Citi Chemicals for the Non-Chemist Conference
November 28, 2016
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; the impact of potential unusual or non-recurring items; 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; the impact of information technology system failures, network disruptions and breaches in data security; 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 GAAP or adjusted 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 latest Annual Report on Form 10-K filed with the SEC which should be reviewed carefully. Please consider the company’s forward-looking statements in light of those risks.
Agenda – Industrial Gases

- Industry Overview
- Production
- Distribution
- Integrated Supply Model
- Praxair Snapshot
- Praxair Everywhere
Global Industrial Gas Market

Total Industry Sales: $72 billion

- Praxair 14%
- Air Products & Chemicals 12%
- Air Liquide 24%
- Linde 20%
- Taiyo Nippon Sanso 4%
- Other 25%

Source: Spiritus Consulting 2015
Excludes non-gas sales such as Praxair Surface Technologies; Airgas is included in Air Liquide

Global participants and “super regional” players
## Industrial Gas Industry Advantages

<table>
<thead>
<tr>
<th></th>
<th><strong>Industrial Gases</strong></th>
<th><strong>Commodity Chemicals</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Competitive Field</strong></td>
<td>Local</td>
<td>Global</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Integrated system</td>
<td>Limited scope</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>Contract</td>
<td>Spot</td>
</tr>
<tr>
<td><strong>Customer Use</strong></td>
<td>Minor part of cost</td>
<td>Significant part of cost</td>
</tr>
<tr>
<td><strong>Raw Materials</strong></td>
<td>Pass-through</td>
<td>Volatile</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td>Steady</td>
<td>Cyclical</td>
</tr>
<tr>
<td><strong>Return on Capital</strong></td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
## IG Critical to an Array of Industries

<table>
<thead>
<tr>
<th>Demand Drivers / Benefits</th>
<th>Select Applications</th>
<th>Primary Gases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food &amp; Bev</strong></td>
<td>Greater yields, Better quality, Flexibility, Shelf Life</td>
<td>Carbonation, Aquaculture, Stunning, Meat Mixing</td>
</tr>
<tr>
<td><strong>Electronics</strong></td>
<td>Productivity, Reliability management, Product quality, safety</td>
<td>Semiconductor fabrication, Solar / PV, Laser Mixtures, LED Mixtures</td>
</tr>
<tr>
<td><strong>Healthcare</strong></td>
<td>Patient health, Full range of medical gases, services and technologies</td>
<td>Medical Oxygen, MRI, Digital Valves, System Monitoring</td>
</tr>
<tr>
<td><strong>Manufacturing</strong></td>
<td>Productivity, Cost Reduction Product Quality</td>
<td>Welding / Cutting, Aerospace, Additive Manufacturing, Shielding Mix Telemetry</td>
</tr>
<tr>
<td><strong>Metals</strong></td>
<td>Fuel Savings, productivity, emissions reduction</td>
<td>Steel production &amp; finishing, Powder metal production, OPTIMELT for Glass, NOx Reduction</td>
</tr>
<tr>
<td><strong>Energy / Chemicals</strong></td>
<td>Energy efficiency, productivity, safety</td>
<td>Refining, Process control, Catalyst regeneration, VOC Recovery</td>
</tr>
</tbody>
</table>
## Industrial Gases Product Lines

<table>
<thead>
<tr>
<th>Products</th>
<th>Sources</th>
<th>Feedstocks</th>
<th>Distribution Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen Nitrogen</td>
<td>Air Separation</td>
<td>Air + Power</td>
<td>✔️ ✔️ ✔️</td>
</tr>
<tr>
<td>Argon</td>
<td>Air Separation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>Steam-Methane Reforming</td>
<td>Natural Gas or Crude Hydrogen</td>
<td>✔️ ✔️ ✔️</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>By-product</td>
<td>Crude Carbon Dioxide</td>
<td>✔️ ✔️</td>
</tr>
<tr>
<td>Helium</td>
<td>US Government Helium Reserve</td>
<td>Natural Gas Fields</td>
<td>✔️ ✔️</td>
</tr>
<tr>
<td>Rare Gases</td>
<td>Air Separation</td>
<td>Air + Power</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Management of diverse set of products and processes
Air Separation Process (video)
Rare Gases Overview

Production & Supply Chain

- Produced from cryogenic distillation of air
- Large scale & challenging economics limit supply
- Xe and Kr produced in tandem
- Ne produced via a separate gas stream

Major Applications

**Neon**
- Semiconductor – Lithography lasers
- Display – LCD/OLED

**Xenon**
- Lighting
- Aerospace

**Krypton**
- Windows
- Lighting

Complex with high entry barriers
Helium – a Process Gas in Limited Supply

Supply Chain

- Scarce, formed by radioactive decay
- 1.7 tcf global reserves*
  - Viable reserves have 0.1%-5% He
  - US (40%), Qatar, Algeria, Russia
- By-product of NG & LNG processing
- 50 - 70% purity
- Cooled to remove N₂, H₂, & methane
- Press swing adsorption removes residual impurity
- Final Product > 99.99%

Liquefy

Natural Gas Reserves

Valuable Properties

- Smallest and light element
- Highly inert
- Lowest boiling point: -450°F
- High thermal conductivity

Top Applications (% of market)

- MRI (20%)
- Lift (15%)
- Fiber Optics (10%)
- Electronics (10%)
- Welding (10%)
- Leak Detection (7%)

*Source: USGS
Hydrogen Steam Methane Reforming Process

Feedstock
Natural Gas / Naphtha

Feedstock Processing
- Sulphur removal
- Heavy hydrocarbon processing

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

Syngas Shift
- Converts CO to $H_2$ and $CO_2$

$H_2$ PSA
- Hydrogen purification

Steam

Hydrogen to Customer

Louisiana
Distribution Modes

On-Site

Ability to serve any size customer

Packaged gas

Merchant
Transportation Vehicles

Serve different volume needs of customers with efficiency
Praxair Snapshot

Industrial Gases
- Critical to customer; small part of their cost
- Local production and distribution
- Long-term contracts

Praxair Sep 2016 YTD Results
- Operating margin 22%
- Return on capital 12%
- Operating cash flow 26% of sales

Sep 2016 YTD Sales

By Segment

- North America 53%
- Europe 13%
- South America 13%
- Asia 15%
- PST 6%

By Supply Mode

- Packaged Gases 28%
- On-Site 29%
- Merchant 35%
- Other 8%

By End-Market

- Manufacturing 23%
- Metals 17%
- Energy 11%
- Other 11%
- Food / Bev 9%
- Chemicals 10%
- Aerospace 3%
- Electronics 8%
- Healthcare 8%

Diversified business positioned for recovery

Praxair Sep 2016 YTD operating margin and return on capital are non-GAAP measures; refer to 09/30/16 Form 10-Q for reconciliations.
Advantages of Integrated Supply Model

CUSTOMERS

- Pipeline (29%)
- Merchant (35%)
- Packaged (28%)

CONTRACTS

- Long-term: 15 – 20 years
  - Take-or-pay provisions ensure base return
  - Pass-through escalation formulas for energy and inflation preserve return throughout project life
- Medium-term: 3 – 7 years
  - Requirements contracts with mix of open contracts, formula and other terms that anticipate changing market conditions
  - Low-cost energy purchase & efficient production drives profitability
- Short-term: 1 – 3 years or purchase order contracts
  - Bundle gas, rent, services, equipment and technology to maximize customer value

Integrated supply and contract terms drive return on capital
## Resilient Markets

<table>
<thead>
<tr>
<th></th>
<th>3Q16 % of Sales</th>
<th>CAGR* (2011-16)</th>
<th>Applications</th>
<th>Primary Gases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food &amp; Beverage</strong></td>
<td>10%</td>
<td>13%</td>
<td>• Carbonation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Aquaculture</td>
<td><strong>O₂</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Stunning</td>
<td><strong>N₂</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Meat Mixing</td>
<td><strong>CO₂</strong></td>
</tr>
<tr>
<td><strong>Healthcare</strong></td>
<td>8%</td>
<td>5%</td>
<td>• Medical Oxygen</td>
<td><strong>O₂</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• MRI</td>
<td><strong>N₂</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Digital Valves</td>
<td><strong>He</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• System Monitoring</td>
<td><strong>CO₂</strong> <strong>N₂O</strong></td>
</tr>
<tr>
<td><strong>Aerospace</strong></td>
<td>3%</td>
<td>5%</td>
<td>• Coatings</td>
<td><strong>O₂</strong> <strong>N₂</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Vacuum carburizing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Autoclave inverting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Launch</td>
<td></td>
</tr>
<tr>
<td><strong>Specialty Gas</strong></td>
<td>6%</td>
<td>8%</td>
<td>• Semiconductor fabrication</td>
<td><strong>O₂</strong> <strong>N₂</strong></td>
</tr>
<tr>
<td>University, Bio/Pharma</td>
<td></td>
<td></td>
<td>• Environmental</td>
<td><strong>Ar</strong> <strong>He</strong></td>
</tr>
<tr>
<td>O&amp;G, Chemicals, Energy</td>
<td></td>
<td></td>
<td>• Research</td>
<td>Mixtures, Rare Gases</td>
</tr>
</tbody>
</table>

Steady and defensive markets with long term growth drivers

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*Ex Currency & Pass-through, includes acquisitions, Sept. YTD annualized
** Excludes impact of US homecare divestiture in 2011
IG Opportunities in US Petchem Industry

Natural Gas/Liquids

- POX or ATR
- SMR
- Ethane Cracking
- PSA
- GTL
- Methanol
- Ammonia
- Ethylene Oxide/Glycol

Chemical Products

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Products</th>
<th>IG Sales Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuels (via GTL)</td>
<td>O₂</td>
<td>++++</td>
</tr>
<tr>
<td>Methanol</td>
<td>H₂ / CO</td>
<td>+++</td>
</tr>
<tr>
<td>Ammonia</td>
<td>H₂</td>
<td>+++</td>
</tr>
<tr>
<td>Acetic Acid</td>
<td>CO</td>
<td>++</td>
</tr>
<tr>
<td>Acetic Acid</td>
<td>O₂</td>
<td>++</td>
</tr>
<tr>
<td>Ethylene Oxide/Glycol</td>
<td>O₂</td>
<td>++</td>
</tr>
<tr>
<td>Ethylene H₂</td>
<td>H₂</td>
<td></td>
</tr>
</tbody>
</table>

Growth in existing backlog and potential going forward
From Daily Life in the Kitchen…

**Water**
Carbon dioxide used in water treatment

**Windows**
Krypton improves insulation qualities

**Knives, Faucet …**
Steel is melted using Praxair’s oxy-fuel combustion technology

**Food and Beverage**
Seafood, poultry, meat, bakery goods, fruit and prepared foods all benefit from Praxair’s cryogenic freezing or chilling technologies using carbon dioxide or nitrogen. Carbon dioxide for carbonation in beverages.

**Lighting**
Specialty gases

**Microwave, Oven, Refrigerator**
Printed wiring boards soldered in nitrogen, route information to display panel. Argon used in stainless steel production.
To Daily Life in the Living Room…

**TV and Electronics**
Argon shielding gases used to weld metal frames

Rare-gas & specialty-gas mixtures used to develop display panels

Nitrogen keeps circuit boards clean

Praxair Surface Technology coated screws are used to extrude the plastic coverings used on wire and cable.

**Flowers**
Kept fresh with nitrogen

**Vase**
Oxygen used in glass production

**Literature**
Oxygen used in paper production
To Holiday Shopping….

**TV and Electronics**

Specialty gases are used to grow the dozens of individual layers in computer chips, some as small as 5 one-billionths of a meter in thickness.

Rare-gas & specialty-gas mixtures are used to develop display panels.

Nitrogen cleans circuit boards.

Argon shielding gases are used to weld metal frames.

**Jewelry**

Argon is used to heat treat gold as it is made into jewelry.

**Perfume**

Perfume-bottle manufacturers use oxygen to melt glass and make it into beautiful bottles.

**Candy**

Nitrogen is used to chill & set chocolate coatings on the outside of sweets, and to freeze and grind up old candy so that the sugars can be used.

**Clothing**

Nitrogen helps put the stretch in fabrics like lycra.
…To the Edge of Technology

Engine and Drivetrain Components
Heat Treating – N₂, H₂, Ar

Bodies/Frames
Welding and Cutting – Ar, CO₂, He, N₂
Hydroforming – N₂

Assembly (OEMs)
Welding (MIG, TIG, Plasma, Laser) – Ar, CO₂, He, N₂
WWT – O₂, CO₂

Climate Control Systems
Welding, Cutting, Heat Treating – Ar, CO₂, He, N₂, O₂

Production Equipment
Machine Tools
Welding – Packaged Gases

Lighting
Specialty Gases

Windows
Glass Combustion, Float Bath Inerting – O₂, N₂, H₂

Electronics
Circuit Boards – N₂

Tires – N₂

Wide applications in automobile production
Innovation Overview

**Direction**

- Cost & efficiency improvement
- Maximize operational flexibility
- Self perform HYCO technologies

**Vision**

- Optimized for Owner/Operator

**Supply Systems**

- Operational analytics
- Asset management
- Failure prevention

**Productivity**

- Resilient market intensification
- Leadership in combustion
- Open innovation

**Applications**

- Prescriptive Decisions
- Win with “new” technology

Solutions to drive business performance
Sustainable Development Highlights

**SAFETY FIRST**

**BEST-IN-CLASS SAFETY PERFORMANCE:**

25x better than US OSHA industrial average lost workday case rate

**$60+MM ENERGY SAVINGS PER YEAR**

**ECO-PORTFOLIO 32% of revenue**

**346,919 BENEFICIARIES GLOBALY from Community Engagement**

**300+ SITES & 12,500+ EMPLOYEES PARTICIPATED IN Praxair's Zero Waste Program**

**2x net GHG benefit through PX applications**

**90% of LEADERSHIP in emerging economies is local**

**125MM people served by water applications**

**RECOGNITION 14 consecutive years named to the**

Dow Jones Sustainability Indices

In Collaboration with RobecoSAM

CDP A LIST CLIMATE

DiversityInc TOP 50 COMPANIES FOR DIVERSITY 25 NOTEWORTHY

Forbes 2016 AMERICA'S BEST LARGE EMPLOYERS