who we are

SHAREHOLDER RETURN
16% over past 10 years

Selected for DOW JONES Sustainability World Index for Ninth Consecutive Year

26% REVENUE FROM environmental applications

26,000 employees in more than 50 countries

FORTUNE 250 COMPANY

92,000 hours contributed to community engagement efforts

Selected for the NYSE Century Index

AMONG TOP 50 Forbes “World’s Most Innovative Companies”
3 | Where your talent makes an impact

+ 50 Countries

- Energy
- Metals
- Chemicals
- Manufacturing
- Electronics
- Food
- Healthcare
- Aerospace
- Other
Air separation: non-cryogenic

- Non-cryogenic (gas only):
  Nitrogen, Oxygen
Air separation: cryogenic distillation

- Cryogenic plants (gas and liquid):
  Nitrogen, Oxygen, Argon

Key:
- Green: 78% nitrogen
- Blue: 21% oxygen
- Red: 1% other gases

Air
Purify
Liquefy by cooling to -320°F
Separate by distillation

Nitrogen -320°F
Argon -302°F
Oxygen -297°F
Cryogenics Supply Systems

Cryogenic Air Separation

Leader in cryogenic distillation

- 20% advantage according to external benchmark

Enabled by strong competencies in:

- Turbomachinery
- Prepurifiers (adsorption/molecular sieves)
- Heat Exchangers
- Packaging and internals
- Condensers

Continuing to develop leading edge technology
distribution systems

On-site Facilities

Pipeline Supply

Cryogenic Liquid Supply

Packaged Gases
Oxygen Enhanced Combustion of Biomass

**Why**
- 28 States require power generation from renewable Green Fuels (Biomass)

**Challenges**
- Converting boilers from coal to biomass can reduce capacity by 35%
- High moisture and large particle size of biomass can create combustion problems and more CO

**Praxair’s Technology**
- Optimized injection of oxygen into the furnace to improve combustion of biomass

**Benefits**
- Maximized power generation with efficient combustion
- Stable process with lower emissions
Oxyfuel Burners for Cupola Furnaces

Why
- Reduce costs by replacing expensive coke with petcoke or coal fines for iron melting

Challenges
- Develop reliable oxy-fuel burners
- Optimize critical operating parameters
- Maximize fuel substitution to achieve savings

Praxair’s Technology
- Oxyfuel Burners (patent pending) customized for Cupola Furnaces and process know-how

Benefits
- Efficient combustion of petcoke
- Customer savings
- Stable & reliable oxyfuel burner operation
Novel industrial gas solutions to:
- Use energy cleanly and efficiently
- Enable new energy supply sources
- Reduce greenhouse gases (e.g. CO₂)

Technology development efforts include:
- Large scale oxygen plants for gasification
- Mercury capture from coal fired power
- Small scale LNG production
- CO₂ capture and sequestration

Positioned well on emerging opportunities:
- Tar sands projects, LNG regasification
- Enhanced Oil Recovery
Praxair develops food refrigeration and freezing equipment

Design leverages core competencies in:
- Sanitary equipment design, heat transfer, fluid flow, liquid supply systems, computational fluid dynamics, and cryogenic freezer fabrication

Advanced equipment yields step change benefits:
- Ultra Performance Cryogenic Tunnel Freezer
  - Linear cryogenic food freezer that uses N₂ or CO₂
  - Provides 35% increase in production capacity
- Improve food processing operations to improve yield and productivity
Enabling the next generation of computing and consumer electronics

**Materials Science Solutions**
- Sputtering targets for physical vapor deposition
- Chemical precursors for atomic layer deposition
- Pads for chemical mechanical planarization
- Electrostatic chucks for wafer clamping
- Specialty coatings for chamber components

**Gas Technology**
- Process deposition, etch and clean gases
- Ion implant gases and delivery
- Bulk specialty gas systems
- Atmospheric gas plants for electronics
Advanced Process Control
- State-of-the-art Model Predictive Control
- Safety and Reliability Monitoring

Supply Chain Optimization
- Energy Market Forecasting
- Strategic Network Planning

Business Analytics
- Pricing Strategy
- Investment Risk Analysis
Compressors
Gas/Steam turbines
Motors
Pumps
Combustion burners
Valves
Piping
Silencer/Vent

Man Turbo inline centrifugal compressor
Air suction filter house (ASFH) compressor noise
  - Air filters are also very effective sound absorbers

Air separation process noise
  - Valve/orifice flow noise, vent/silencer noise, root blower noise

Steam methane reforming (SMR) for H₂ production
  - Reformer tubes creep detection

Distributed acoustic sensing (DAS)
  - Hydrogen storage cavern mechanical integrity monitoring

Leak detection
  - Through detecting vibration in ultrasonic range

SoundPLAN for plant noise model

High-speed data loggers for condition monitoring

Sensors and data analytics

Wireless connectivity
Noise Examples

ASFH Noise between 2nd and 3rd Stage Filters

Measured at inlet pipe level