California Energy Commission
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Selecting Locations for Hydrogen Infrastructure

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Hydrogenics in Brief

- Electrolyzer and Fuel Cell manufacturer
- Delivering hydrogen systems since 1948
- Over 10 fueling stations in California and 40 worldwide
- Office in California servicing 10 stations
  - On site electrolysis
  - On site SMR
  - Delivered Hydrogen

Today's Workshop Questions

- What defines the optimal hydrogen station location?
- What is the best approach for selecting site locations for stations in the future?

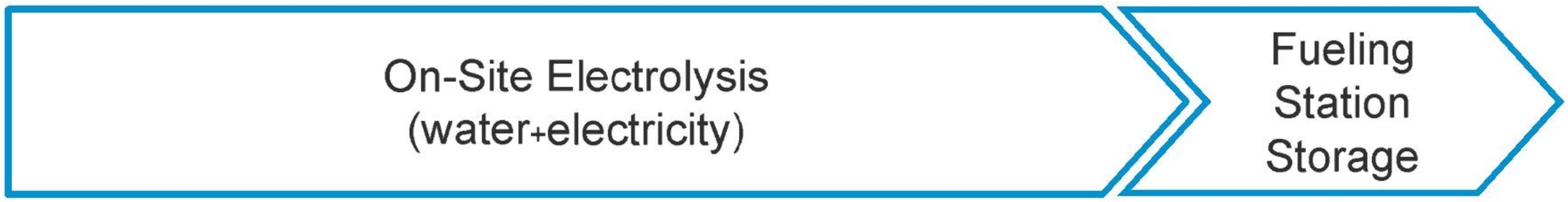
Optimal Hydrogen Fueling Station Location

Location Criteria	
• Supply Chain	• Centralized or On-Site Production
• Customer Reach	• Major Cities and Interstate Links
• Delivered Hydrogen Price	• $/kg
• Low Carbon Footprint	• Green Hydrogen
• Scalable	• Expand station capacity to accommodate larger Fuel Cell vehicle fleet in future
• Integrate Renewable Generation	• Fast Frequency Regulation • Energy Storage

Alternative Hydrogen Fueling Station Supply Chains

SMR Plant Supply Chain

Electrolysis Plant Supply Chain



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Hydrogen Stations using Electrolyzers have excellent customer reach…

- Have a retail feel
- Are compact
- Are safe and meet SAE and local standards
- Can be located in highly densely populated urban areas

Electrolysis 260 kgpd
Oslo, Norway

Electrolysis 260 kgpd + LH2 (500 kgpd)
Hamburg, Germany

Electrolysis 65 kgpd
Santa Monica, CA

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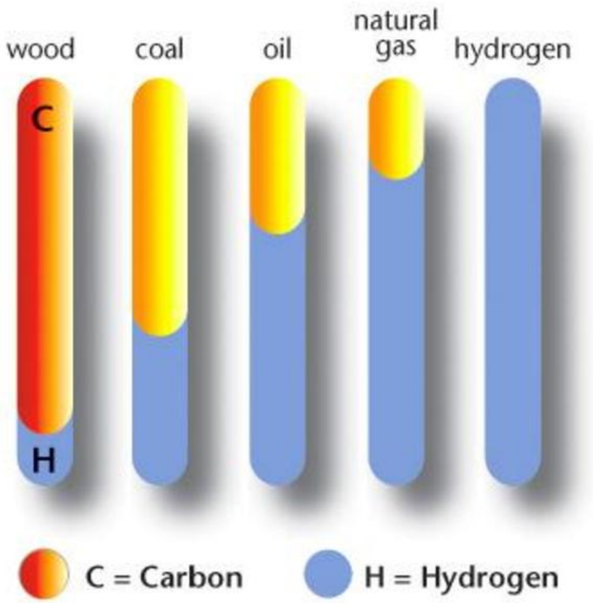
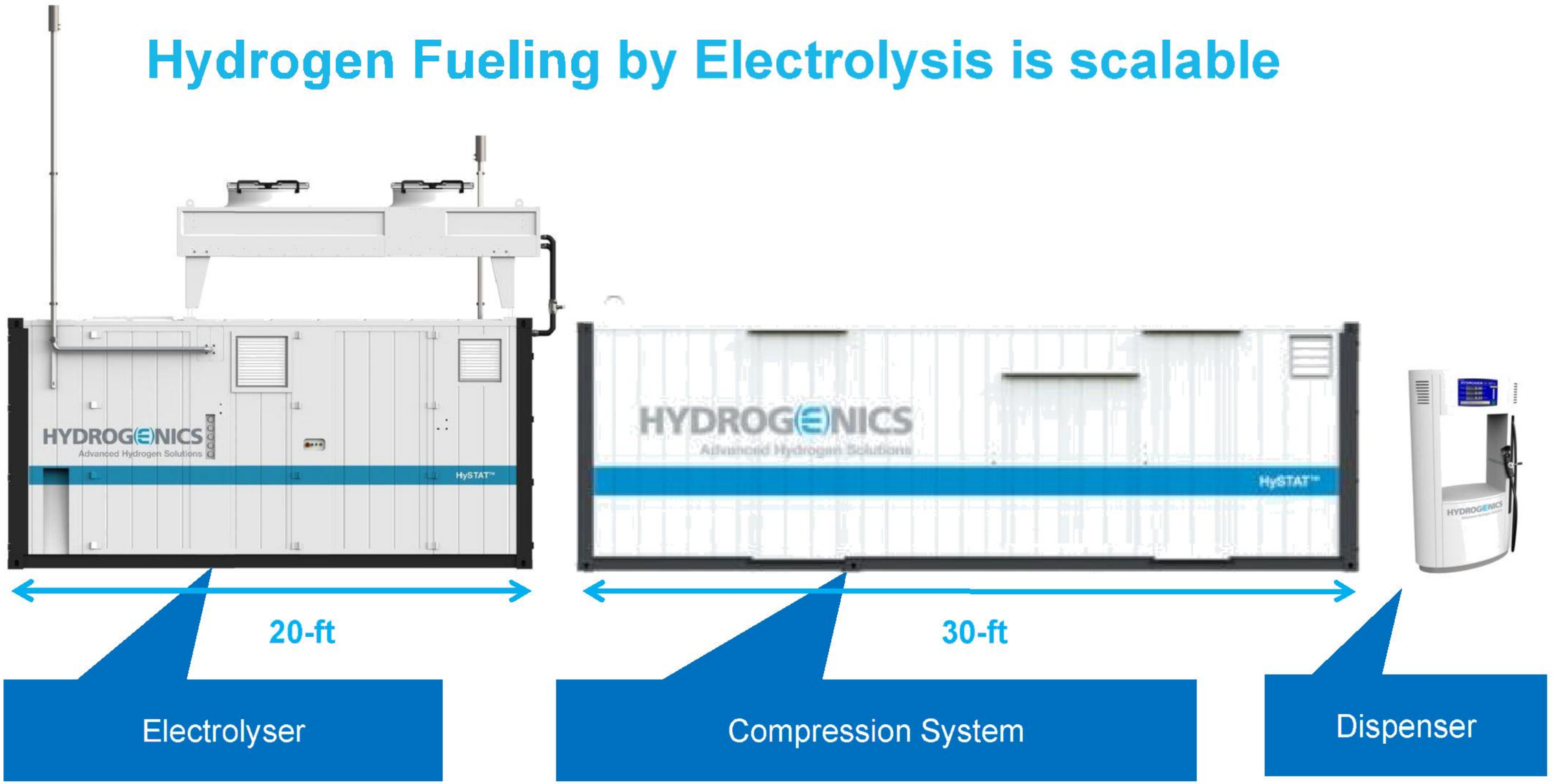
...and produce green hydrogen at the fueling station giving the lowest carbon footprint



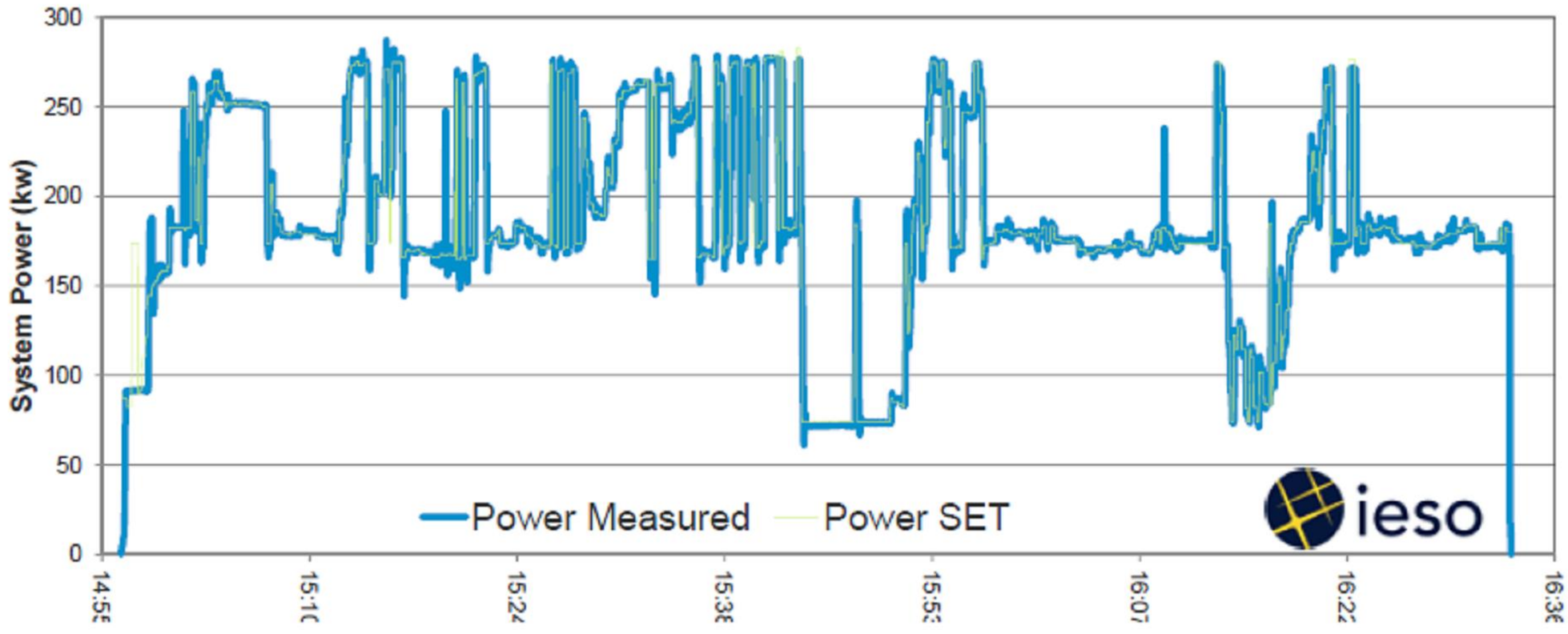
TIME

Hydrogen Fueling by Electrolysis is scalable



- Electrolyzer: up to 130 kgpd in a 20ft container
- 99.999% clean hydrogen
- 5,000 and 10,000 psi fill pressure

Another capability of an electrolyzer is as a dynamic load which can be used to provide fast frequency regulation to help balance the variability of intermittent RE generation



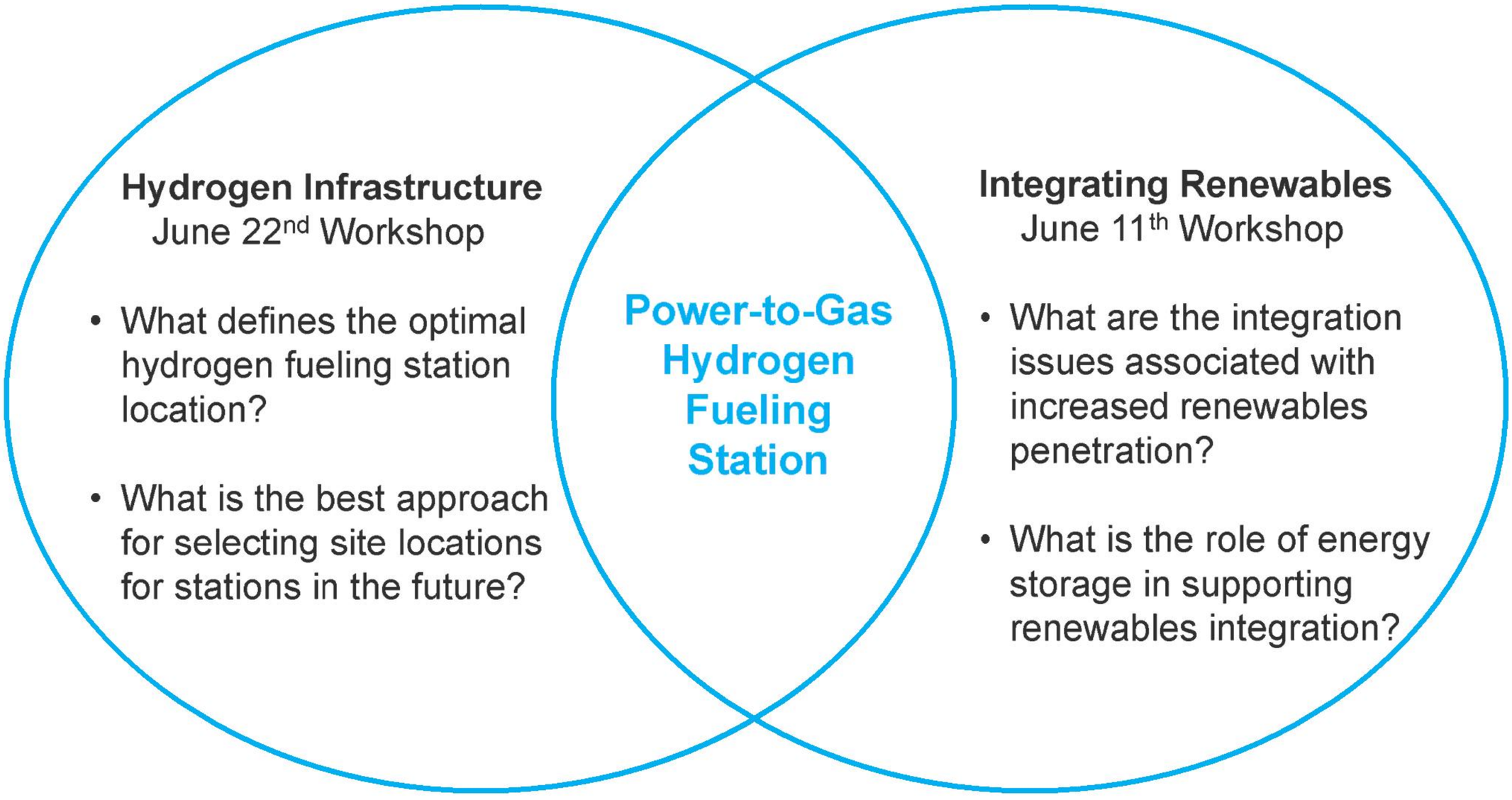
Hydrogenics has successfully demonstrated signal tracking in a test with the ISO in Ontario for the Study of Distributed Loads for Regulation in 2011

During its June 11th workshops, the California Energy Commission explored ways to minimize RE integration costs

Integrating Renewables
June 11th Workshop

- What are the integration issues associated with increased renewables penetration?
- What is the role of energy storage in supporting renewables integration?

What if you could address both challenges at once?



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Distributed Power-to-Gas Hydrogen Fueling Stations would convert surplus renewable generation to hydrogen, provide fueling for fuel cell electric vehicles, and provide energy storage in the existing natural gas infrastructure

Power-to-Gas Hydrogen Fueling Station

Integrate Renewable Generation

Power Network

Off-Peak Power →

Fast Regulation Services ↓

California ISO
Shaping a Renewed Future

Hydrogen Fueling

Load Electrolyzer

↑ *Hydrogen* →

Energy Storage

Natural Gas Pipeline

In summary, California is well positioned to capture all of the value of hydrogen that electrolysis can deliver

Location Criteria	Power-to-Gas Hydrogen Fueling Stations
• On-Site Supply Chain	✓
• Customer Reach	✓
• Delivered Price	✓
• Green Hydrogen	✓
• Scalable	✓
• Fast Frequency Regulation	✓
• Energy Storage	✓