



Hyrdogen via Electrolytic Processes

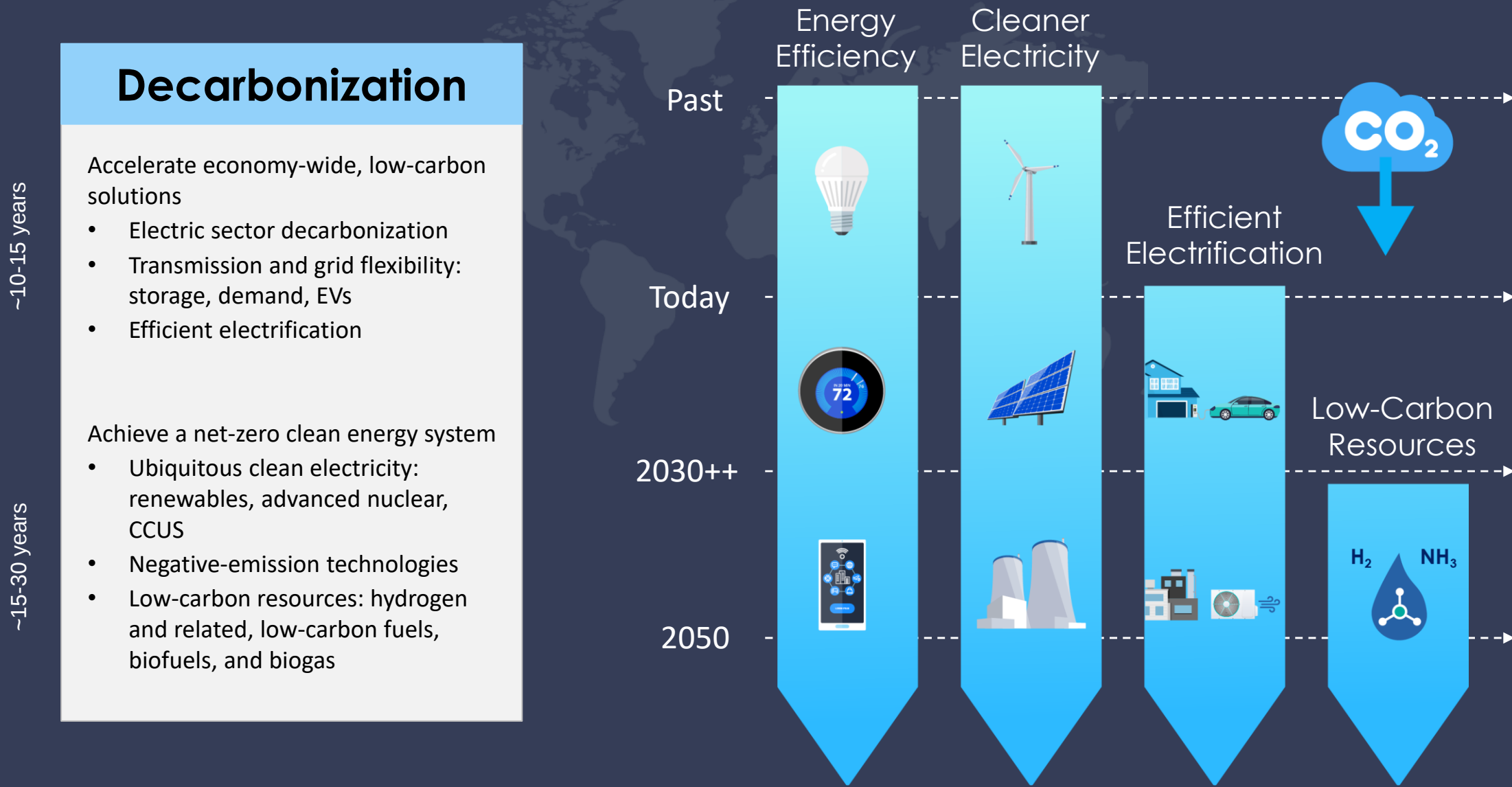
Chemical Storage for the Grid

Brittany Westlake, Ph.D.
Sr. Technical Leader

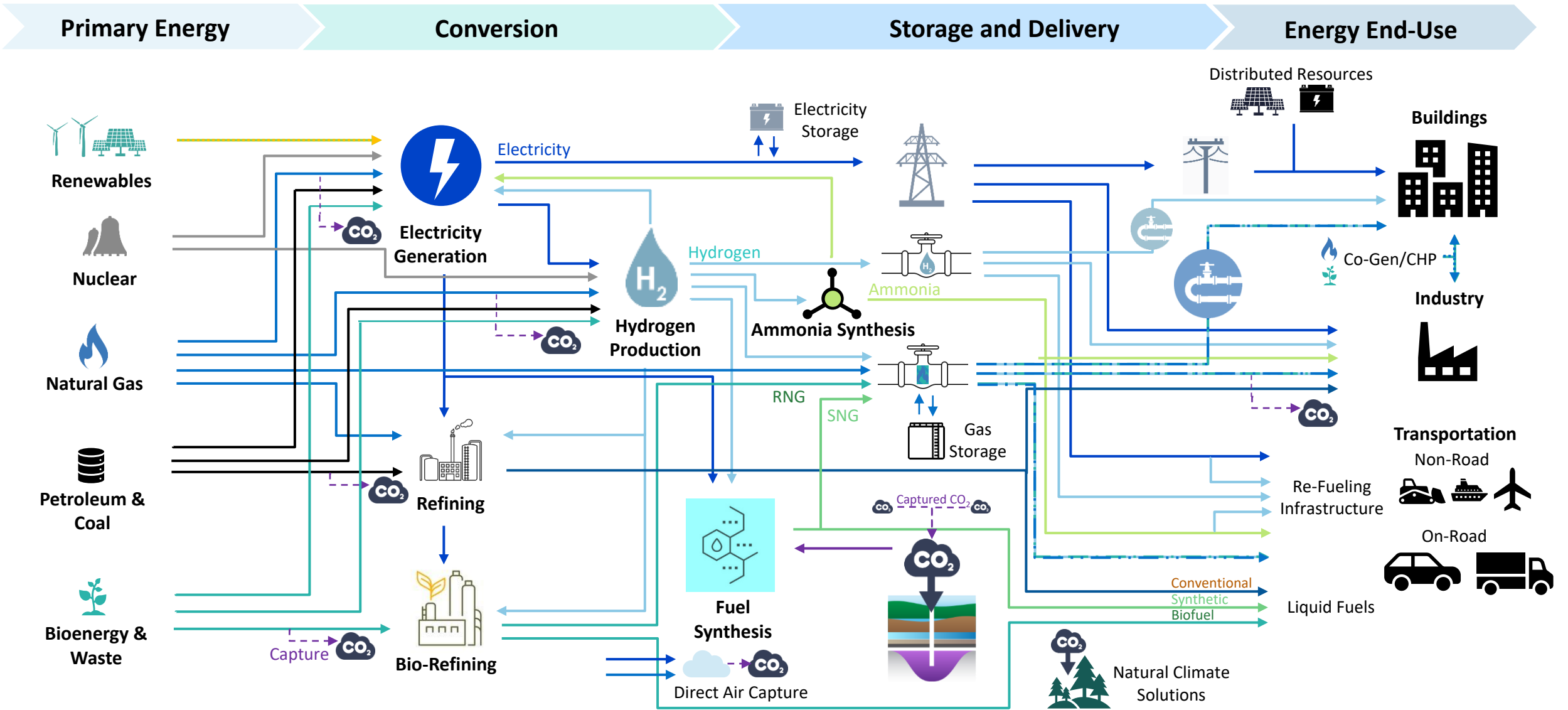
ESIG Hydrogen Tutorial
March 21, 2022



Decarbonization Pathways Enabled by Innovation



Economy-Wide Low-Carbon Energy Pathways



New Targets for Hydrogen



1 Dollar



1 Kilogram

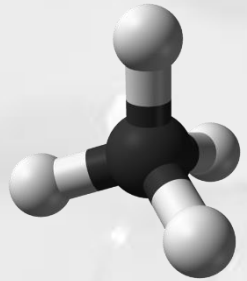
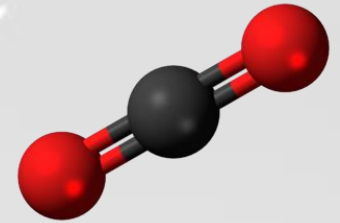


1 Decade

<https://www.energy.gov/articles/secretary-granholm-launches-hydrogen-energy-earthshot-accelerate-breakthroughs-toward-net>



Steam Methane Reformation

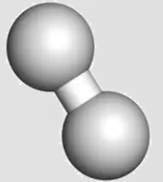
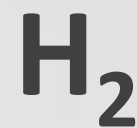


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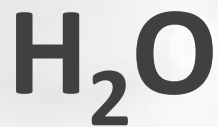
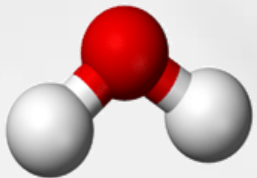
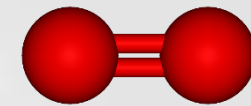
Steam



+



Water Electrolysis

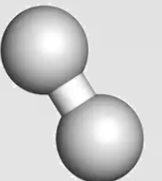
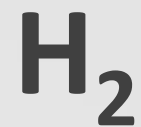


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Electricity

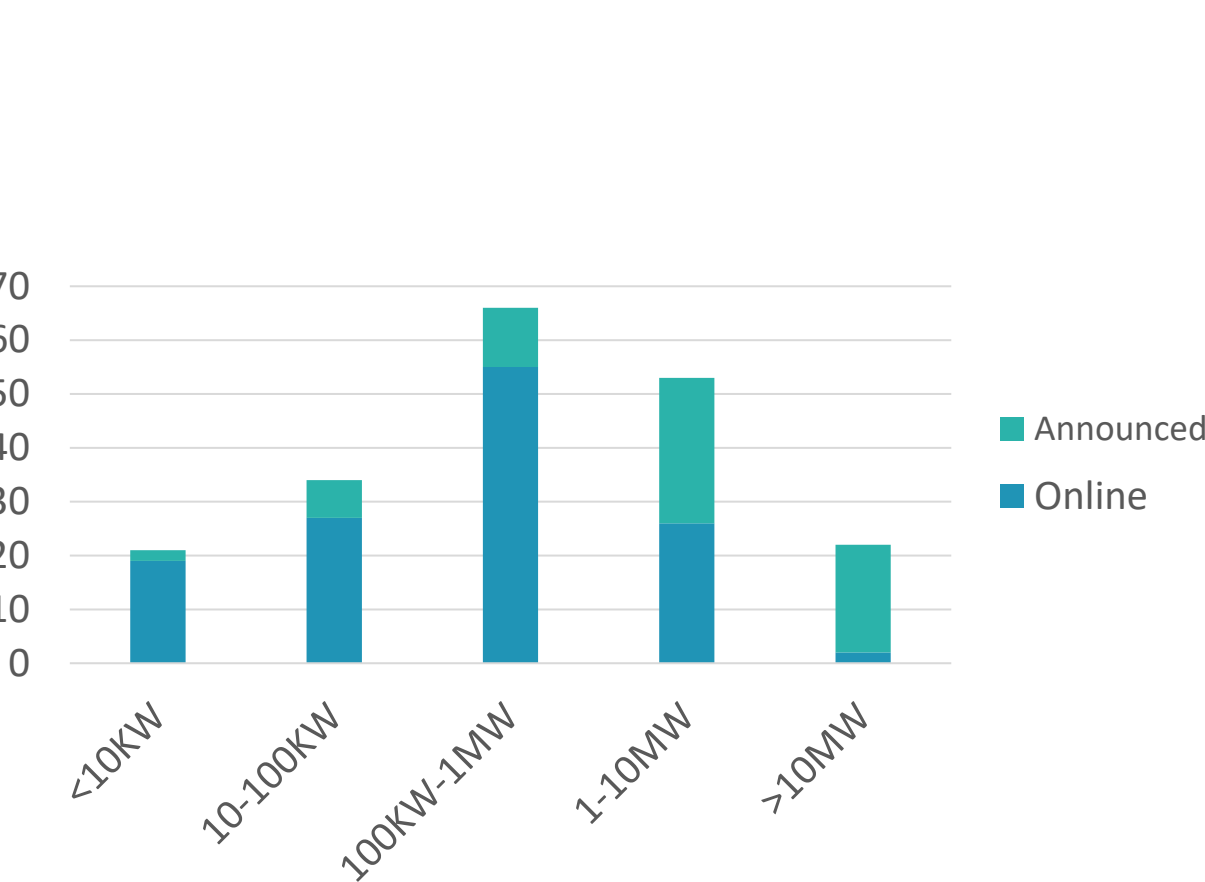


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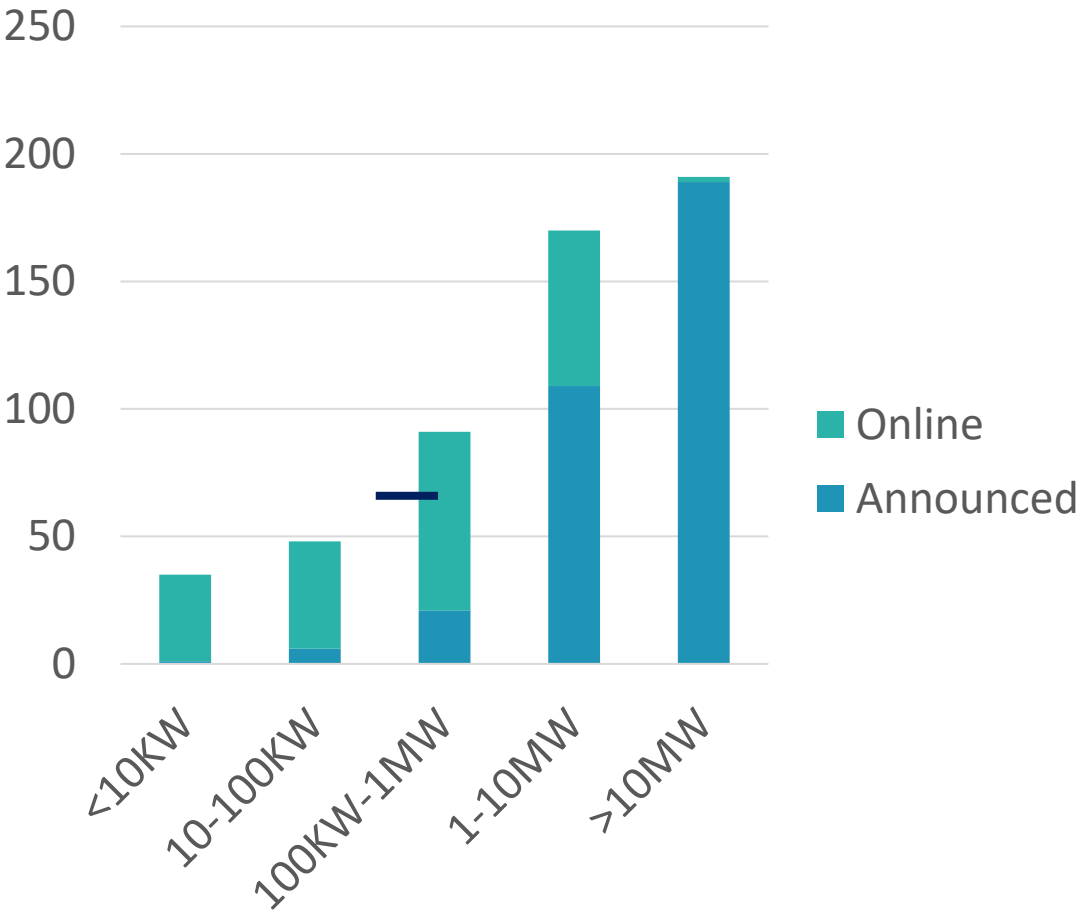


Electrolyzer Projects Took off Worldwide

IEA Projects Oct 2020



IEA Projects Oct 2021



Changing Generation

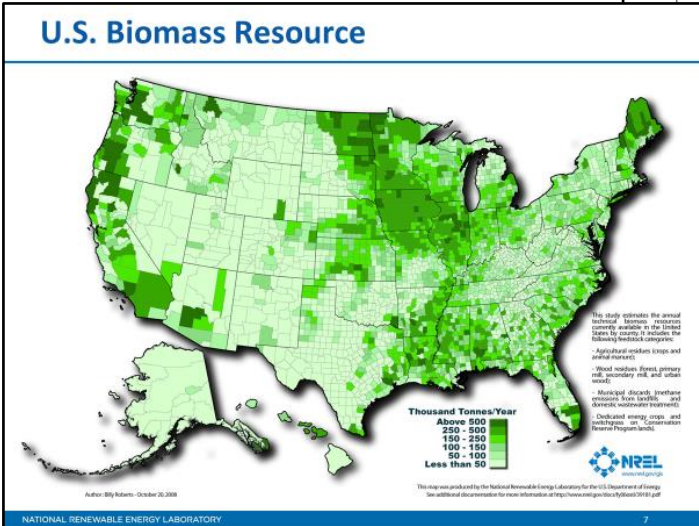
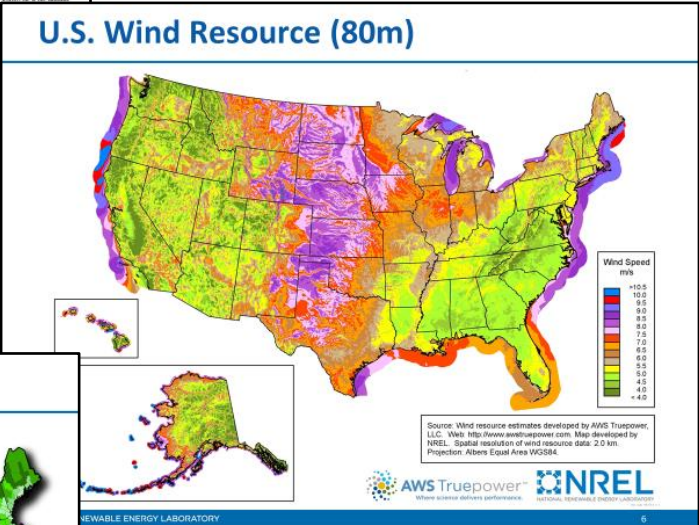
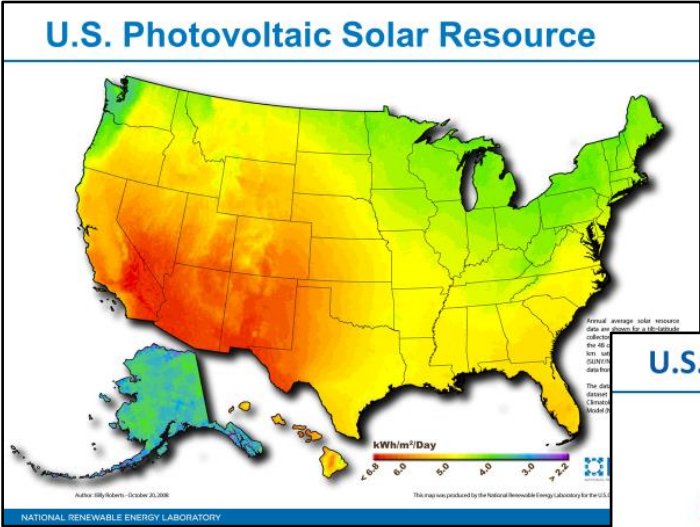
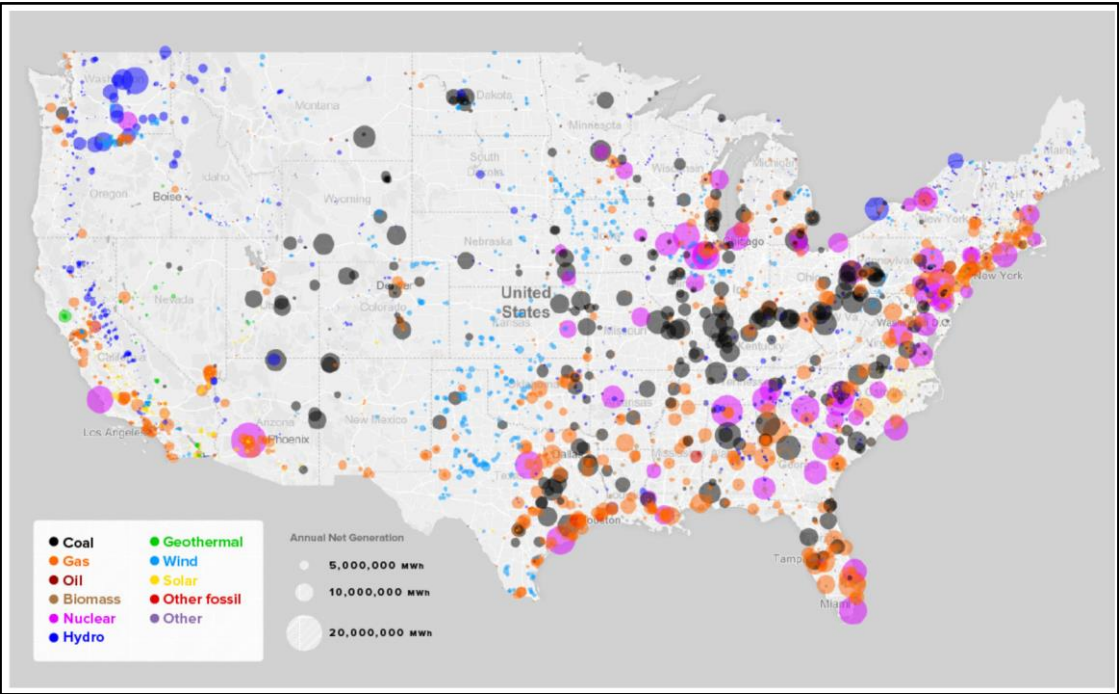


Image: NREL Renewable Technology Potential

Slide borrowed from
Clifford Ho, SNL
Energy StorM
Workshop Intro



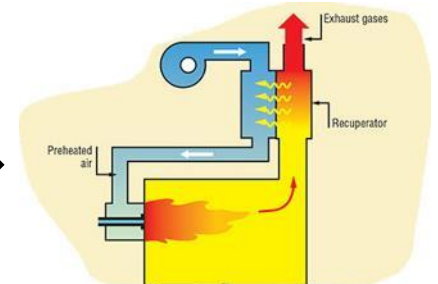
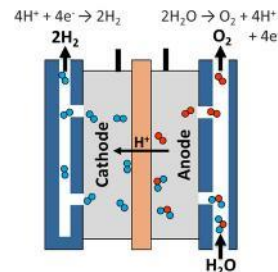
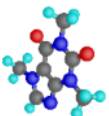
Electrical



Thermal



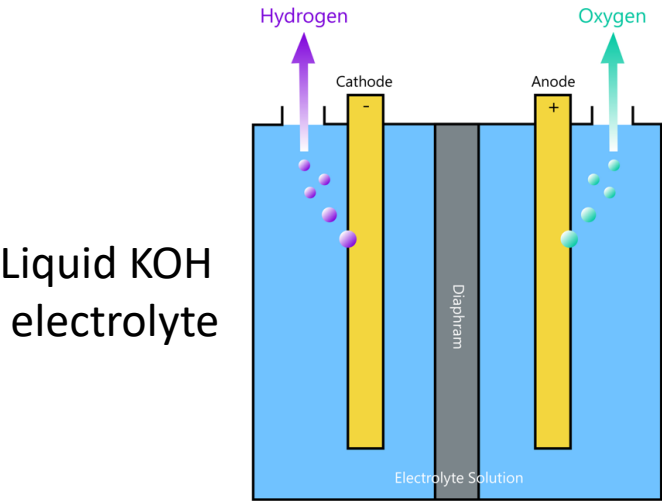
Chemical





Commercial Electrolysis Technologies

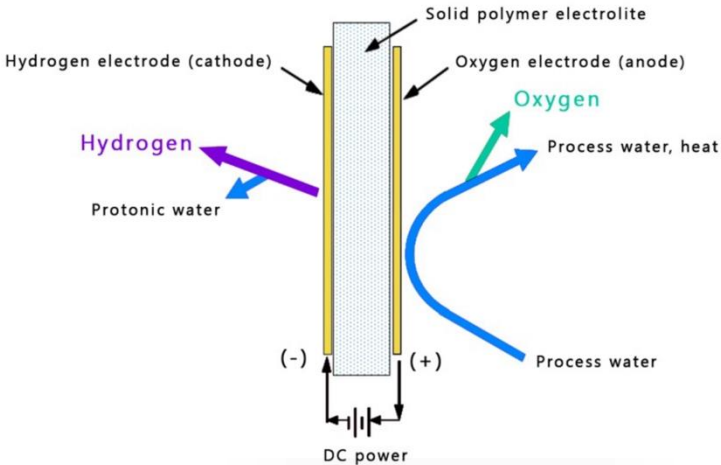
Alkaline



2.25 MW
alkaline stack



Proton Exchange Membrane (PEM)



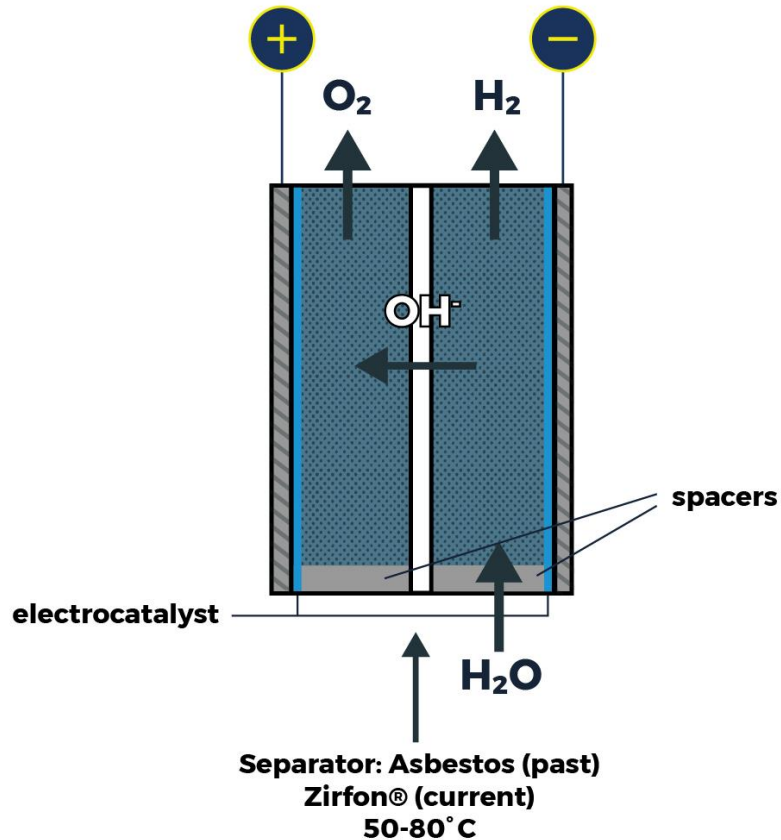
Solid
polymer
electrolyte

1.25 MW
PEM Stack

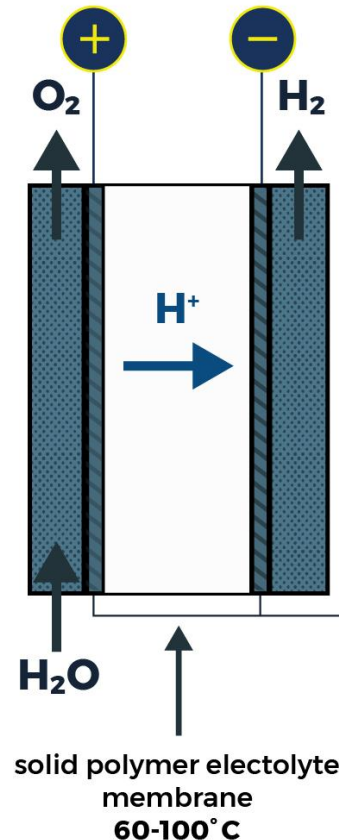


Major Electrolysis Technology Types

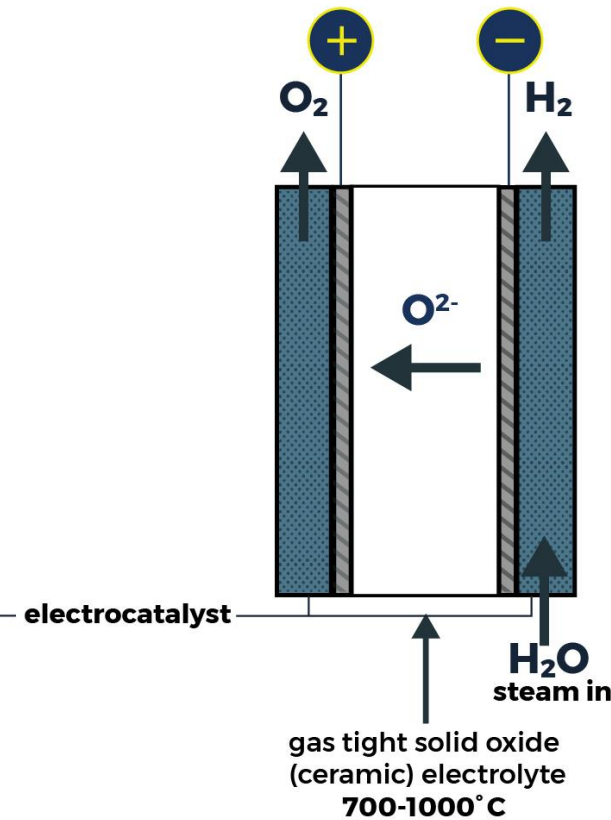
Alkaline Electrolysis



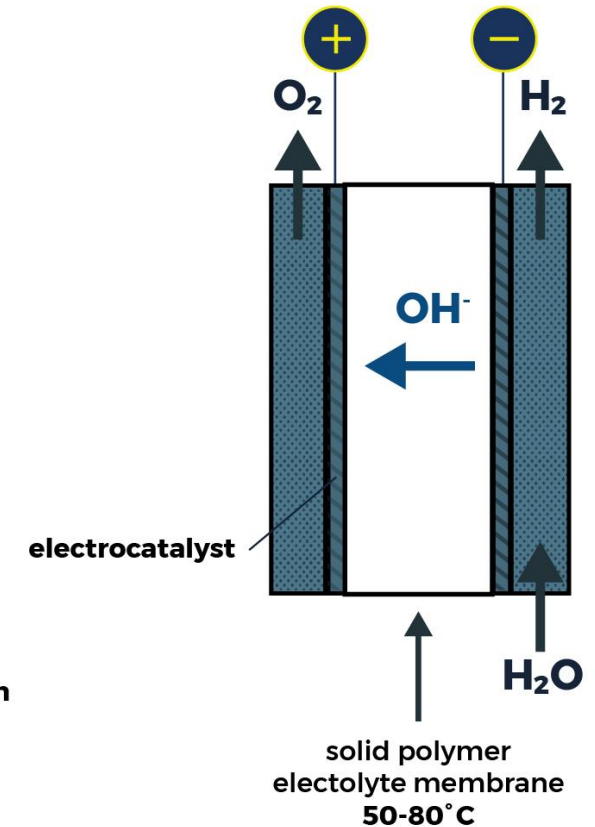
PEM Electrolysis
(Proton Exchange Membrane)



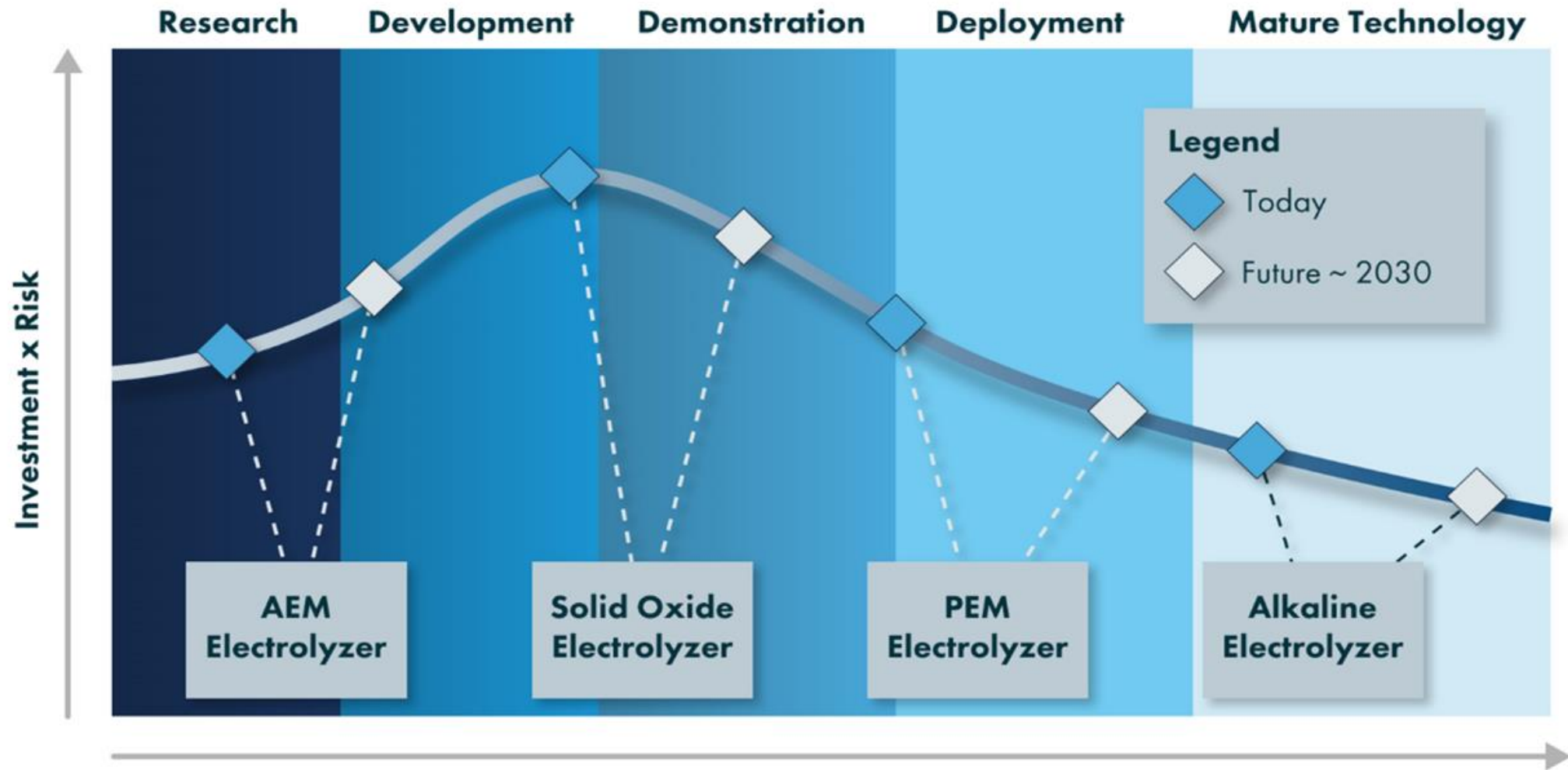
SOEC Electrolysis
(Solid Oxide Electrolyzer Cell)



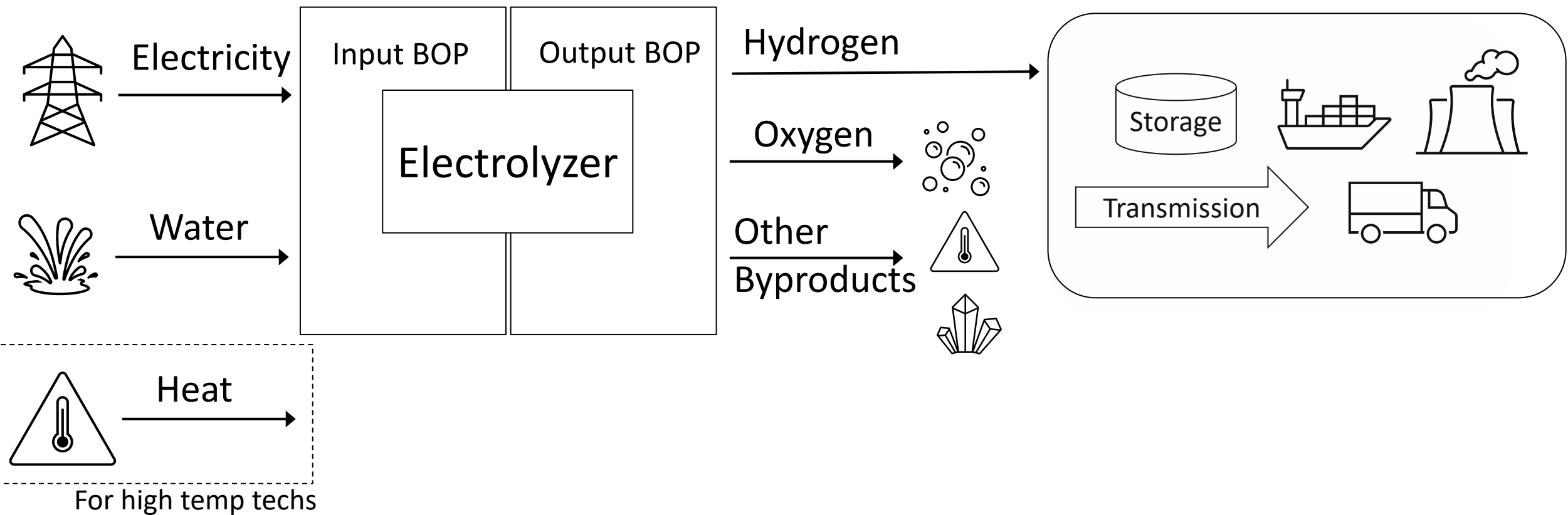
AEM Electrolysis
(Anion Exchange Membrane)



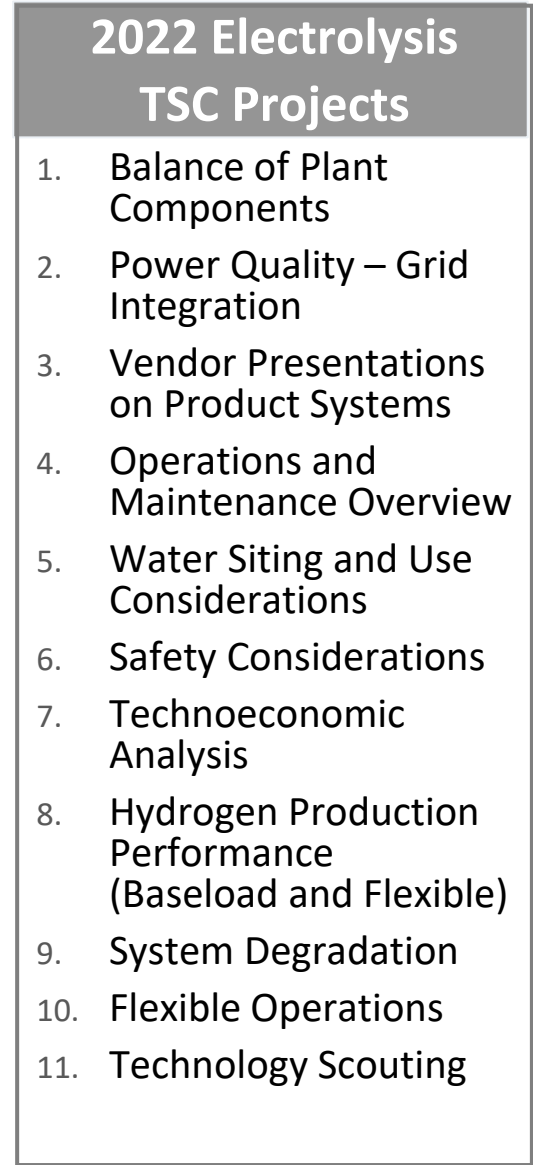
Status of Major Technology Types



Electrolytic Hydrogen Production



LCRI
LOW-CARBON
RESOURCES INITIATIVE



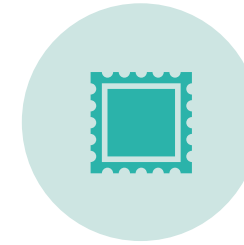
Working to Understand Electrolytic Hydrogen Production



PERFORMANCE



COST



LIFETIME

In the context of member decision making.



To meet future Low-Carbon goals.



LCRI

LOW-CARBON
RESOURCES INITIATIVE

Enabling the Pathway
to Economy-Wide Decarbonization

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