

Growing Demands of the Industrial Gas Industry

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Technology and operating experience

■ Air separation plants:

- ✓ Leader in oxygen and nitrogen production technology
- ✓ Leadership position in large oxygen plant design
 - **More than 60 units built by AL above 1,000 tons per day**



■ H₂/CO/syngas plants

- ✓ More than 30 plants worldwide operated or under construction by AL
- ✓ Partnerships with Haldor-Topsøe and CB&I Howe-Baker for steam-methane reformer technology
- ✓ In-house technology for hydrogen and carbon monoxide purification



4 main Markets

Products

Main Applications



Chemicals

- Basic and fine chemicals
- Petrochemicals

Oxygen
 Nitrogen
 Hydrogen and Carbon Monoxide
 Synthesis Gas
 Utilities

Oxidation reactions (EO, EDC, PO,...)
 Process gas for polyolefins / inert gas applications
 TDI/MDI, polycarbonate, fatty alcohols,...
 Oxo alcohols
 Power/steam cogeneration, compressed air, DMW



Metals

- Iron and steel industry
- Copper/Gold/Zinc

Oxygen
 Nitrogen
 O₂ injection Technologies

O₂ for air blast enrichment (Coal Injection) and/or air Blast Temperature increase (Hot Stoves)
 O₂ for decarburation of pig iron in converter
 O₂ for partial oxycombustion of Reheating Furnaces
 O₂ for Decarburation, Post Combustion in EAF
 N₂ for bottom stirring (converter)
 N₂ as vector gas and inert gas



Oil & Natural Gas

- Refining industry
- IGCC

Hydrogen
 Nitrogen
 Oxygen
 Utilities

Hydrotreating / Hydrocracking
 Purging and other inert applications / vapor recovery
 FCC and Claus plant enrichment gasification
 Power/steam cogeneration, compressed air, DMW



Energy Conversion

- Gasification
- GTL
- Methanol / DME

Oxygen
 Synthesis Gas
 Utilities

New applications for the conversion of stranded gas resources to liquid fuels and to chemicals (GTL: Gas To Liquids)
 Synthetic liquid fuels (diesel, naphtha)
 Chemicals: methanol synthesis / Dimethyl ether
 Power integration (steam/electricity)

La Porte, Texas, U.S. – 400 t/d ASU



Mons, Belgium – 1,300 t/d ASU



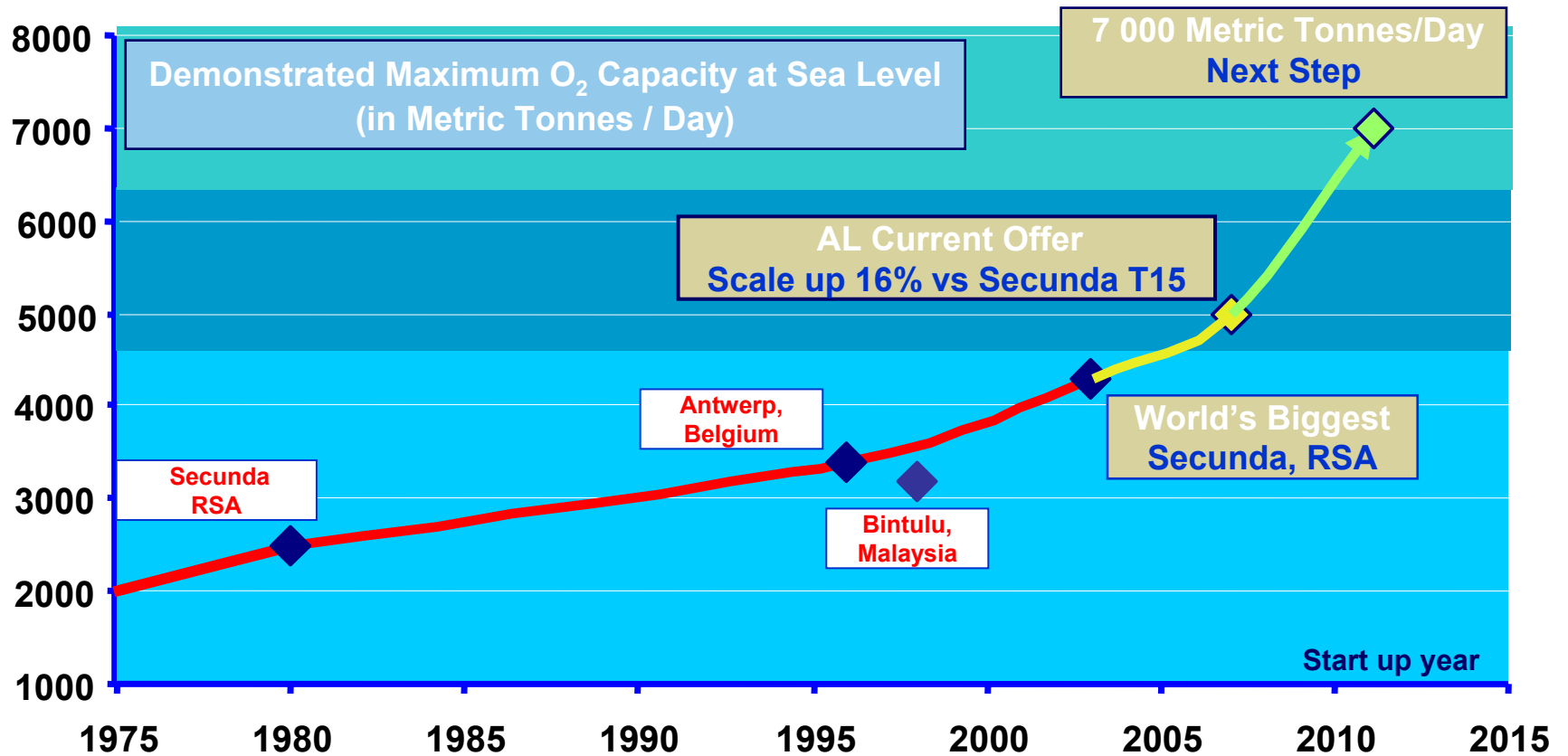
Gulliver, Belgium – 3,200 t/d ASU



Sasol T15 – 4,000 t/d ASU



Leadership in large ASU projects



Increase in Scale is the Result of 30 Years of Continuous R&D and Engineering Work on the Key Features of the Plant

Compression, Purification and Distillation

Freeport, TX – 35 mmscf/d SMR



Port Jérôme, France – 55 mmscf/d SMR



El Segundo, CA – 90 mmscf/d SMR



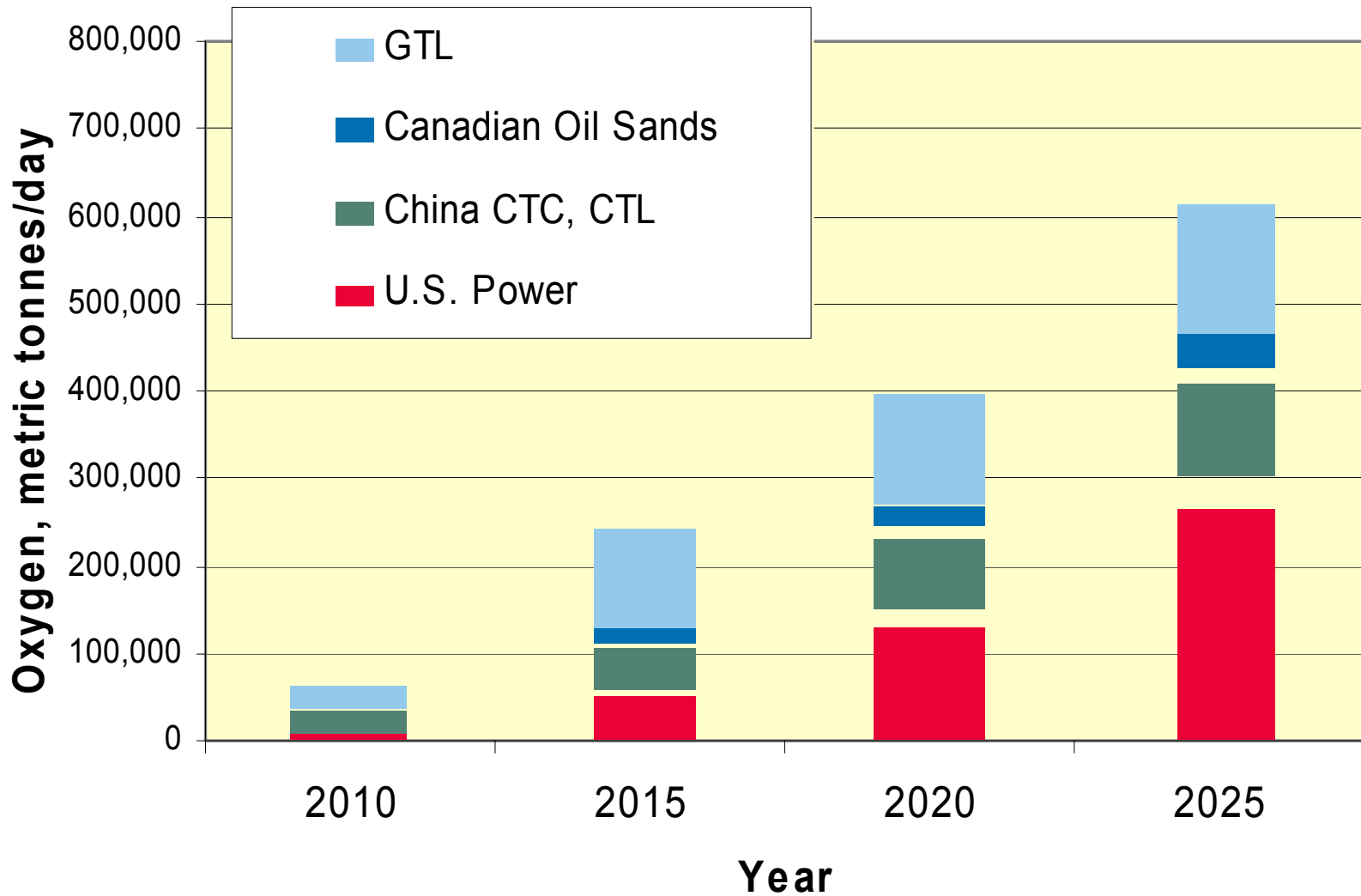
Antwerp, Belgium – 90 mmscf/d SMR



Projected Growth – L.I. market as we know it today

Global Large Industries Basic Markets		Annual Growth Rate	Capital Intensity	Global Investments
2004 <i>(in millions)</i>				2015 <i>(in millions)</i>
AirGas	\$5,000	5%	3.5	\$11,000
HyCO	\$2,400	8%	2	\$6,000
\$7,400				\$17,000

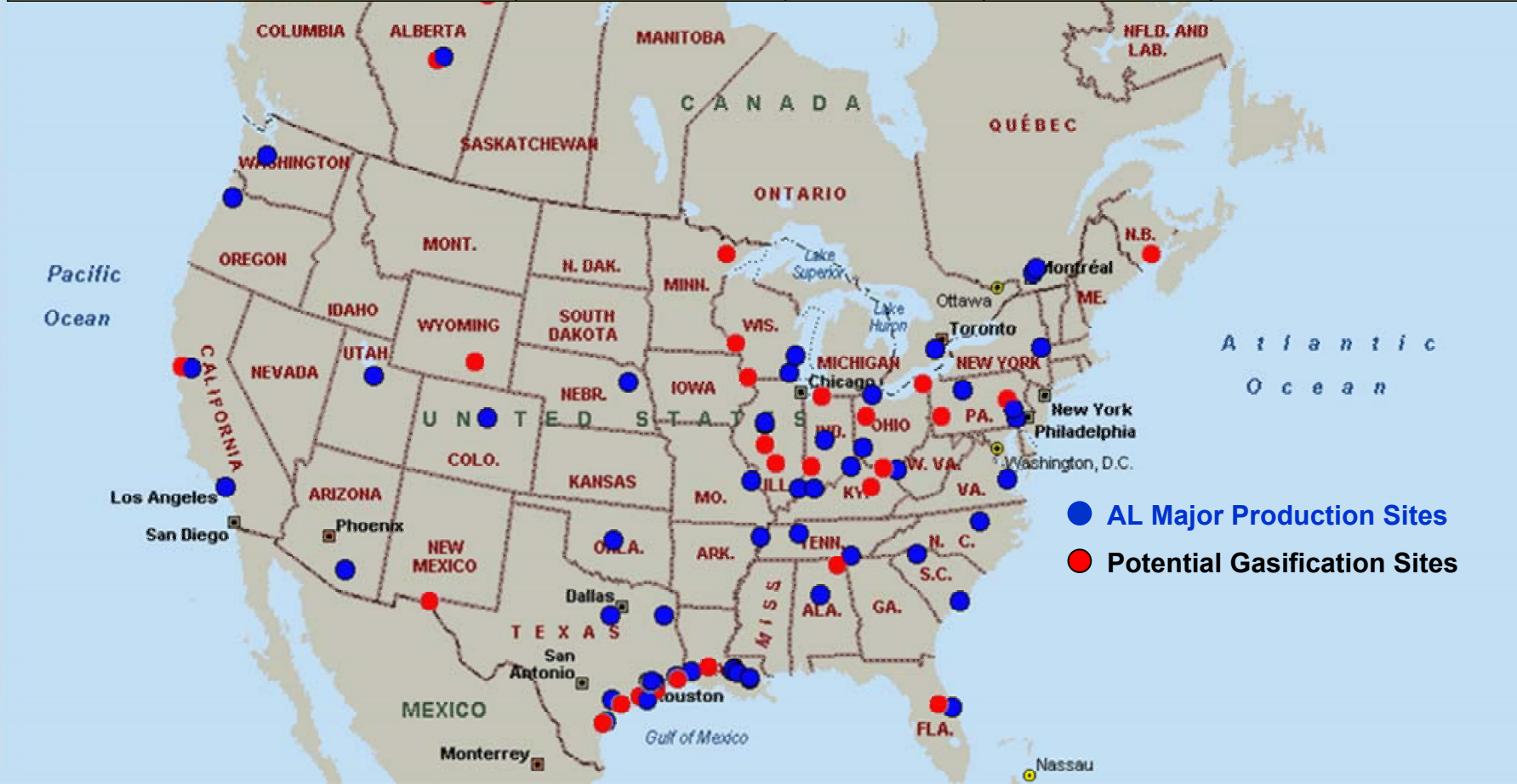
Cumulative Oxygen Potential to 2025



Gasification for Power U.S.

Gasification – Power – U.S.

Market Segment	Probable Demand	Timeframe	4000 mtpd ASUs per Year	Total Capex
Power -US	300,000 mtpd	2010-2025	5	\$10,500 million



- AL Major Production Sites
- Potential Gasification Sites

Coal to Chemicals

Coal to Liquids

China

Oil Sands

Alberta, Canada

Oil Sands – Alberta, Canada



Market Segment	Probable Demand	Timeframe	4000 mtpd ASUs per Year	Total Capex
Oil Sands - Canada	40,000 mtpd	2010-2025	1	\$1,400 million

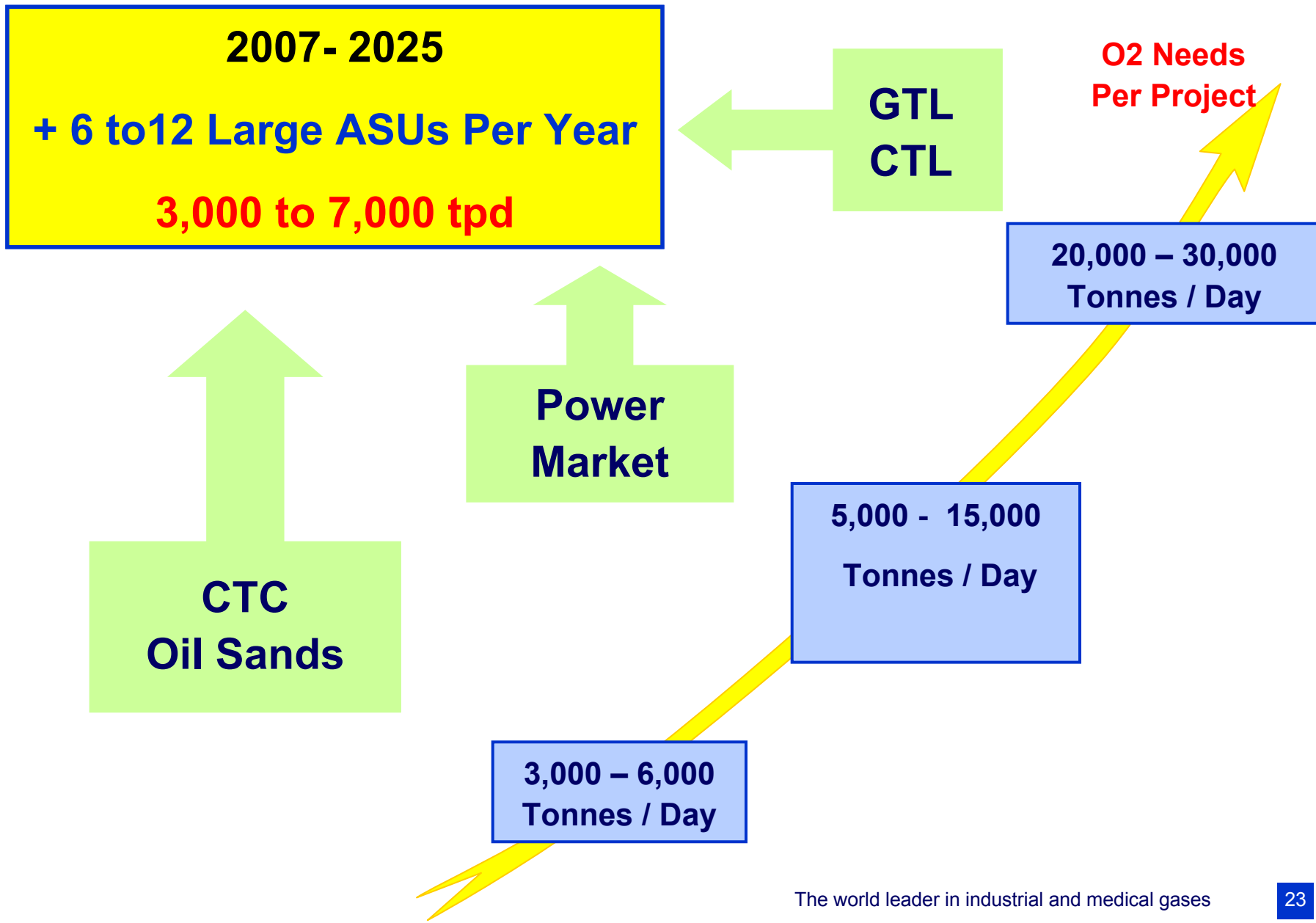
Gas to Liquids (GTL) Middle East

GTL – Middle East



Market Segment	Probable Demand	Timeframe	4000 mtpd ASUs per Year	Total Capex
GTL - Middle East	180,000 mtpd	2006-2025	3	\$6,300 million

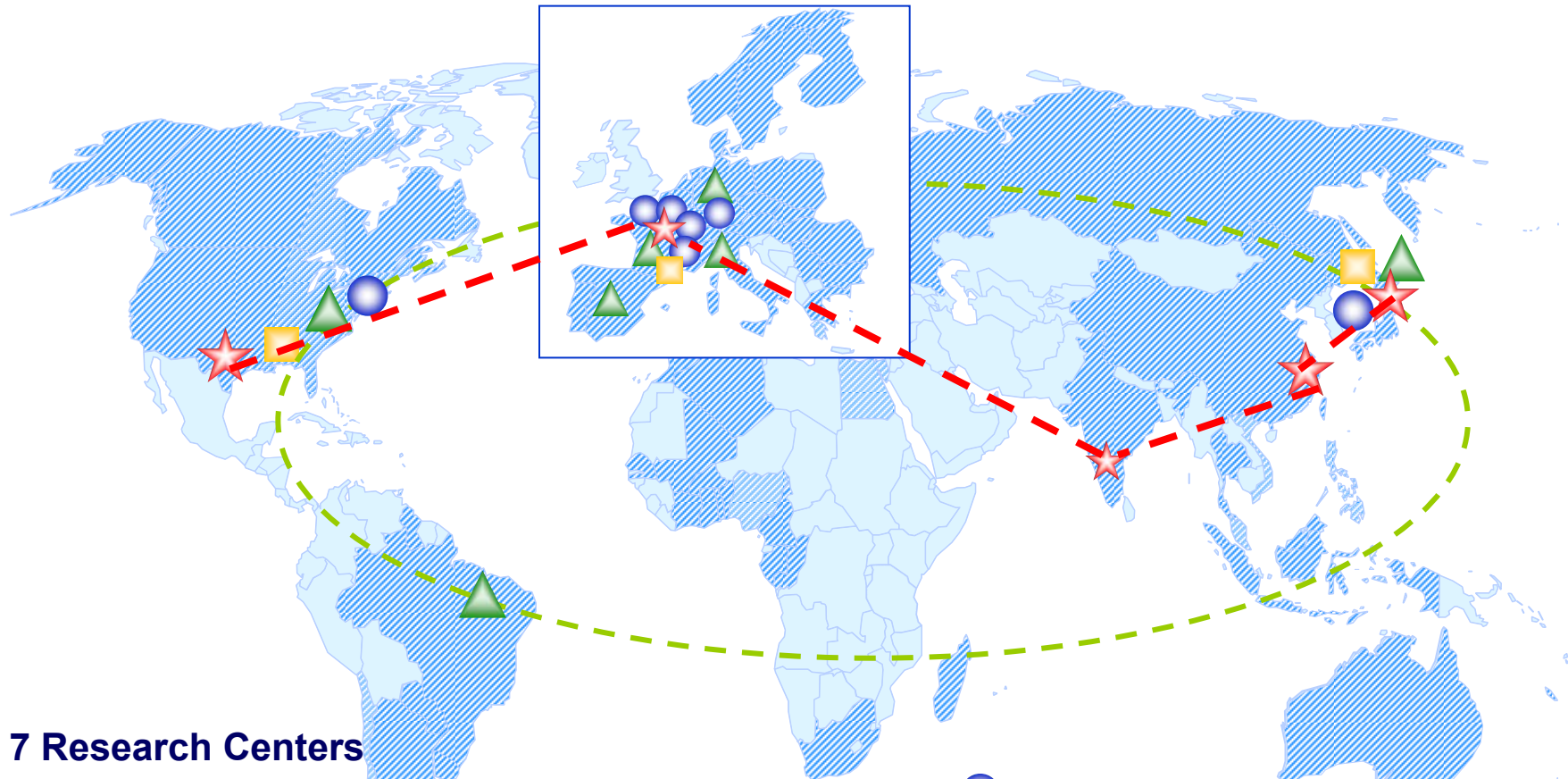
Potential Oxygen Needs For Mega Projects



Energy Conversion Potential (O₂ only)

Market Segment	Probable Demand	Timeframe	4000 mtpd ASUs per Year	Total Capex
Power -US	300,000 mtpd	2010-2025	5	\$10,500 million
CTC, CTL - China	125,000 mtpd	2006-2025	2	\$4,400 million
Oil Sands - Canada	40,000 mtpd	2010-2025	1	\$1,400 million
GTL - Middle East	180,000 mtpd	2006-2025	3	\$6,300 million
Energy Conversion Markets	645,000 mtpd		11	\$22,600 million
Basic Markets		2015		\$17,000 million
All Markets				\$39,600 million

Developing Technology and Innovation



7 Research Centers

➤ 550 Researchers, > 2 600 Patents in Last 15 Yrs

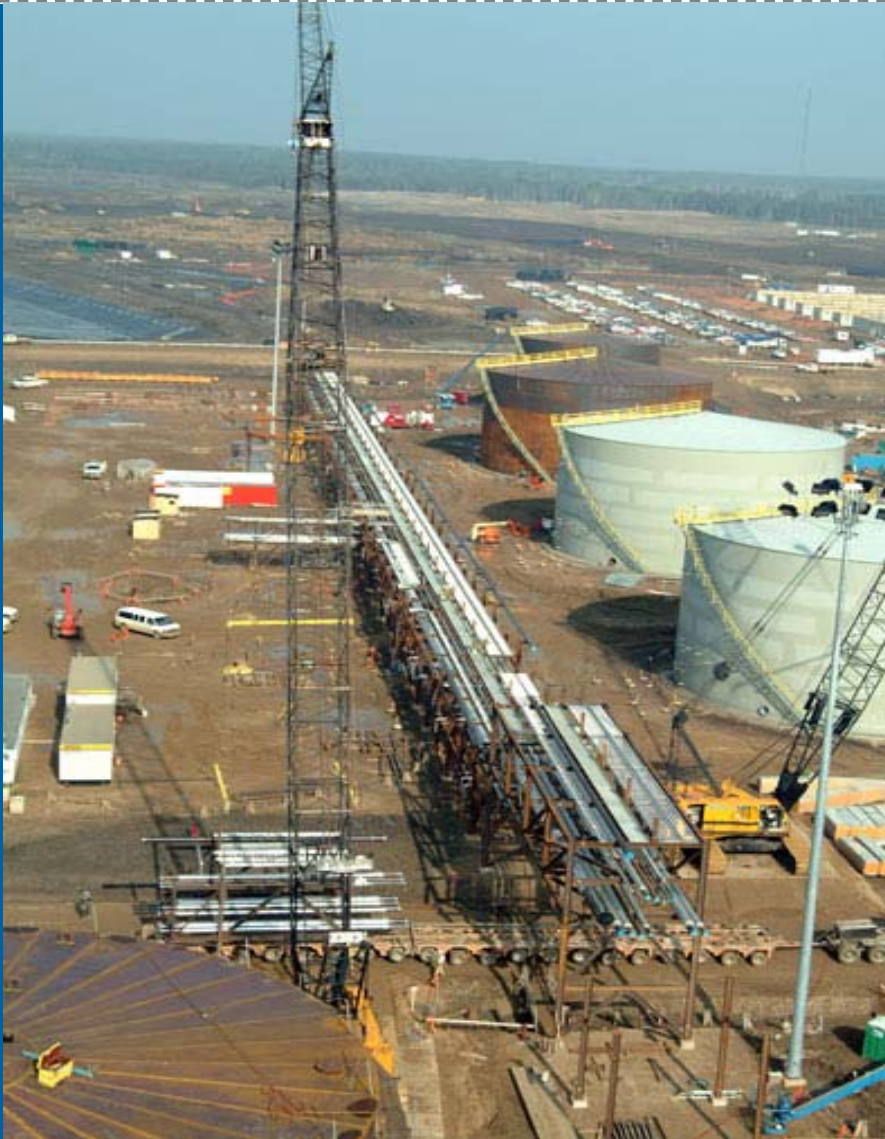
5 Engineering and 4 Fabrication Sites

➤ Paris, Houston, Hyderabad (India), Shanghai, (Hangzhou), Harima (Japan)

➤ 1200 People

- Research Centers
- Engineering and Construction
- Electronics
- Applied Technology Center Network
- Network
- Air Liquide Presence**

Are we ready?



Source: Long Lake Project, Alberta