Hydrogen & FCV Implementation Scenarios, 2010 - 2025

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2010-2025 Scenario Analyses

2005 2010 2015 2020 2025

Hydrogen Fuel Initiative

R&D to Meet Targets

Technology Readiness based on lab results and high-pressure storage

Hydrogen Fuel Initiative

Production vehicles

Learning Demo 1		Learning Demo 2	
Gen 1	Gen 2	Gen 3	Gen 4

2,000 hours FC durability
250 mile range
$3/gge H_2 at pump

5,000 hours FC durability
300+ mile range
$2.50/gge at pump

Alternative Scenario Analyses

Production vehicles based on road tests and integrated fuel network

Lighthouse Valid.

Cold Start

3,500 hours durability

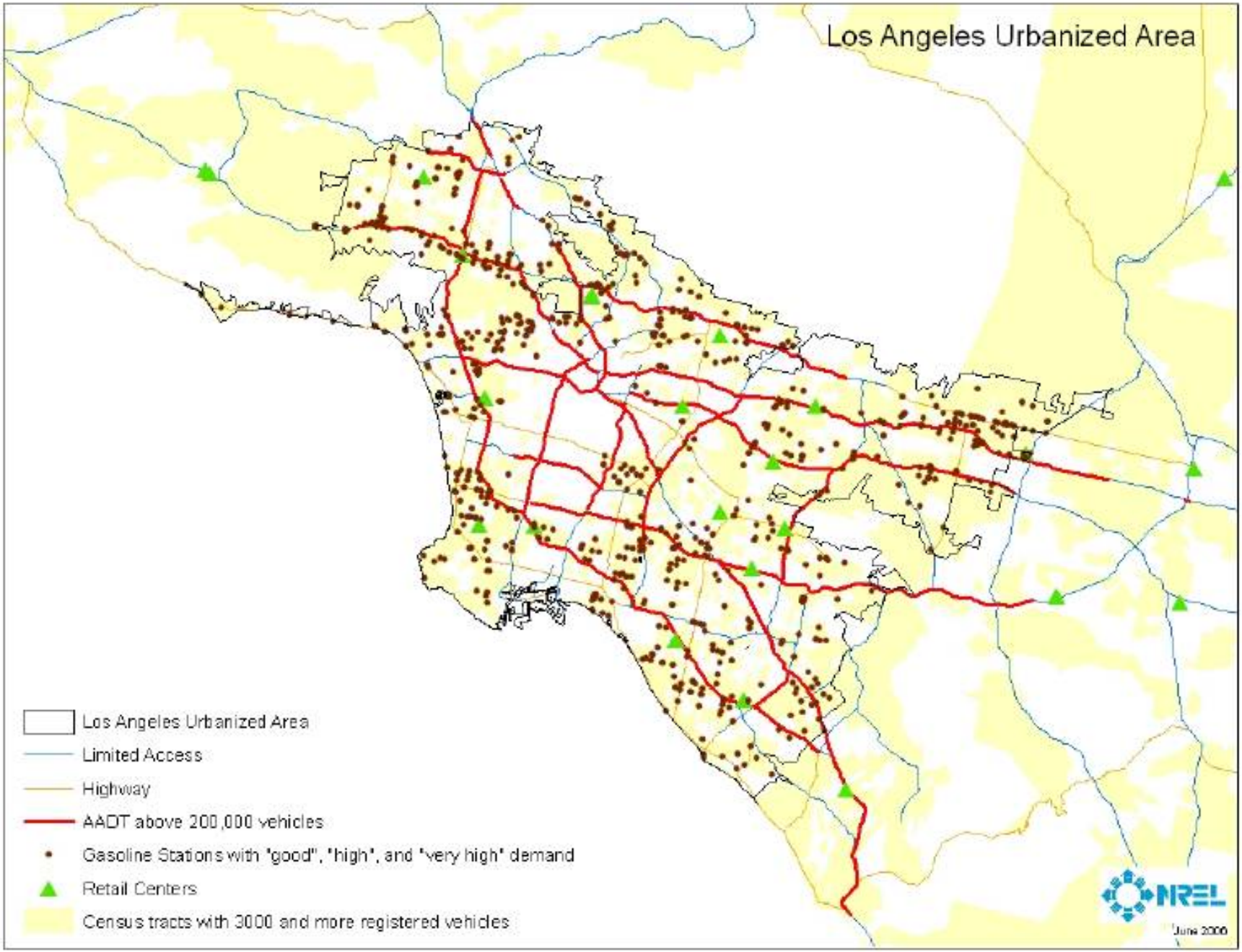
5,000 hours FC durability
300+ mile range
$2.50/gge at pump
Cost of storage and FC TBD

Policy Actions

Infrastructure, Vehicle

2010 – 2015 Baseline Scenario

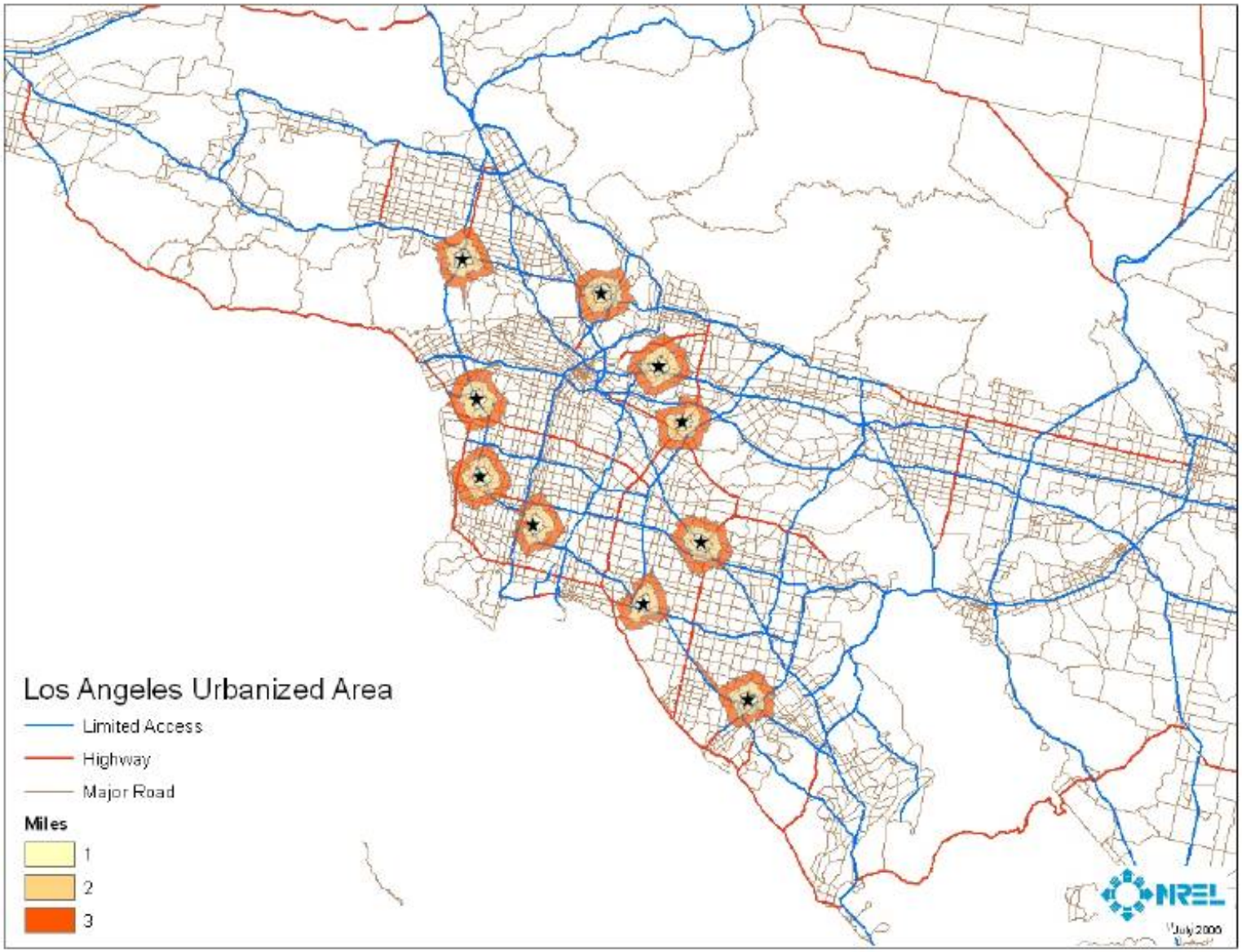
- Fuel Cells
  - ➔Demonstrate 5,000 hours life in laboratory (2010)
  - ➔Demonstrate low cost competitive fuel cell stack (2010)
  - ➔Cold start capability in laboratory (2010)
- Storage
  - ➔5,000 or 10,000 psi compressed storage tanks
  - ➔Low pressure liquid hydrogen
  - ➔Low pressure material systems
- Hydrogen Production
  - ➔$3.00/gge untaxed when produced in quantity
  - ➔Use of Existing Hydrogen Production Capacity
- OEMs have indicated 100s of vehicles/year if targets are achieved
  - ➔starting 2010 or 2012
  - ➔Fleet vs Consumer
- Integrated fueling network (2015)
- ZEV mandate
- Would be capable of going into mass production


Los Angeles Urbanized Area
Los Angeles Urbanized Area
Limited Access
Highway
AADT above 200,000 vehicles
Gasoline Stations with "good", "high", and "very high" demand
Retail Centers
Census tracts with 3000 and more registered vehicles
NREL
June 2006

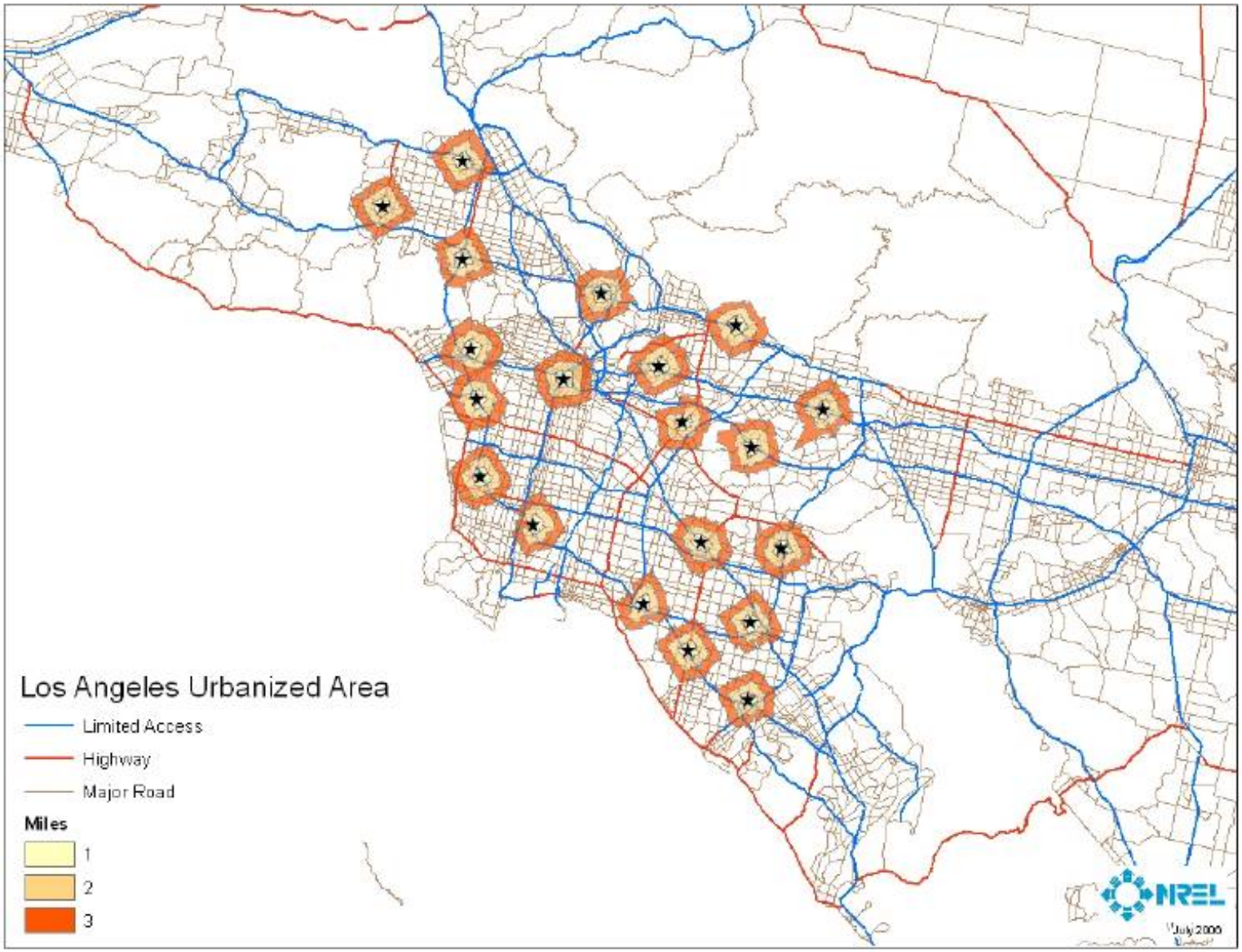
Station Selection Criteria

- Consumer strategy attributes rated good and above
- Close to airports (within 5-6 miles)
- Within 2 mile from a road with traffic above 200,000 vehicles per day
- Within 2 miles of a retail center
- Within a Census tract with 3000 and more registered vehicles (above average vehicle population)
- Accessible by major and secondary roads
- Balanced coverage

Option 1 - 10 Stations (2010-2012)



Option 2 - 20 Stations (2010-2015)



Population - Twenty Station Locations

Drive Distance	Population	% Population (2000 Census LA Urbanized Area)
1 Mile	435,000	4%
2 Mile	1,652,000	14%
3 Mile	3,568,000	30%

Deploy 100 Stations in LA Basin and Implement Regional Infrastructure

Regional – 600 Stations

At 600 Stations, regional deployment extends into Las Vegas, San Francisco, San Diego, Phoenix, and surrounding areas…

Scenario 1
Vehicle Transition and Deployment

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Los Angeles													
0.6	0.8	1.1	5	5	7	20	40	55	70	85	90	100	120
				New York									
				3	5	20	40	50	60	60	70	80	100
						Chicago, San Francisco							
						10	20	30	40	50	60	70	80
								Washington/Baltimore, Boston, Philadelphia					
								15	20	30	50	60	70
									Detroit, Dallas				
									10	15	25	30	40
										Atlanta, Houston			
										10	15	25	40
											Phoenix, Minneapolis, Miami		
											15	20	30
												Denver, Seattle, Cleveland	
												15	20
													Pitts-burgh
													5

Scenario 2
Vehicle Transition and Deployment

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Los Angeles													
1	2	2	40	60	80	100	120	130	140	150	160	190	205
			New York										
			10	25	40	50	70	90	100	110	120	135	140
				Chicago, San Francisco									
				15	20	30	50	70	90	100	110	125	130
					Washington/Baltimore, Boston								
					10	15	30	50	65	75	90	110	120
						Philadelphia							
						5	10	15	25	30	35	50	60
							Dallas, Houston, Detroit						
							20	35	45	60	70	85	95
								Atlanta, Minneapolis					
								10	20	30	40	55	60
									Miami, Cleveland, Phoenix, Seattle				
									15	25	35	55	70
										Denver, Pittsburgh, Portland, Cincinnati, Indianapolis, St. Louis			
										20	25	40	50
											Kansas City, Milwaukee, Columbus, Orlando		
											15	40	50
												Charlotte, Nashville, Salt Lake City	
												15	20
													Buffalo
													5

Scenario 3
Vehicle Transition and Deployment

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Los Angeles													
1	2	2	25	40	50	85	120	160	190	210	250	270	300
			New York, Chicago										
			25	40	50	85	120	150	175	185	225	240	270
				San Francisco, Washington/Baltimore									
				20	30	55	85	120	140	160	190	210	230
					Boston, Philadelphia, Dallas								
					20	50	85	120	145	165	195	210	220
						Detroit, Houston							
						25	50	80	120	140	160	190	210
							Atlanta, Minneapolis, Miami						
							40	75	100	115	130	160	180
								Cleveland, Phoenix, Seattle					
								45	70	90	120	150	170
									Denver, Pittsburgh, Portland, St. Louis, Cincinnati, Indianapolis, Kansas City				
									60	80	110	130	150
										Milwaukee, Charlotte, Orlando, Columbus, Salt Lake City			
										55	80	110	130
											Nashville, Buffalo, Raleigh		
											40	70	90
												Nationwide	
												260	540

SUMMARY

- In response to the National Research Council recommendation, several scenarios have been proposed for analysis of the possible impact and cost of “alternative market interventions”.
- An urban regional model is proposed during the nascent hydrogen introductory period.
- A report is due to be presented to the NRC by March, 2007 for their further analysis and assessment in compliance with EPACT.
- Industry involvement and feedback is an integral part in the development of an inclusive set of scenarios to be analysed.