



Hydrogen Infrastructure for the Next Generation of Fuel Cell Vehicles

Sustainable Transportation Summit

July 12, 2016



Dave Edwards
Air Liquide

Hydrogen: 40 years in industry

- \$2.5B Revenue (refinery and chemicals)
- 1850 km of pipelines
- 1000 trucks
- 18 Billion Nm³/year from 46 large plants (enough for 15M vehicle refills)
- 75 filling stations
- 300+ fuel cell installations



Large H₂ Plants and Pipelines



Air Liquide Hydrogen Mobility:

Light vehicle refueling

- GM/Shell demo stations- NY and CA
- Germany - H₂ mobility
- California - 4 stations in development
- NE Fueling network

Mass transit stations

- BC Transit - Whistler Station
- Oslo, Norway
- Birmingham, AL -Demo

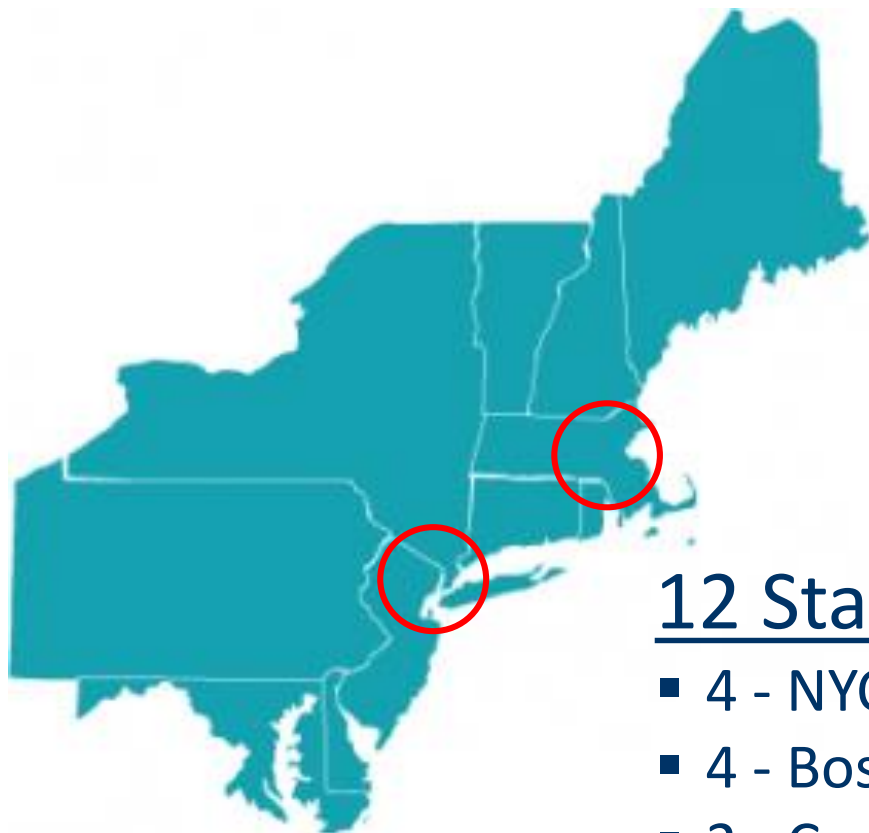
Materials handling applications

- Walmart
- Coca Cola
- Procter & Gamble





Hydrogen Refueling Stations



Toyota - Air Liquide Partnership



12 Stations for the North East

- 4 - NYC and Long Island
- 4 - Boston Area
- 2 - Connector Stations:
Hartford, CT & Providence, RI
- 2 - Northern New Jersey

North East Distribution Model - Hub & Spoke

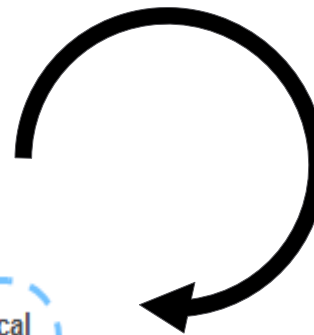
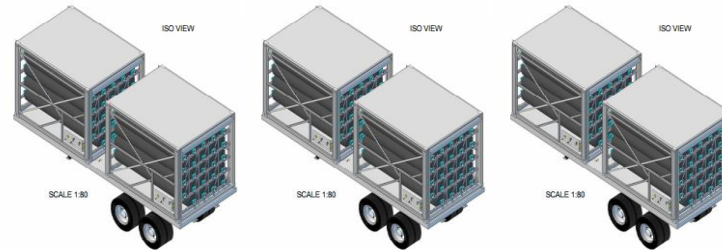


Liquid H2 Source



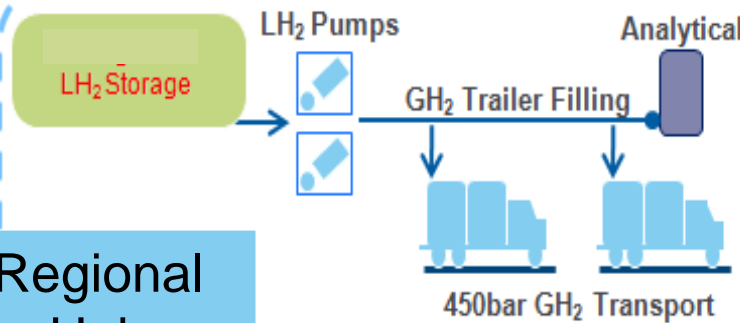
Liquid Transport
300 - 600 miles

Gaseous Transport
0-150 miles



Stations in
Regional
Cluster

H₂ Hub Location



2 Regional Hubs – 1 Each for NYC and Boston clusters

- Delivered liquid from Canada with (5) back-up sources
- Capacity: 2100 kg/d (each hub) or 4200 kg/d total
- Allows for flexible demand growth
- Uses proven hub technology used in forklift applications

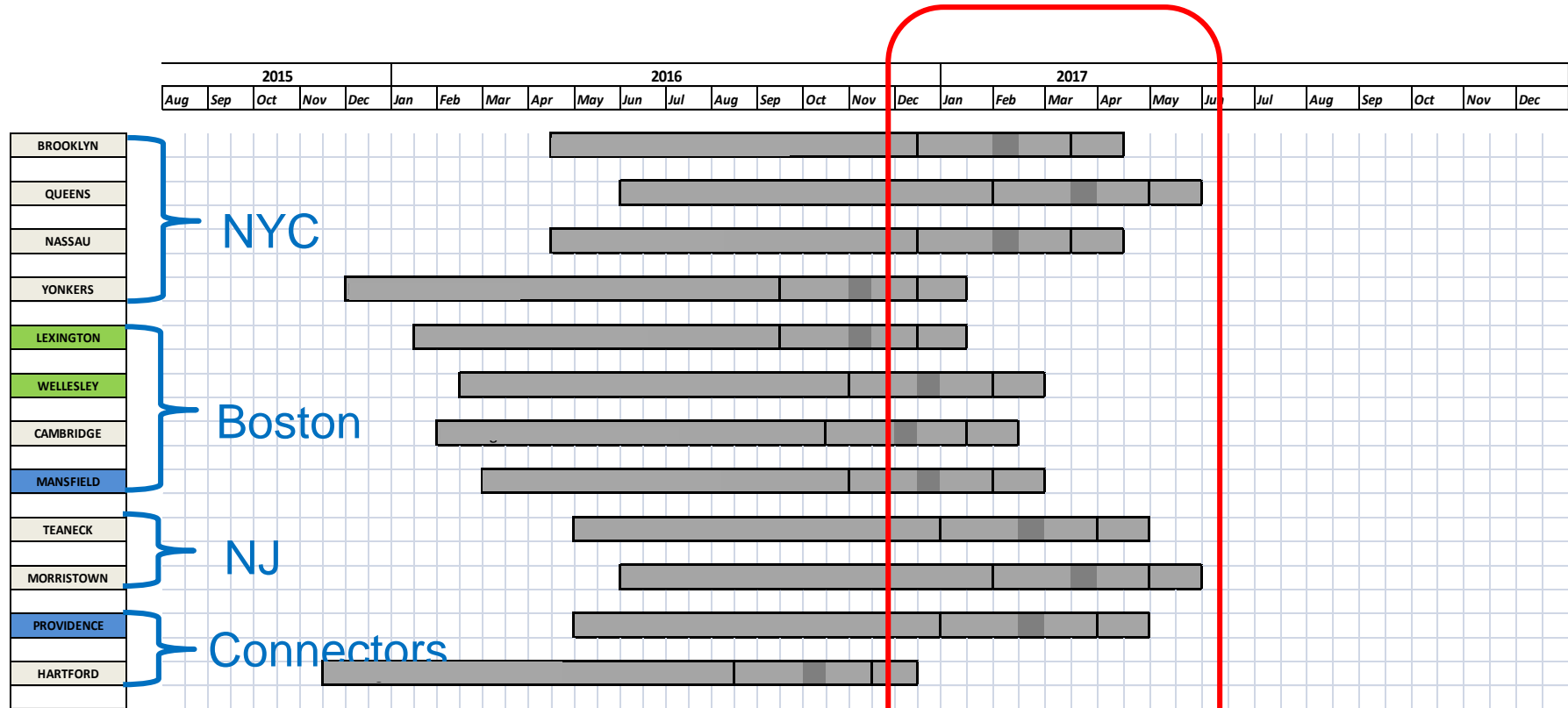
Boston Regional Hub

- Lease signed, approved by planning, and construction permitting underway
- Room for expansion

NYC Regional Hub

- Using existing Air Liquide fill facility
- Other sites being evaluated for planned expansion

Current Station Schedules



Stations Online in First Half of 2017

TYPICAL 12-MONTH SCHEDULE AFTER LEASE SIGNATURE

site engineering and permitting	construction	commissioning
8 months	3 months	1 month
	■ set equipment	



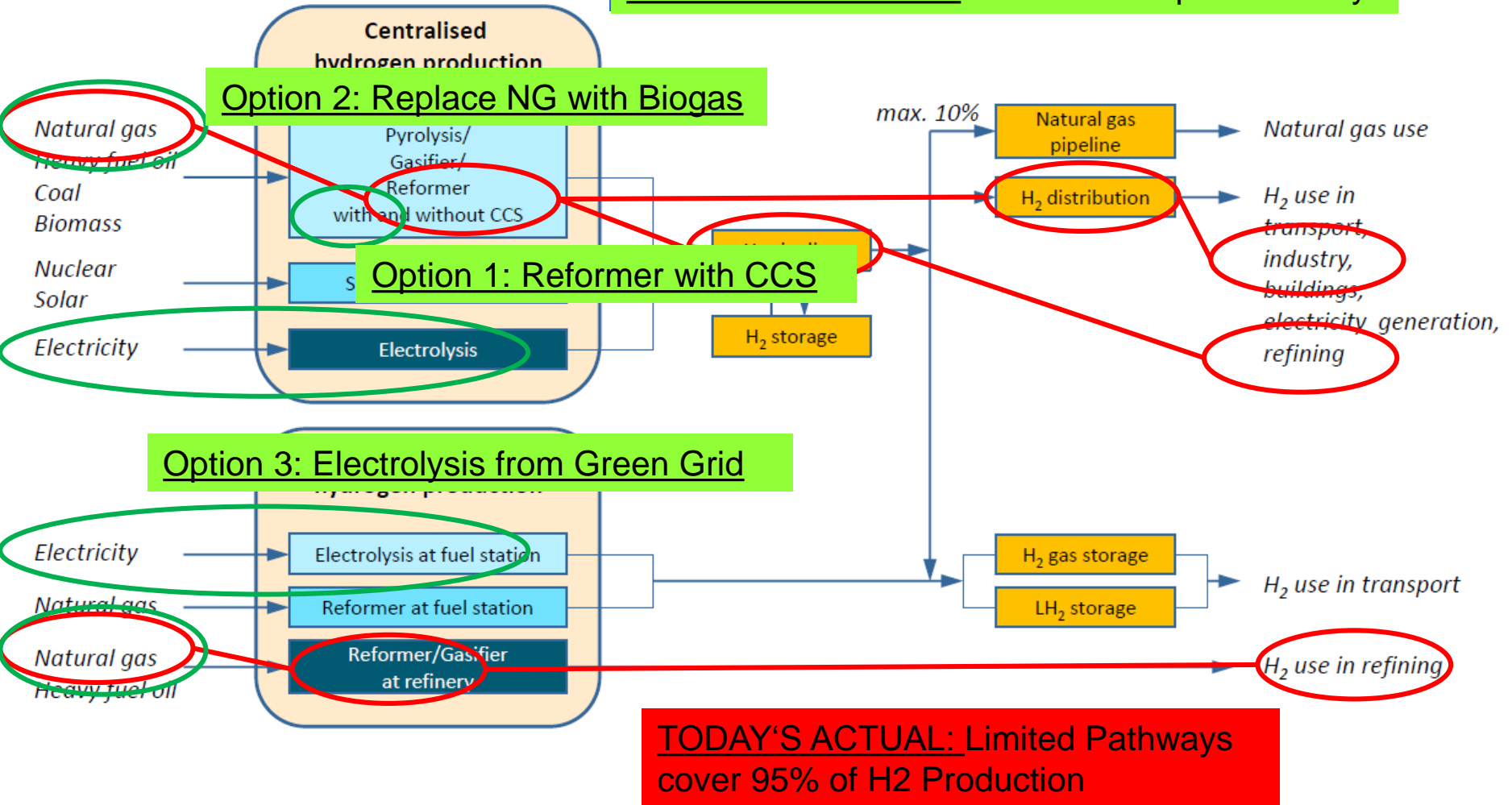


Hydrogen Production

Hydrogen Supply and Distribution

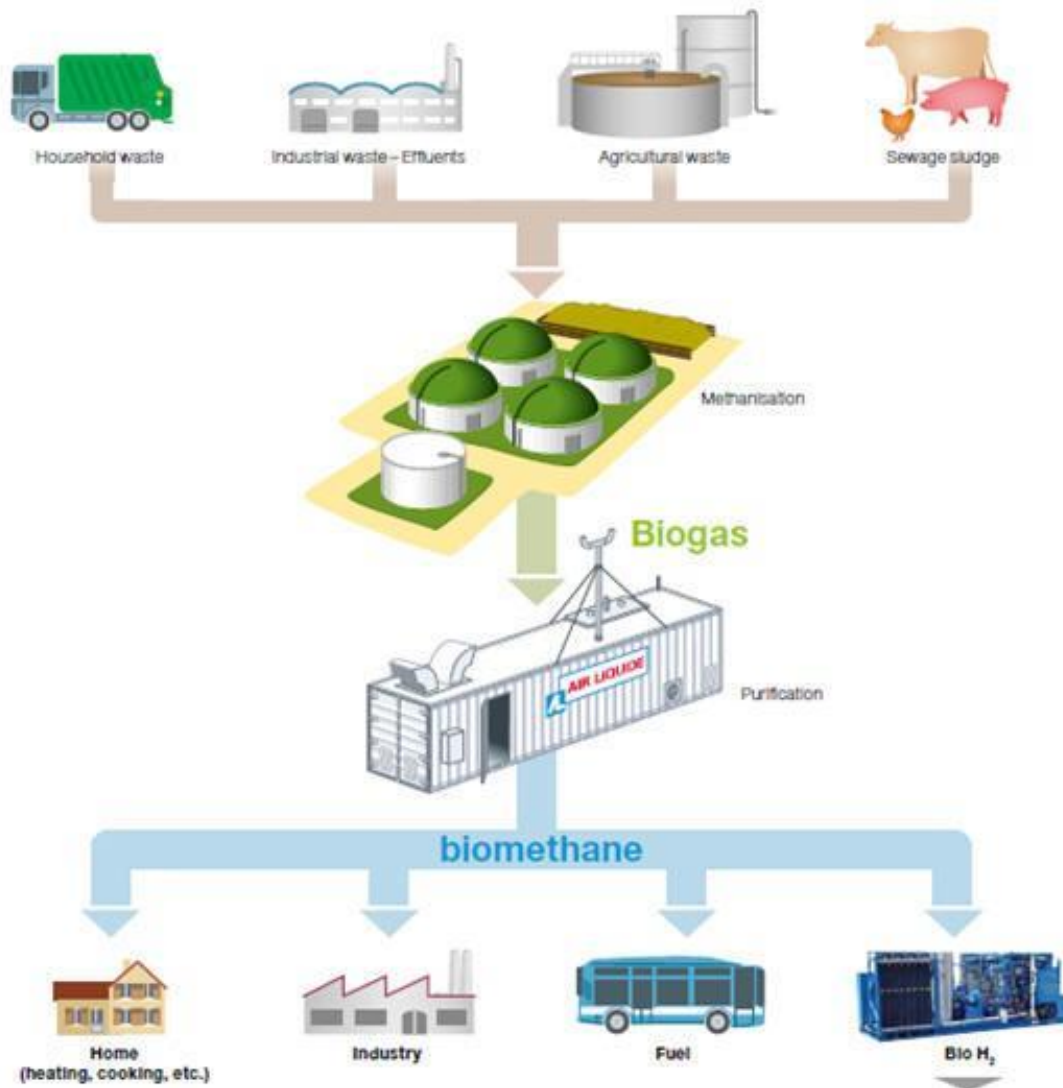


GREEN PATHWAYS: Most Viable Options Today



* IEA North American Hydrogen Workshop, 2012

Hydrogen Supply and Distribution



Summary and Key Points



- The cars are coming
- The infrastructure will be ready
- California and Northeast states lead the way
- Targeting existing retail sites with enough space
- Hydrogen stations and fueling equipment are commercially available
- Blue hydrogen enables sustainable supply



