Global Hydrogen Growth Investor Day
June 22, 2011
Global Hydrogen Growth Investor Day
Global Growth Outlook

Steve Angel
Chairman, President and Chief Executive Officer
### Global Hydrogen Growth Investor Day and Field Trip Agenda

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steve Angel</td>
<td>Global Growth Outlook</td>
</tr>
<tr>
<td>Amer Akhras</td>
<td>Hydrogen Use and Global Market</td>
</tr>
<tr>
<td>Dan Yankowski</td>
<td>Execution Excellence</td>
</tr>
<tr>
<td>Eduardo Menezes</td>
<td>North American Strength</td>
</tr>
<tr>
<td>Jim Sawyer</td>
<td>Financial Outlook</td>
</tr>
</tbody>
</table>

**Q&A**

**Depart for Praxair Whiting**
Forward Looking Statement

This document contains “forward-looking statements” within the meaning of the Private Securities Litigation Reform Act of 1995. These statements are based on management’s reasonable expectations and assumptions as of the date the statements are made but involve risks and uncertainties. These risks and uncertainties include, without limitation: the performance of stock markets generally; developments in worldwide and national economies and other international events and circumstances; changes in foreign currencies and in interest rates; the cost and availability of electric power, natural gas and other raw materials; the ability to achieve price increases to offset cost increases; catastrophic events including natural disasters, epidemics and acts of war and terrorism; the ability to attract, hire, and retain qualified personnel; the impact of changes in financial accounting standards; the impact of changes in pension plan liabilities; the impact of tax, environmental, healthcare and other legislation and government regulation in jurisdictions in which the company operates; the cost and outcomes of investigations, litigation and regulatory proceedings; continued timely development and market acceptance of new products and applications; the impact of competitive products and pricing; future financial and operating performance of major customers and industries served; and the effectiveness and speed of integrating new acquisitions into the business. These risks and uncertainties may cause actual future results or circumstances to differ materially from the projections or estimates contained in the forward-looking statements. The company assumes no obligation to update or provide revisions to any forward-looking statement in response to changing circumstances. The above listed risks and uncertainties are further described in Item 1A (Risk Factors) in the company’s Form 10-K and 10-Q reports filed with the SEC which should be reviewed carefully. Please consider the company’s forward-looking statements in light of those risks.
### Praxair Track Record

**Strong Underlying Fundamentals...**

<table>
<thead>
<tr>
<th></th>
<th>Praxair</th>
<th>Competitor 1</th>
<th>Competitor 2</th>
<th>Competitor 3</th>
<th>S&amp;P Chemicals</th>
<th>S&amp;P 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Growth*</td>
<td>6%</td>
<td>5%</td>
<td>6%</td>
<td>3%</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>Operating Margin**</td>
<td>21%</td>
<td>17%</td>
<td>12%</td>
<td>15%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>EPS Growth*</td>
<td>14%</td>
<td>3%</td>
<td>8%</td>
<td>9%</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>Return on Capital**</td>
<td>14%</td>
<td>11%</td>
<td>8%</td>
<td>12%</td>
<td>9%</td>
<td>3%</td>
</tr>
</tbody>
</table>

* 5-year CAGR
** 2010 calendar year; for Praxair refer to 2010 Annual Report Item 7

### Driving Industry - Leading Returns (5-year TSR)

<table>
<thead>
<tr>
<th></th>
<th>Praxair</th>
<th>Competitor 2</th>
<th>Competitor 1</th>
<th>Competitor 3</th>
<th>S&amp;P Chemicals</th>
<th>S&amp;P 500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16%</td>
<td>16%</td>
<td>11%</td>
<td>9%</td>
<td>9%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: Bloomberg and internal analysis

**Leading value creation in the industry**
Growing Project Backlog $2.7B

Record project backlog driving increasing capital spend
Global Praxair Forecast through 2015

Sales Growth Components

Backlog
- ASU: 3% - 4%
- Hydrogen: 1% - 2%

New Applications
- 2% - 3%

Base Business
- 2% - 3%

Annual Organic Growth*

Sales
- 8% - 12%

Operating Profit
- 10% - 15%

EPS
- 12% - 18%

After-tax ROC
- 15+% 

* Excludes acquisitions, divestitures and foreign currency
Hydrogen Will Be a Major Growth Driver…

2010 Sales $10B

2015F ~$16B

Hydrogen Will Be a Major Growth Driver…

... of a well-diversified business portfolio

Source: Internal Analysis
Hydrogen Market Drivers

Developed Markets
- Heavy/sour crude capability
- Product upgrading

Emerging Markets
- Refined products demand
- Euro-fuel standards
- Heavy/sour crude capability
- Outsourcing

H₂ Production (B scfd)

2009
- US ~30B
- Rest of World ~5B
- Outsourced

2015F
- US ~38B
- Rest of World ~10B
- Outsourced

Source: Internal Analysis

Huge opportunity for outsourcing
Careful Project Selection Criteria

- H₂ market growth 8B scfd
- Outsource 5B scfd
- Strategic geography
- Refinery asset viability
- Competitive advantage
- Return/risk
- Target 1.7B scfd

Significant opportunities going forward
Hydrogen Plays to Praxair’s Core Competencies

- **Customer Knowledge**
  - In-depth refinery expertise

- **Capital Discipline**
  - Locked-in minimum returns with upside

- **Contract Management**
  - Years of air-separation unit and hydrogen experience

- **Project Execution**
  - On-budget / on-schedule ±2%

- **Operational Excellence**
  - Reliability key to customer value proposition
Global Hydrogen Growth Investor Day
Hydrogen Use and Global Market

Amer Akhras
Vice President, Business Development Global Hydrogen Business
## Major End User Markets for H₂

<table>
<thead>
<tr>
<th>Industry</th>
<th>Key Applications</th>
<th>Supply Systems</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Industrial</td>
<td>Power generation, Heat treating, Laboratories</td>
<td>Small on-site, Cylinders, Tube trailers, Liquid H₂</td>
<td>Low &lt;5 mmscfd</td>
</tr>
<tr>
<td>Electronics</td>
<td>Thin-film solar, Semi-conductors</td>
<td>Tube trailer, Liquid H₂, Small on-site</td>
<td>Medium 5-15 mmscfd</td>
</tr>
<tr>
<td>Glass</td>
<td>Float glass mfg</td>
<td>Liquid H₂, Small on-site</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Chemicals, Biofuels</td>
<td>Pipeline, Large on-site</td>
<td></td>
</tr>
<tr>
<td>Refining</td>
<td>Hydro-processing</td>
<td>Pipeline, Large on-site</td>
<td>High 30-200+ mmscfd</td>
</tr>
</tbody>
</table>

Refining is the largest market for hydrogen
Anatomy of a “Simple” Refinery

- Sweet/Light Crude Component Mix
- Refined Product Mix
- Refinery Gases, 3%
  - Gasoline 32%
  - Distillate 30%
  - Heavy 35%
- Refinery Gases, 4%
  - Gasoline 30%
  - Distillate 34%
  - Diesel
  - Jet Fuel
  - Heating Oil
  - Heavy 32%

Distillation Column
- Vapor (Light)
  - Propane / Butane
- Liquid (Heavy)
  - Low Octane Gasoline
  - Kerosene / Diesel
  - Light Gas Oil
  - Medium Gas Oil
  - Heavy Fuel Oil

Reactor
- Reforming
- Hydrogen Source
  - Diesel / Jet fuel

Hydrotreater
- High Octane Gasoline

Vacuum Distillation Unit
- Fuel Oil

Hydrogen self-sufficient; Intensity 100-150 scf per barrel
Global Shift to “Complex” Refining

Volume expansion; Hydrogen intensity 800-1200 scf per barrel
What Are Hydrocracking and Hydrotreating?

**Hydrocracking – gasoline & diesel**
- Longer chain hydrocarbons cracked using heat and fully saturated by hydrogenation

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**Hydrotreating – sulfur removal**
- Chemical treatment required

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**Reaction Schematic**

**Hydrocracking**

- Heat
- $\text{H}_2$

**Hydrotreating**

- $\text{S}-\text{C}$ + $\text{H}_2$ → $\text{C}$ + $\text{H}_2\text{S}$
- $\text{N}-\text{C}$ + $\text{H}_2$ → $\text{C}$ + $\text{NH}_3$

---

2000 – 3000 scf $\text{H}_2$ per bbl

> 800 scf $\text{H}_2$ per bbl

---

Hydroprocessing fundamental to refineries of the future
How is Hydrogen Produced?

- Process choice determined by feedstock availability / cost
- Gasification significantly more capital intensive
- Chinese refineries increasingly using gasification
  - Limited natural gas supply

**Steam Methane Reforming (SMR)**

\[ \text{CH}_4 + \text{H}_2\text{O} \leftrightarrow \text{CO} + 3\text{H}_2 \]

**Water - Gas Shift**

\[ \text{CO} + \text{H}_2\text{O} \leftrightarrow \text{H}_2 + \text{CO}_2 \]

**Purification (PSA)**

**Coal / Pet coke**

**Gasification**

\[ \text{C}_n\text{H}_m + (2n + m)/4\text{O}_2 \rightarrow n\text{CO} + m/2 \text{H}_2\text{O} \]

**Gas Treatment**

**Water - Gas Shift**

\[ \text{CO} + \text{H}_2\text{O} \leftrightarrow \text{H}_2 + \text{CO}_2 \]

**Purification (PSA)**

**H}_2**

SMRs continue to dominate within refining
Hydrogen Market Drivers Around the World

North America
- Complexity

Europe
- Complexity

Latin America
- Complexity
- Capacity expansion
- Outsourcing

Middle East & India
- Complexity
- Capacity expansion
- Outsourcing

Asia
- Complexity
- Capacity expansion

Strong growth across all regions
Hydrogen Demand Growth

Global Refining Capacity (MM bpd)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>91</td>
</tr>
<tr>
<td>2015</td>
<td>98</td>
</tr>
<tr>
<td>2025</td>
<td>105</td>
</tr>
</tbody>
</table>

Hydrogen Intensity (scf per bbl)

<table>
<thead>
<tr>
<th>Year</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>450</td>
</tr>
<tr>
<td>2015</td>
<td>525</td>
</tr>
<tr>
<td>2025</td>
<td>560</td>
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</table>

~8B scfd of H₂ Demand Growth through 2015

Strong hydrogen demand growth from refining
Growing Trend of Outsourcing Hydrogen Production

**Benefits of Outsourcing**

- Scope Reduction
- Efficiency
- Reliability

**Praxair Strengths**

- Project execution and discipline
- Pipeline systems / economies of scale
- Integrated $\text{H}_2$ and energy solutions
- Optimized process selection
- Plant design
- Operational excellence / infrastructure
- Pipeline systems / unique USGC $\text{H}_2$ cavern

Gradual conversion process taking hold globally
Hydrogen Growth

Praxair Hydrogen Capacity (MM scfd)

- Current: 1,000
- Backlog: 700
- New Projects: 500 - 600
- 2015F: 2,200 - 2,300

Growing backlog with robust pipeline
Global Hydrogen Growth Investor Day
Execution Excellence

Dan Yankowski
President, Global Hydrogen
Praxair Externally Recognized for Execution Excellence

- Extracted ratings from 2010 Independent Project Analysis (IPA), benchmarking
- High quintile performance among global players
- Predictable high quality project management

<table>
<thead>
<tr>
<th>Absolute Cost Performance Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quintiles</td>
</tr>
<tr>
<td>Wacker</td>
</tr>
<tr>
<td>PRAXAIR</td>
</tr>
<tr>
<td>Evonik</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
</tr>
<tr>
<td>Rio Tinto Alcan</td>
</tr>
<tr>
<td>MERCK</td>
</tr>
<tr>
<td>sanofi pasteur</td>
</tr>
<tr>
<td>Dow</td>
</tr>
<tr>
<td>Dow Corning</td>
</tr>
<tr>
<td>Cargill</td>
</tr>
<tr>
<td>Flint Hills Resources</td>
</tr>
<tr>
<td>Conoco Phillips</td>
</tr>
<tr>
<td>Alyeska pipeline</td>
</tr>
<tr>
<td>EASTMAN</td>
</tr>
<tr>
<td>Chevron Phillips</td>
</tr>
</tbody>
</table>
Highly Disciplined Project Management

Potential Project Identified

Heads-Up Review

First Pass Review

Final Approval and Proposal

Detailed Design

Monthly Project Reviews / Updates

FEL-1

Engineering

Project Audit

Start-Up
Process Selection and Technology Deployment

Feedstock Processing
- Sulphur removal
- Heavy hydrocarbon processing

Reformer Island
- Catalytic gas reforming
- Catalyst
- Mechanicals
- Tube material

Syngas Shift
- Converts CO to H₂ and CO₂

H₂ PSA
- Hydrogen purification

Design & Configuration

Design and configuration differentiate us
World-class Project Execution Capabilities

Location of Project Execution Centers

- Core capability located in Houston
- Strategically located regional centers
- Key third party alliances
- Technology flexibility

Capable of executing around the world
Technology Development for Continuous Improvement

Typical H₂ Product Cost Structure

- Energy is primary cost driver
- Operating 5%
- Capital 25%
- Energy 70%

Key Actions

- Advanced syngas generation (1%)
- Improved heat recovery (2 - 3%)
- Improve PSA efficiency
- Reliability improvement programs

Variable cost reduction of 4 - 5% targeted
## Significant Projects Under Construction

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Est. Start-Up</th>
<th>MM scfd*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Whiting, IN</td>
<td>2010/2011</td>
<td>200</td>
</tr>
<tr>
<td>Indian Oil Co Ltd</td>
<td>India</td>
<td>2012</td>
<td>90</td>
</tr>
<tr>
<td>Valero</td>
<td>St. Charles, LA</td>
<td>2012</td>
<td>135</td>
</tr>
<tr>
<td>Valero</td>
<td>Port Arthur, TX</td>
<td>2013</td>
<td>135</td>
</tr>
<tr>
<td>Chevron</td>
<td>Richmond, CA</td>
<td>2014</td>
<td>260</td>
</tr>
</tbody>
</table>

*capacity
Global Hydrogen Growth Investor Day
BREAK
Global Hydrogen Growth Investor Day
North American Strength

Eduardo Menezes
Senior Vice President and President, North American Industrial Gases
Largest Industrial Gases Company in North America

- $5.1B Sales 2010
- On-site and Bulk Gases
  - > 400 production plants
  - > 15,000 customer locations
  - Several pipeline enclaves
- Packaged & Specialty Gases
  - > 100 production facilities
  - > 500,000 customers
- Unique helium, argon and rare gases production & supply capabilities

Strategically positioned to benefit from hydrogen market growth
United States Hydrogen Supply Capabilities

2010 North America Sales

- 0.9B scfd $H_2$ installed
- 0.5B scfd $H_2$ under construction
- 400 miles of $H_2$ pipelines
- 50MM scfd liquid $H_2$

Hydrogen Production Facilities

- Niagara Falls, NY
- Butte, MT
- Carneys Point, NJ
- Institute, WV
- Leechburg, PA
- Ecorse, MI
- Institute, WV
- Mcintosh, AL
- Norcross, GA
- Pt. Arthur, TX
- Richmond, CA
- Geismar, LA
- Ontario, CA

- Hydrogen Production
- $H_2$ Liquefiers
- $H_2$ Pipelines
Praxair Gulf Coast Area Hydrogen Pipelines

Gulf Coast Pipeline (TX / LA)
- 15,000 tpd O₂ / N₂ capacity
- 600MM scfd H₂ capacity
- 135MM scfd H₂ under construction
- 300+ miles of pipelines
- 2.5B scf Hydrogen cavern storage

Lower Mississippi Pipeline (LA)
- 90MM scfd H₂ capacity
- 135MM scfd H₂ under construction
- 35 miles of pipeline
- 45 mile pipeline expansion

~ 1 billion scfd by mid-2013
Valero and Motiva Projects

Valero Port Arthur / St. Charles Projects
- 2 new hydrocrackers / biodiesel
- Fast track execution (late 2012 / early 2013)
- Contracted hydrogen supply
  - 150MM scfd at Port Arthur
  - 120MM scfd at St. Charles

Motiva Norco Project
- Norco to shut-down old SMR
- Supply requires 45 mile pipeline from Praxair Geismar SMRs
- Ability to supply nearby new customers

Recent wins validate Praxair business model
Praxair Advanced Pipeline Control Centers

Pipeline Control Centers

Chicago

Houston

Objectives / Benefits

- **Maximize efficiency**
  - Natural gas / power management
  - Operational flexibility

- **Guaranteed reliability**
  - 24/7 coverage
  - Consistent maintenance practices

- **Eliminate variation (Lean / Six Sigma)**
  - Real time management oversight

System optimization is critical to our success
Praxair Chicago Area Pipelines

- 25,000 tpd O₂ / N₂ capacity
- Largest liquid argon and rare gases production center in North America
- 230MM scfd H₂ capacity
- Integrated liquid hydrogen production
- 130 miles of pipeline
- 30 customers
- Advanced pipeline control center
Whiting, Indiana Hydrogen SMR Overview

- BP Whiting, IN $5B Refinery Expansion
  - Canadian crude processing

- Supply for additional 185MM scfd of H₂ and steam

- Praxair’s Whiting facility adjacent to refinery (since 1956)

- Praxair designed, engineered and constructed
Global Hydrogen Growth Investor Day
Financial Outlook

James S. Sawyer
Executive Vice President and Chief Financial Officer
We Generate Strong Cash Flow and Are Able to Reinvest at A Greater Rate

*Refer to 2010 Annual Report Item 7.

*Praxair*
Return on Capital Drives Shareholder Value

Future contribution from:
- Incumbency positions
- Pipeline enclaves
- Co-product opportunities

- Smaller bolt-on projects in high-density regions
- Large stand-alone ASU or H₂ projects
- Foregone projects

Hurdle Rate
Cost of Capital
With Natural Gas or Without Natural Gas

- Hydrogen purchase agreements can be structured to include or exclude the price of natural gas.
- When gas is included, the unit price includes the natural gas value and escalates with its price.

**Include Natural Gas**
- Existing Texas/Louisiana pipeline systems
- Valero St Charles and Port Arthur
- Chevron

**Exclude Natural Gas**
- BP Whiting
- India Oil Company Ltd.
- Potential Latin America projects

Significant difference in operating profit as a % of sales
Sales Mix by Supply Mode

2010 $10B
- Packaged 29%
- Merchant 30%
- ASU 18%
- H₂ 7%
- Other 16%

2015F ~$16B
- Merchant 28%
- ASU 18%
- H₂ 13%
- Other 14%
- Onsite 31%
- Packaged 27%

Major increase in on-site supply
Cash Flow Projections – 2011 to 2015 cumulative

Cash Flow Generated from Operations
$18B

Cash Flow Distributed
$7B

Capital Expenditures
$11B
Key Messages

- The refinery hydrogen growth opportunity is large and Praxair is well positioned in both the U.S. and emerging markets
- Every refinery situation is different… Winning is a function of bringing the right configuration, schedule and terms to the customer
- Execution is critical to customer satisfaction, future business and to achieving desired financial results
- Praxair’s strong financial performance enables us to capitalize on hydrogen opportunities without compromising return on capital and simultaneously expand our platform for future high return growth
Global Hydrogen Growth Investor Day Questions and Answers
Principles of Sustainable Development

**Governance and Integrity**
Maintain strong systems and a culture of global corporate governance, compliance, ethics, human rights, integrity and accountability.

**Strategic Leadership**
Stay current with, and take advantage of, emerging global opportunities, developments and challenges to position Praxair for the future.

**Customer Commitment**
Focus relentlessly on the delivery of customer value through continuous innovation that helps our customers enhance their product quality, service, reliability, productivity, safety, energy efficiency and environmental performance.

**Environmental Responsibility**
Achieve continuous environmental performance improvement and energy efficiency in our operations.

**Employee Safety and Development**
Provide opportunities that allow employees to develop to their fullest potential in a creative, inclusive and safe environment.

**Community Support**
Participate in community development in regions where we operate.

**Financial Performance**
Maintain year-on-year recognition from shareholders and stakeholders for top-tier financial performance.

**Stakeholder Engagement and Communication**
Partner with internal and external stakeholders to achieve a strong, secure and sustainable society, economy and environment.
Global Hydrogen Growth Investor Day
June 22, 2011