

DOCKETED

Docket Number:	17-HYD-01
Project Title:	Renewable Hydrogen Transportation Fuel Production
TN #:	215721
Document Title:	Presentation - Renewable Hydrogen in California
Description:	By Marino Monardi
Filer:	Tami Haas
Organization:	PG&E Corporation
Submitter Role:	Public
Submission Date:	2/1/2017 1:39:42 PM
Docketed Date:	2/1/2017

Renewable Hydrogen in California

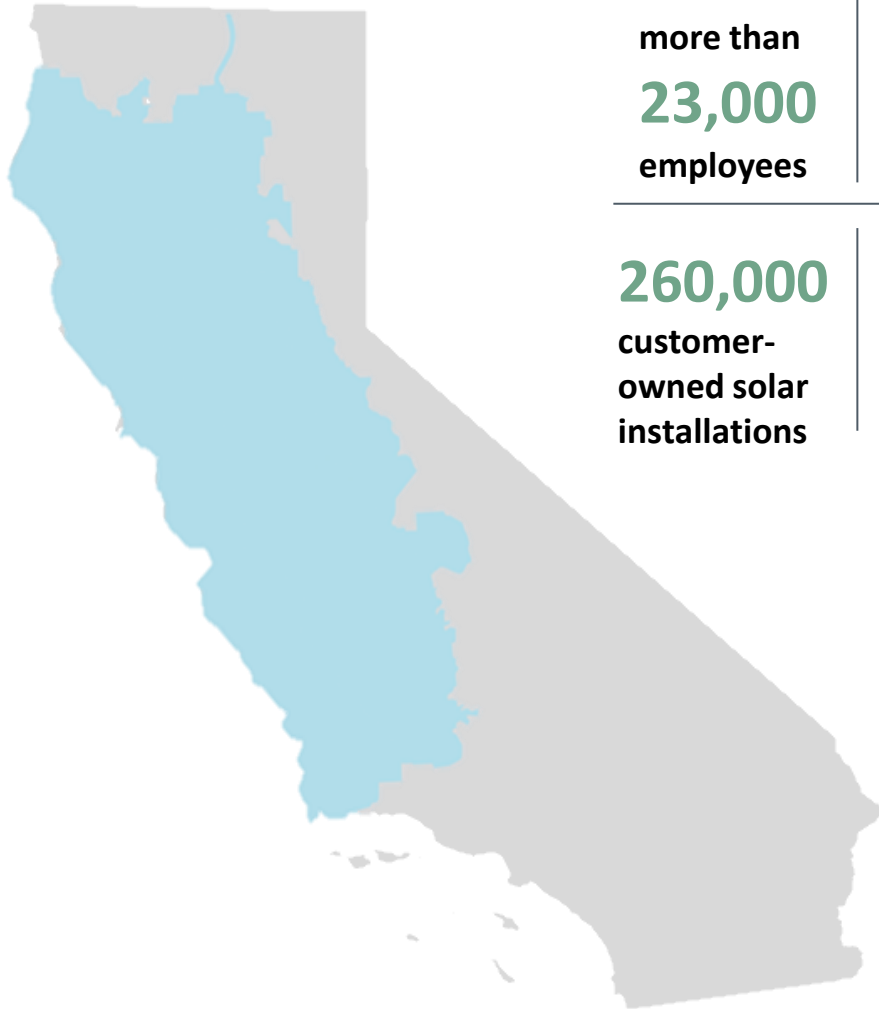
CEC Workshop: Renewable Hydrogen Transportation Fuel Production

Marino Monardi
Corporate Strategy

PG&E Corporation

January 30th, 2017

PG&E is focused on providing safe, reliable, affordable and clean energy to nearly 16 million Californians



more than
23,000
employees

5.3 million
electric
customers

4.4 million
gas distribution
customers

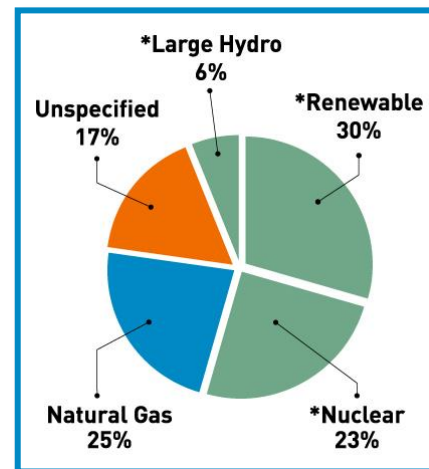
70,000
square mile
service area

260,000
customer-
owned solar
installations

70,000
GWh of electric
sales annually

900
BCF of natural
gas annual
throughput

7,300
MW renewable
capacity in
portfolio



PG&E 2015 Power Mix

Why is PG&E interested in hydrogen?

1

HELPS MEET CLEAN ENERGY GOALS



Meet State GHG Goals



Clean Fuel for Transportation

2

GAS & ELECTRICITY PRODUCE HYDROGEN



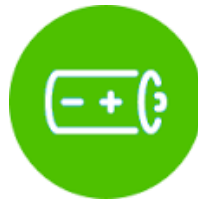
Steam Methane Reformation



Electrolysis

3

POTENTIAL TO AID IN GRID OPERATIONS



Potential for Storing Energy

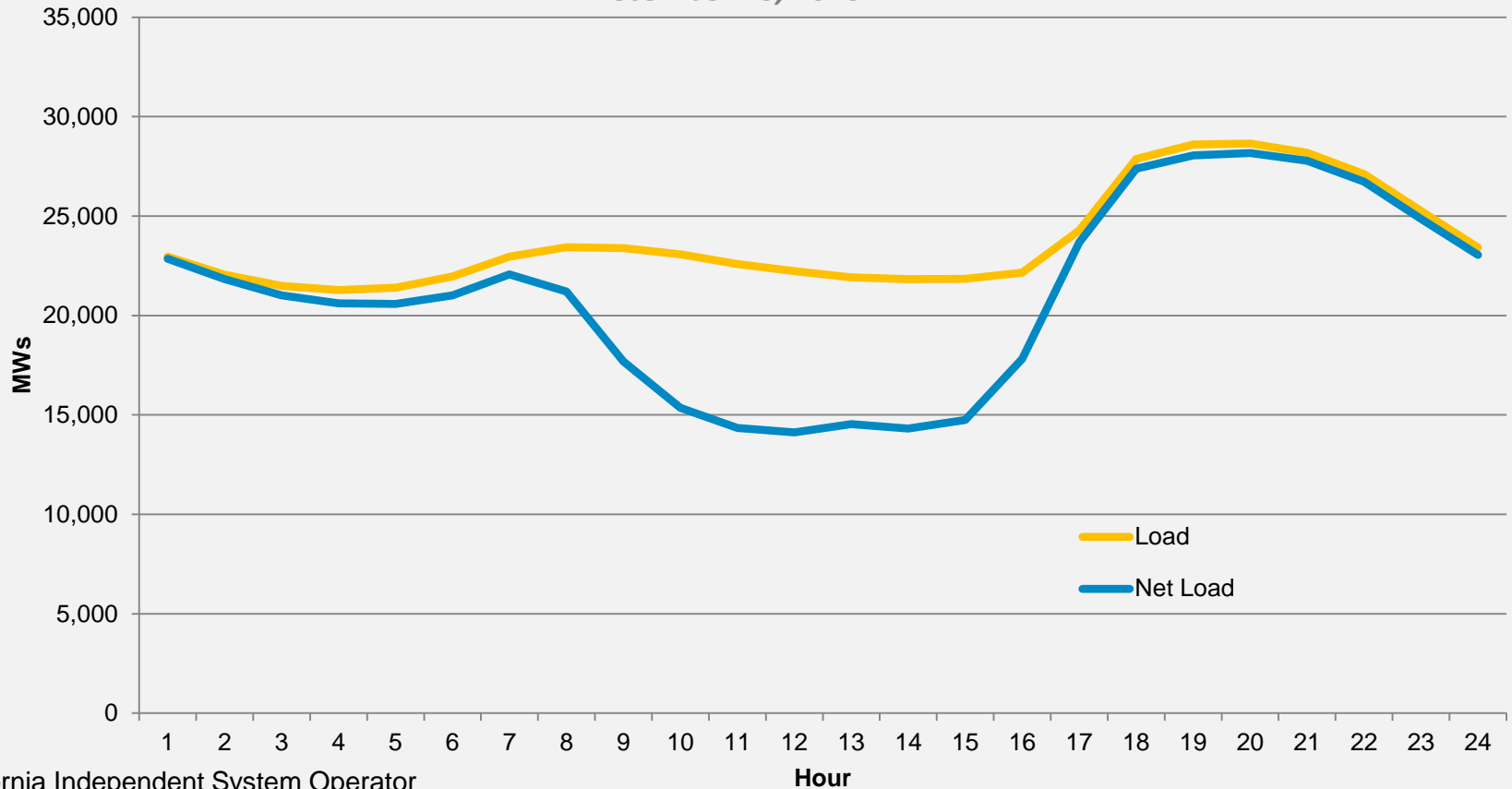


Assist in Grid Balancing

The Need for Controllable Storage

CAISO* Load Net of Solar and Wind

December 18, 2016



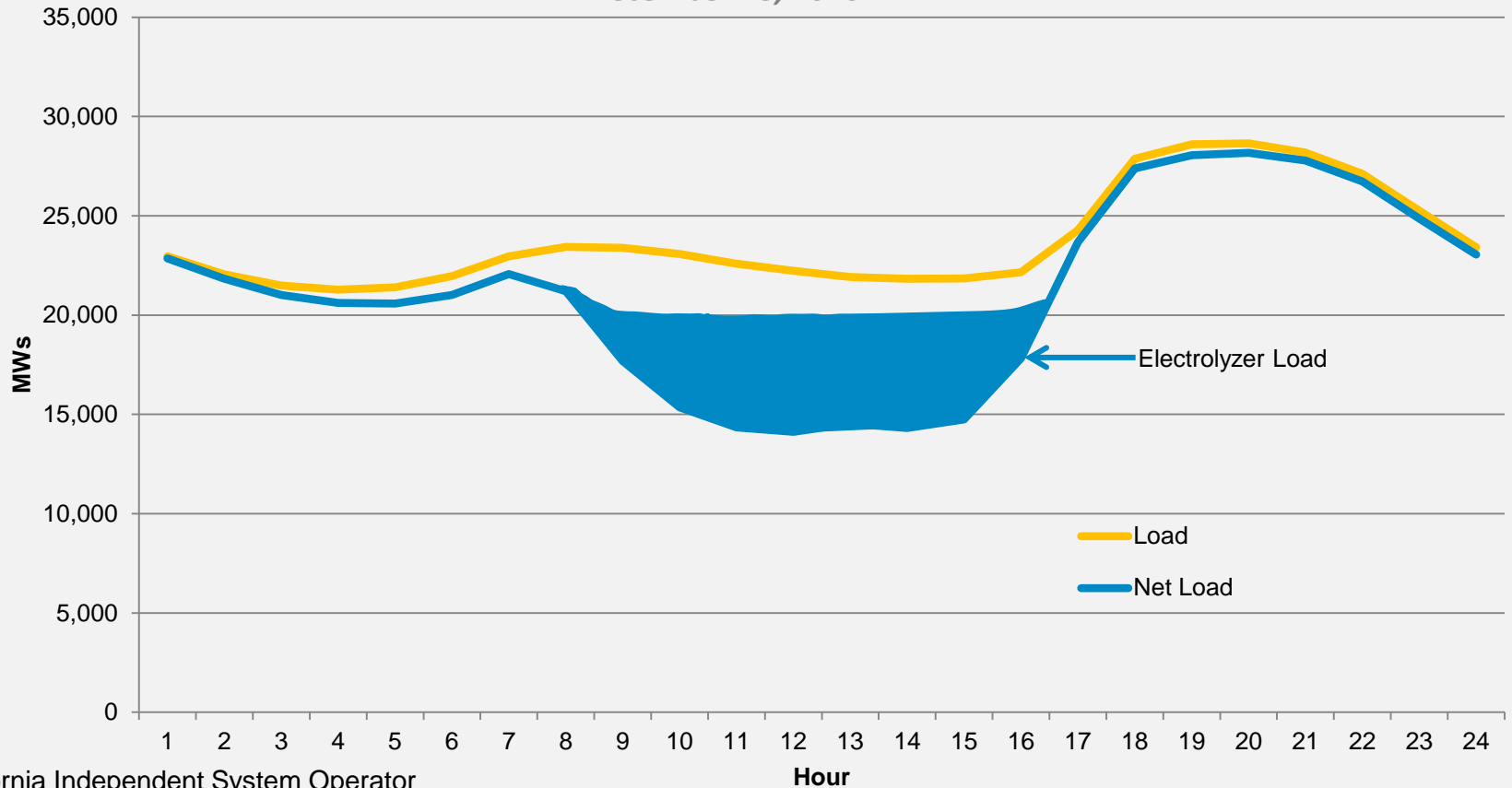
*California Independent System Operator

- Solar and Wind combined to reduce load **by over 8,000 MWs during mid-day.**
- Late afternoon/evening net load three hour ramp was **over 12,600 MWs.**

The Need for Controllable Storage

CAISO* Load Net of Solar and Wind

December 18, 2016

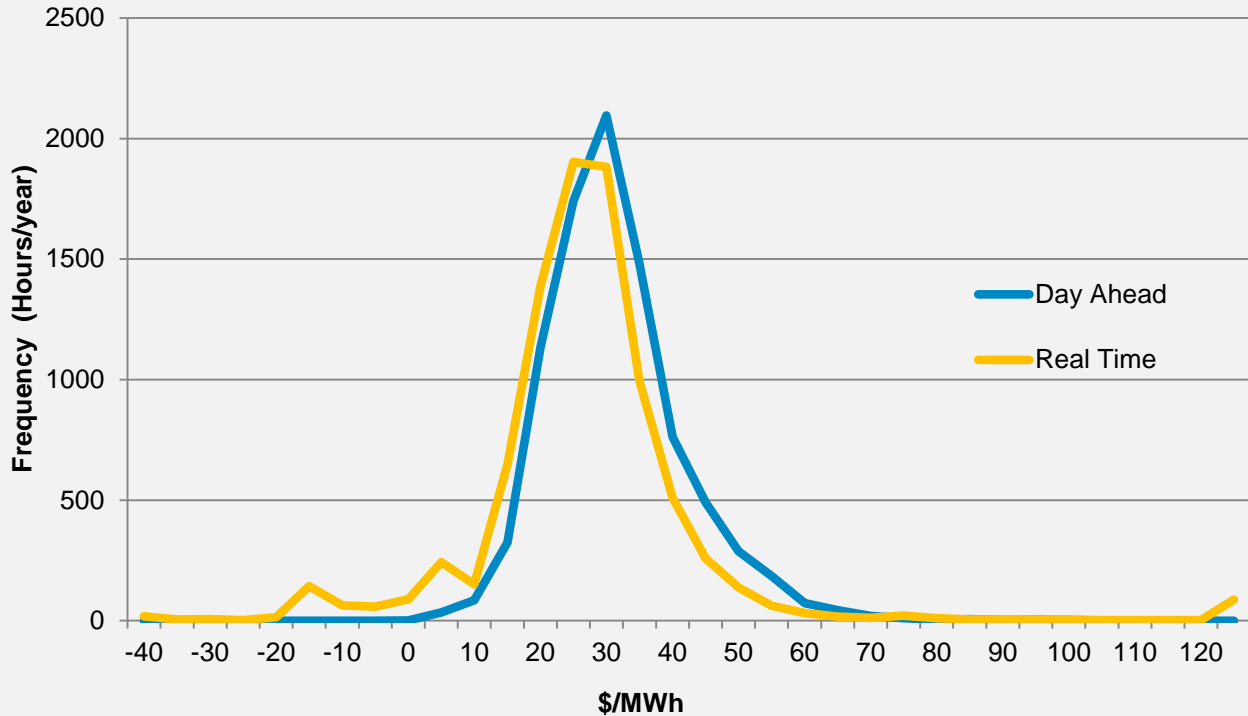


*California Independent System Operator

- Solar and Wind combined to reduce load **by over 8,000 MWs during mid-day.**
- Late afternoon/evening net load three hour ramp was **over 12,600 MWs.**

CAISO NP 15 Power Prices

Calendar Year 2016



- Recent Day Ahead market prices were below \$25/MWh about 40% of the year
- In the Real Time Market, prices were below \$0/MWh about 5% of the time

The Power Market in Power to Gas



Electrolyzer characteristics

- Conversion efficiency
- Fixed and variable costs



Access to wholesale power

- Wholesale or retail
- Electric Storage-like regulatory treatment
- Dedicated renewable generation



Low cost wholesale power

- Overall system supply/demand
- CAISO expansion
- Investments in electric storage
- Increase in renewables
- Commitments to flexible generation
- Retirements of baseload generation

- **PG&E's goal is to deliver energy that is:**
 - Safe
 - Reliable
 - Affordable
 - Clean
- **Utility investments need to satisfy multiple objectives**
- **Safety comes first**
 - Ensure customer and employee safety
- **Affordability is an important consideration**
 - Demand stagnation and increased system investments for reliability can increase costs to our customers



Thank you!

Questions?