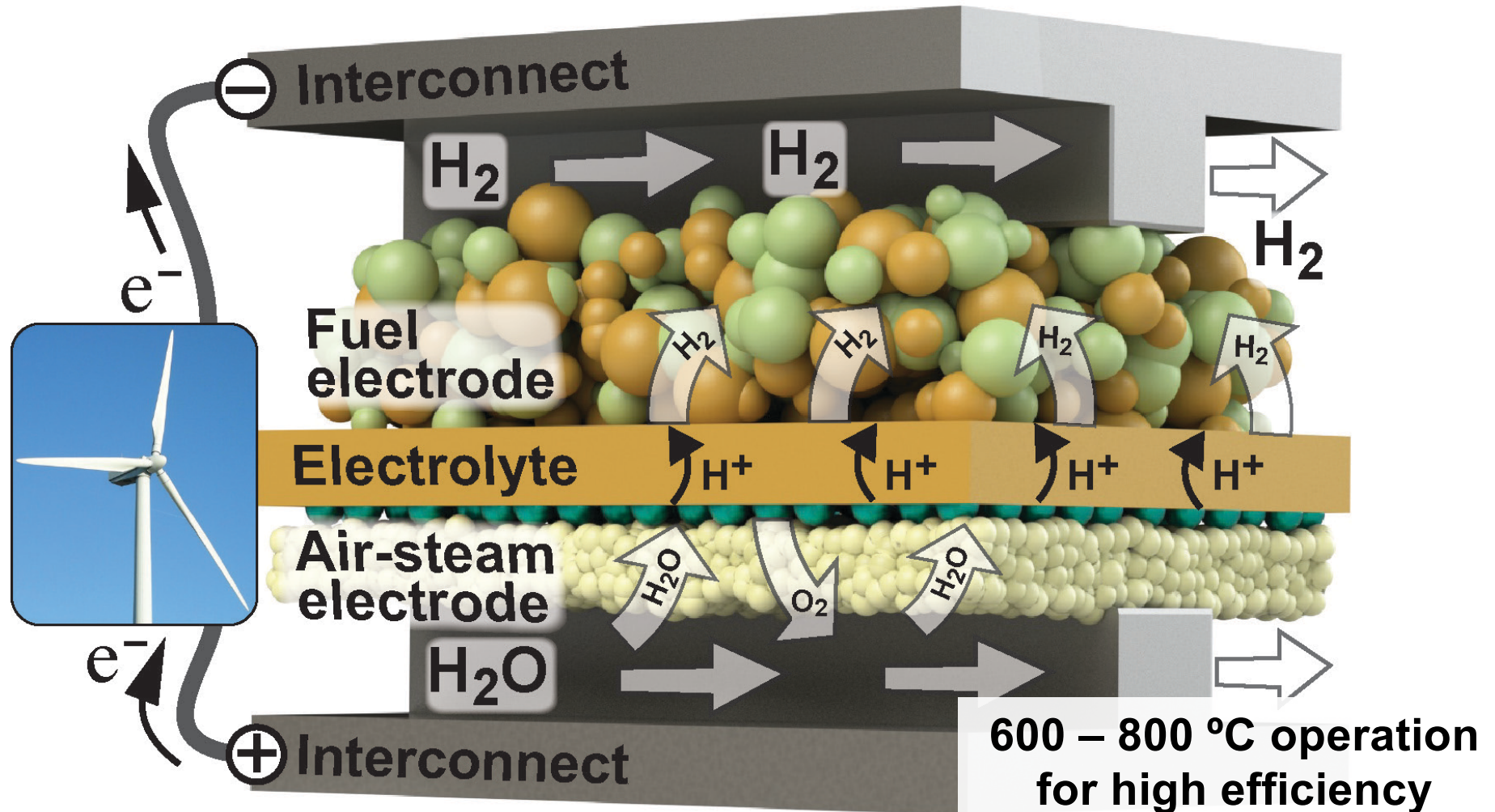


Our solid-oxide (ceramic) electrolyzers / flow batteries make pure, dry pressurized hydrogen



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The team at the Colorado Fuel Cell Center works with developers to scale up these emerging technologies

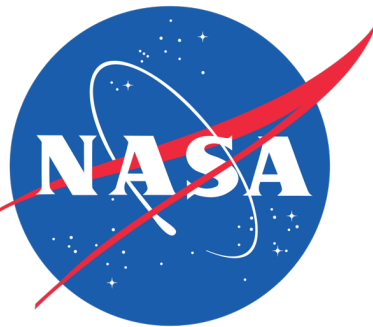
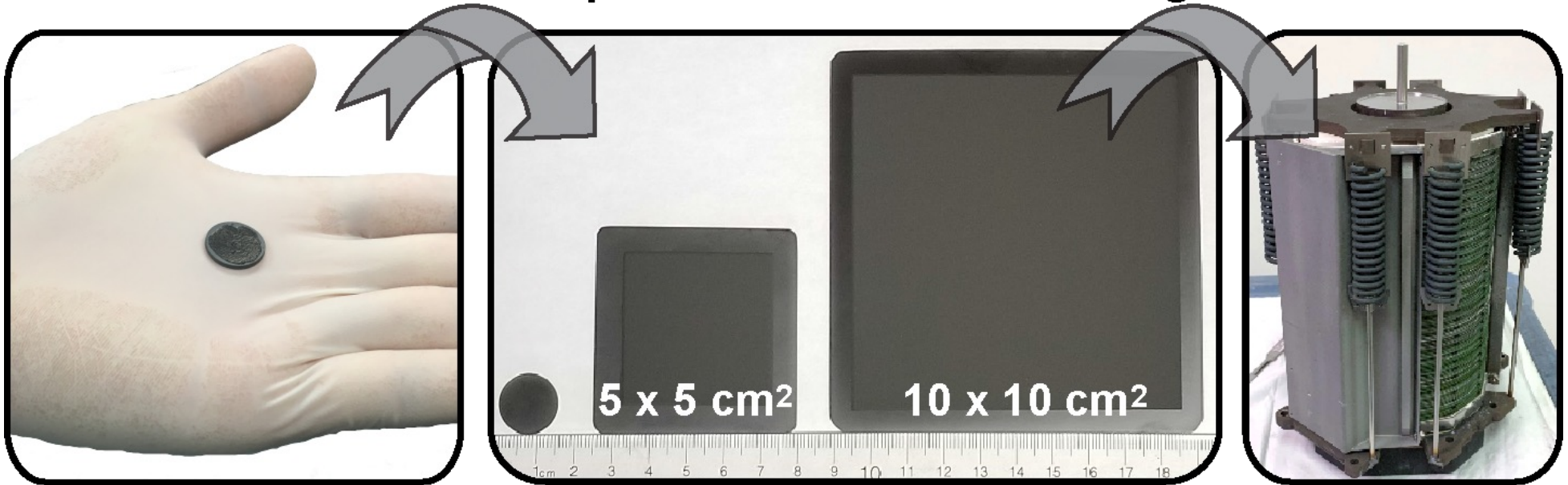


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Cell scale up

Stack integration



adaptive
energy

ceres

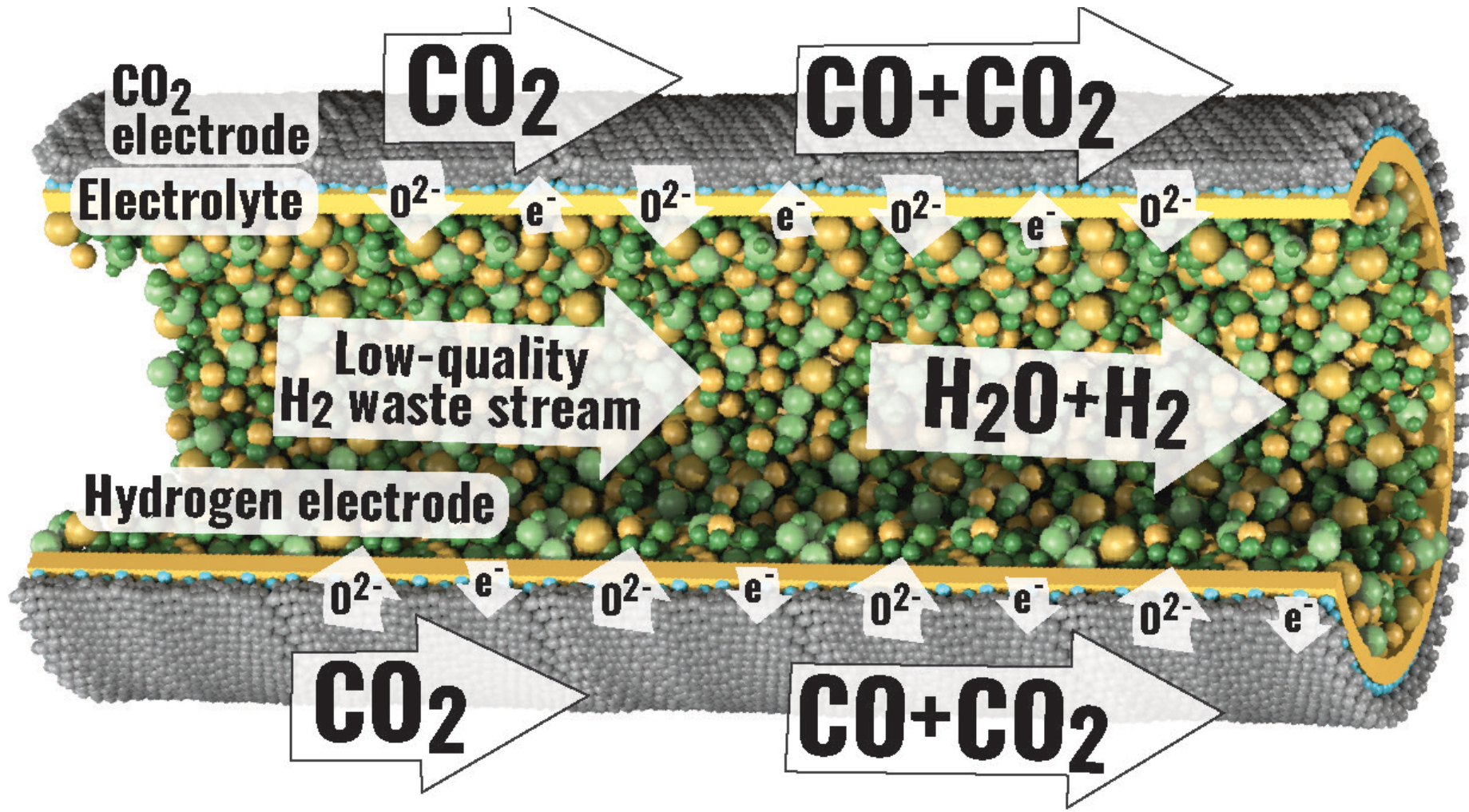
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We are working with industrial partners on Green Steel production and CO₂ re-use



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Materials discovery; system demonstrations; scientific training are key outcomes of the CFCC



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Dr. Gladys Anyenya
Wabtech Corporation



Dr. Sean Babiniec
Ball Aerospace



Michelle Butler
Heliogen



Dr. Amy Gray
Engineering Systems



Dr. Long Le
Pacific NW National Lab



Dr. Daniel Murphy
WHA International

