



# Emerging Manufacturing Sectors

## Hydrogen: Deployment Innovation



# Praxair at a Glance

A Fortune 250 company with 2017 sales of \$12.3 billion

One of the largest industrial gases companies worldwide and the largest in North and South America

Doing business in more than 50 countries

27,000 employees

One million customers worldwide



## MAJOR MARKETS SERVED

Aerospace

Food

Chemicals

Metals

Electronics

Manufacturing

Energy



# Hydrogen Supply Modes



- **Proven supply solutions for all applications**
  - Industrial Gas & Equipment Supplier
  - Opportunity to customize
- **Optimal solution**
  - Volume
  - Supply Distance
  - Purity
  - Pressure
- **Economics**
  - Capital & variable costs



## On-site Supplies

Steam Methane Reformer

Electrolyzer

Methanol Reformer

Dis-associated Ammonia

## Hydrogen Demands Respect

- Hydrogen requires low ignition energy
- Flammable limits in Air: 4% to 75%
- Burns with invisible flame
- Colorless, odorless, tasteless

## Standards for Use

- Compressed Gas Association (CGA)
- National Fire Protection Association (NFPA)
- American Society of Mechanical Engineers
- Society of Automotive Engineers

## Always Consider

- The environment: heat, sparks, open flames
- Equipment Handling: cylinders, distribution systems, point of use
- Tools, instrument, electrical systems
- Ventilation

## Regional Leadership Centers

- Development & Commercialization Focus
- University, National Lab or Non-Profit
- Education, technical guidance, best practices
- Example: DOE Regional CO2 Partnerships

### ✓ **Articulate Regional Capabilities**

- Supply modes
- Physical location
- Optimization

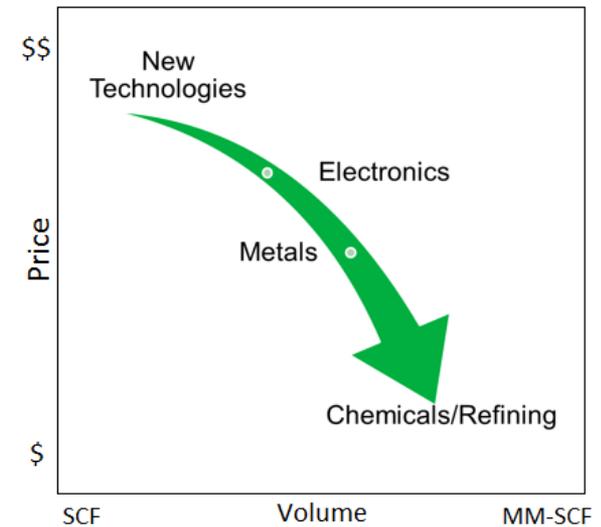
### ✓ **Evaluate H2 Sources**

- Identify all H2 generation locations
- Evaluate supply conditions & monetary value
- Foster commercialization of source

### ✓ **Accelerate H2 Economy**

- Promotes regional sustainability
- Stimulates competitive environment

## DOE Regional Sequestration Partnerships



- Fuel Cells
  - Material Handling
  - Vehicles
  - Backup Power
  
- Hydrogenation
  - Bio-feedstocks
  - Lubricant
  - Chemicals

# Questions