

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

Findings and Methods

July 26, 2016

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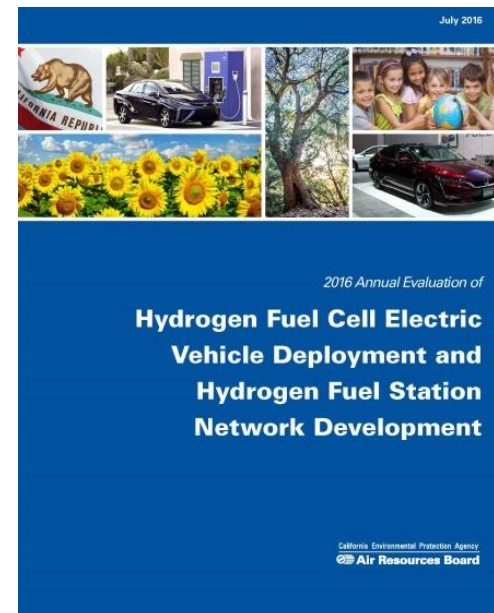
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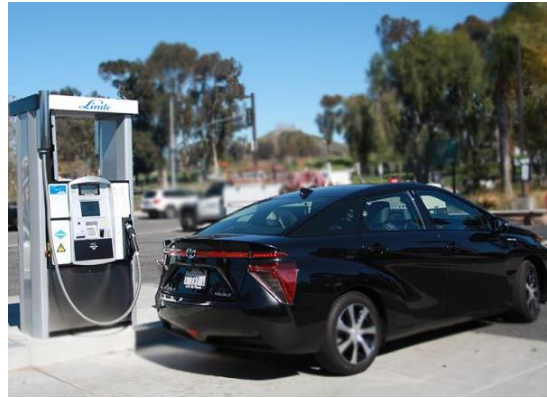
Overview of AB 8

- 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



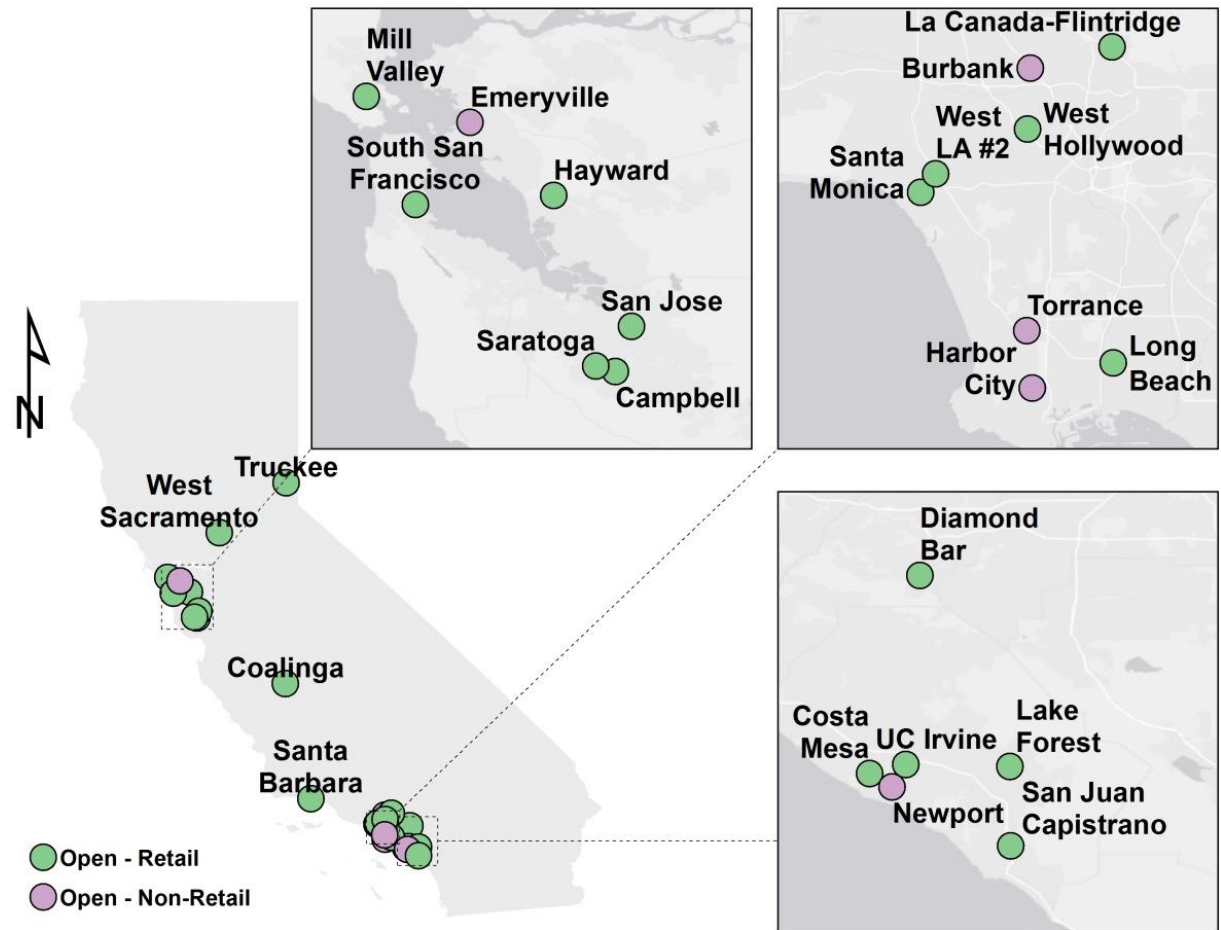
Background

Hydrogen
fueling stations
are needed
ahead of FCEVs
to enable
market launch



Finding 1

With 20 Open-Retail hydrogen fueling stations, California has launched a nascent retail station network.



Finding 1

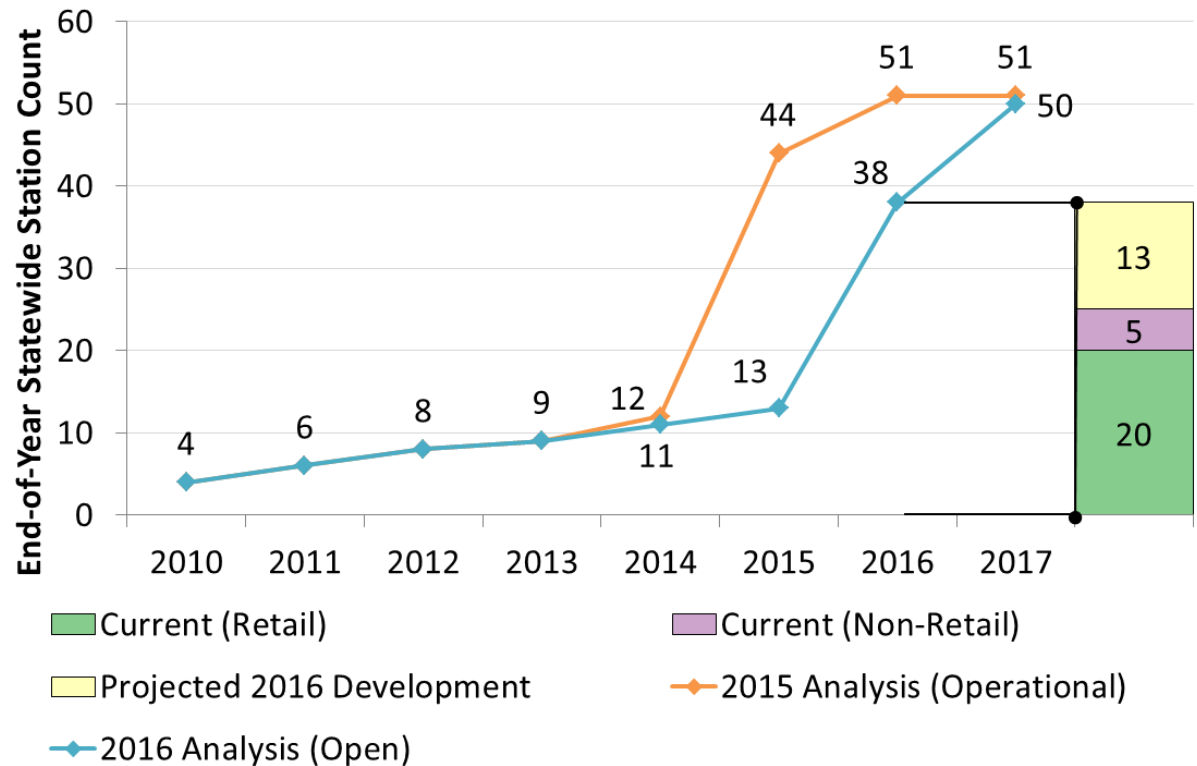
- Bay area sub-network established
- Basic redundancy starting in west LA and Orange county
- Travel between northern and southern California
- Travel to popular vacation destinations

Mary's Valley Rally *From Los Angeles to Sacramento*



Finding 2

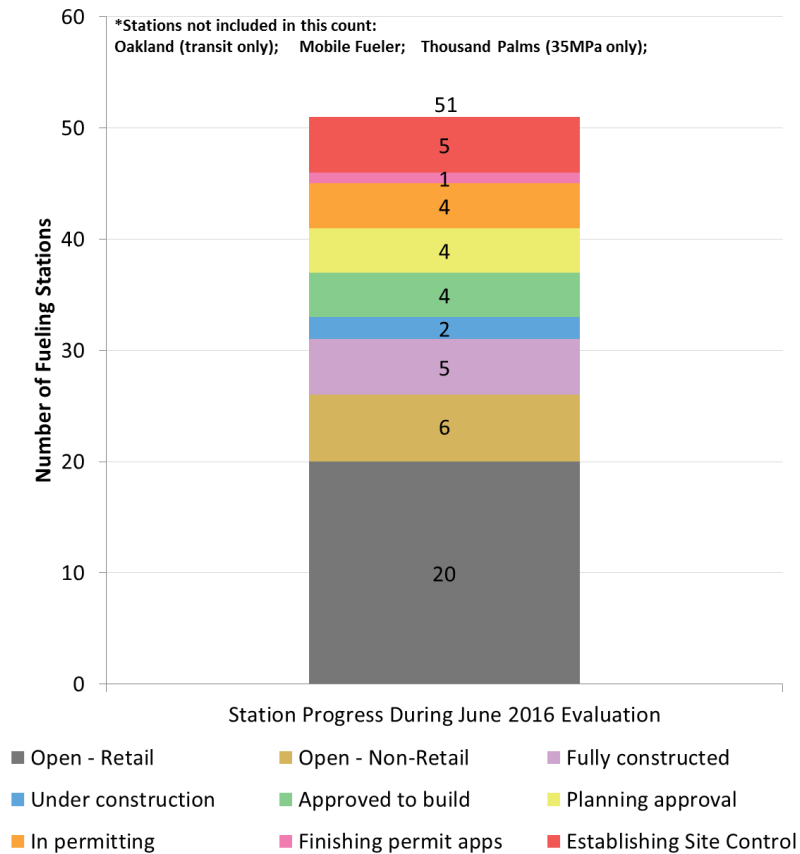
Station development has progressed at a slower pace than projected in 2015.



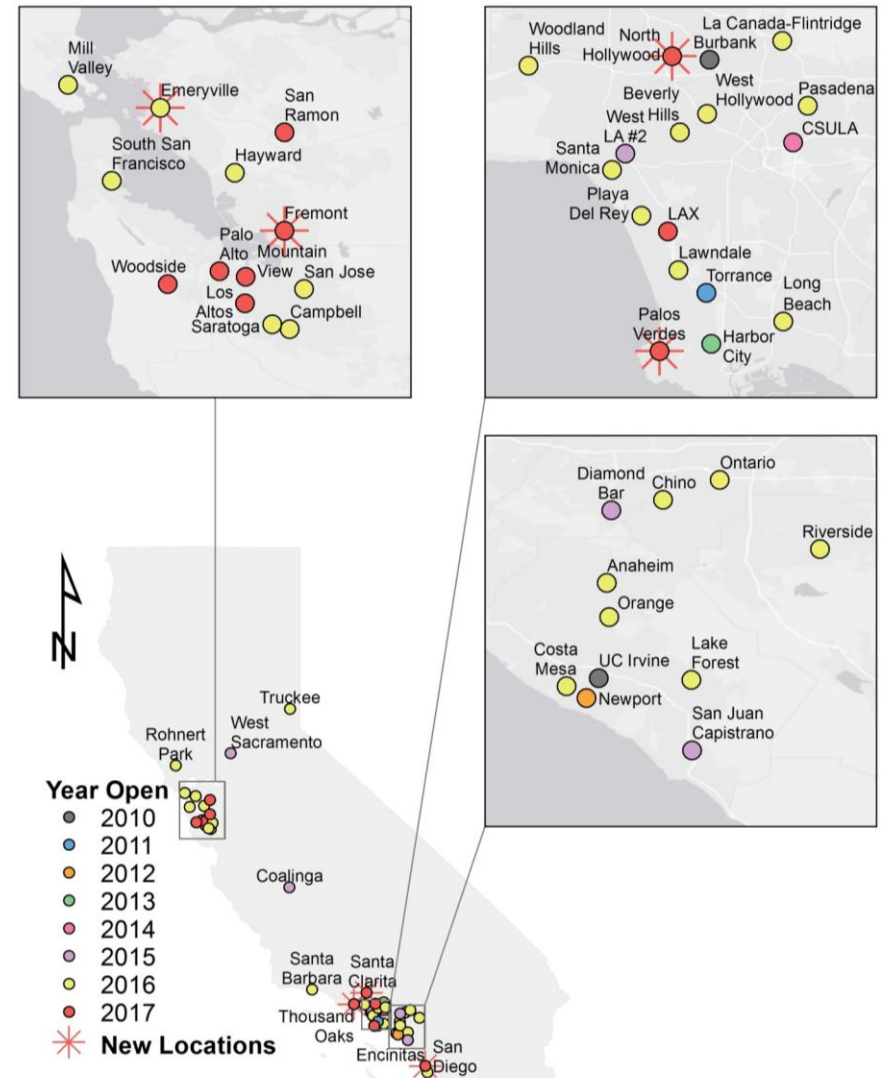
Finding 2

Individual Station Projections

As of June 17, 2015:

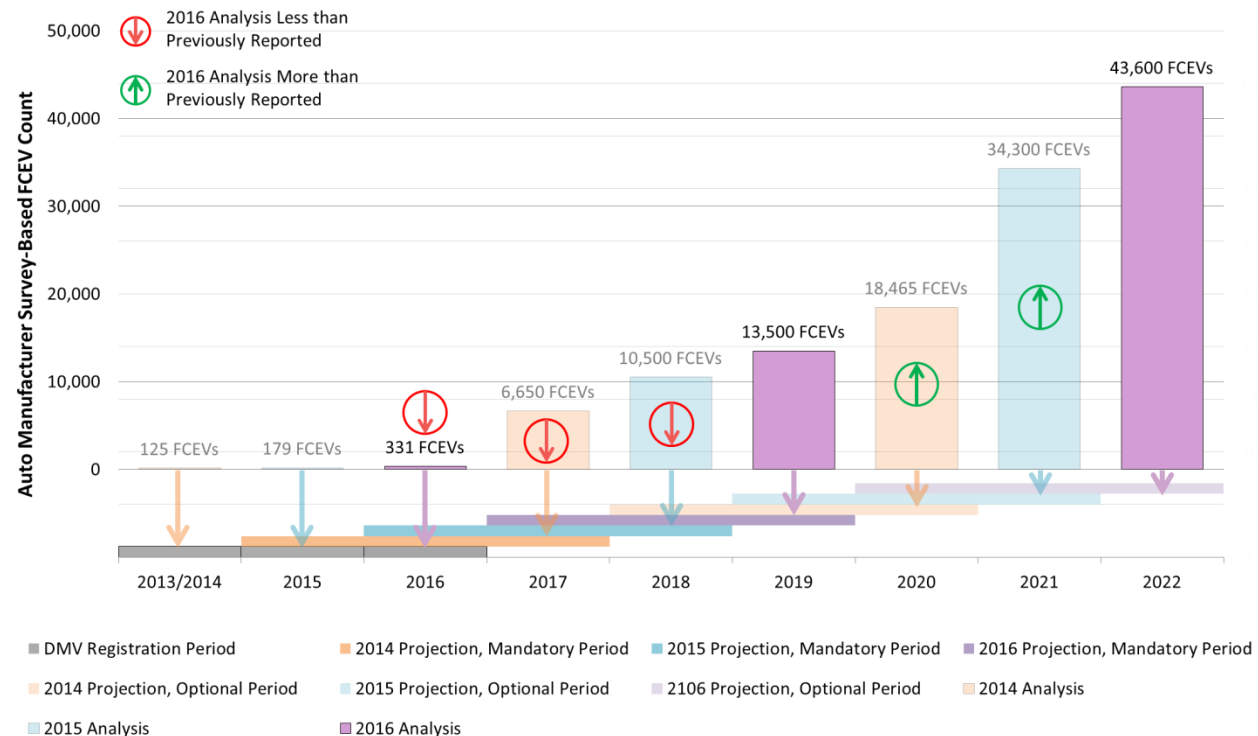


Source: CEC and GO-Biz

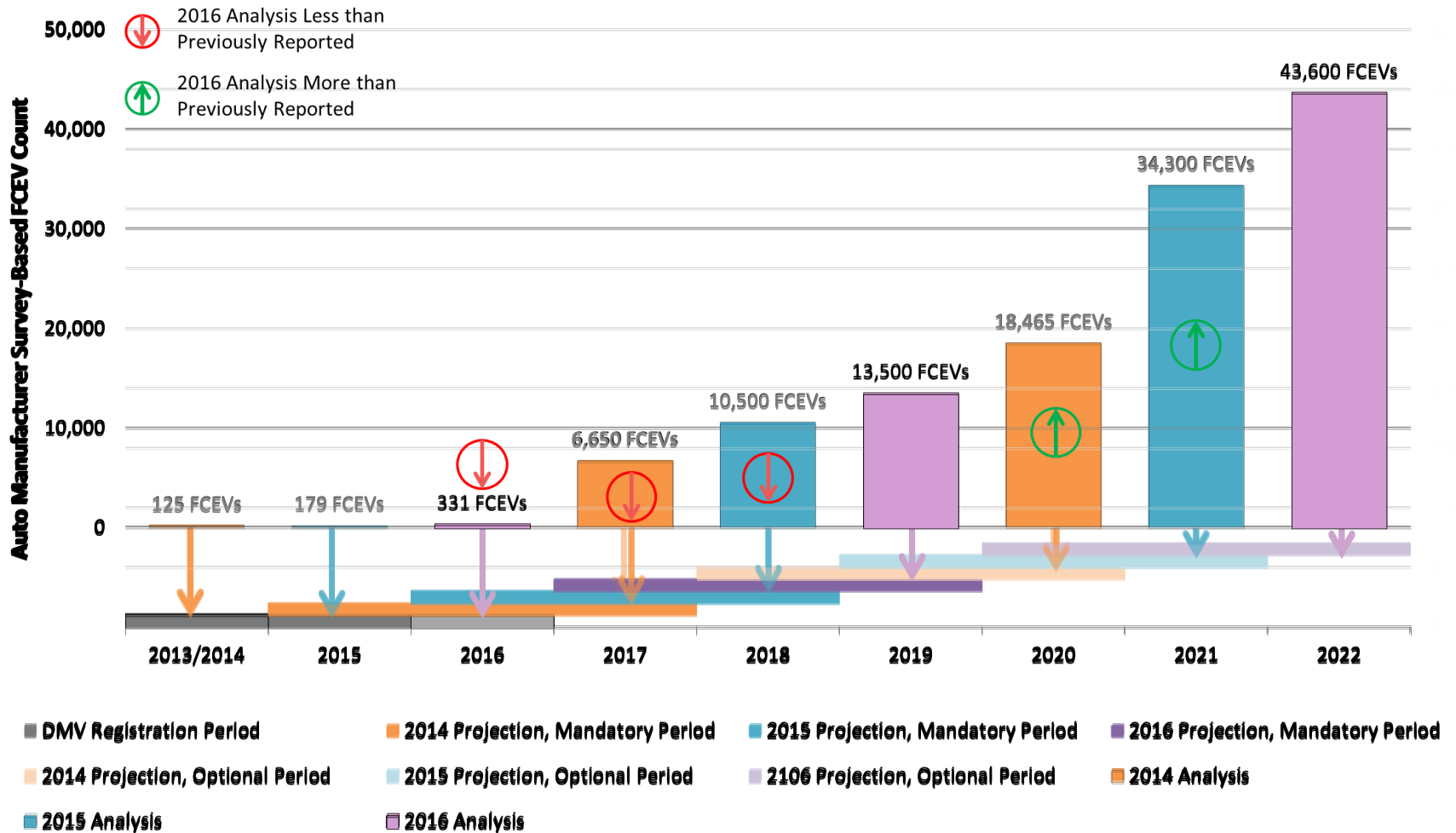


Finding 3

Auto manufacturers' plans for 2020 and beyond continue to indicate robust FCEV deployment in California despite projecting fewer vehicles for the near term.

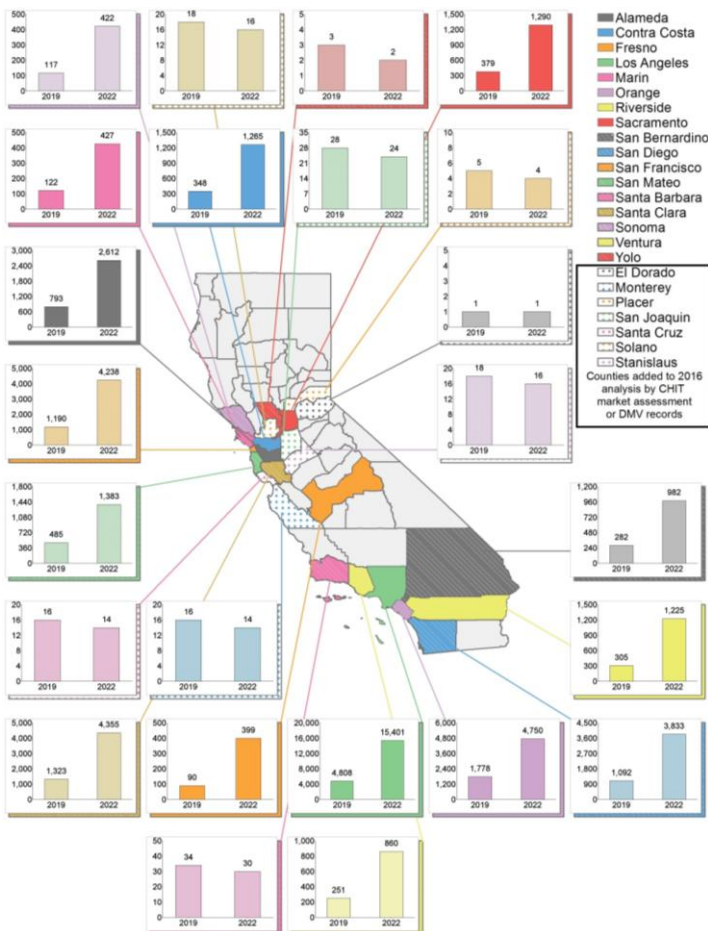


Finding 3

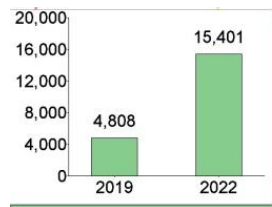


Finding 3

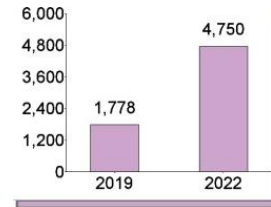
County-Based Survey and Analysis



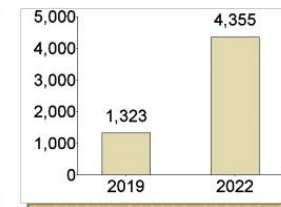
Los Angeles



Orange

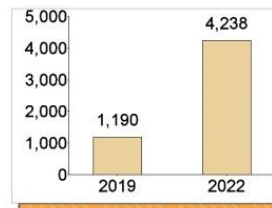


Santa Clara



Larger Markets
(# FCEVs)

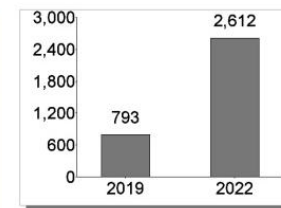
San Francisco



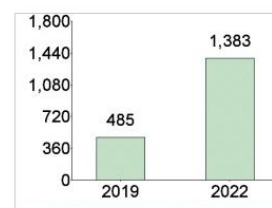
San Diego



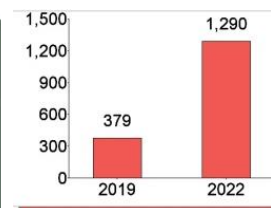
Alameda



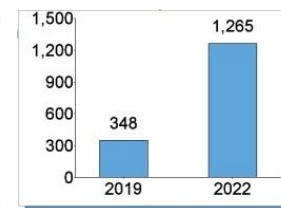
San Mateo



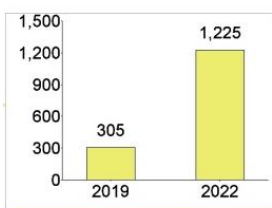
Sacramento



Contra Costa



Riverside



Finding 4

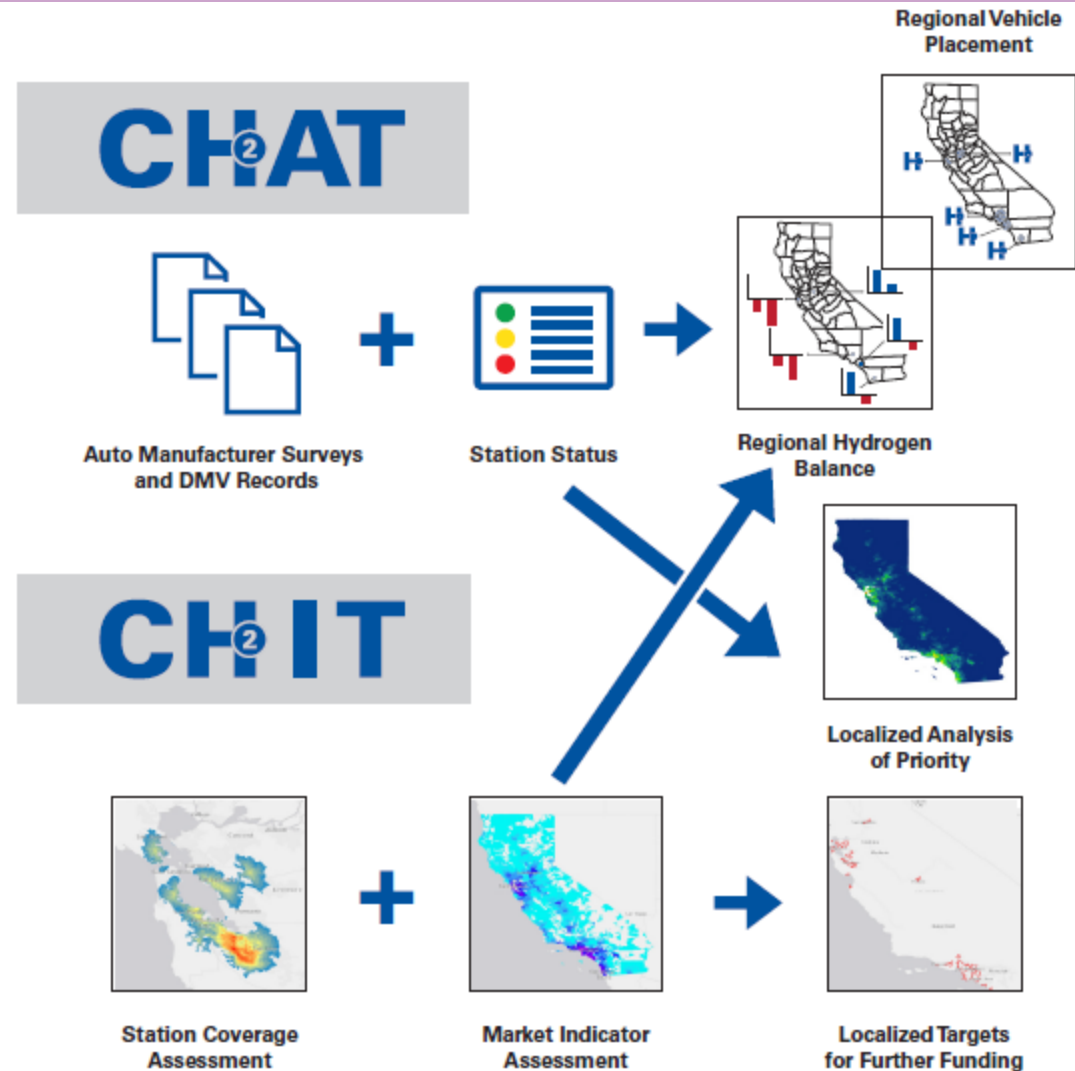
San Francisco, Berkeley and surrounding cities, Greater Los Angeles, San Diego, and Torrance continue to be the highest priorities for further fueling network development.

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

Finding 4

CHIT/CHAT Updates

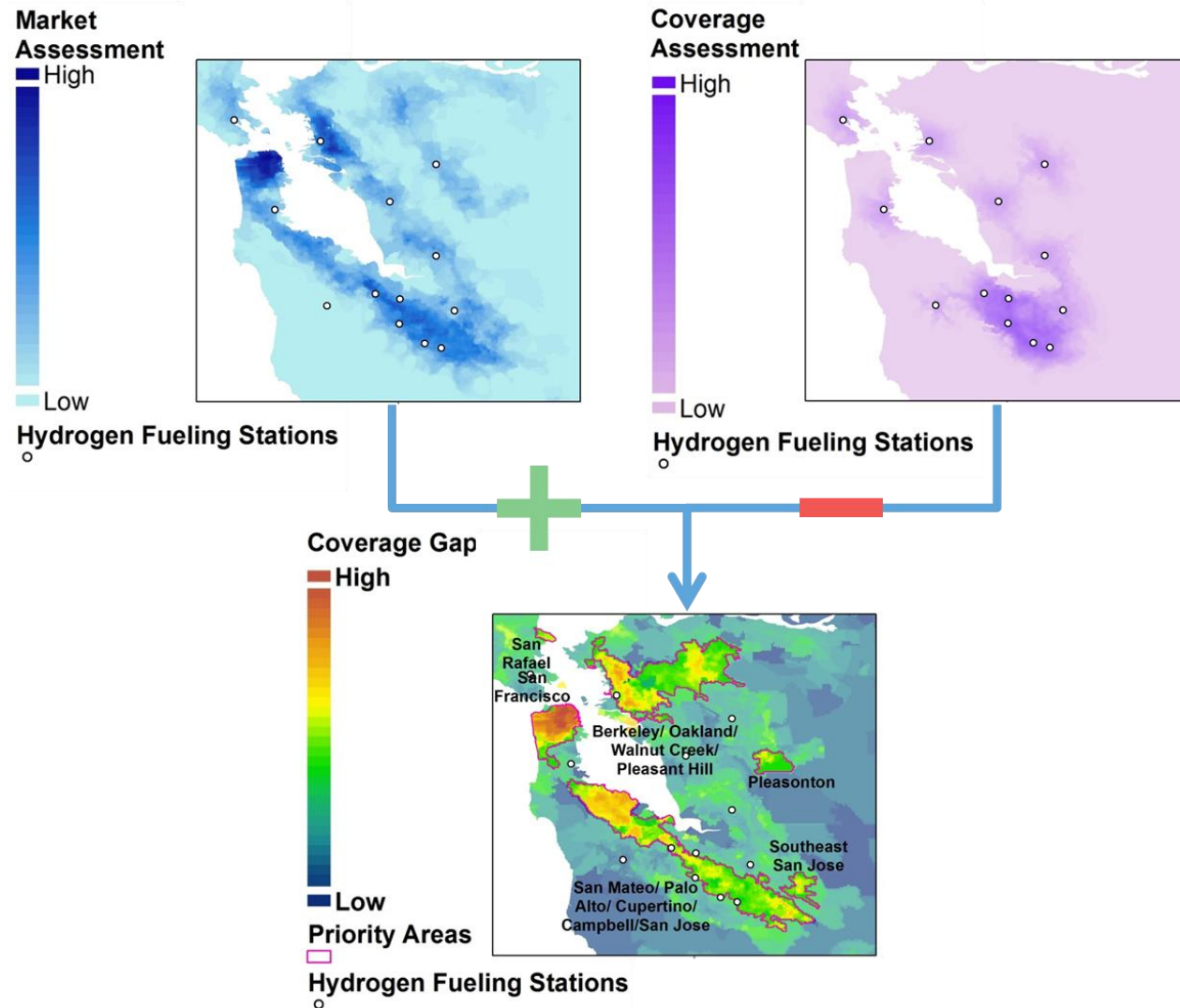
- Harmonized CHIT and CHAT assessments
- Auto manufacturer surveys enabled feedback on CHIT assessments of county-level market shares
- Used CHIT to assign station capacities to markets in and out of host county



Finding 4

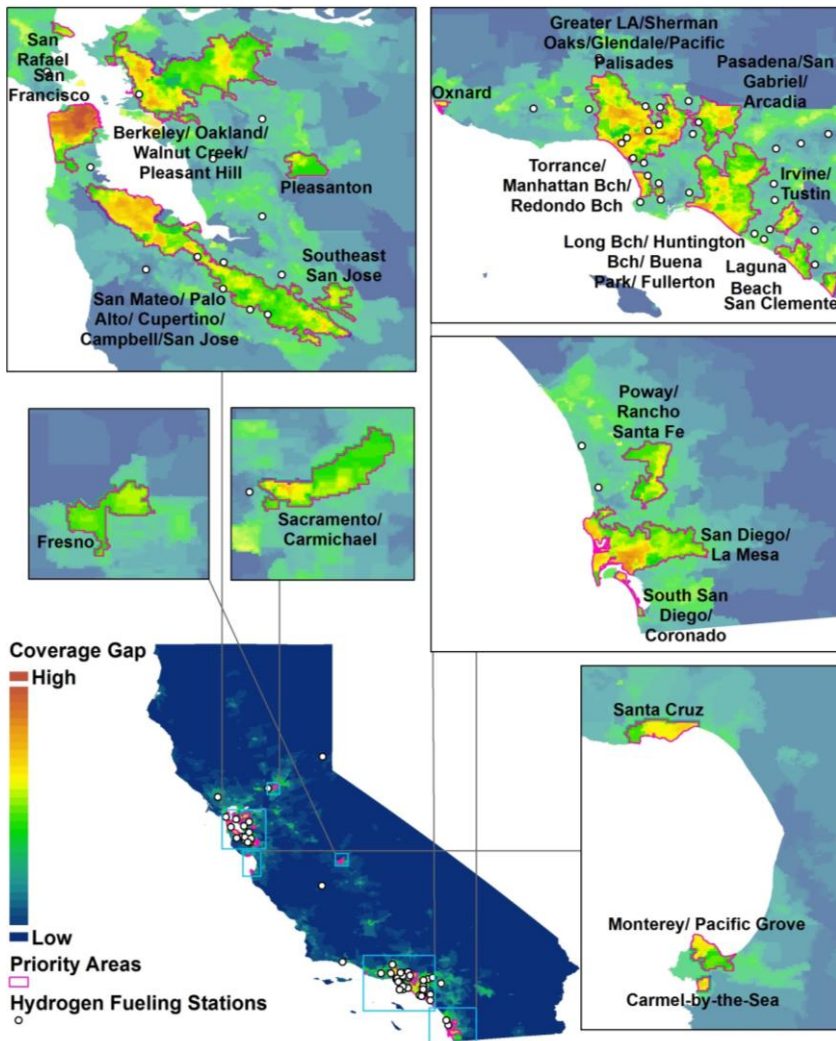
CHIT Tool Review

- 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



Capacity Need

- High Need
- Medium Need
- Low Need

Low Need
 Small Station: 0.15
 Medium Station: 0
 Large Station: 0

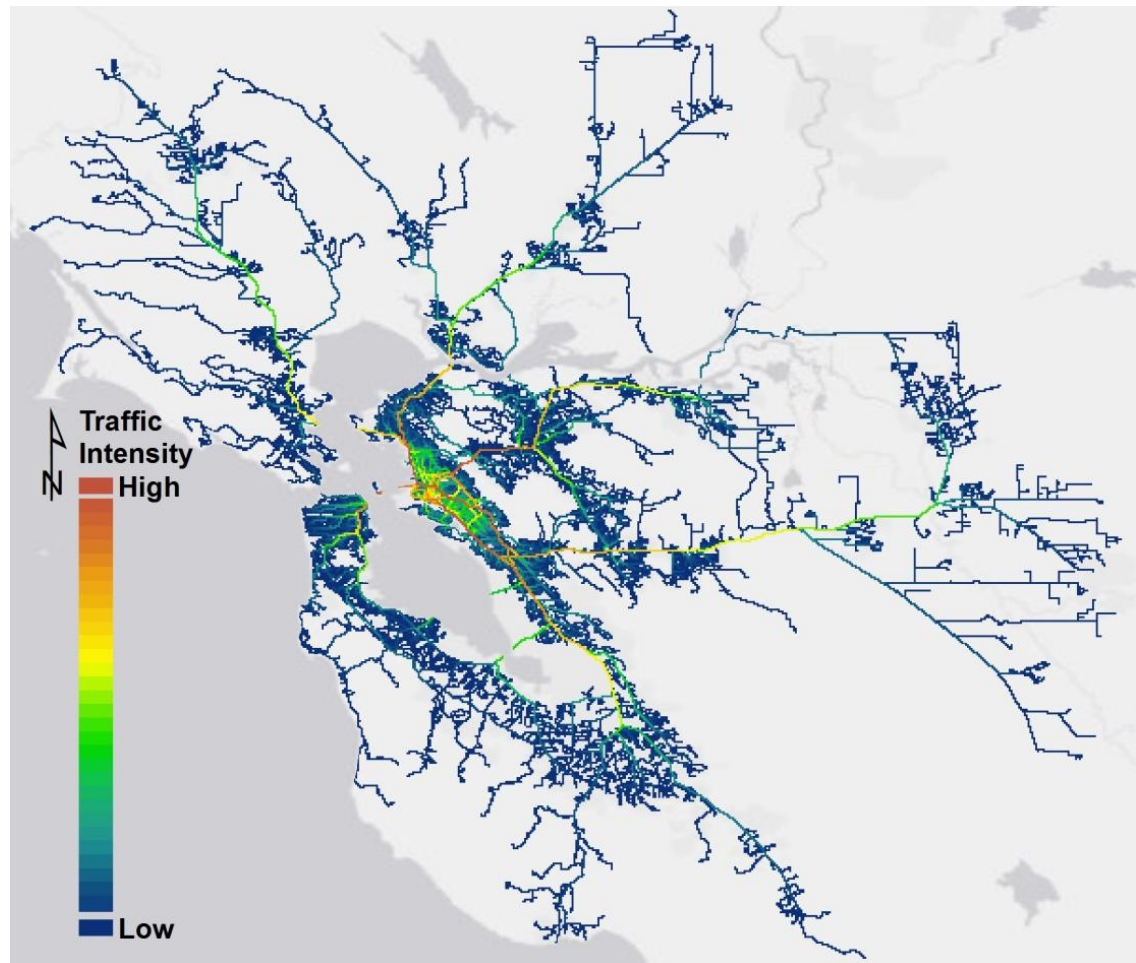
High Need
 Small Station: 0.37
 Medium Station: 0.39
 Large Station: 0.64

Medium Need
 Small Station: 0.27
 Medium Station: 0.32
 Large Station: 0

Finding 4

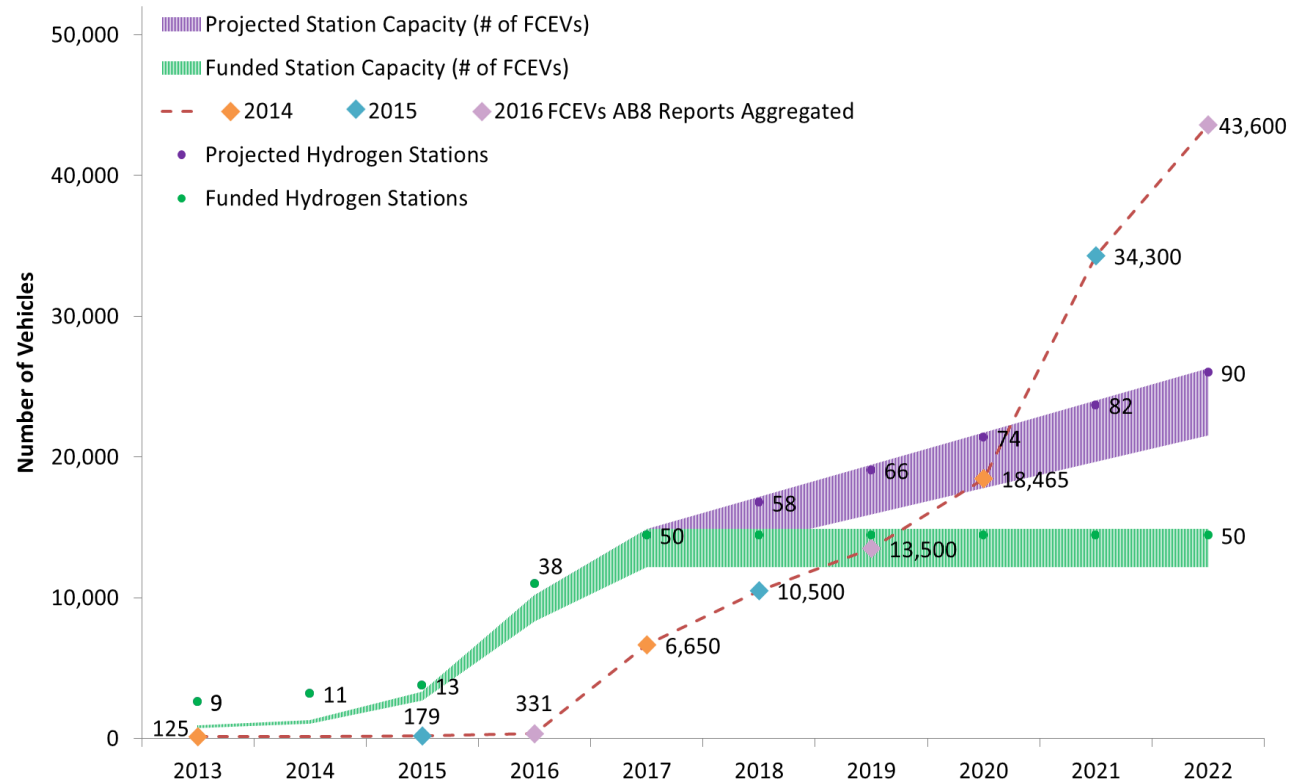
Ongoing CHIT Improvements

- Consistent stakeholder feedback to consider garaging location and driving patterns together for station placement
- LODS O-D and TIGER/ITN to simulate commuter routes and determine traffic intensity in analysis cells
- Significant parallel processing effort

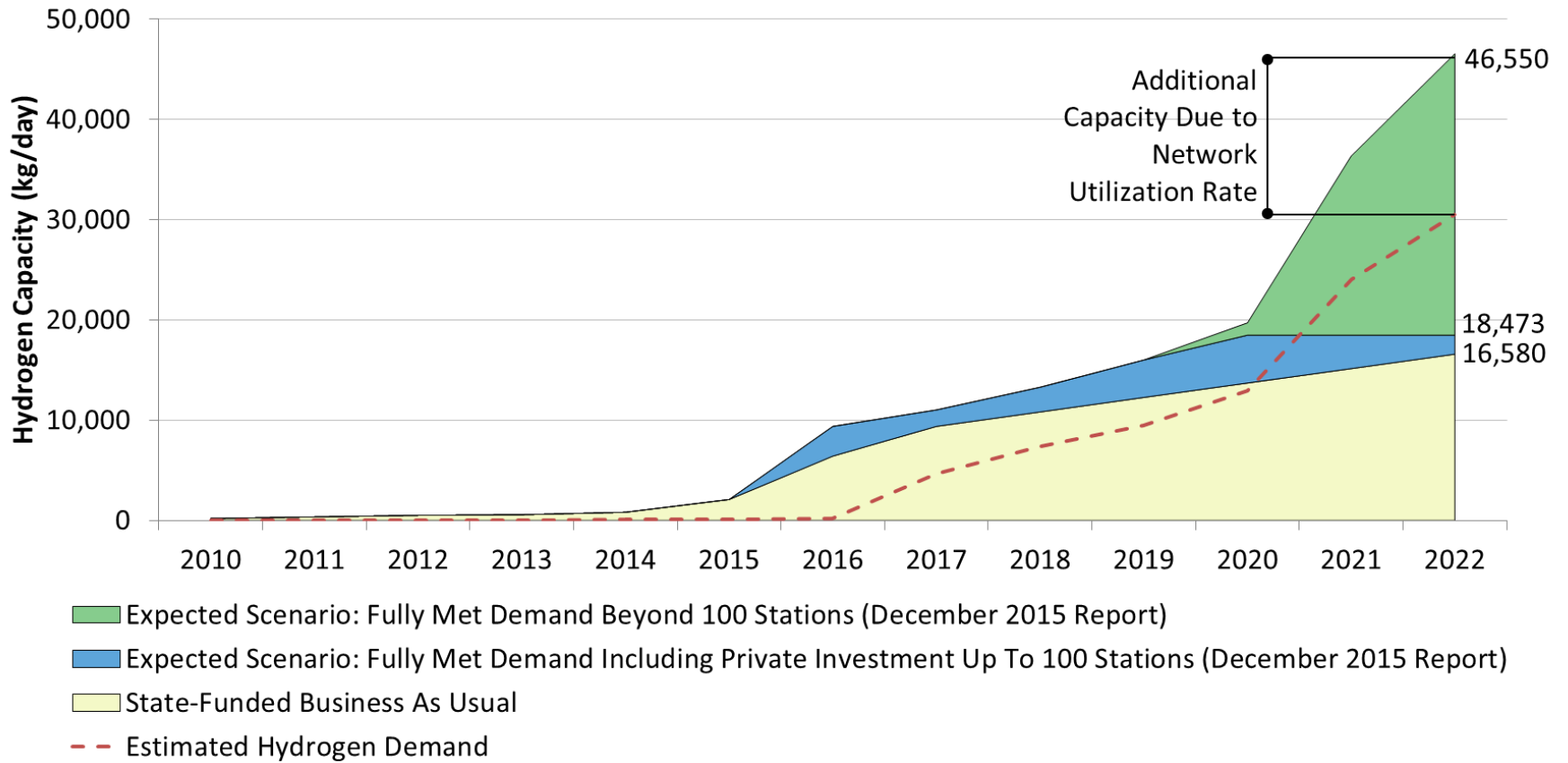


Finding 5

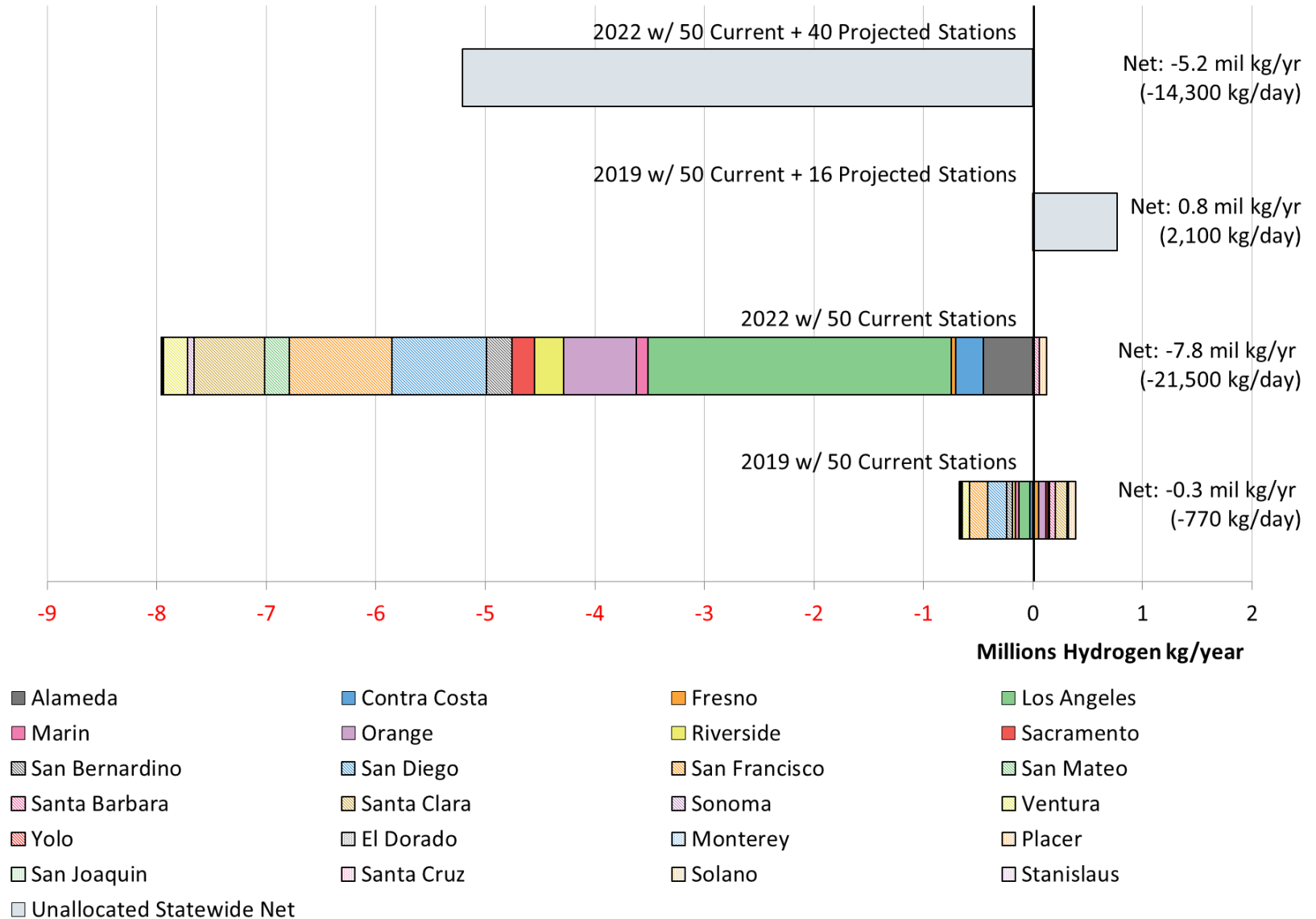
In order to meet the expected hydrogen demand in the developing FCEV market, the full \$20 million in annual funds should continue to be utilized. With a continuing projection of capacity shortfall around 2020, there is increased urgency to identify opportunities to maximize the fueling capacity leveraged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



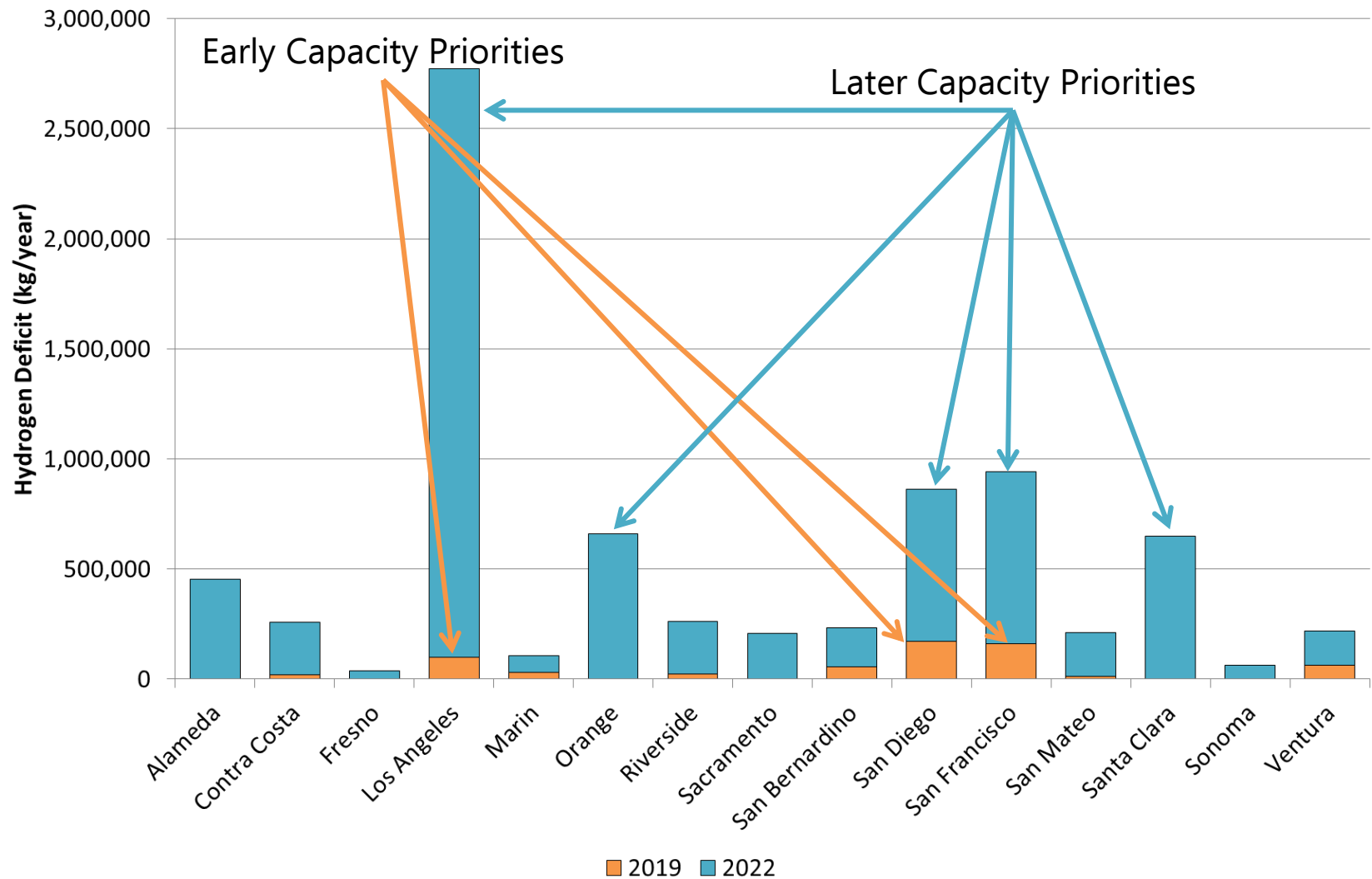
Finding 5



Finding 5

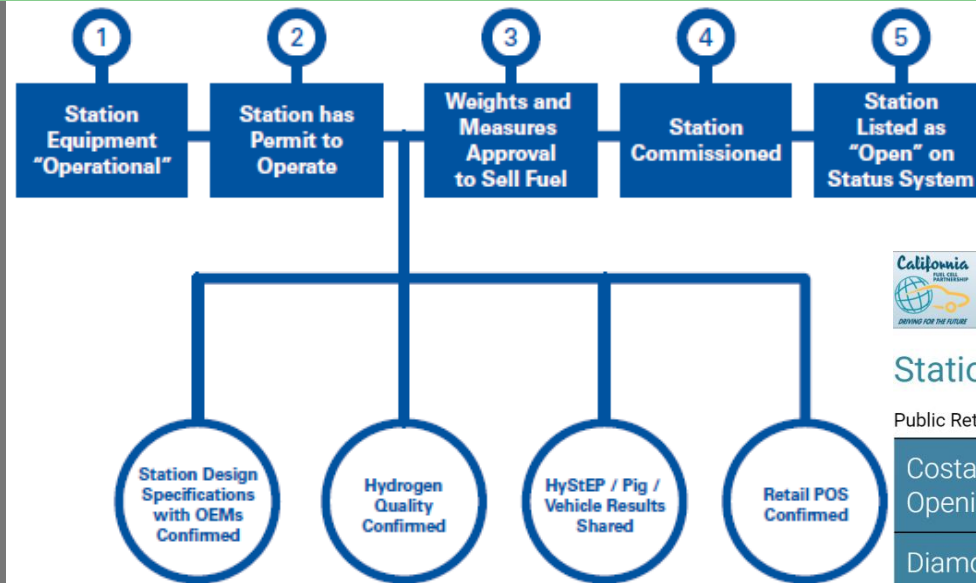


Finding 5



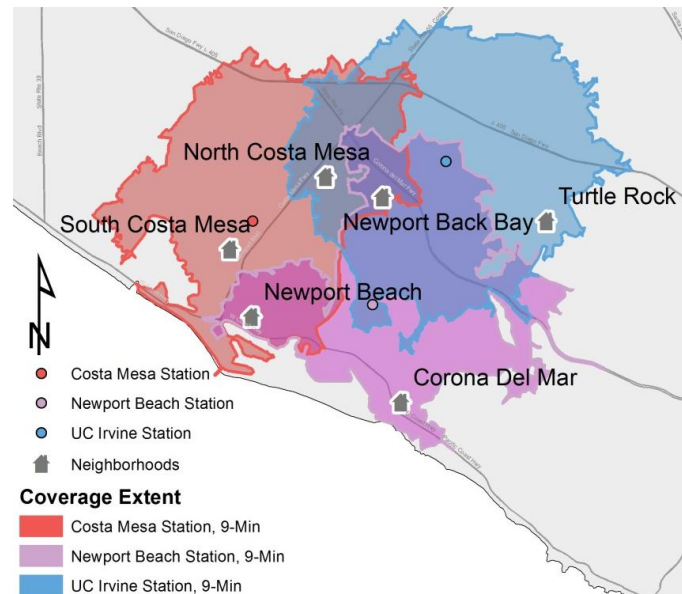
Finding 6

Learnings from the first retail stations highlight the need for a customer-centric focus in planning and implementing hydrogen stations.



Station Status

Public Retail Stations	H70	H35
Costa Mesa (Soft Opening)	●	●
Diamond Bar	●	●
Fairfax-LA (Soft Opening)	●	●
Harris Ranch	●	●
Hayward (Soft Opening)	●	●
La Canada Flintridge (Soft Opening)	●	●
Lake Forest (Soft Opening)	●	●
Long Beach (Soft Opening)	●	●
San Jose (Soft Opening)	●	●



Finding 7

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

Station Accepted

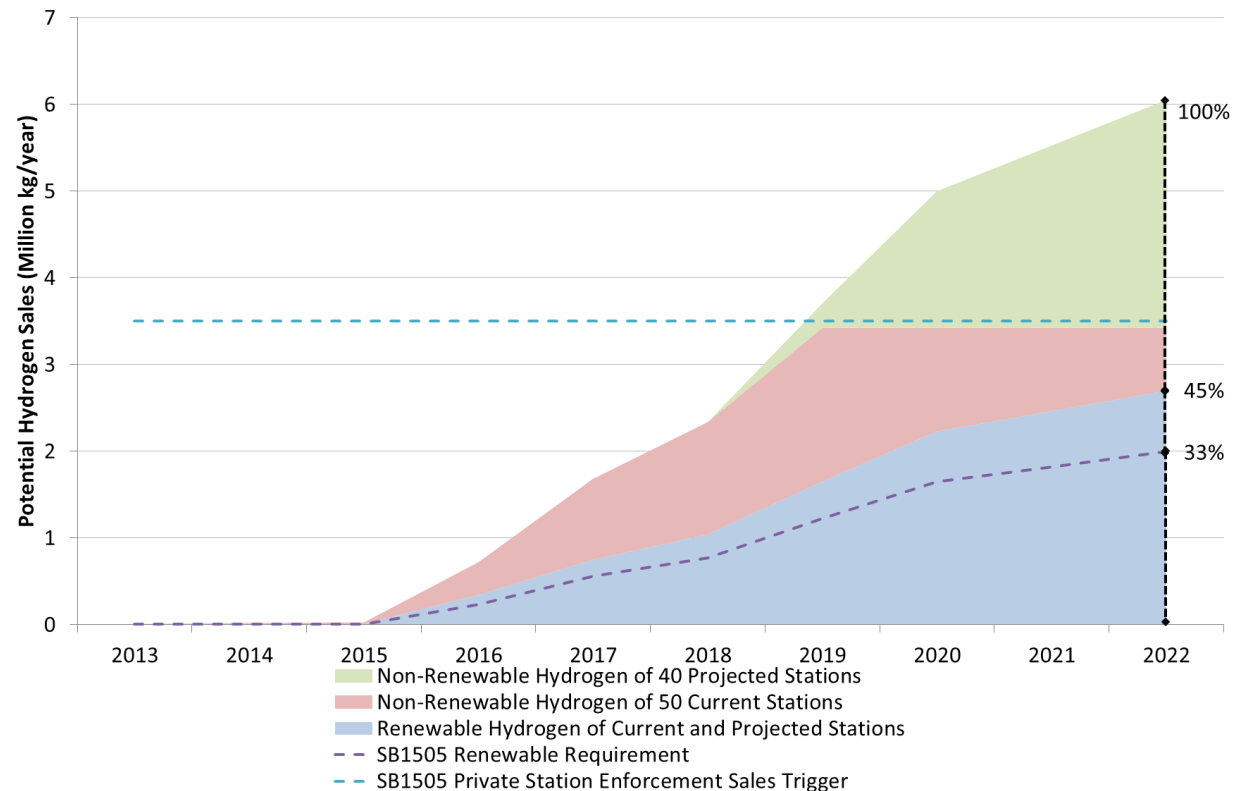


Source: Terry Johnson, Sandia National Lab, Pacific Northwest National Lab, and H2Tools

Finding 8

California's Low Carbon Fuel Standard (LCFS) program offers important revenue potential to hydrogen stations.

Fuel Pathway	Applicant	Carbon Intensity (gCO ₂ /MJ)	Assumed Value per Credit \$100
			LCFS Value (\$/kg)
HYGN009	LyTen	29.84	\$2.30
HYGN006	AC Transit	0	\$2.66
HYGN011	Fuel Cell Energy	-0.82	\$2.67
HYGN008	LyTen	-46.91	\$3.22



DISCUSSION

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