

IPHE

SESSION 3: Integrating Energy Systems

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Expected Policy Influence:

Lessons learned in the deployment of innovative clean energy solutions to meet emissions and petroleum reduction goals.

Appropriately scaled solutions are a MUST, without viable financials the markets/users simply will remain indifferent. No movement forward towards COP21 goals.

Identification of key barriers that governments can potentially address to accelerate the deployment of clean energy technologies, with a focus on FCH

Need to reward Green H₂ with tangible Tax Incentives, & attribute the real cost of grey H₂ (CO₂ emitting) to producers in the system, nobody is enemy of its own money

Actions for industry and governments to accelerate the deployment of FCH technologies, integration of clean transportation and energy systems

BIG Idea → Small Idea..... 5/5 Mandate: a 5% of all H₂ used in refining to be green in 5 years

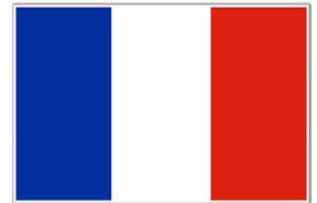
Ideas for an initial network of leading cities, utilities, and companies working to integrate clean transportation and energy systems using technologies including FCH

This will happen symbiotically when REAL financial carrots & sticks are in place.

Lessons in Energy Storage : Electrolyzers for H₂ from renewables in 2010 were too small and too costly



- Provided Areva's Electrolyzer Stacks for "Myrte & Green Box projects" High efficiency: 47 kWh/kg (2010 – 2013)
- Provided Viessmann / Audi with same for Bio-Methanation H₂ (2015 - 2016) at 1/3 cost and 3X scale



What measures may contribute to more rapid integration of clean energy systems?

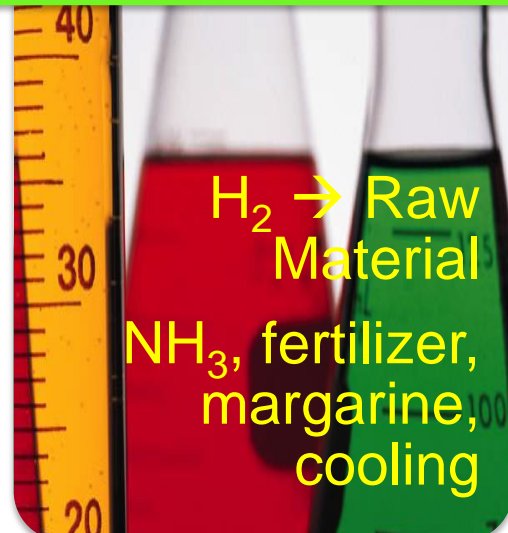
Stranded Power \rightarrow H_2 \rightarrow \$, €, £, ¥...



H Y D R O G E N



Energy Storage



Product / Raw Material



Fuel

Long-term vision policies support CE technologies?

Make realistic & goals with clean cut economic rewards

Key policy or regulatory drivers to take action, to consider hydrogen and fuel cell technologies?

Financial Drivers → Stockholders require ROI based on known incentives on CapEx or Opex but real and immediate

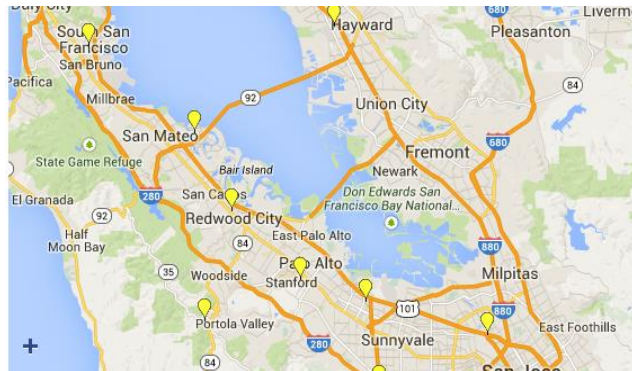
Key impediments to integration of clean systems:

- 1) Technical – Speed of deployment infrastructure at scale
- 2) Economic – Positive NPV in >5 yrs
- 3) Regulatory – Unwillingness from Legislature to mandate minimum conversion rates of say 1% per year from Grey to Green H₂

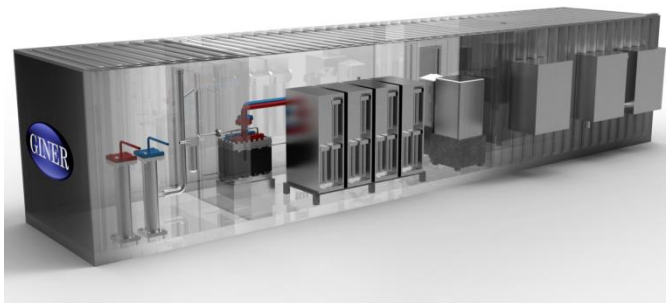
Lessons from Mobility

Electrolyzers for HRS - Automotive H₂

- In Collaboration with CEC, in 2016 Giner installs Onsite H₂ gen Systems for 3 HRS hydrogen refueling stations in CA



- Lack of standards make permitting process slower than optimal



- Scale challenges most component manufacturers

What actions does industry need to take to realize the use of clean energy technologies in the economy, including hydrogen and FCs?

Be a true cost competitive alternative to Gasoline, Batteries and Nat-Gas NOW.



Year : 1995 2000 2010 2015 2020

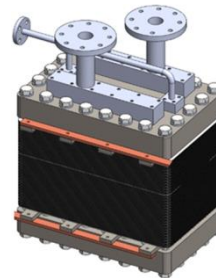
Scale : 1X 30X 200X 1,000X



2 kg/d
5kW



65 kg/d
150kW



450 kg/d
1 MW Stack



2,250 kg/d
5 MW Stack

System \$ / kW :

5,000

2,500

1,350

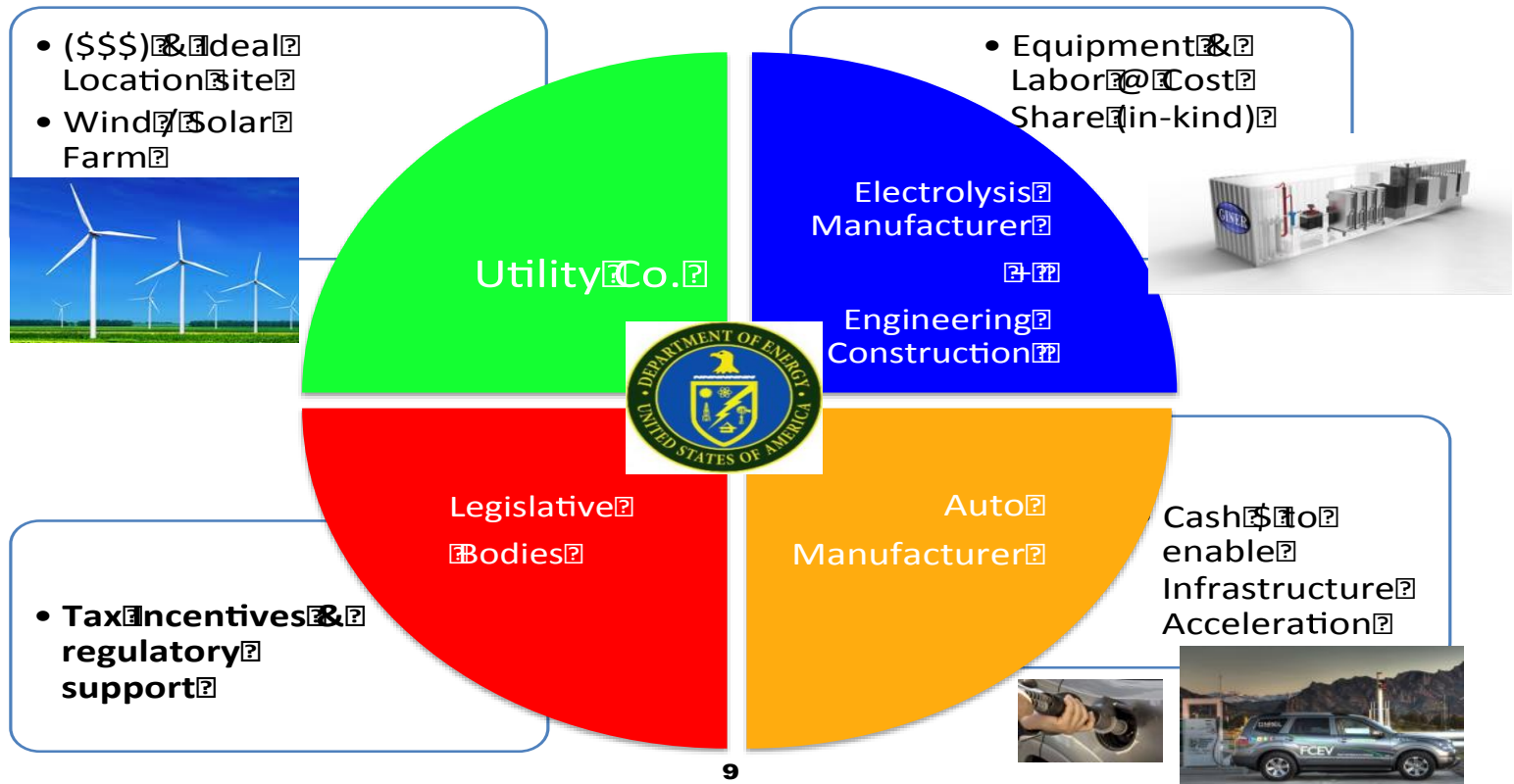
850

395 ?

Gov Actions to enable the use of clean energy technologies, including hydrogen and fuel cells?

- I. Pass legislation w/same incentives for FCEVs = to EVs
- II. Pass legislation to allow \$1 Inv in Green H₂ CapEx or OpEx = \$1 reduction in Corporate Taxes

Mid Term coordinate a Large Multi-MW+ DoE led “P2M™ Partnership”



*Helping store and convert
Green Energy*

Thank you !



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