2016 ANNUAL EVALUATION OF FCEV DEPLOYMENT AND H₂ FUEL STATION NETWORK DEVELOPMENT

Findings and Methods

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For questions or comments, contact:
Andrew Martinez
(916) 322-8449
andrew.martinez@arb.ca.gov

Gerhard Achtelik
(916) 323-8973
gerhard.achtelik@arb.ca.gov
Overview of AB 8

- Signed by Governor Brown in 2013
- Allocates up to $20M annually for hydrogen infrastructure investment

- ARB annually reports to CEC by June 30
  - Current and projected FCEV fleet and station progress
  - Assessment of coverage and capacity
  - Recommended station placement
  - Recommended funding level (up to $20M)
  - Recommended station technical specifications
Hydrogen fueling stations are needed ahead of FCEVs to enable market launch.
With 20 Open-Retail hydrogen fueling stations, California has launched a nascent retail station network.
Finding 1

- Bay area sub-network established
- Basic redundancy starting in west LA and Orange county
- Travel between northern and southern California
- Travel to popular vacation destinations

Mary’s Valley Rally
*From Los Angeles to Sacramento*
Station development has progressed at a slower pace than projected in 2015.
Finding 2

Individual Station Projections

As of June 17, 2015:

Source: CEC and GO-Biz
Auto manufacturers’ plans for 2020 and beyond continue to indicate robust FCEV deployment in California despite projecting fewer vehicles for the near term.
Finding 3
County-Based Survey and Analysis

Los Angeles
Orange
Santa Clara

San Francisco
San Diego
Alameda

San Mateo
Sacramento
Contra Costa
Riverside

Larger Markets (# FCEVs)
San Francisco, Berkeley and surrounding cities, Greater Los Angeles, San Diego, and Torrance continue to be the highest priorities for further fueling network development.

<table>
<thead>
<tr>
<th>First Priority</th>
<th>Stations</th>
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<tbody>
<tr>
<td>San Francisco</td>
<td>2</td>
</tr>
<tr>
<td>Berkeley/Oakland/Walnut Creek/Pleasant Hill</td>
<td>2</td>
</tr>
<tr>
<td>Greater LA/Sherman Oaks/Glendale/Pacific Palisades</td>
<td>1</td>
</tr>
<tr>
<td>San Diego/La Mesa</td>
<td>1</td>
</tr>
<tr>
<td>Torrance/Manhattan Bch/Redondo Bch</td>
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<tr>
<td>South San Diego/Coronado</td>
<td>1</td>
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<tr>
<td>Pasadena/San Gabriel/Arcadia</td>
<td>1</td>
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<tr>
<td>Long Bch/Huntington Bch/Buena Park/Fullerton</td>
<td>1</td>
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<tr>
<td>Santa Cruz</td>
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<tr>
<td>Irvine/Tustin</td>
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<tr>
<td>San Mateo/Palo Alto/Cupertino/Campbell/San Jose</td>
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<td>Sacramento/Carmichael</td>
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<td>San Clemente</td>
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<tr>
<td>Laguna Beach</td>
<td>1</td>
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</tbody>
</table>
Finding 4

CHIT/CHAT Updates

- Harmonized CHIT and CHAT assessments
- Auto manufacturer surveys enabled feedback on CHIT assessments of county-level market shares
- Used CHIT to assign station capacities to markets in and out of host county
CHIT is a planning tool intended to provide general direction indicating areas of needed infrastructure.

CHIT evaluates relative need for hydrogen infrastructure based on a gap analysis between a projected market and current infrastructure.
Finding 4

CHIT Assessment Update for GFO-15-605

[Map showing coverage gaps and priority areas with color coding for high, medium, and low need for hydrogen fueling stations.]
Finding 4

• Consistent stakeholder feedback to consider garaging location and driving patterns together for station placement

• LODES O-D and TIGER/ITN to simulate commuter routes and determine traffic intensity in analysis cells

• Significant parallel processing effort
In order to meet the expected hydrogen demand in the developing FCEV market, the full $20 million in annual funds should continue to be utilized. With a continuing projection of capacity shortfall around 2020, there is increased urgency to identify opportunities to maximize the fueling capacity leveraged by State investments.
Finding 5

- 2022 w/ 50 Current + 40 Projected Stations
  - Net: -5.2 mil kg/yr
    (-14,300 kg/day)

- 2019 w/ 50 Current + 16 Projected Stations
  - Net: 0.8 mil kg/yr
    (2,100 kg/day)

- 2022 w/ 50 Current Stations
  - Net: -7.8 mil kg/yr
    (-21,500 kg/day)

- 2019 w/ 50 Current Stations
  - Net: -0.3 mil kg/yr
    (-770 kg/day)

- Millions Hydrogen kg/year

- Alameda
- Marin
- San Bernardino
- Santa Barbara
- Yolo
- San Joaquin
- Unallocated Statewide Net
- Contra Costa
- Orange
- San Diego
- Santa Clara
- El Dorado
- Santa Cruz
- Fresno
- Riverside
- San Francisco
- Sonoma
- Monterey
- Solano
- Los Angeles
- Sacramento
- San Mateo
- San Francisco
- Ventura
- Placer
- Stanislaus
Finding 5

Early Capacity Priorities

Later Capacity Priorities

Hydrogen Deficit (kg/year)

- Alameda
- Contra Costa
- Fresno
- Los Angeles
- Marin
- Orange
- Riverside
- Sacramento
- San Bernardino
- San Diego
- San Francisco
- San Mateo
- Santa Clara
- Sonoma
- Ventura

2019
2022
Learnings from the first retail stations highlight the need for a customer-centric focus in planning and implementing hydrogen stations.
California has successfully confirmed station performance through early testing and certification programs. These programs must be further developed and supported by State agency efforts.

Today’s Problem: Each OEM performs vehicle test fills to validate station

Tomorrow’s solution: HyStep is vehicle surrogate; operated by testing agency

Source: Terry Johnson, Sandia National Lab, Pacific Northwest National Lab, and H2Tools
California’s Low Carbon Fuel Standard (LCFS) program offers important revenue potential to hydrogen stations.
DISCUSSION

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