

# Utility Perspective on the Role of Gaseous Fuel in Renewables Integration

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*Glad to be of service.®*

# Renewable and Zero-carbon CH<sub>4</sub> and H<sub>2</sub> pathways

Natural Gas w/ CCUS

Organics Conversion

Power-to-Gas

Artificial Photosynthesis



Anaerobic Digestion

Thermo-chemical

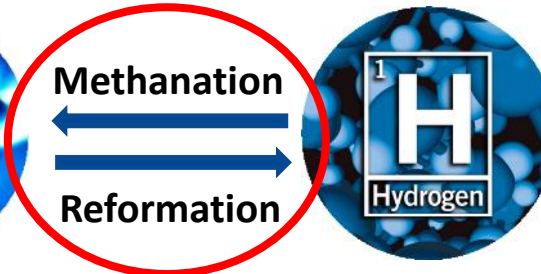
Electrolysis



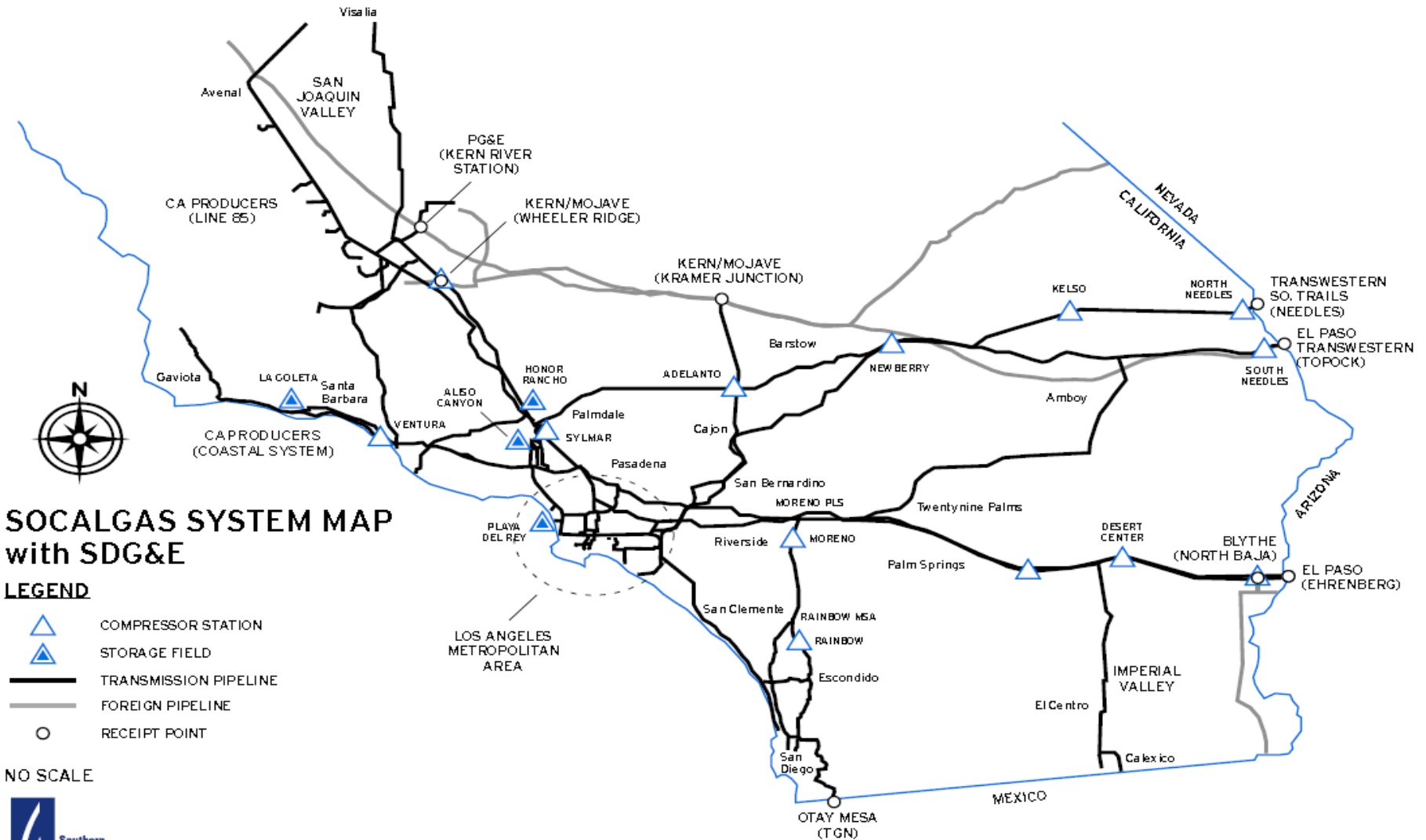
Renewable Natural Gas

Hydrogen






CO<sub>2</sub>



# The existing gas system provides nearly universal deliverability and storage capability

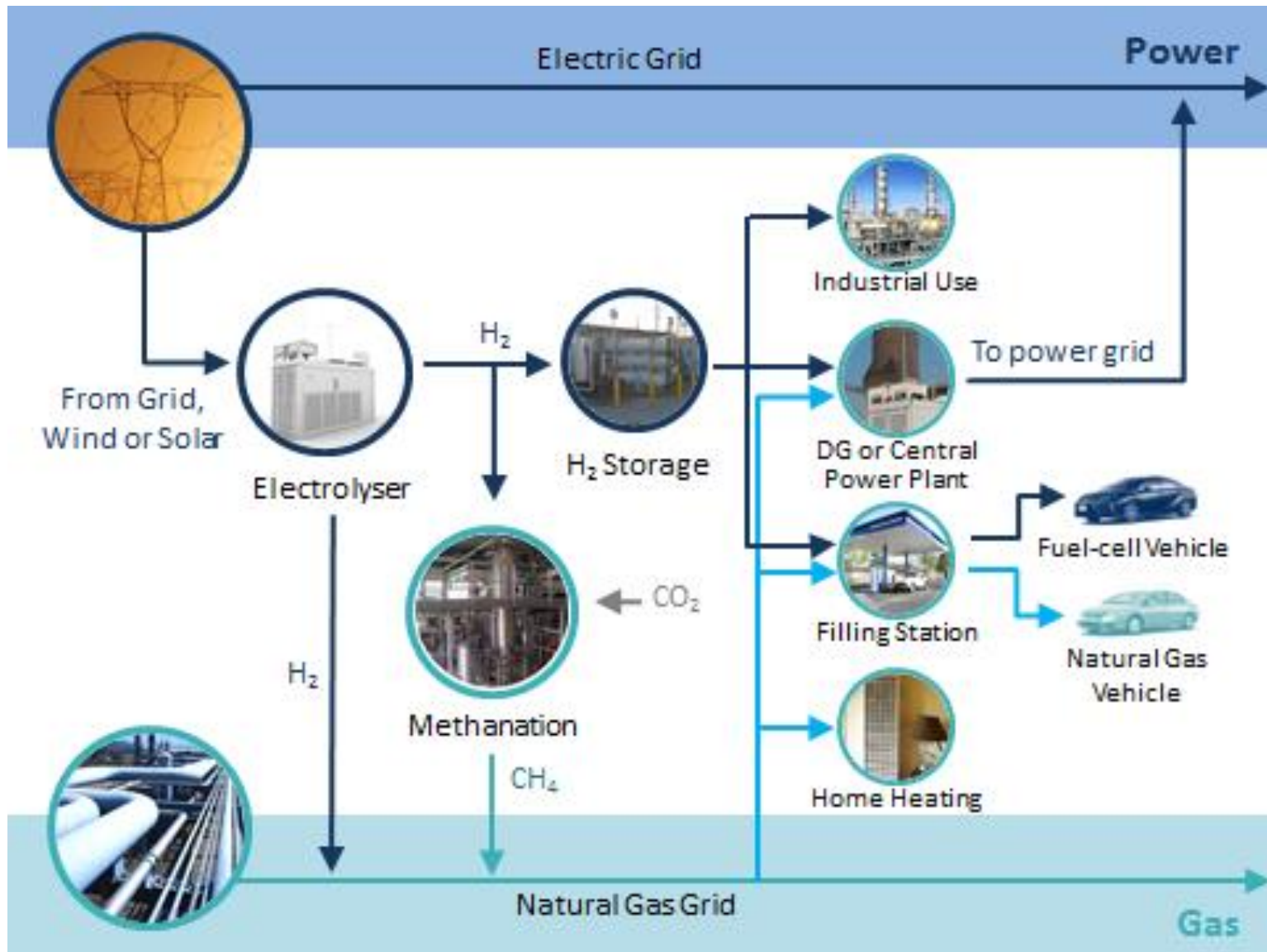


**SOCALGAS SYSTEM MAP with SDG&E**

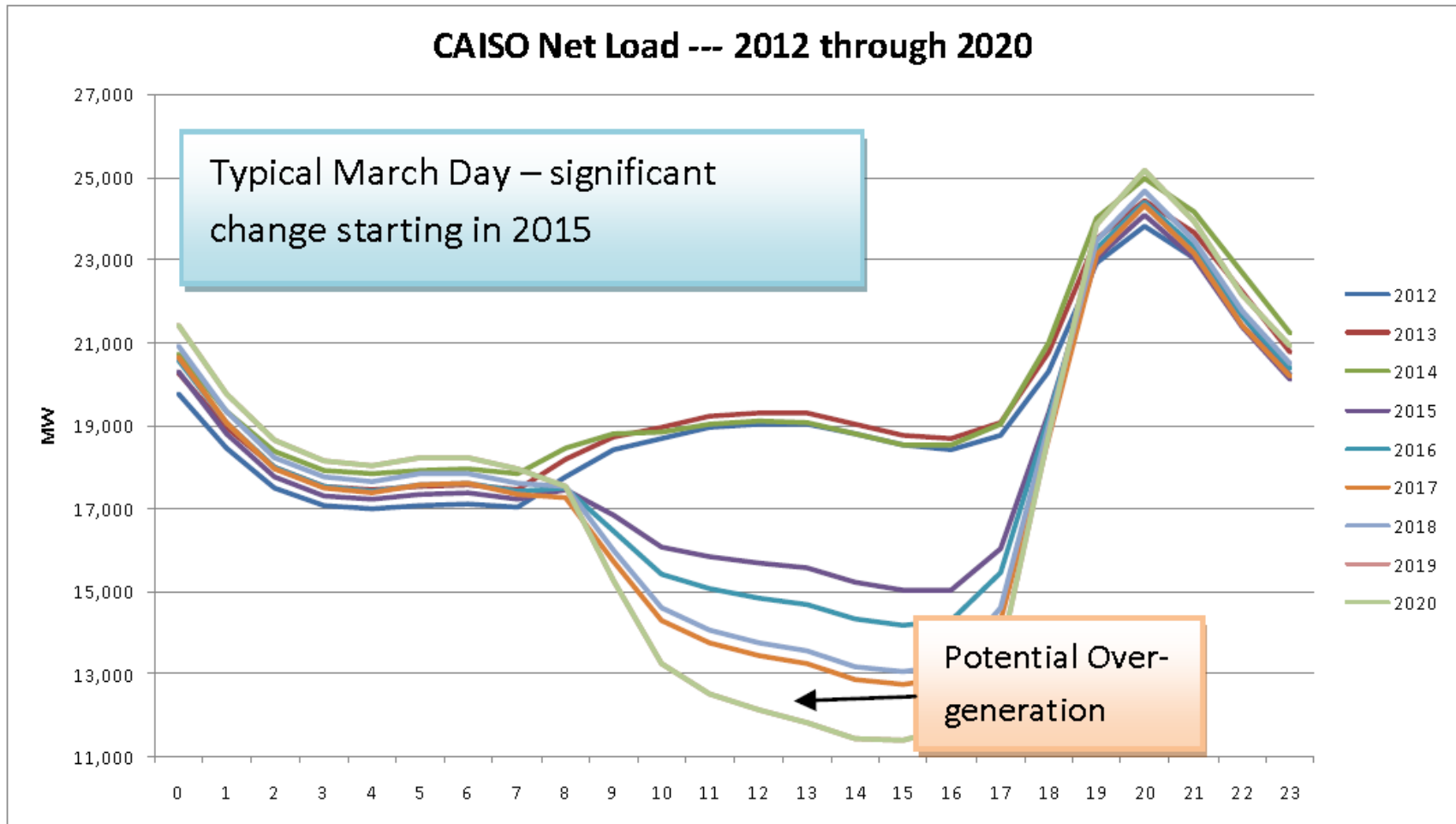
- LEGEND**
-  COMPRESSOR STATION
  -  STORAGE FIELD
  -  TRANSMISSION PIPELINE
  -  FOREIGN PIPELINE
  -  RECEIPT POINT



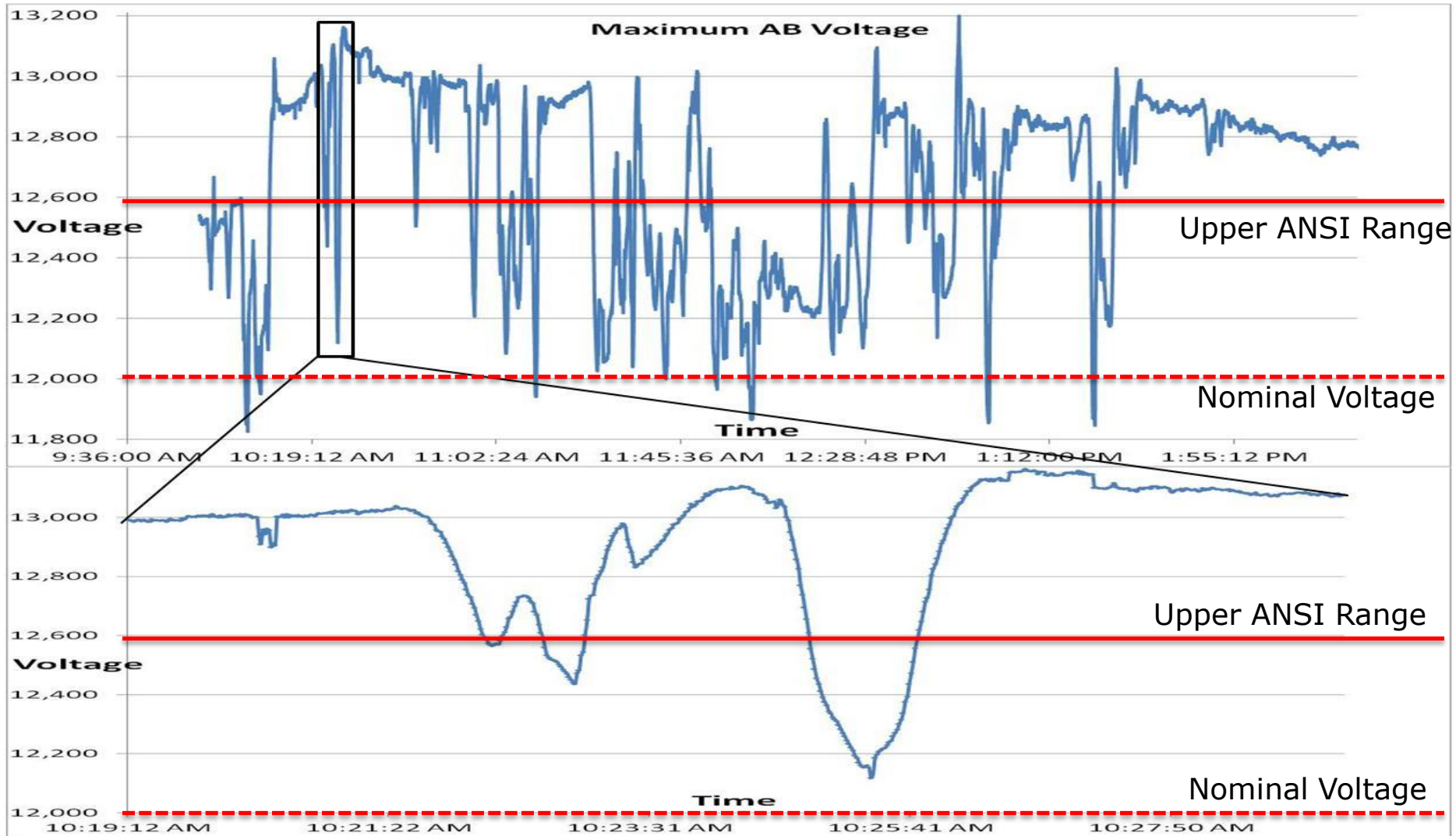
# Power-to-Gas Concept



# Long-predicted impacts of high renewables penetration on the California system load are now upon us

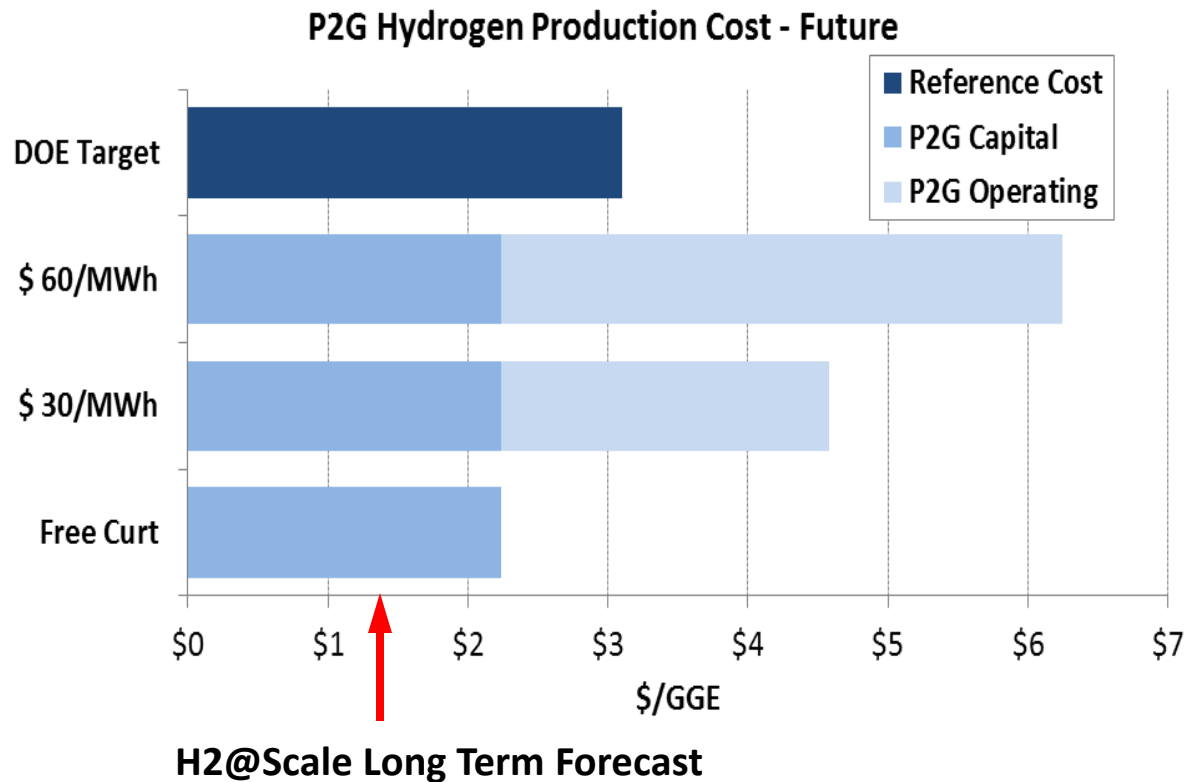


# Localized grid impacts are also becoming significant



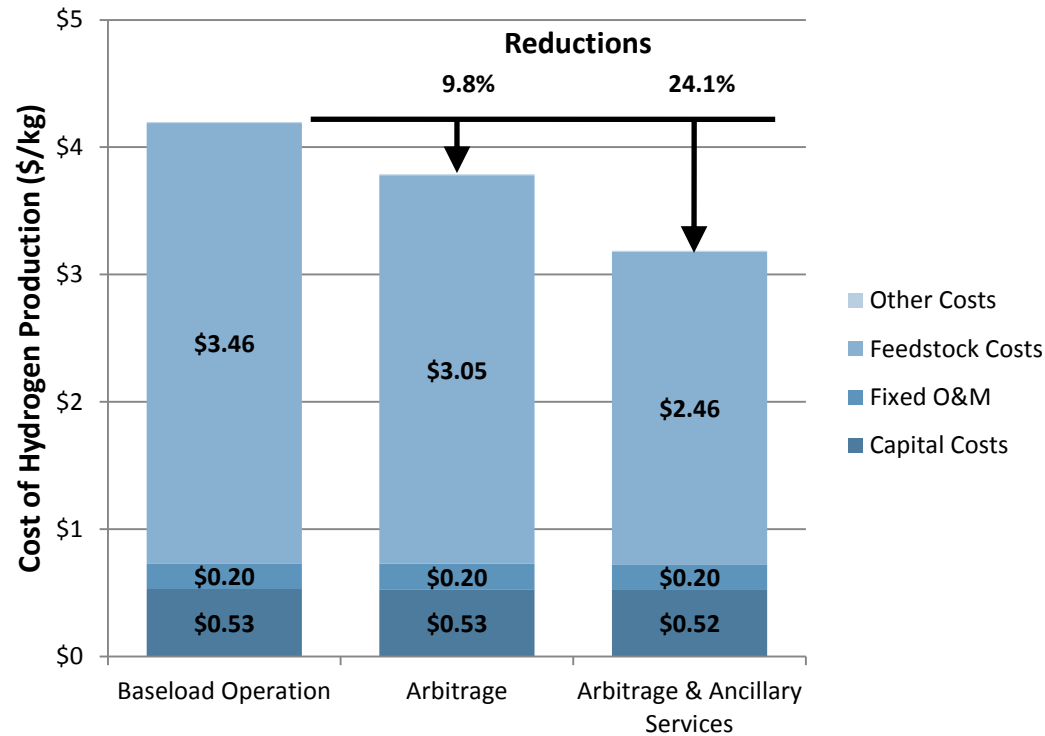


# Indicative Fuel Production Cost



Source: UC Irvine and NREL analysis

# Grid services will become increasingly important to overall economics



Source: UC Irvine and NREL analysis



# Understanding and capturing the full range of value streams is the key challenge – P2G is a regulatory orphan

- » View electrolyzer as a multi-function dispatchable resource
  - Produce fuel for transportation or other uses
  - Cycle/load follow... other grid services
- » Produce in any hour that marginal revenue exceeds marginal cost
- » Current storage regime views P2G only as a load but no special rates are in place and market for grid services is not yet developed
- » The P2G community needs to create a picture of the potential future for policy makers – value to the 2025 and 2035 grid not the 2016 grid
- » Electrolyzer manufacturers are generally smaller companies with limited experience to engage in proceeding and policy making at the:
  - 1) Legislature
  - 2) PUC
  - 3) ARB
  - 4) CEC
  - 5) CAISO
  - 6) DOE and other federal agencies
  - 7) through N>20) air districts and local permitting agencies