

# Fuel Cell-Powered Lift Truck Fleet Deployment

Gary Mills  
Sysco Corporation



# Project Overview

- Our partners are Plug Power, GenDrive Fuel Cell Systems and Air Products, Hydrogen and Infrastructure Provider
- Our goal was to build a greenfield distribution center that would utilize an alternative fuel source that would also promote operational and equipment efficiencies
- Sysco Houston transitioned to triple pallet trucks (from double jacks) and support hydrogen fuel cells versus lead acid electric batteries
- By converting to hydrogen fuel cells the life cycle will increase from 3 – 4 years to 8 years or beyond and extend the years of service of the pallet trucks

# Sysco Houston, Inc.

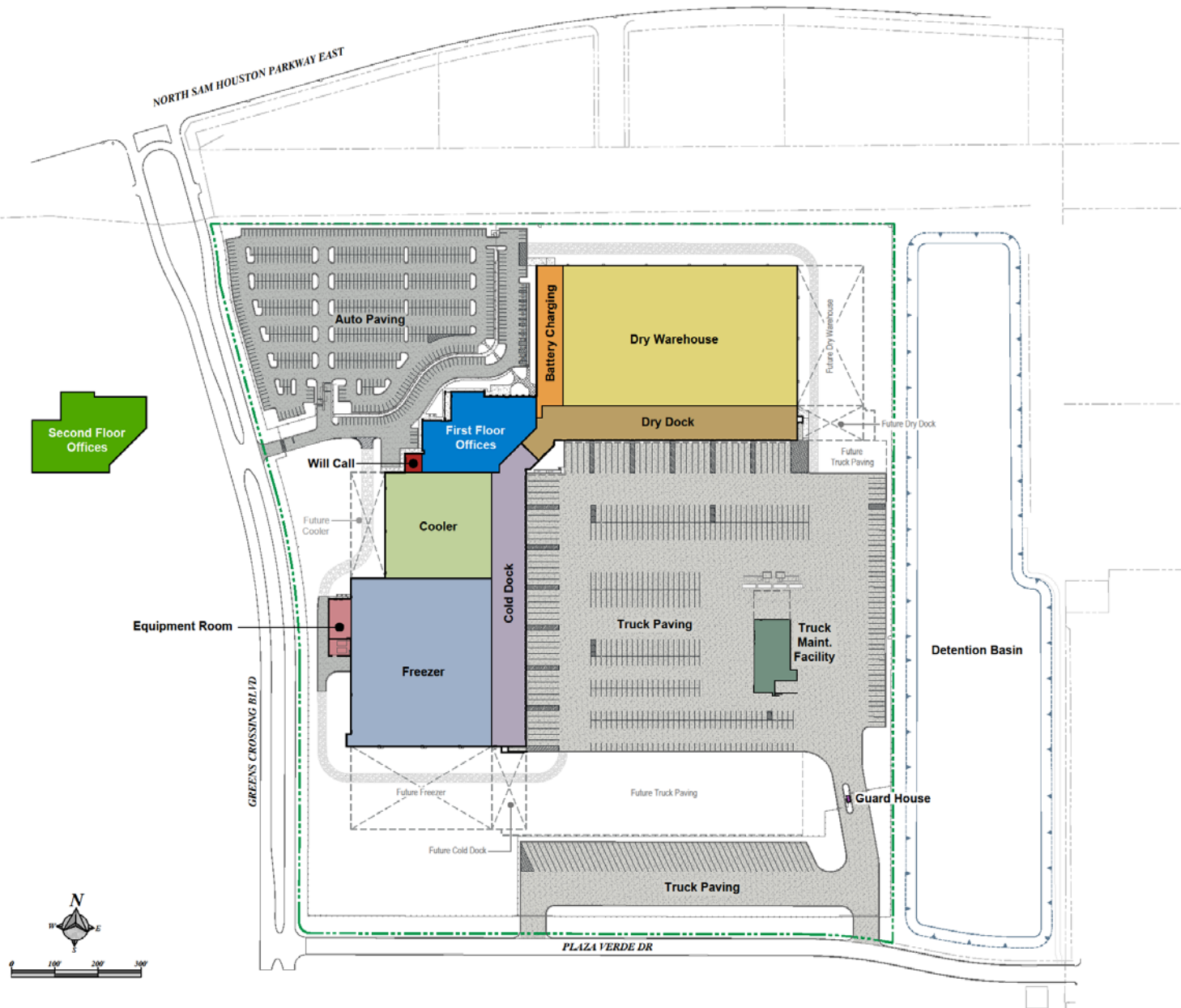
## 2009 New Facility

### Legend:

Freezer	126,890ft <sup>2</sup>
Dry Warehouse	175,562ft <sup>2</sup>
Cooler	60,310ft <sup>2</sup>
Dry Dock	48,675ft <sup>2</sup>
Cold Dock	54,280ft <sup>2</sup>
First Floor Offices	31,850ft <sup>2</sup>
Will Call	1,706ft <sup>2</sup>
Second Floor Offices	37,913ft <sup>2</sup>
Battery Charging	20,085ft <sup>2</sup>
Equipment Room	4,735ft <sup>2</sup>
Truck Maint. Garage	16,745ft <sup>2</sup>
Guard House	200ft <sup>2</sup>
Auto Paving	152,500ft <sup>2</sup>
Truck Paving	544,800ft <sup>2</sup>

### Future:

Dry Whse	49,680ft <sup>2</sup>
Dry Dock	12,268ft <sup>2</sup>
Cooler	19,500ft <sup>2</sup>
Freezer	62,630ft <sup>2</sup>
Cold Dock	15,281ft <sup>2</sup>
Truck Paving	136,817ft <sup>2</sup>



# Background

- Sysco's Senior Management wanted to promote new technology that is environmentally friendly
- The Sysco Houston project was the perfect opportunity since there would not be additional costs to rebuild or convert the current infrastructure
- We will realize cost savings from lowering our use of KWH, no battery charging equipment is necessary, no reserve batteries are needed since the hydrogen fuel cell is refueled within 1-2 minutes, and most importantly we do not have to dispose of the lead acid battery after their life
- Lead acid batteries are not 100% recyclable and the new hydrogen fuel cells are! The hydrogen fuel cell also delivers a steady source of power versus the lead acid battery performance which lowers with the reduction of electrical charge

# Deployment

- Hydrogen will be used to power 72 Class 3 pallet trucks and 26 Class 2 forklifts, Sysco Houston's entire fleet (Sysco nationally utilizes approximately 10,000 pallet trucks, forklifts, and dock equipment)
- Our newly designed 585,000 sq. ft. distribution facility is located in Central Houston, Texas
- Being a temperature controlled food service operation our new equipment will be designed to also operate in 238,000 sq. ft. of various degree temperatures as low as -20 degrees

# Description of Fuel Cell System

## Class 3 Fuel Cell System

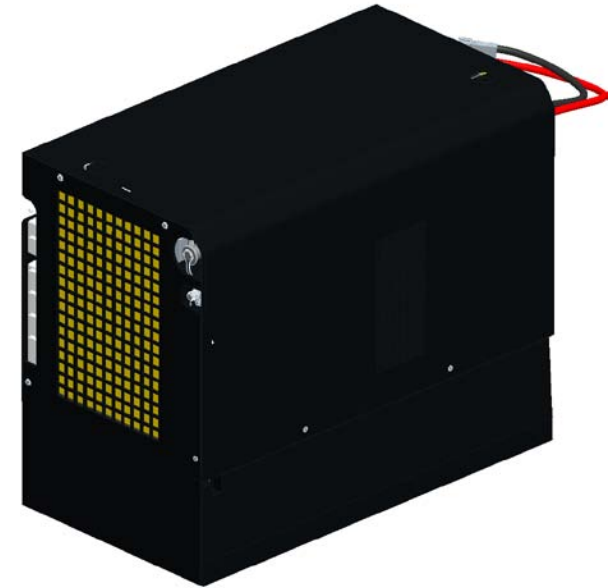
- Nominal Voltage: 27 Vdc
- Operating Voltage Limits: 18-31 Vdc
- Peak Output Current: <1 second: 1125 A
- Equivalent Nominal Ahr Rating: 550 Ahr
  
- Regenerative Current Input: 500 A
  
- Hydrogen Storage: 0.8 kg
- Operation: 32°F to 104°F
- Dimensions: 13" x 31" x 38.5"
- Weight: 590 lb
  
- Electrical Connector: SB 175



# Description of Fuel Cell System (cont.)

## Class 2 Fuel Cell System

- Nominal Voltage: 36 Vdc
- Operating Voltage Limits: 25-43 Vdc
- Peak Output Current: <1 second: 1800 A
- Equivalent Capacity: 15 kWhr
- Regenerative Current Input: 500 A
- Hydrogen Storage: 1.0 kg
- Operation: -22°F to 104°F
- Dimensions: 38.3" x 20.25" x 30.75"
- Weight: 2600 lb
- Electrical Connector: SB 350



# Description of Hydrogen Refueling

- **Hydrogen Demand**
  - Design Daily Usage: 140 kg/day
  - Design Fill Time: 1-2 Minutes
- **Hydrogen Pumping System**
  - Type & Drive of Compression: Cryogenic, Electric
  - Number of Compressors/Pumps: 2
- **Dispensing and Vehicle Interface Requirements**
  - Dispenser Type: Wall mounted
  - Dispenser Quantity: 3
  - Dispensing Pressure: (2) 250 bar, (1) 350 bar
- **Storage**
  - Type: Gaseous Vessels
  - Quantity: 6
  - Type: Cryogenic Liquid Tank
  - Total Storage at Operating Pressure: 9,000 Gallons
  - Hydrogen will be supplied as delivered liquid.





# Results to-date

Since we moved into Sysco Houston's new facility on March 1<sup>st</sup> of this year, the class 3 fuel cells (jacks) are running perfectly. We have to refuel them after an average of 12-14 hours. The class 2 fuel cells (forklifts) are being installed at the present time and are having to be refueled every 6 hours on average. There have been significant productivity gains but it is difficult to attribute them specifically to fuel cells since there is also a huge benefit from their new facility versus their old one.

# Questions?