

# Discrete Choice Analysis: H<sub>2</sub> FCV Demand Potential

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H<sub>2</sub> Scenario Analysis Workshop  
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# Overview

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- Motivation for work
- Methodology
- Relative Attribute Strengths
- Insights and Recommendations
- Responses to Key Questions

# Acknowledgments

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Trish Bross	-- NREL
Don Jones	-- RCF

for insightful  
feedback

# Motivation

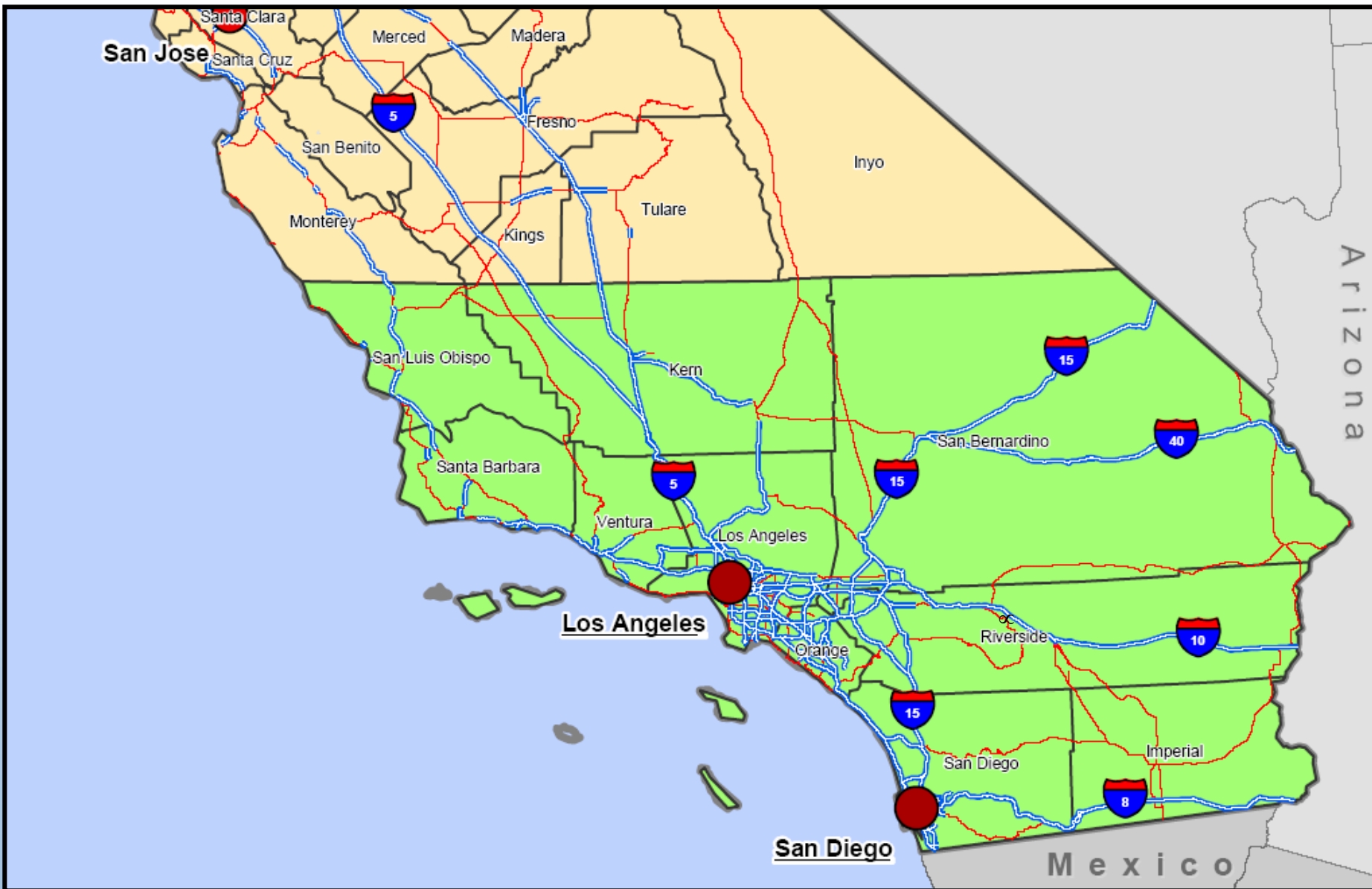
- Quantify sensitivity of H<sub>2</sub> FCV market potential to station convenience
- Move beyond “% stations” or “distance to nearest station” metrics
- Input quantified parameters into HyDIVE™ (other models?) for *data driven* analysis
  - quantify “chicken-and-egg” barrier
  - develop robust, high leverage policies/strategies

# Methodology

- Discrete Choice Analysis
  - consumers “choose” among vehicles w/diff. attributes
  - through repeated choices, sensitivities are determined
- Responses being obtained from 500 households
  - Knowledge Networks’ Knowledge Panel<sup>SM</sup>
  - 10 choice tasks per respondent, 2 decisions per task
  - $500 \times 10 \times 2 = 10,000$  choice observations
- NREL used BIOGEME\* for parameter estimation, model development (logit, nested logit, etc.)

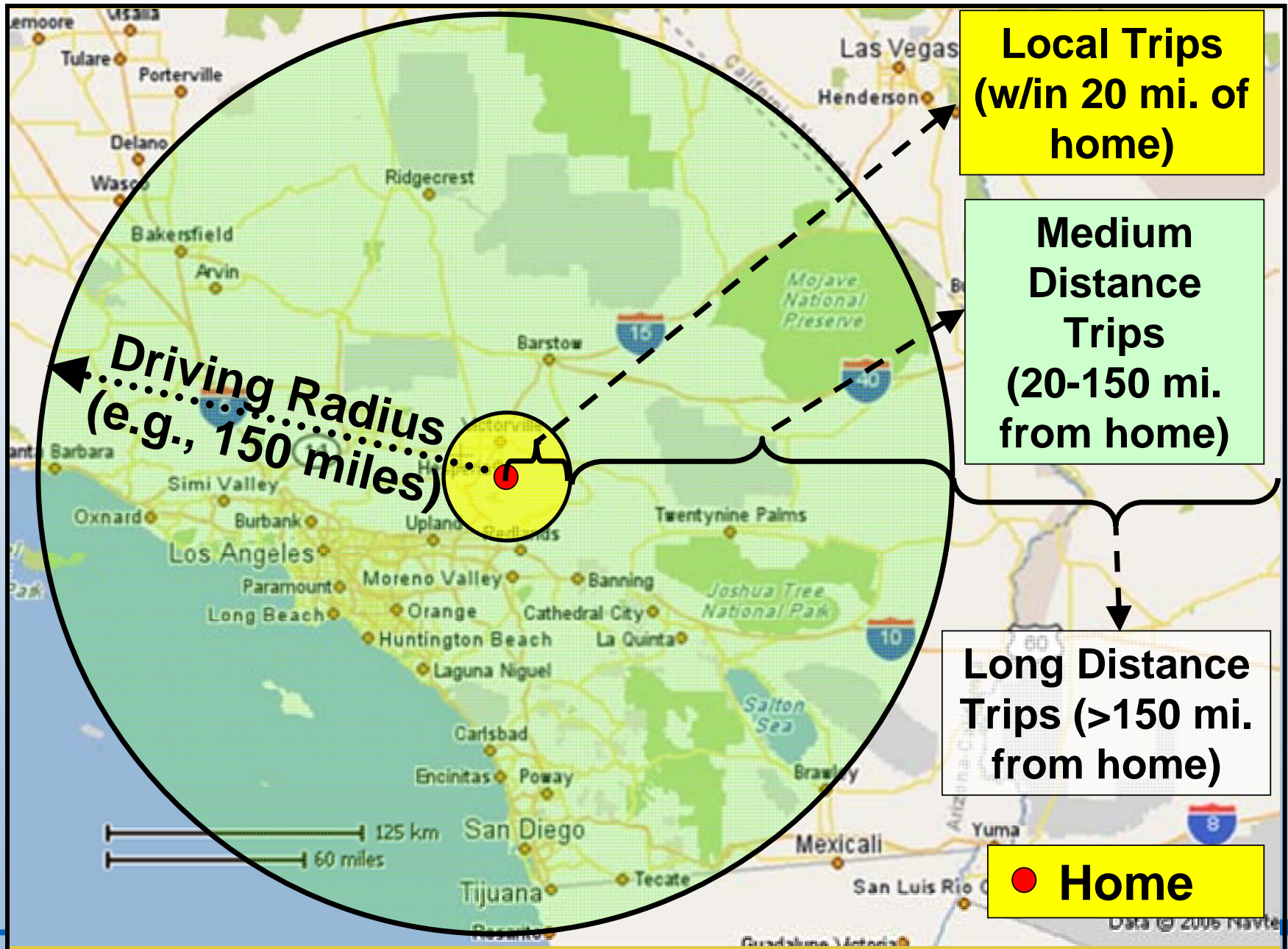
\* Bierlaire, M. (2003). [BIOGEME: A free package for the estimation of discrete choice models](#), *Proceedings of the 3rd Swiss Transportation Research Conference*, Ascona, Switzerland.

# Target Region: Southern California





# Spatial Characterization



# Example: “Choice Task”

	Gasoline Vehicle (Similar to Honda Accord)	Alternative Fuel Vehicle A (Similar to Honda Accord)	Alternative Fuel Vehicle B (Similar to Honda Accord)
<i>Click on the attributes for definitions</i>		<u>Virtually NO oil used or imported</u>	
		<u>No smog emissions</u>	
		<u>30%-70% fewer Greenhouse Gas emissions</u>	
<u>Extra Time (one-way) to Local Stations</u>	0 minutes	3 minutes	10 minutes
<u>Driving Radius</u>	Same as your Honda Accord (typically ~200 miles)	150 miles	150 miles
<u>Medium Distance Trips with No Advance Planning</u>	100%	50% no planning	90% no planning
<u>Long Distance Trips that are Possible</u>	100%	50% possible	50% possible
<u>Fuel Cost (\$/month)</u>	\$110	\$110	\$165
<u>Purchase Price</u>	\$32,000	\$27,200	\$32,000
<b>Vehicle you are MOST likely to purchase</b>	●	●	●
<b>Vehicle you are LEAST likely to purchase</b>	●	●	●



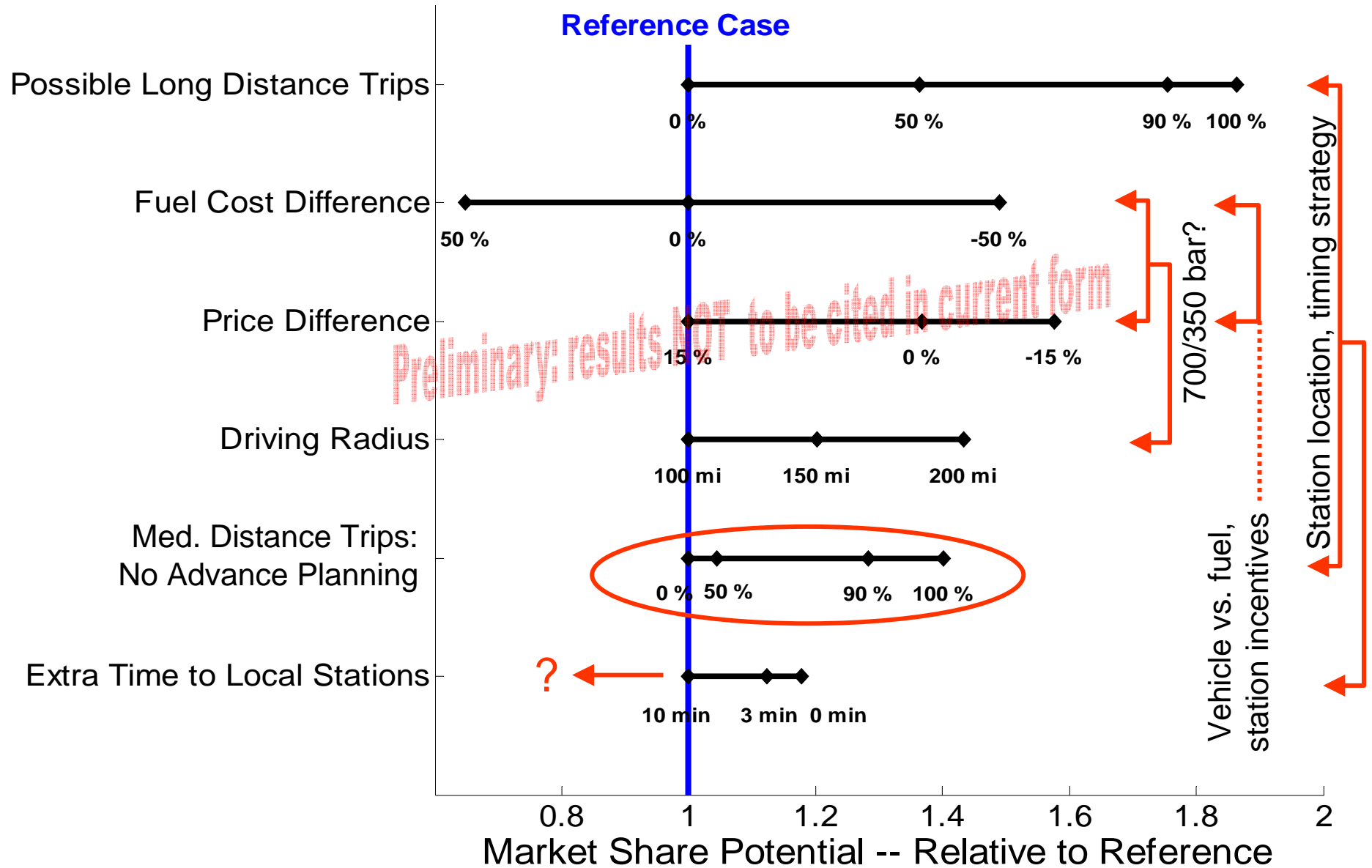
# Why are results “preliminary”

- Data recently received (Jan. 25)
- Subset of total dataset (451/500)
- Doesn't yet consider consumer heterogeneity
  - via segmentation and/or “random” coefficients
- Interactions/non-linearity not *fully* explored
- Demographic balance to be quantified

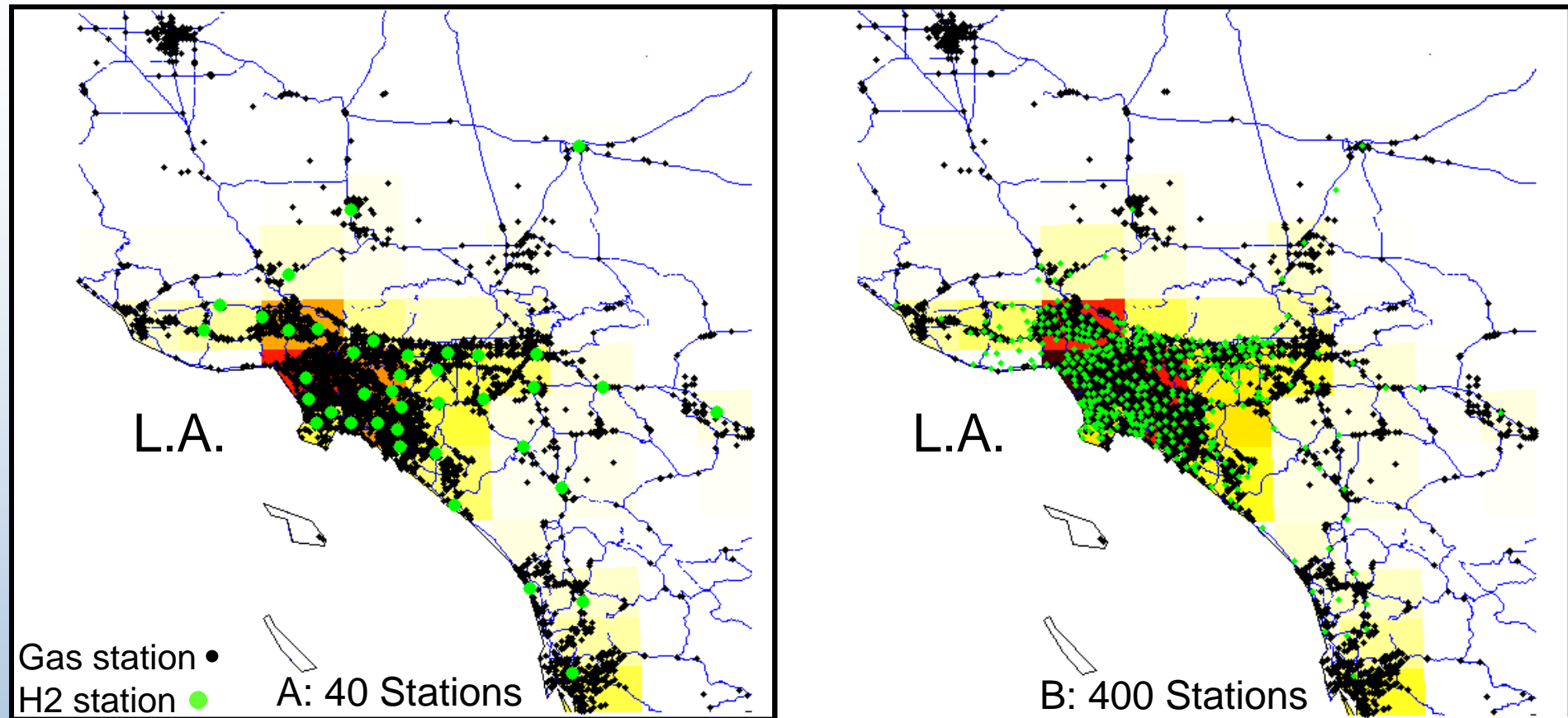
However, results are considered to be directionally accurate, and all estimated coefficients are statistically significant.

# Tornado Chart: H<sub>2</sub> FCV Market Share Potential

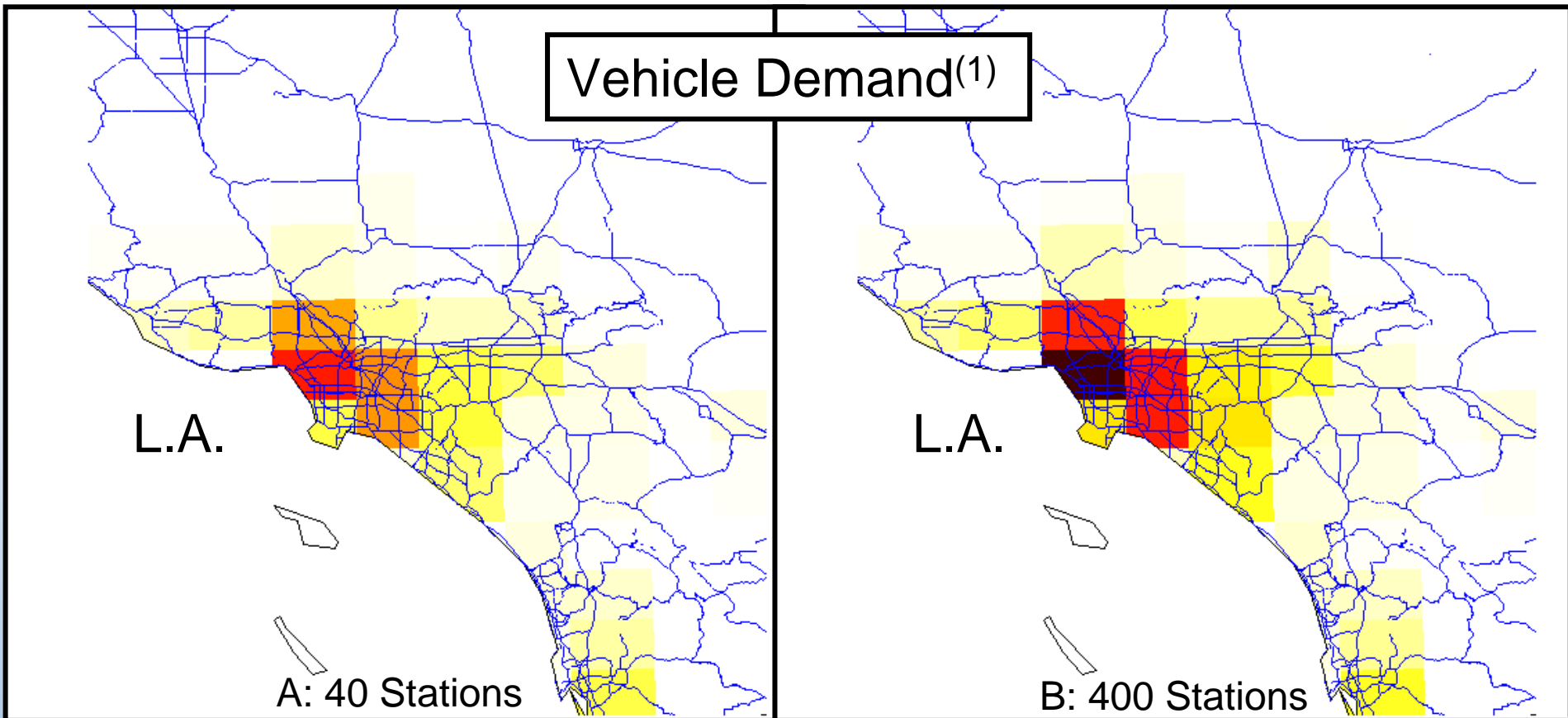
How NOT to read this chart: widest is “most important”



# HyDIVE Example – “Static”



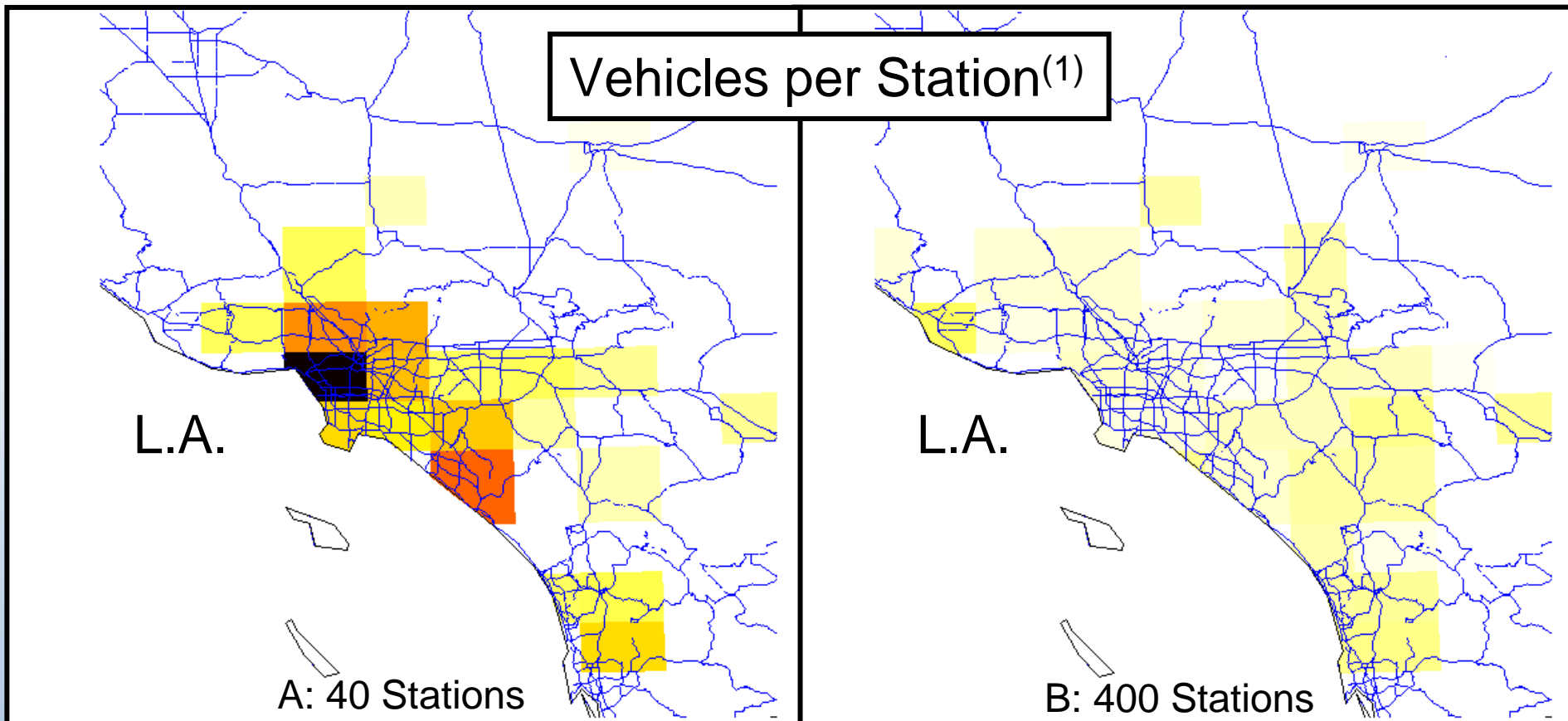
# HyDIVE Example – “Static”



Greater demand<sup>(1)</sup> potential due to improved station coverage/convenience

(1) All else equal (e.g., net vehicle price, availability, etc.)

# HyDIVE Example – “Static”

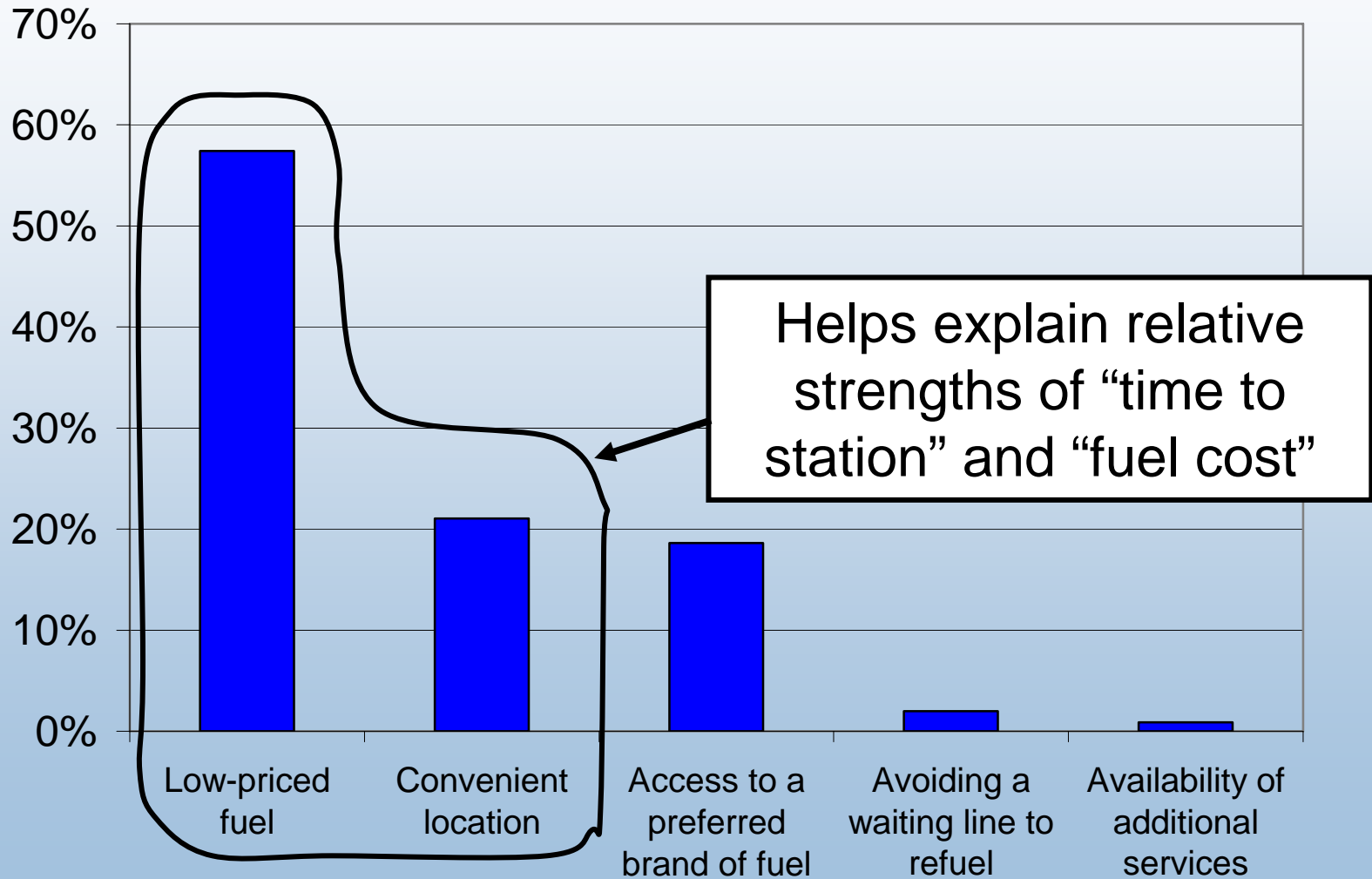


However,  
Vehicles/Station<sup>(1)</sup> (B)  $\ll$  ? Vehicles/Station (A)

(1) An indicator of station profitability

# Station Selection Considerations

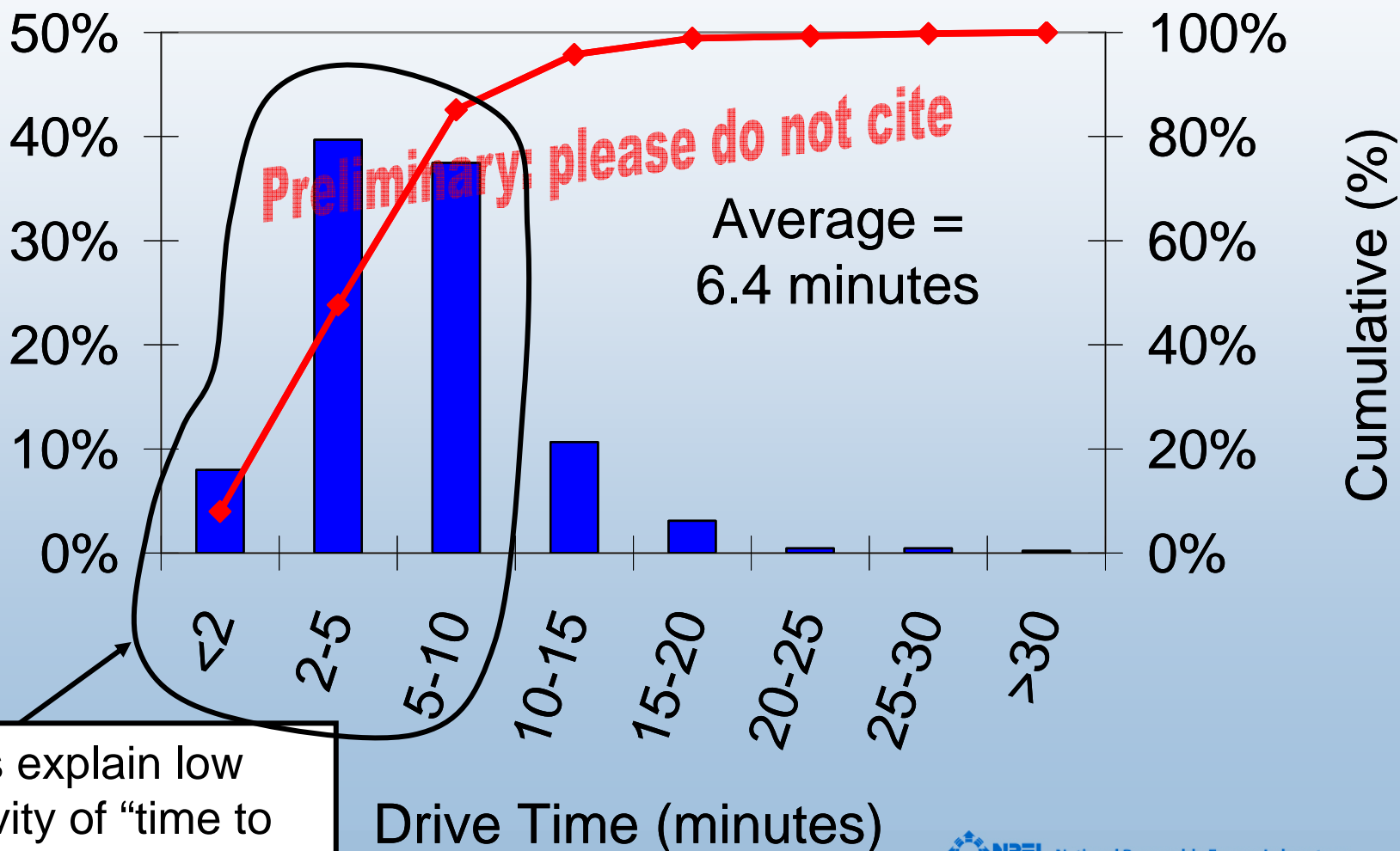
What is your most important consideration when choosing where to refuel your vehicle?





# Convenient Time to Station

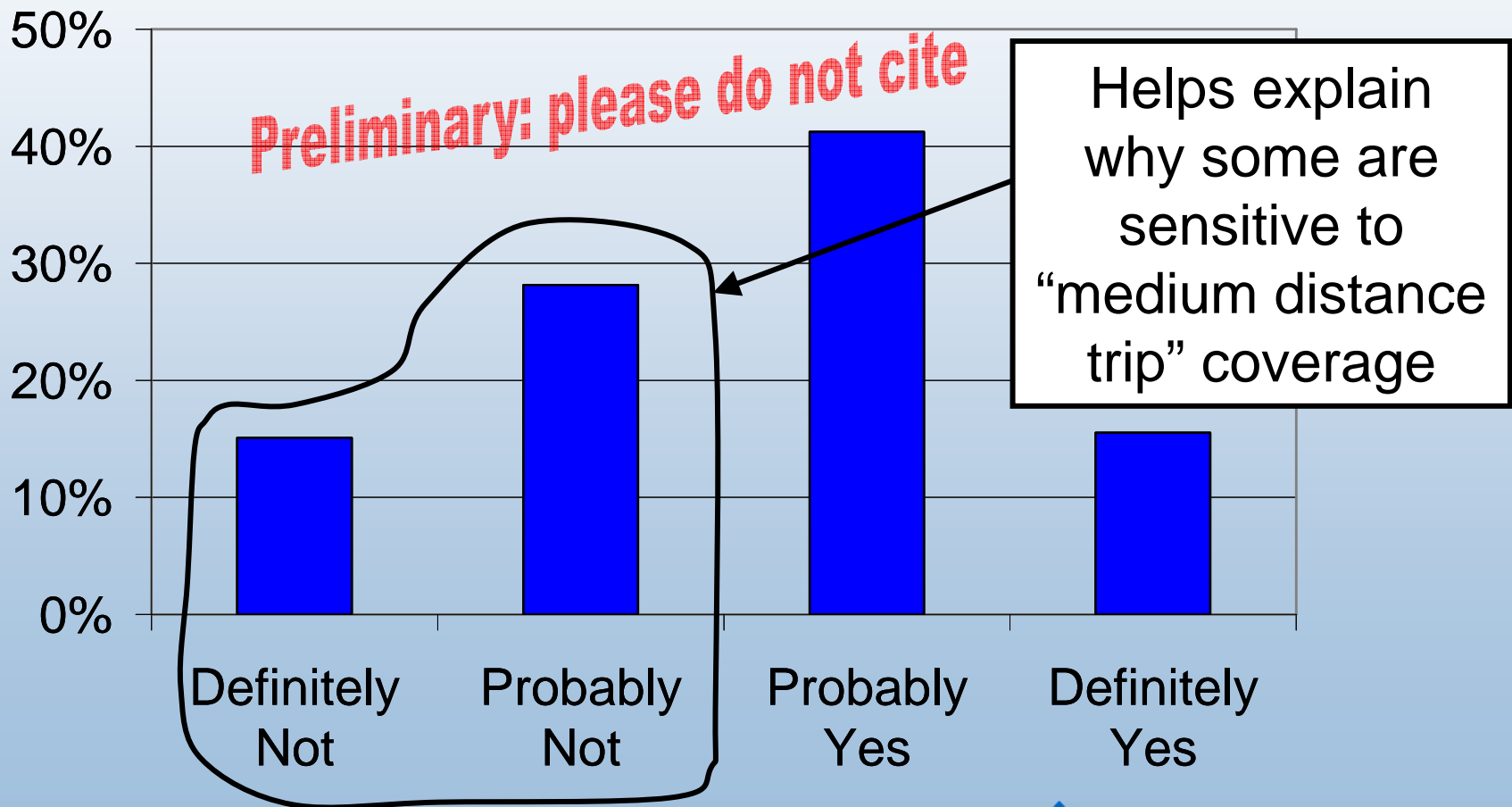
What is the longest time you would drive to a refueling station and still consider it to be “convenient” ?



Helps explain low sensitivity of “time to station” below 10 min.

# “Comfort Level” – No Stations Nearby

Would you be comfortable estimating whether you had enough fuel in your tank to travel to a destination with no refueling stations nearby?



# Insights and Recommendations

- Diminishing returns of local coverage once local time to station is within 5-10 minutes
- Adding more stations induces demand, but *depending on the starting point*,
  - can reduce overall station utilization/profitability.
  - In such a case, adding more stations is not high leverage.
    - Vehicle demand would need to increase via other means (e.g., price incentives, vehicle availability, fuel cost reductions, etc.)
- The *spatial, temporal* behavior of this highly complex, non-linear *system* needs rigorous modeling/analysis considering *uncertainty* in various inputs to develop robust policies and strategies that are likely to be effective.

# Additional Slides

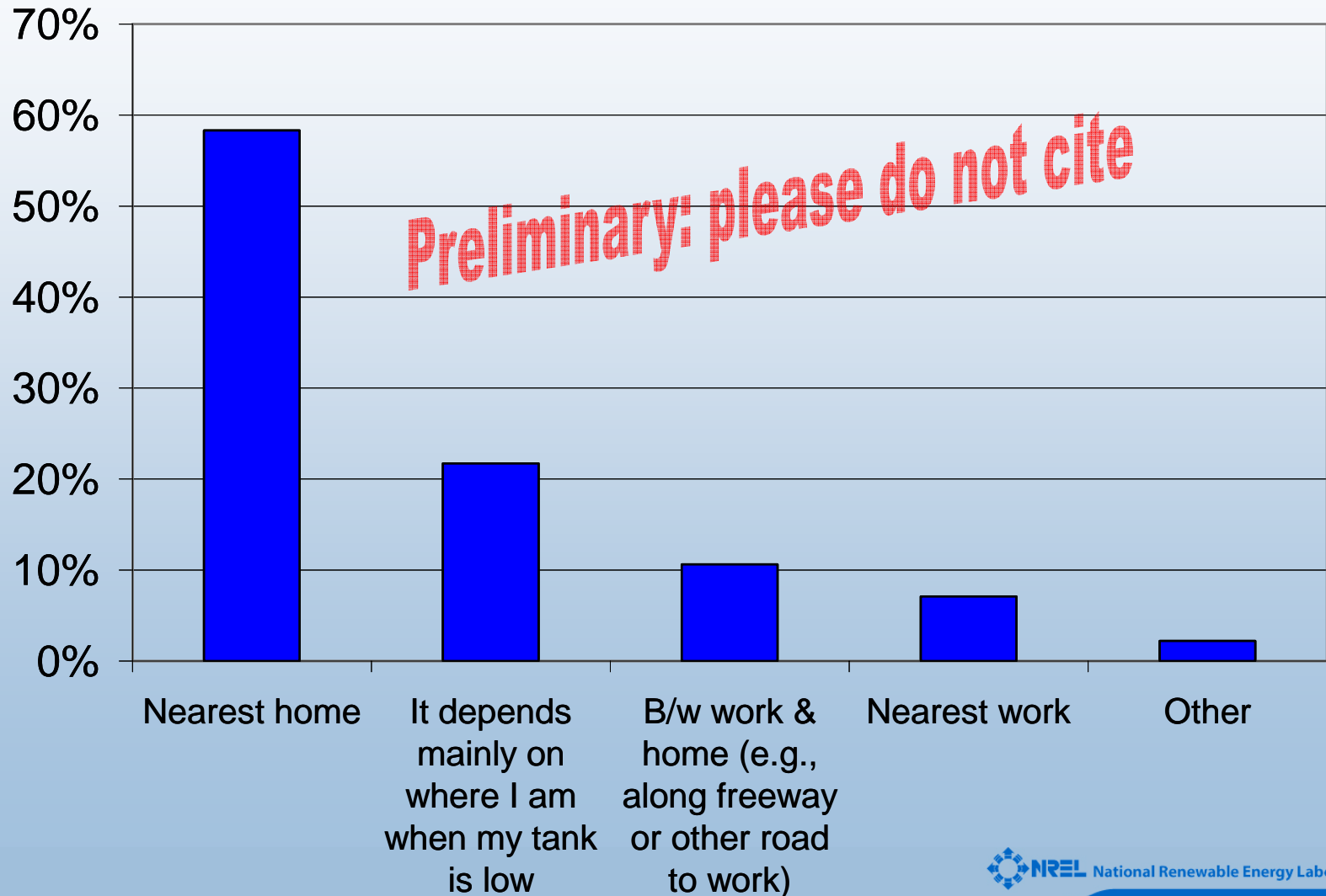
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# “Market Share Potential” Calculation

- Can be thought of as an equilibrium, upper bound market share, assuming:
  - H<sub>2</sub> FCV “option” universally available (all makes/models)
  - All consumers “aware” of H<sub>2</sub> FCV technology option
  - All consumers are “aware” of actual levels of station coverage (i.e., no difference b/w reality and perception)
- The dynamics of growth in “availability” and “awareness” would lower actual forecast market share relative to the “potential”
  - To be incorporated in future analyses (beyond Apr 07)

# Refueling Location

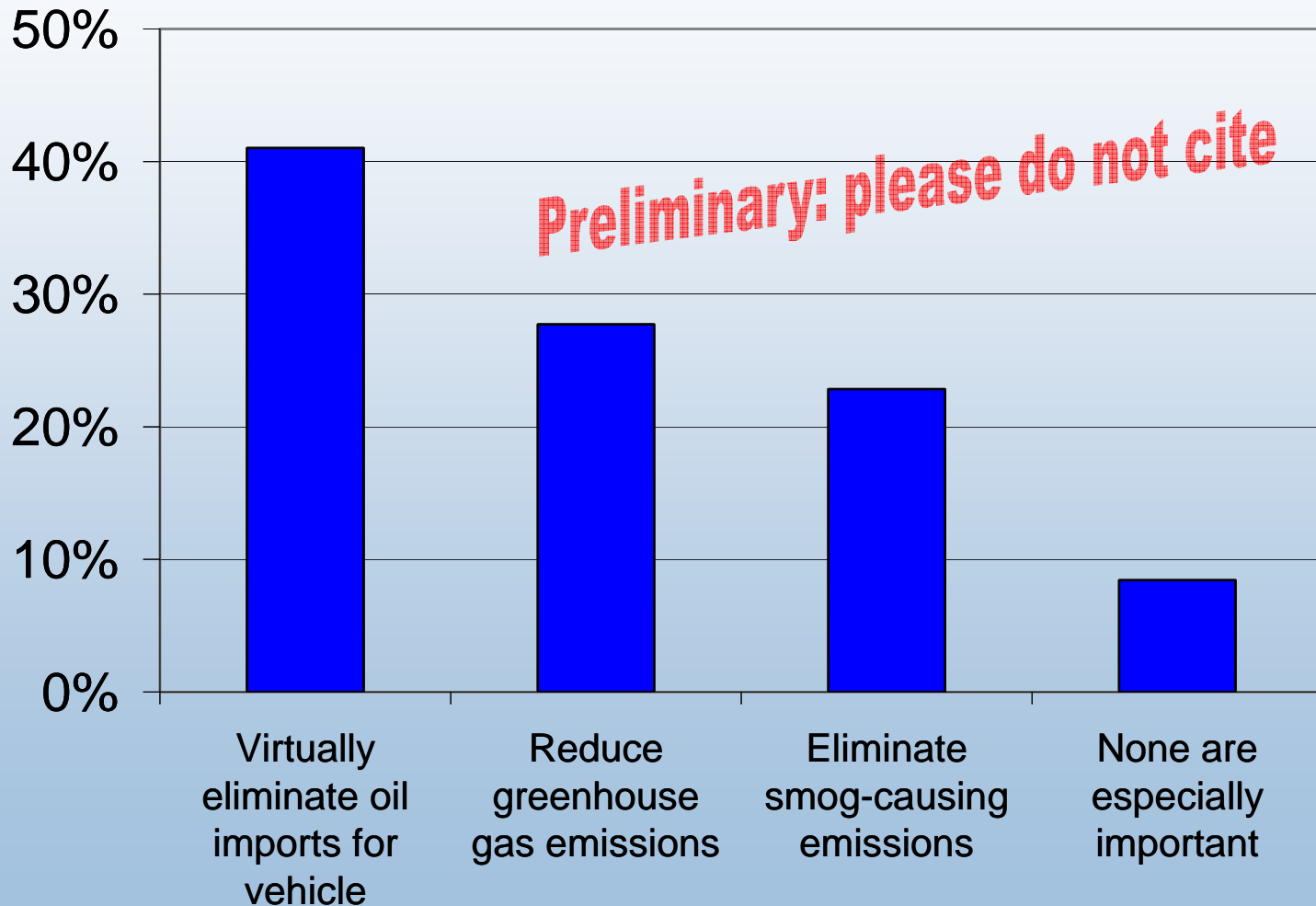
Where do you most frequently refuel your vehicle?





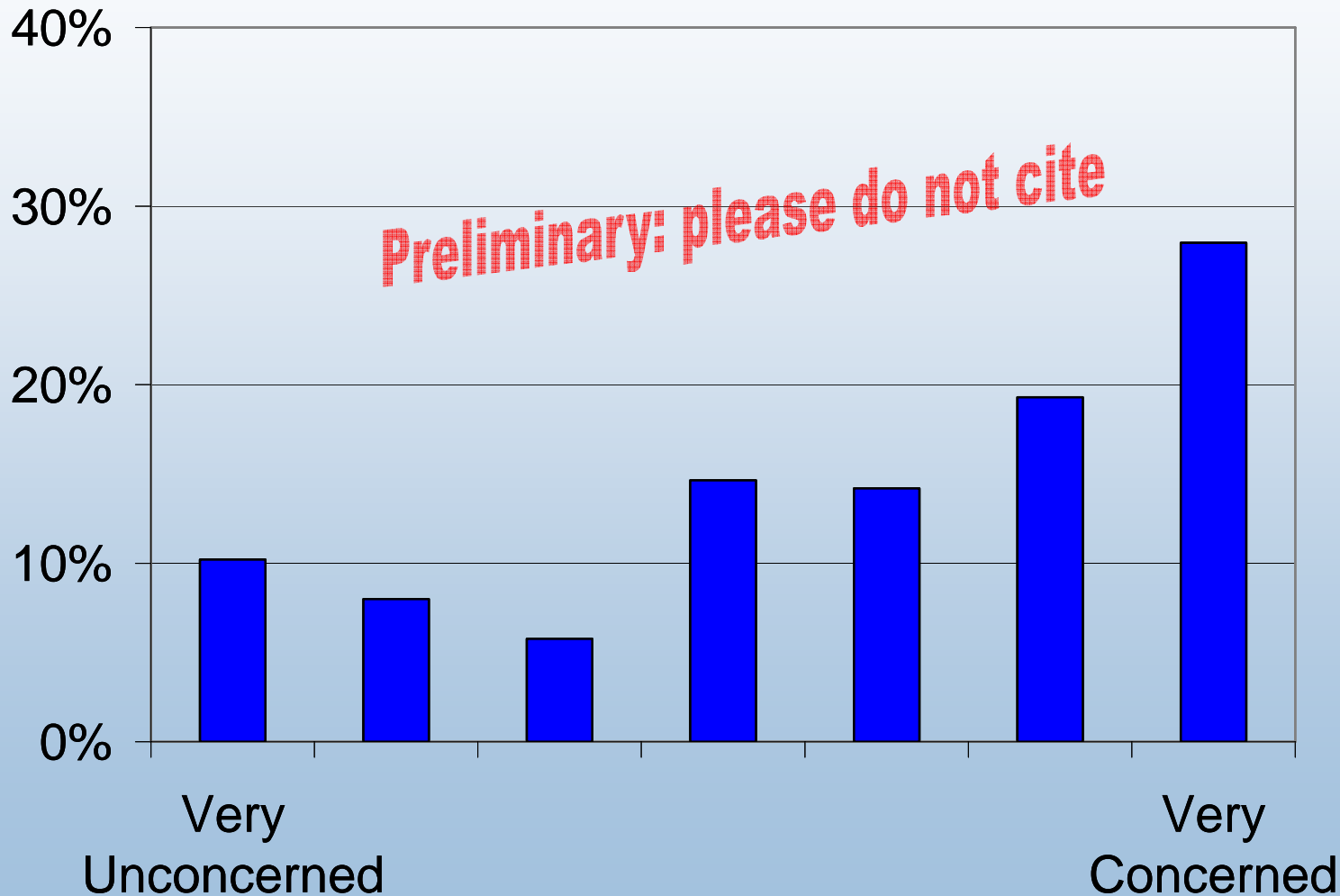
# Importance of Vehicle Benefits

Which of these vehicle benefits is most important to you?



# Global Warming

How concerned are you about global warming?



# Pollution/Smog

How concerned are you about local air pollution or smog?

