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AIR PRODUCTS 

Full Oxy-fuel Glass Furnace Conversion in Asia

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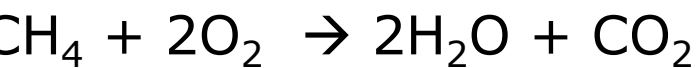
What is Full Oxy-fuel?

Air-Fuel



(+ NO + NO₂ + N₂O) + . . .

Oxy-Fuel

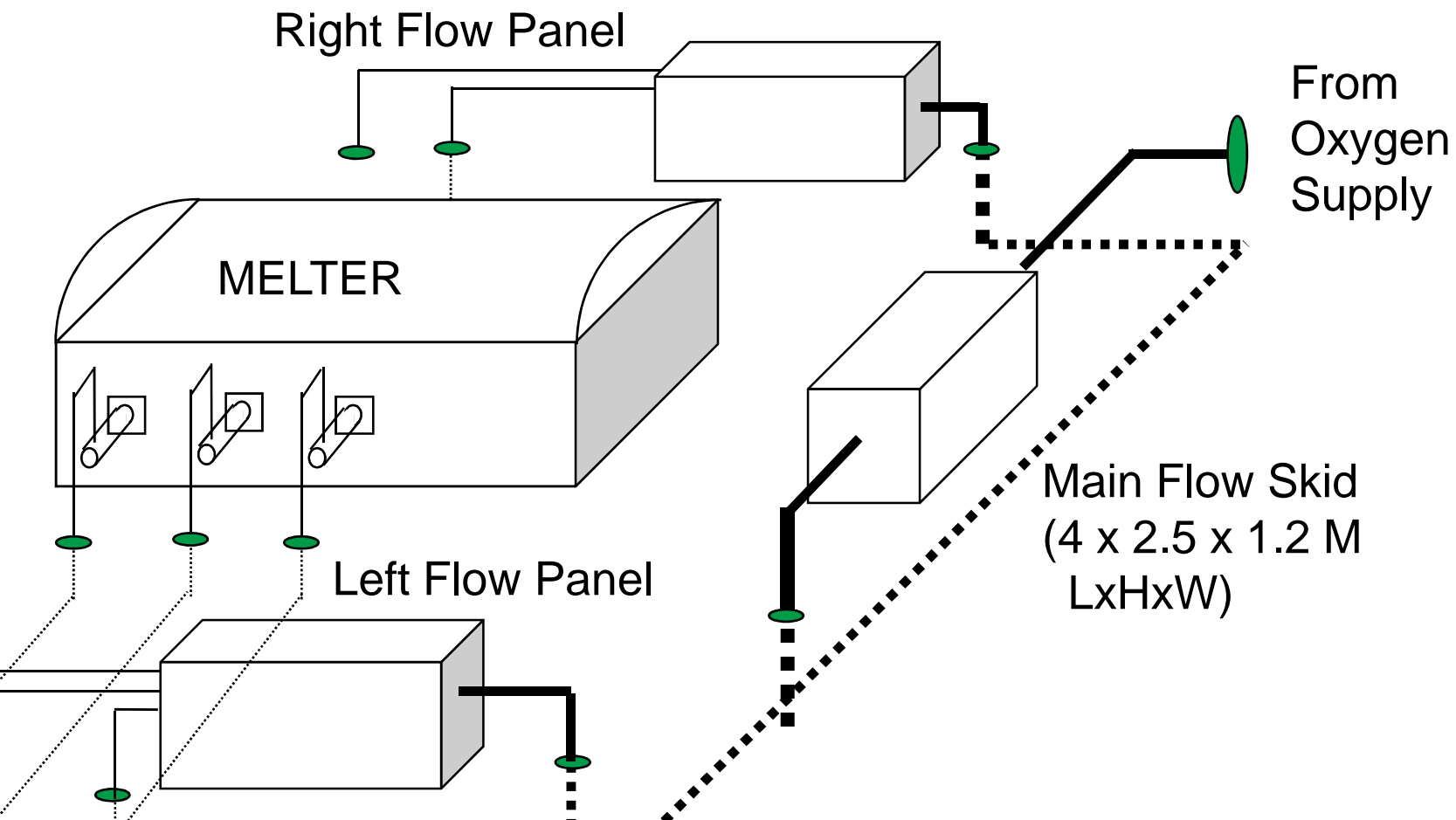


- Nitrogen and NOx nearly eliminated
- >70% reduction in flue gas volume
- Particulates & volatilization reduced
- >65% available heat increase



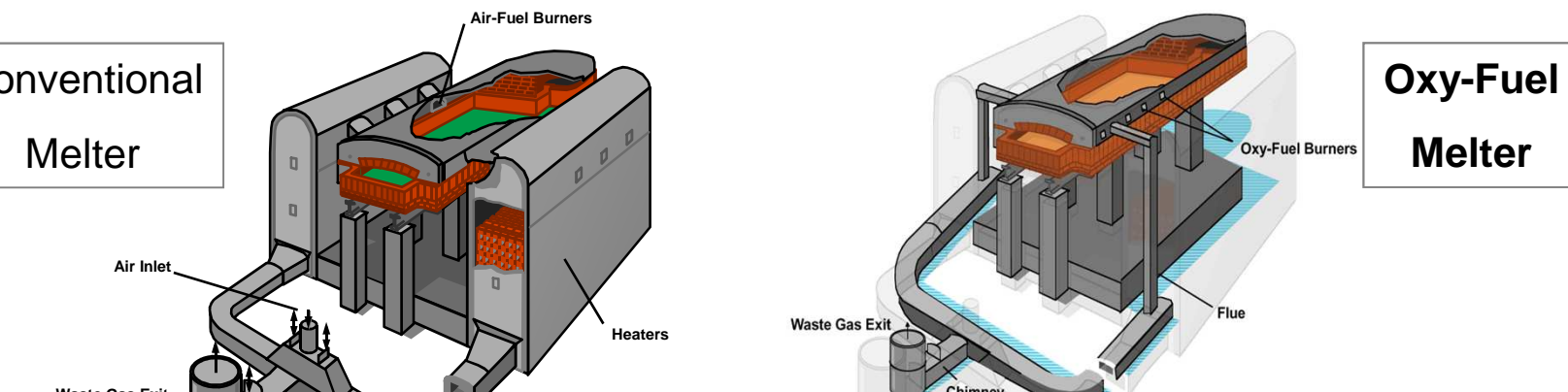
Clean Energy Laboratory

Typical Oxy-fuel Equipment Layout



Environmental Friendly

- Float/Container/Displays/Fibers
- Oxy-Fuel Melting: 60-85% NO_x Reduction
 - Reduced capital/fuel/maintenance
 - Extension to float glass



Number of Full Oxy-fuel furnaces in Asia 5 TPD ~ 600 TPD

	Float	Flat & Solar Cell	Container	Specialty & Tableware	Glass Wool	E Glass Fiber	TFT - LCD	Total
China	2	>5	2	6	2	>50	>6	>77
India	-	-	3	-	3	3	>10	>19
Japan	-	-	-	-	-	10	>20	>30
South Korea	1	1	-	-	>2	>2	>5	>11
USA	-	-	-	-	-	2	-	2
Asia	<2%	30%	<3%	20%	~40%	~90%	100%	>139

Full Oxy-fuel is mandatory for TFT-LCD Glass and E Glass Fiber recently

Full Oxy-fuel has been well adopted by Solar Cell Glass manufacture

Full Oxy-fuel is preferred by Boron contained Glass such as heat resistant glass and Glass Wool

Full Conversion After Cold Repair in Container Glass



Before And After Conversion

Heavy Oil	<u>Air-fuel</u>	<u>Oxy-fuel</u>	<u>Change</u>
	270TPD	300TPD	+11%
ce Area	117sqm	117 sqm	Same
ton Glass	4.35 MMBTU/T glass	3.6 MMBTU/T glass	-17%
ic Boosting	550Kwh	N/A	Delete
mmission	300ppm	No measure Req'd	-80%
y		Improved	Improved

Cleanfire® HR_e™ Burner – New Offering

(patent pending)

First Smart Burner for glass
electronic monitoring of key
burner parameters

Wireless data transfer

Battery powered (~6 month
lifetime)

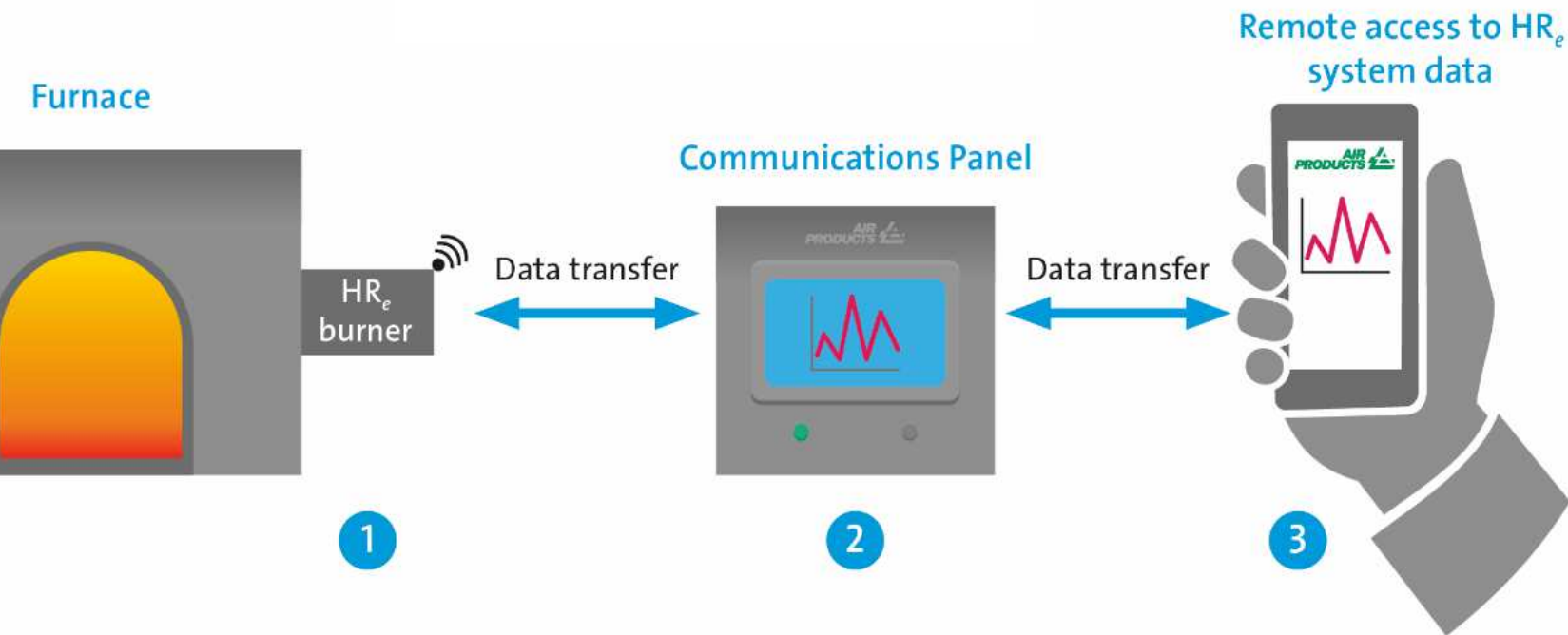
IEC stamped

Direct replacement for HR_i™
burner



HR_eTM Burner – System Overview

(multiple patents pending)



The HR_eTM System includes:

HR_eTM burners with wireless data communication

Communications panel box

Data accessible via internet with username and password

Air Products Combustion Solution For Full Oxy-fuel Glass Furnace

Years of experiences in Oxy-Fuel applications

Reliable oxygen supply system, Cleanfire[®] burners, flow control system and process safety

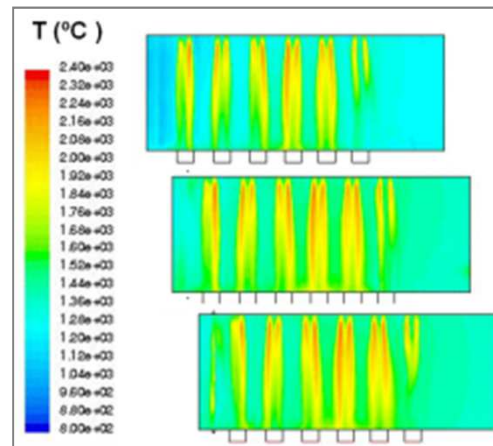
Assistance in furnace design and option selections

Burner Arrangement/Configuration

Economic analysis which includes evaluation of different options

Recommendations on operating conditions and computer modeling

Startup assistant / Safety training



Mode of Supply – Factors For Consideration

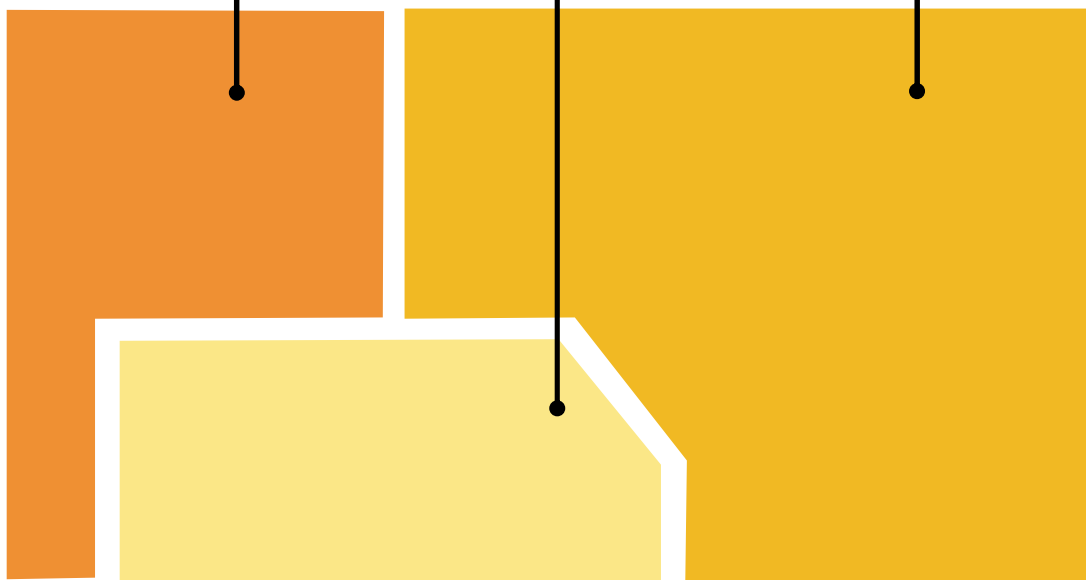


urity %

5%

03%

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- Liquid
- Adsorption
- Distillation

Air Products' On-Site Generation - Concept

Air Products designs, invests, installs, maintains, owns and operates generator at customer's site

Dedicated production capacity and corresponding product back-up capability will be provided

Long-term Supply Agreement (typically 10 to 15 years)

Monthly Facility Charge

Customer responsible and typically pay for the supply of:

- Land, foundation and civil
- Power
- Utilities (cooling water, IA)

Air Products' On-Site Supply for Glass Industry – Safe and Reliable

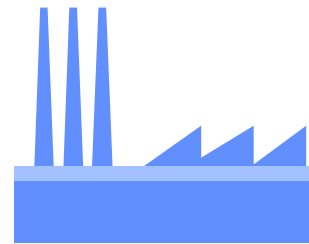


PRISM® VSA Oxygen System

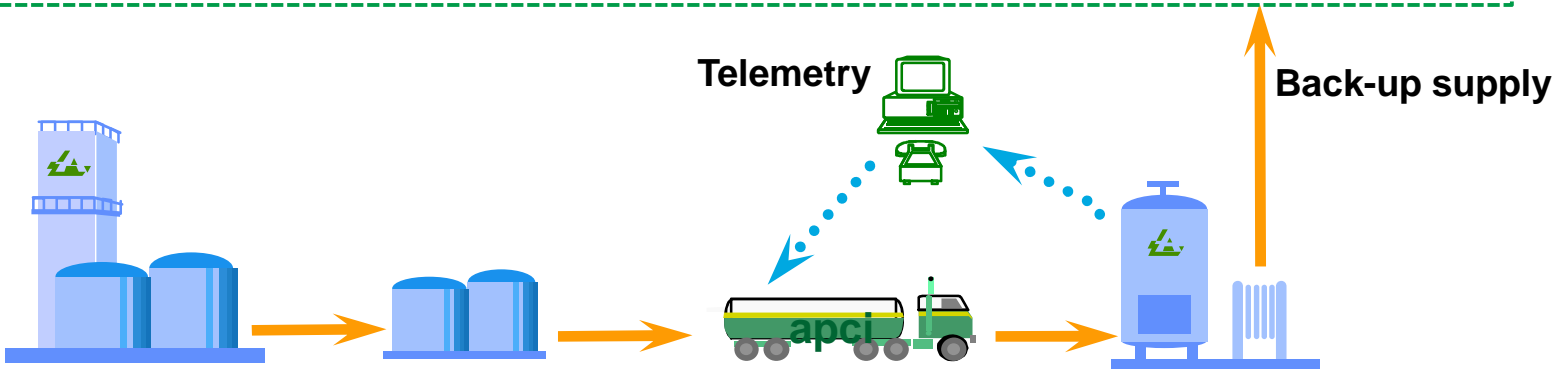
Customer's Site



Pipeline



Customer Operations



Telemetry

Back-up supply

Our Products' On-Site Generation - Advantages

State-of-the-art VSA technology (Vacuum Swing Adsorption) for generation of Oxygen

Highly reliable plant and efficient operation to ensure minimum gas supply interruption

Integrated back-up liquid supply further ensure uninterrupted gas supply all-year-round

Sharing of spares regionally – save times and costs

No Capex spend for customer

Strong Presence in the Glass Industry in Asia!

More than 33 customers with more than 40 plants installed and in operation!

Country	Main Product
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	Container/Tableware
China	Container/Tableware
Taiwan	E-Glass Fiber
Korea	E-Glass Fiber
Korea	E-Glass Fiber
Korea	E-Glass Fiber

Country	Main Product
Korea	Container/Tableware
China	Container/Tableware
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	E-Glass Fiber
China	Special Glass
Thailand	Frit
Thailand	Float
Taiwan	Special Glass
Taiwan	E-Glass Fiber
Indonesia	Float
Taiwan	E-Glass Fiber
China	E-Glass Fiber
China	Special Glass
China	E-Glass Fiber
China	E-Glass Fiber

Thank you
tell me more

