



Hydrogen

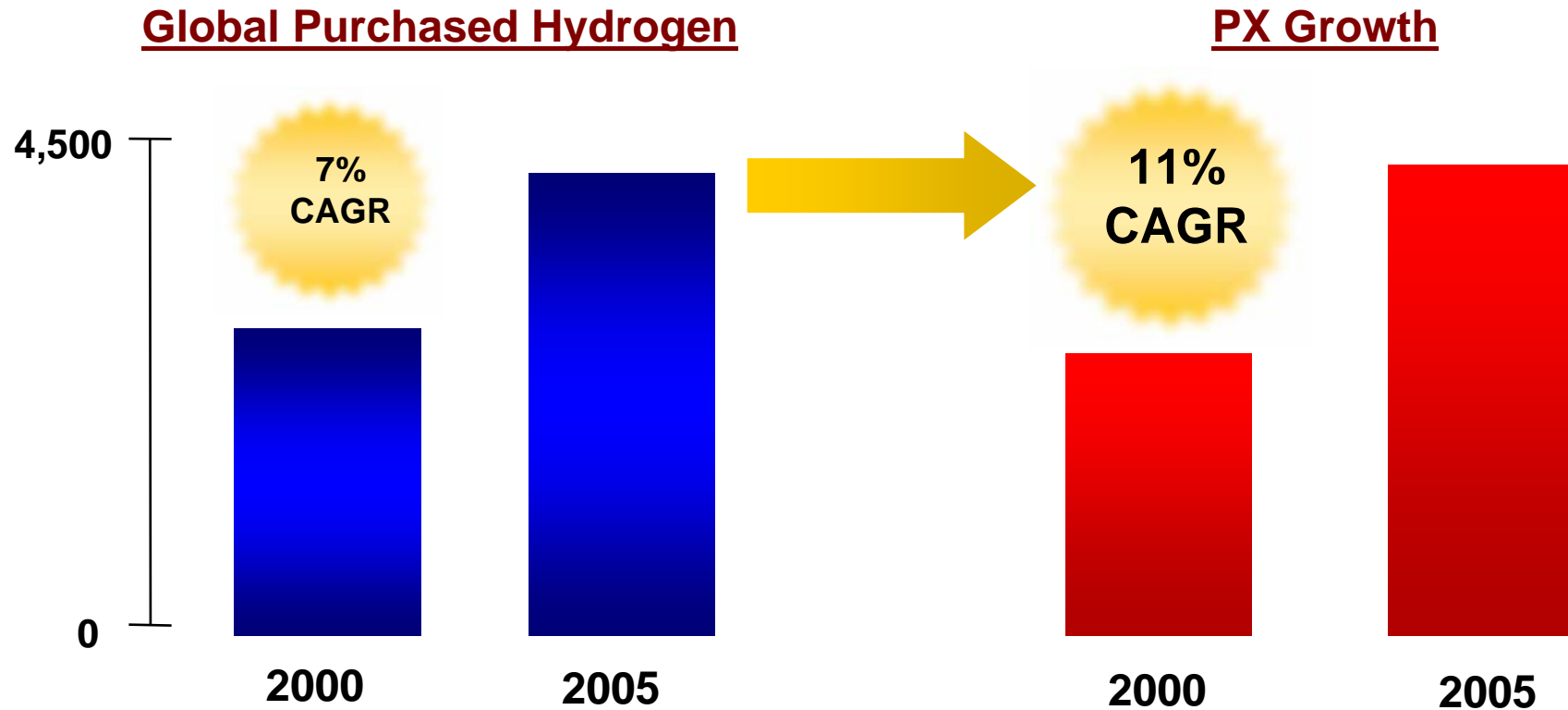
*Becoming the Supplier of Choice for
the Refinery Industry*



Mark Gruninger

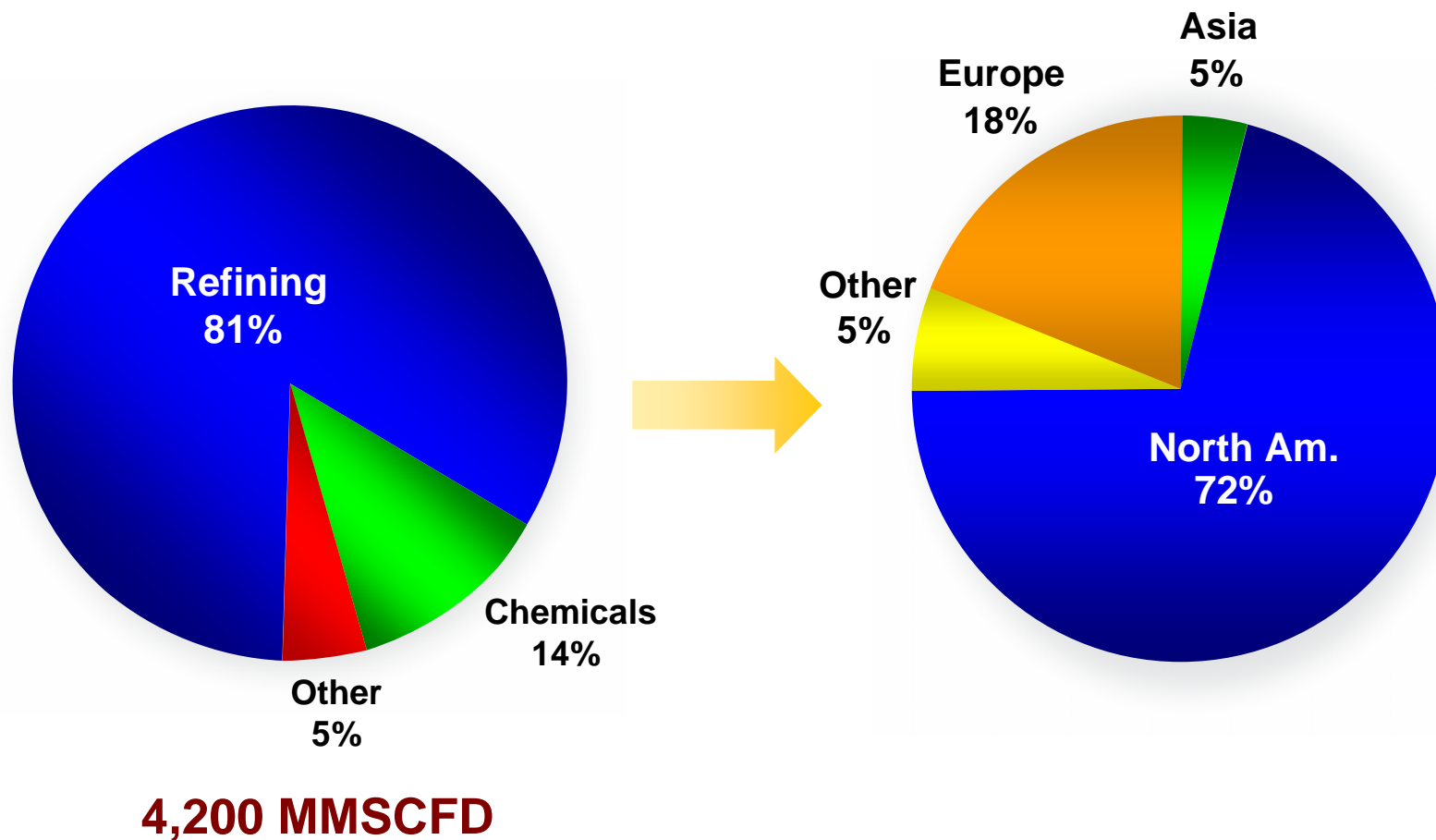
Growth in Hydrogen

MMSCFD



Market CAGR 7% → Praxair CAGR 11%

2005 Global Purchased Hydrogen Market



North American refining uses dominate the world's sourced hydrogen

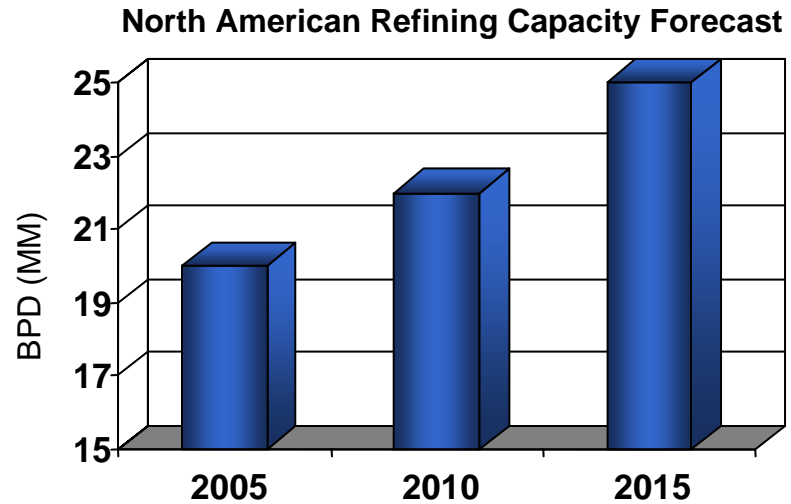
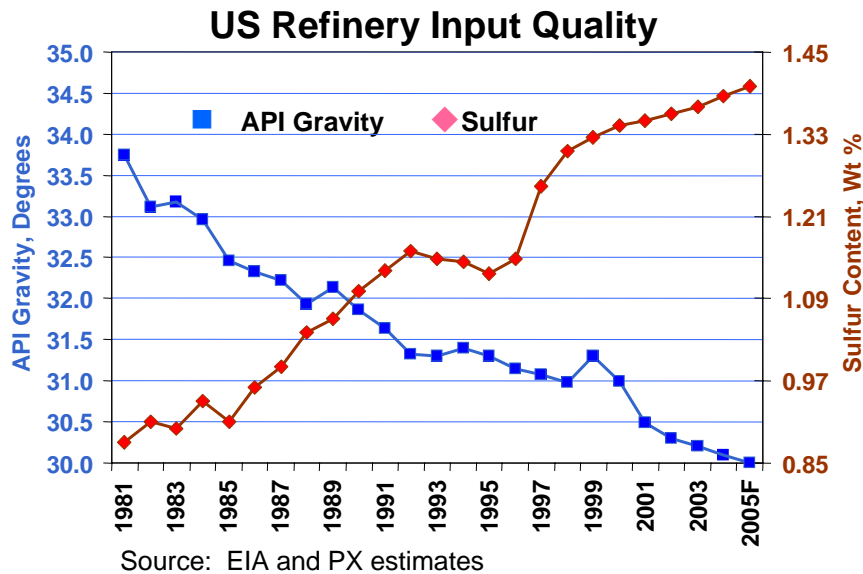
*Praxair Estimate

Refining Demand for Hydrogen

- ◆ Low sulfur fuel regulations
- ◆ Heavy crude upgrading
- ◆ Planned refinery expansions to process heavy crude
- ◆ Replacing refineries old reformers

Sulfur Fuel Specifications

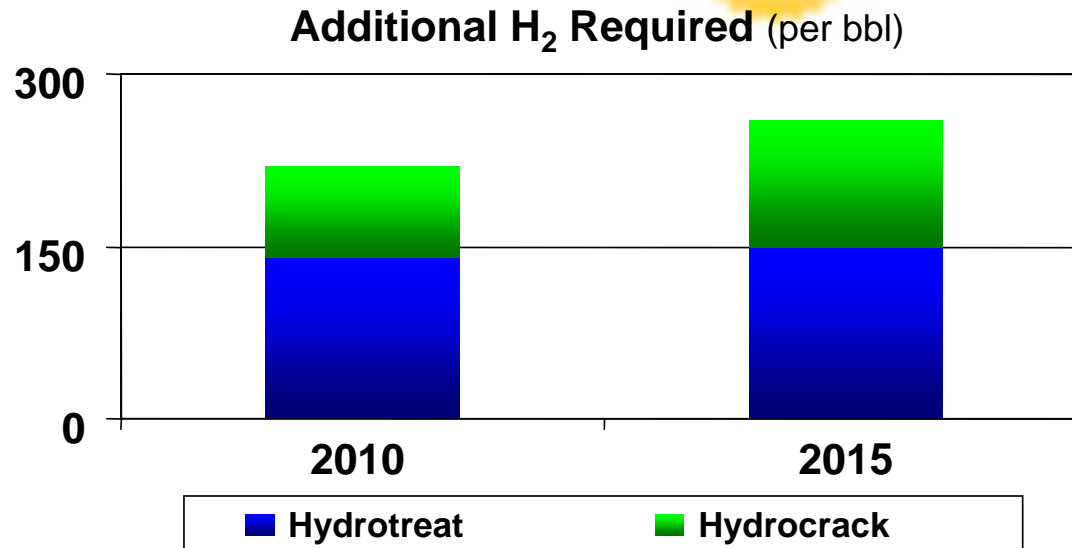
	Gasoline	On-Road Diesel	Off-Road Diesel	Locomotive & Marine
2004	120ppm			
2005	30ppm			
2006	↓	15ppm		
2007		↓	500ppm	500ppm
2008			↓	
2009			15ppm	
2010			↓	
2011				↓
2012				15ppm



Environmental, economic and capacity additions driving H₂ demand

North American H₂ Refining Segment

	<u>2005</u>	<u>2010</u>	<u>2015</u>
Crude Oil Refined (MM bbls per day)	18	19	20
H ₂ per bbl (scf)	<u>490</u>	<u>710</u>	<u>750</u>
Required H ₂ for Refining (MMSCFD)	8,800	13,400	15,000
Purchased H ₂ Market (MMSCFD)	2,200	5,000	6,000
	25%		40%



Two-thirds of demand growth will be outsourced

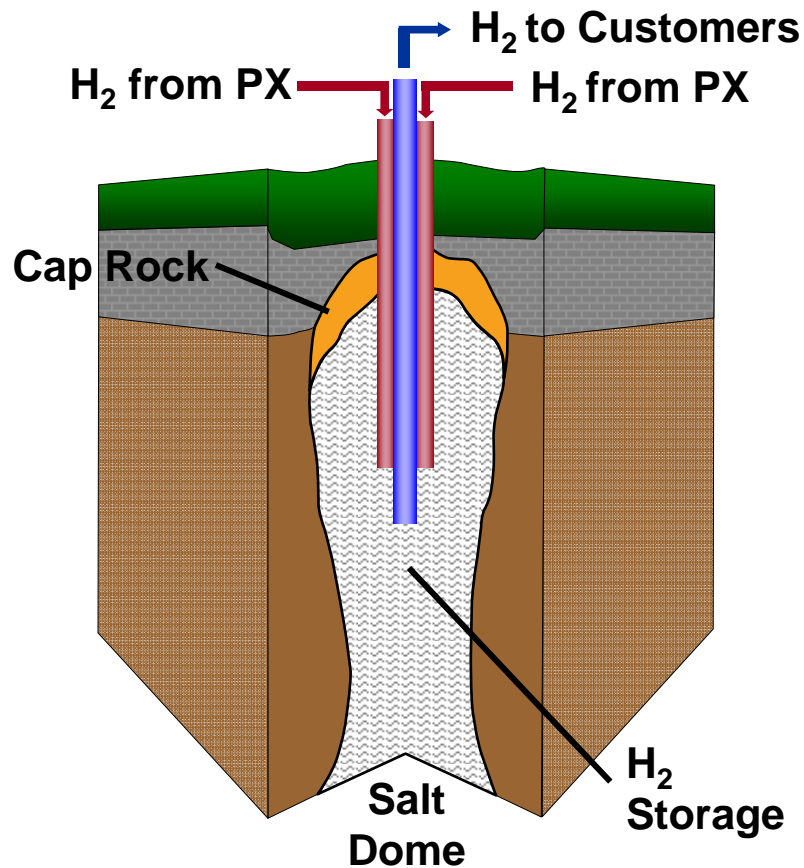
Gulf Coast Hydrogen System



- ◆ 310 miles of pipeline; 12 sources / 700 MMSCFD; Connected to 85% of refining capacity
- ◆ Competitive alternative to refinery investment
- ◆ Pipeline system provides very positive economics for high PX returns

System reliability is a central value proposition for growth

Hydrogen Storage Cavern

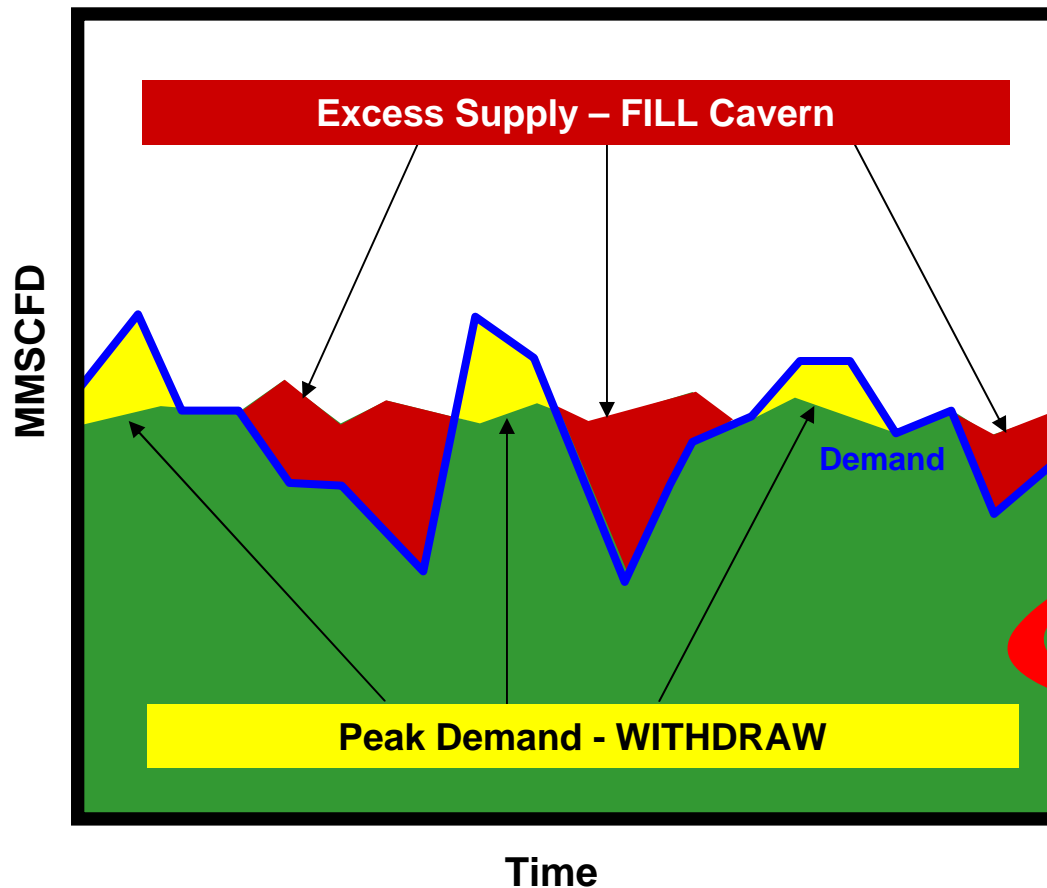


- ◆ First commercial H₂ storage cavern
- ◆ Heightened availability - 100 mmscfd additional capability
- ◆ When hydrogen supply exceeds demand H₂ is injected into cavern
- ◆ When hydrogen supply falls short of demand H₂ is withdrawn from cavern

Equivalent to 50 MMSCFD SMR

Storage Cavern Management and Value

H₂ Supply / Demand Balance



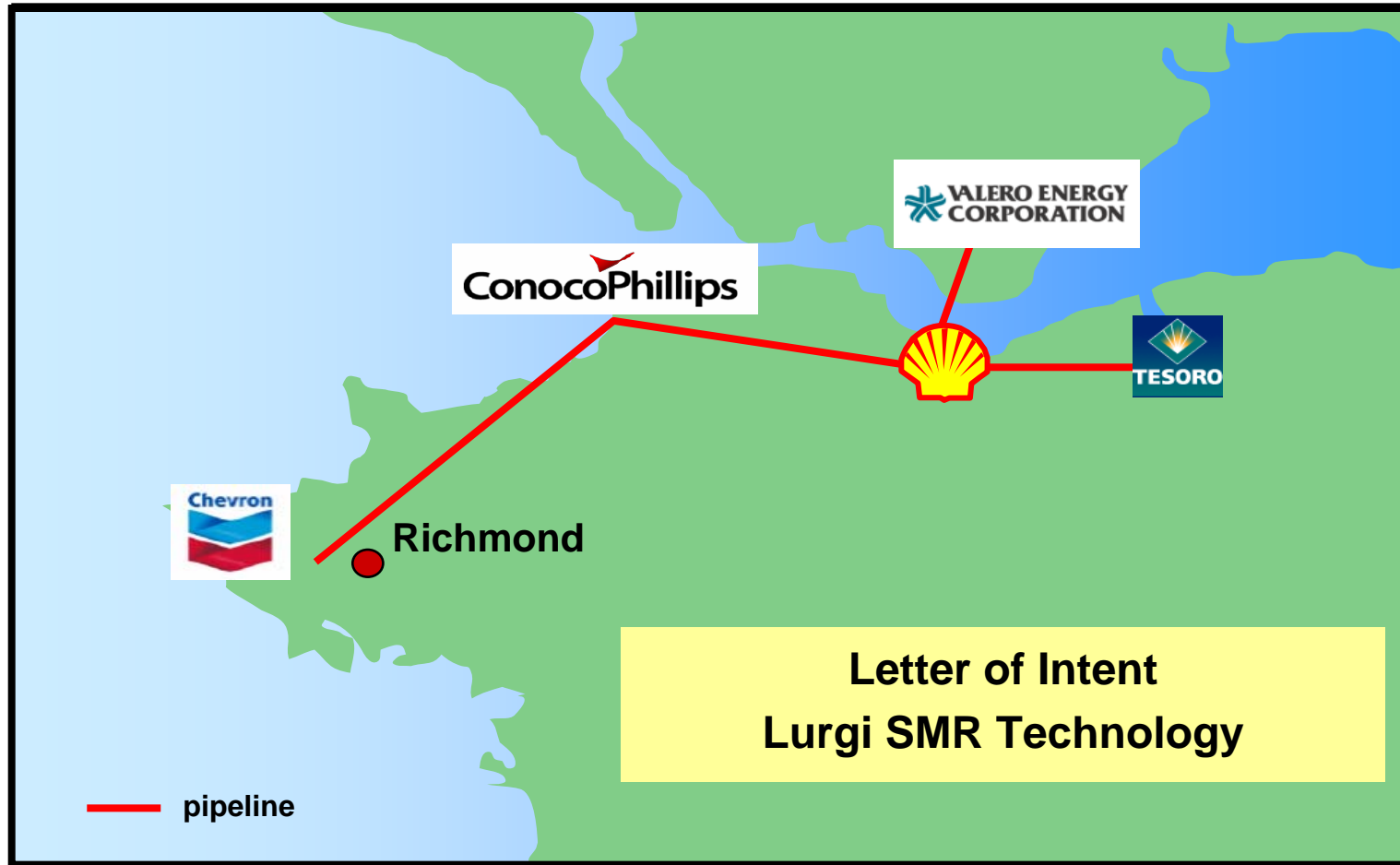
- ◆ Hydrogen supply relatively steady
- ◆ Typical refinery demand varies 10% of average

Sour uplifting value: \$15/bbl
Natural Gas: \$7/mmbtu
Peak H₂ Demand: 750 to 1500 scf/b
Peak H₂ Value: \$10/mcf → \$20/mcf
Current avg. contract price ~\$3.50

Significant economic value in having on-demand H₂

Praxair Northern California Pipeline System

260 MMSCFD H₂ Capacity - Q3 08



600-700 MMSCFD additional demand potential

Hydrogen Supply Additions

Project	MMSCFD	Start-Up
BP, Texas City	165	Jun 04
Motiva, Port Arthur	100	July 04
Valero, Houston	100	Aug 06
BP, Whiting	20	Oct 06
N. California LOI	260	Aug 08
PX Total Additions	645	
PX Total NA Capacity	1,100	

Significant expansion of North American system capacity

Hydrogen Awarded 2004 YTD

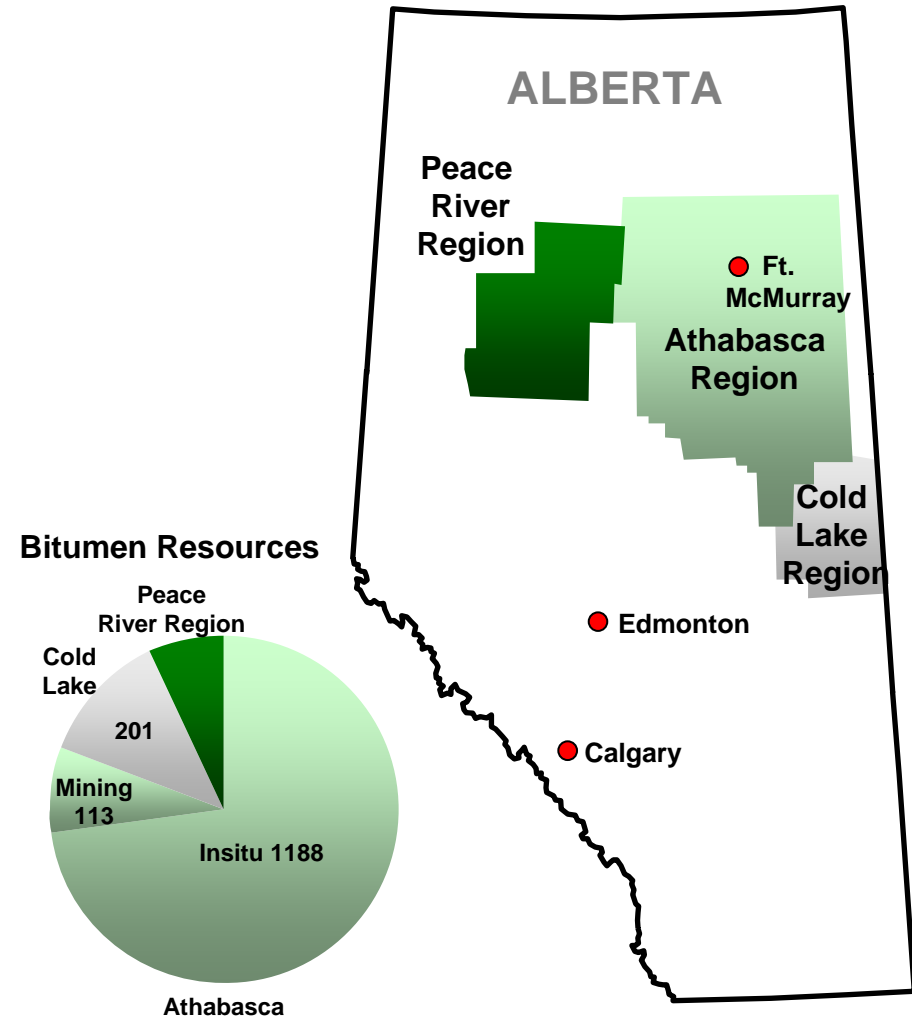
<u>Company</u>	<u>Share</u>
PX	45%
Comp 1	31%
Comp 2	15%
Comp 3	9%
Total	100%

US and Canada

700 MMSCFD awarded to Praxair

Canadian Oil Sands

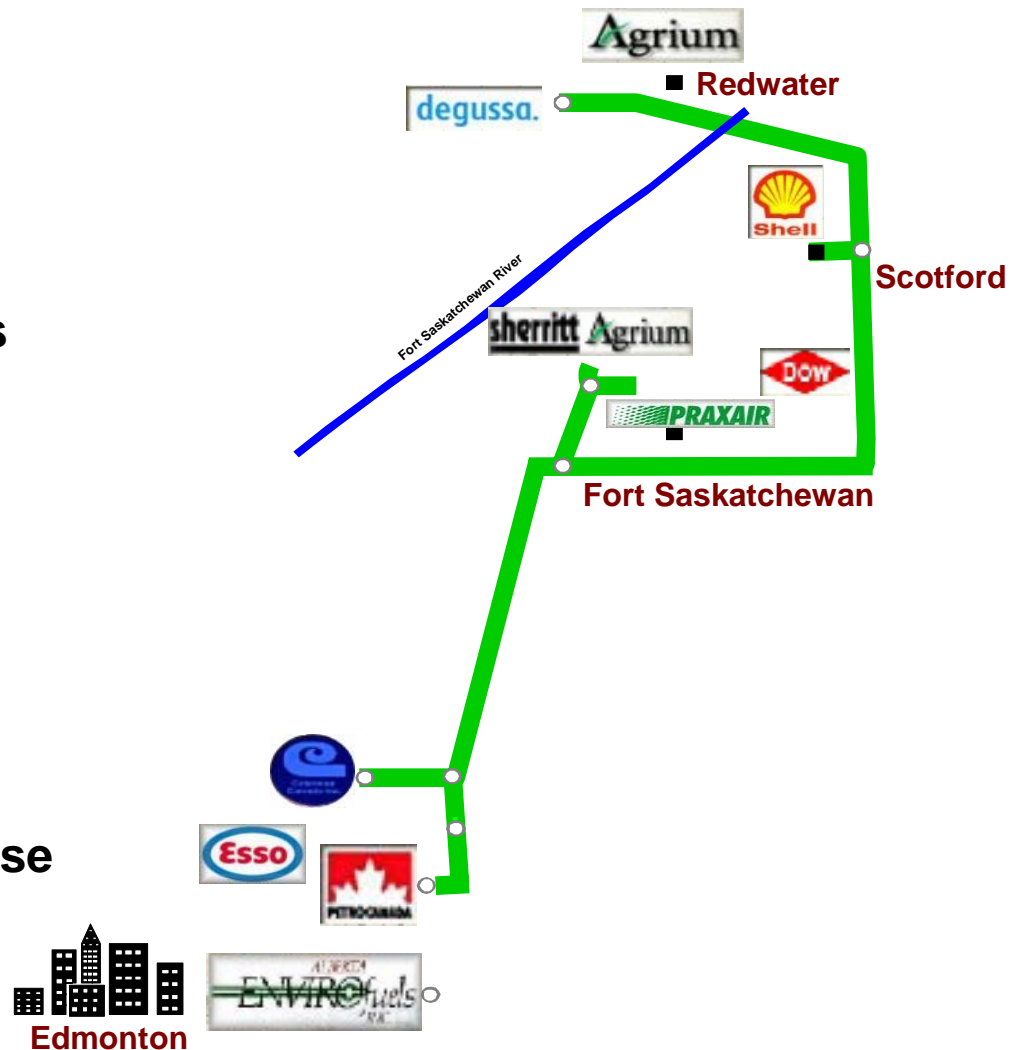
- ◆ 175 B barrels of proven reserves (second only to Saudi Arabia)
- ◆ Current production of 1.1 MM bpd expected to triple by 2015
- ◆ Over 2.0 B SCFD of additional H₂ for upgrading bitumen
- ◆ Large O₂ requirements for proposed gasification projects
- ◆ Bitumen will be increasingly upgraded outside Ft. McMurray in Canada and US



Potentially a huge opportunity

Praxair Canada Edmonton Infrastructure

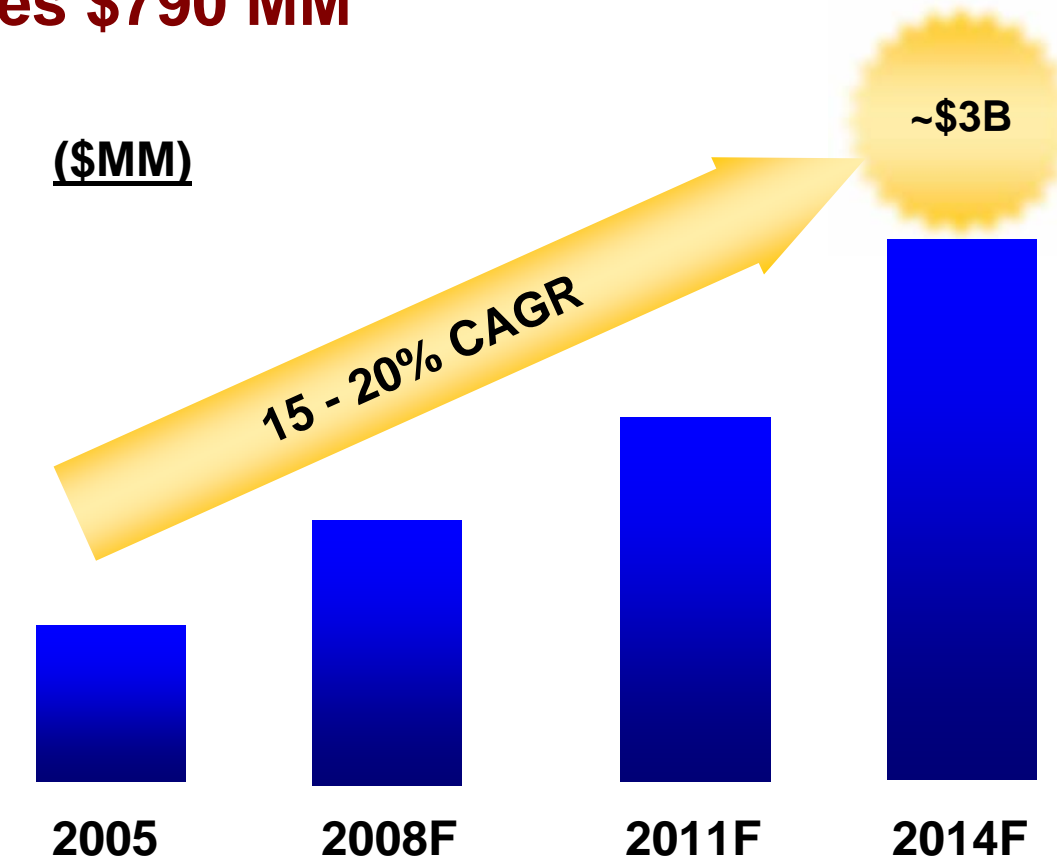
- ◆ Fully integrated air separation plant and pipeline complex
 - 50 km of pipeline
- ◆ Pipeline system strategically located near proposed projects
 - Fort Hills JV
 - Northern Lights
 - Northwest
 - North American
 - BA Energy
- ◆ Strong local operations expertise



Praxair well positioned for future H₂, O₂ and N₂ opportunities

PX Global Hydrogen

2005 Sales \$790 MM



Forecast assumes \$7.00 natural gas

HYCO

Significant growth in short and long term

Summary

- ◆ **Robust North America demand for outsourced hydrogen**
- ◆ **Environmental and economic drivers to increase hydrogen usage**
- ◆ **Praxair well positioned to profitably capture share**
 - **Geographically**
 - **Best offerings**
 - **Key customers**
 - **Experience refining team**
- ◆ **Strong growth forecast for at least 5-10 years**