

Selecting Locations for Hydrogen Infrastructure

Presentation to the California Energy Commission

Linde North America



Steve Eckhardt – Program Manager, Hydrogen
Fueling

The Linde Group worldwide

Linde Gas

The Linde logo, featuring the word "Linde" in a white, stylized script font, set against a dark blue background with a wavy, light blue line above it.

- Linde operates in over 100 countries generating over \$17 billion in revenues
- Supplier of compressed and cryogenic gases and technology
 - Hydrogen, oxygen, nitrogen, argon, helium, LNG, LPG, rare gases
- Designed and built over 75 hydrogen fueling stations with over 300,000 safe fuelings
 - Auto, material handling, bus and ship fueling systems
 - Expertise spans entire value chain – hydrogen production & distribution, fueling station & gases supply
 - Member of Fuel Cell and Hydrogen Energy Association, California Fuel Cell Partnership, California Hydrogen Business Council
- Linde designed, built and operates the worlds largest landfill gas to renewable LNG plant in Livermore CA with our partners Waste Management

Linde's first questions when entering any market...

Linde Gas

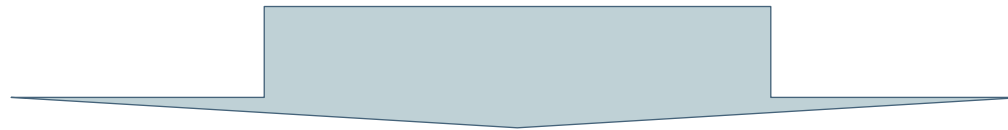
The Linde logo, featuring the word "Linde" in a white, stylized script font, set against a dark blue background with a wavy, light blue line above it.

What does the customer want?

*How do we cost-effectively
meet those needs?*

Importance of OEM involvement in site selection

- The OEM's have a very good understanding of where likely fuel cell vehicle buyers will be located
- Significant State investment of over \$1 m per station
- Any funding process that increases the risk that stations are located where there are few buyers → OEM's may look at California as a less attractive fuel cell vehicle market
 - We are in a competition with other countries
- That risk may serve to reduce station developer interest in California



Very important to align initial fuel cell vehicle target markets with station site selection
Linde recommends this be accomplished with significant input from OEM's

Selection of station locations

Linde recommendations

Linde Gas

The Linde logo, featuring the word "Linde" in a white, stylized script font, set against a dark blue background with a wavy, light blue line above it.

- Include a score for site location value along with other scoring criteria

For cluster stations.....

- First criteria is to locate station inside the OEM designated clusters
 - If site is outside a cluster, it should be removed from consideration
- “Cluster” sites scored based on how well they improve the existing station network
 - Reduce average drive times
 - More complete coverage in a cluster
- Station selection can be based on UC Irvine STREET modeling in some fashion, however, we do not recommend strict adherence to UC Irvine STREET model specific locations as this only increases the “price” for stations in that specific neighborhood
- Likely requires an iterative scoring process as multiple station sites are evaluated and scored in a specific cluster -- but will improve the selection process!

Selection of station locations

Linde recommendations

- **Selection between two sites in close proximity to each other**
 - Consider for funding the station with the highest overall score
 - The lower scoring station is not funded in the same round
 - *Minimize drive time for all, not just for people in one neighborhood*
 - *Back-up, reliability is achieved with the cluster network*
 - “Proximity” will need to be defined. 1 mile, 3 miles, 5 miles apart?

Benefits of proposed scoring approach

Linde Gas

The Linde logo, featuring the word "Linde" in a white, stylized script font, set against a dark blue background with a wavy, light blue line above it.

- Ensures alignment between OEM target markets and early station sites
- Integrates very well with existing CEC scoring system
- Ensures good coverage of clusters and only selects a low volume site (destination, connector) if OEM's agree it is of greater value than a cluster station at this time

Most stations awarded funding in this round need to be ready for demanding customers

Linde Gas

The Linde logo, featuring the word "Linde" in a white, stylized script font, set against a dark blue background with a wavy, light blue line above it.

- Most stations from this solicitation will be commissioned in 2014
 - Fuel cell vehicle commercialization is 2014-2016

We encourage the CEC to consider what fuel cell vehicle drivers expect when they begin buying these cars.

Coverage – minimizing risk
Station performance – the experience

If the OEM's see stations that meet consumer needs, they will bring more cars to California.....

...and consumers will buy them!!

Linde requests the opportunity to provide further comments on station performance at the June 29 workshop

Thank-you

steve.eckhardt@linde.com

510-786-5925

Linde