

# FIELD Upgrading

## **New Technology for Heavy Oil Desulphurization and Upgrading “DSU”**

IBIA Annual Convention  
November 4, 2014



# Field Upgrading Overview

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- Technology development company based in Calgary, Canada
- Focused on heavy oil desulphurization and upgrading
- Core technologies based on oil industry experimental work paired with CoorsTek ceramic ionic conductor technology

**COORSTEK**  
*Amazing Solutions®*



CoorsTek Staff and Laboratory, Utah, USA

# Field Upgrading Overview

- Building \$18 million, 10 bpd (500 TPA) pilot plant
  - Private and government funding in place
- World-class leadership and staff
  - Chairman: Former president and founder of several multi-billion dollar oil companies: Chauvco, Fort Chicago Energy Partners, Western Oil Sands
  - CEO: Former executive at Shell, Petro-Canada and Suncor Energy
  - CoorsTek staff and lab
  - Technical team with deep oil refining and marketing experience
  - Advisory Committee comprised of members from major oil companies and bunker industry

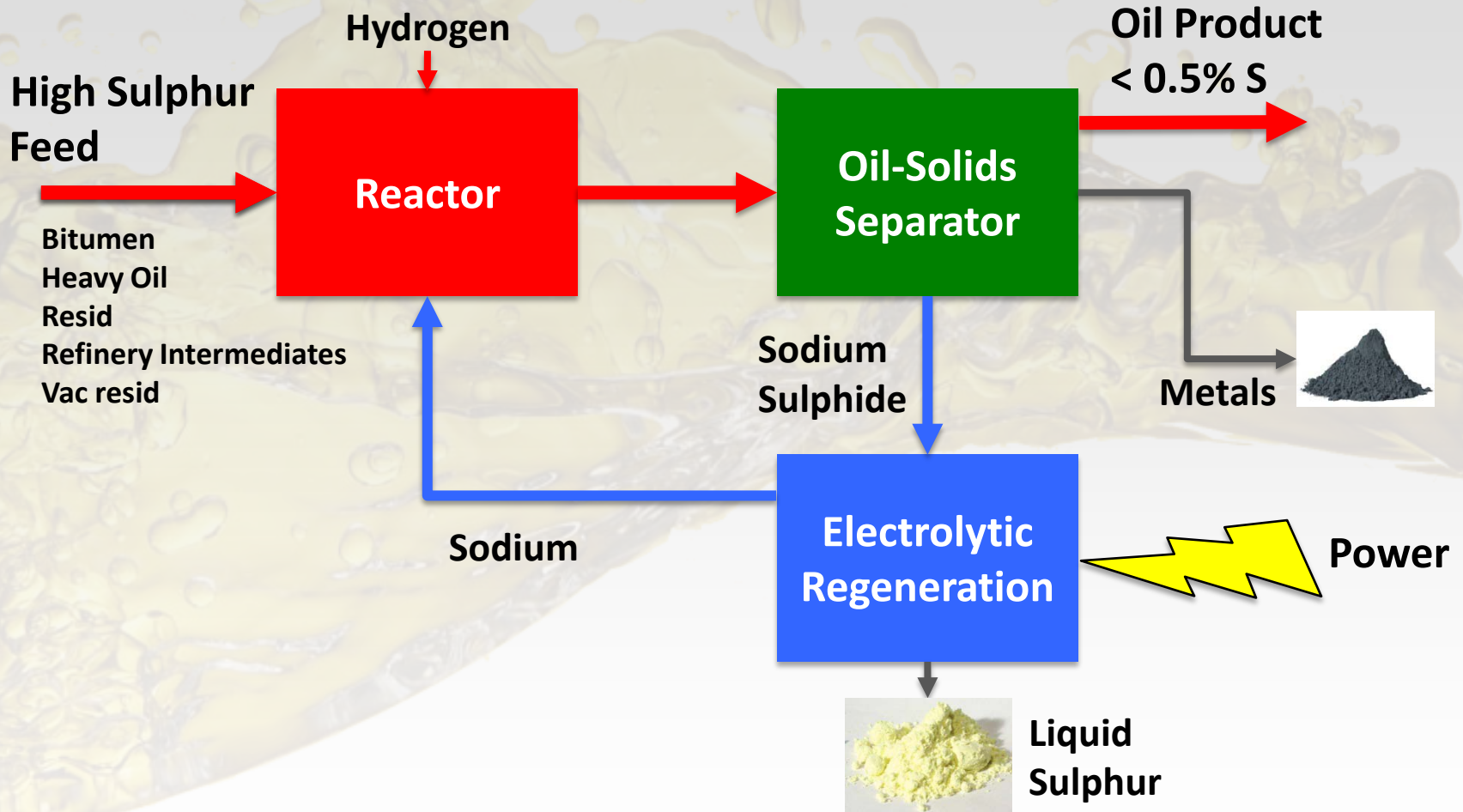


Sister Company Pilot Plant, Alberta, Canada





# Field Desulphurization & Upgrading (DSU) Process Overview



# Field DSU

## <0.5% S Bunkers From High Sulphur Feeds

Property	DSU Feed: Vac Resid	DSU Raw Product	DSU Blended Product <sup>1</sup>	ISO 8217 2010 RMG 380 Specs
Sulphur, wt%	6.24	0.49	0.46	Varies
Density, kg/m <sup>3</sup>	1,040	975	963	991 Max
Viscosity at 50° C, cSt	2,778,233	943	357	380 Max
Acid Number, mg KOH/g	1.9	<0.1	<0.1	2.5 Max
MCRT, wt%	22.4	14.6	13.6	18 Max
CCAI			824	870 Max
Flash Point, ° C	>60	>60	>60	60 Max
Pour Point, ° C	>30		<-12	30 Max
Compatibility, Spot#			1	Not required
Vanadium, wppm	309	4	4	350 Max
Aluminum + Silicon, wppm	4	<4	<4	60 Max
Ash, wt%	0.1	<0.1	<0.1	0.1 Max
Sodium, wppm		<100 <sup>2</sup>	<100 <sup>2</sup>	100 Max

<sup>1</sup>7% distillate in DSU Blended Product

<sup>2</sup>Process will be designed to meet ISO spec

- Demonstrated ability to reduce 6.2% S vac resid to 0.46% S ISO spec blended product
- Expect 0.1% S bunker from 2% S vac resid feed
- Significant density and viscosity reduction
- Removes nearly all metals and acids
- Sulphur and metals are the only byproducts

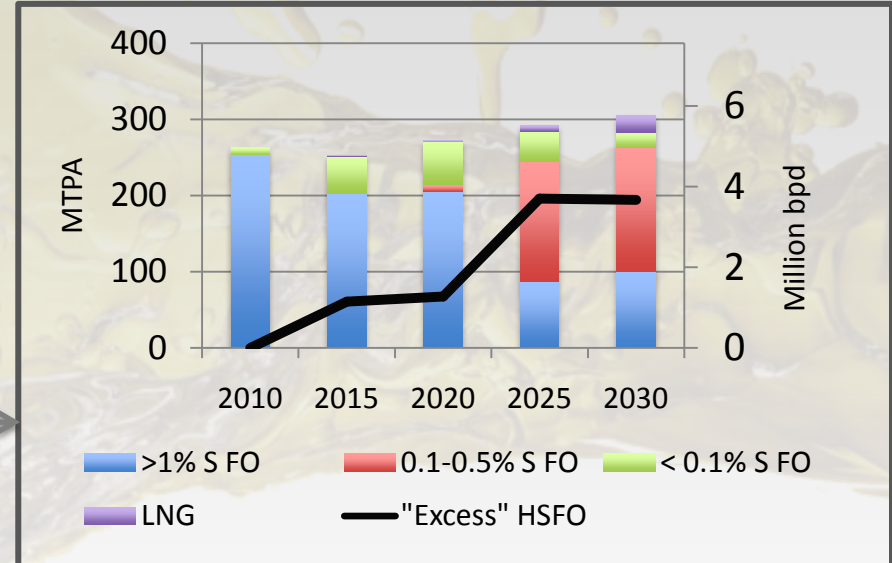
# Unprecedented Change in Bunker Market

## Bunker Fuel Oil Sulphur Specifications

Date	ECAs	Global
Current	1.0%	3.5%
January 2015	0.1%	3.5%
January 2025	0.1%	0.5%

New specs and increasing resid supply lead to 200 MTPA "excess" HSFO by 2025  
 <0.5% S FO demand up by 200 MTPA

## Forecast Bunker Fuel Oil Demand and "Excess" HSFO



### Refiner's Options

- Do nothing: Sell HS RFO into new markets
- Invest in resid destruction: Sell MDO, less RFO
- Invest in resid desulphurization: Sell LS RFO

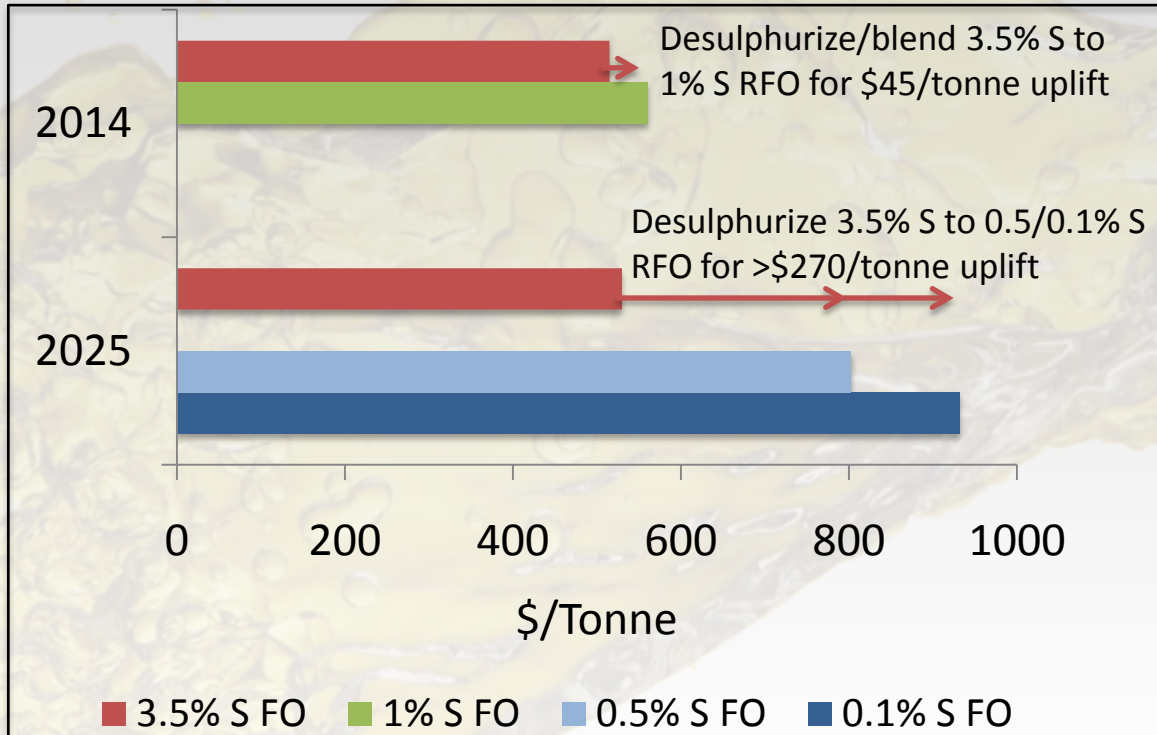
### Vessel Operator's Options

- Do nothing: Buy LS RFO or MDO
- Install scrubbers: Buy HS RFO
- Invest in LNG: Buy LNG



# Spec Changes Create Large Desulphurization Opportunity

## Bunker Pricing: Low Sulphur vs. High Sulphur Fuels



## 2014

Uplift from 3.5% S to LS	Volume	Total Uplift
\$45/tonne (\$7/bbl)	30 MTPA (0.6 MBPD)	\$1 B/yr

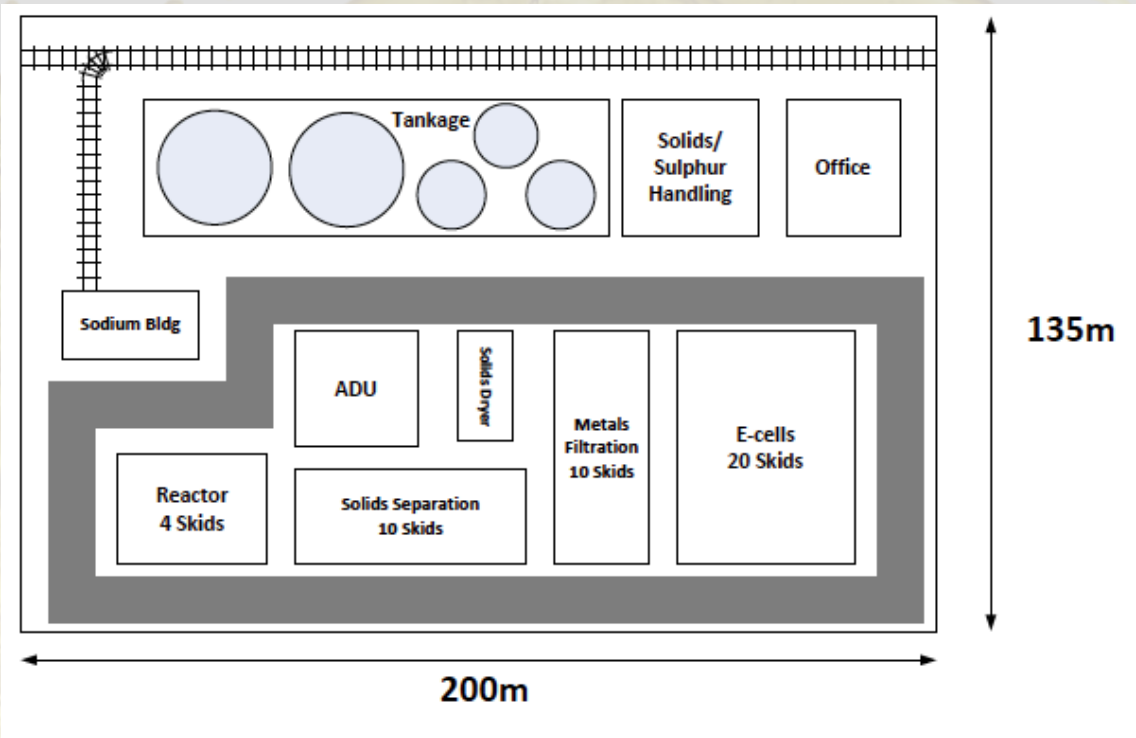


## 2025

Uplift from 3.5% S to LS	Volume	Total Uplift
>\$270/tonne (>\$40/bbl)	200 MTPA (3.8 MBPD)	>\$55 B/yr

# Field DSU Plant Layout


## Typical Layout for 10,000 bpd (500,000 TPA ) Field DSU Plant



- Modular design
- Process units pre-fabricated in 12'x12'x48' (4mx4mx15m) building blocks or "skids"
- 45 skids for 0.5 MTPA plant
- Minimal on-site construction
- Lower CO<sub>2</sub> intensity & minimal SO<sub>x</sub>.
- Utilities:
  - 20 MW power supply
  - 5 mmscfd hydrogen supply



# Field DSU Commercialization Timeline

2012	2014	2015	2016	2017	2018	2019
<b>LAB</b>						
<b>Core lab work: 2012-2014</b>						
	<b>PILOT: 500 TPA (10 bpd)</b>					
	<b>Design</b>	<b>Start-up</b>				
			<b>COMMERCIAL DEMO: 50,000 TPA (1,000 bpd)</b>			
			<b>Design</b>		<b>Start-up</b>	
					 <p><b>LARGE-SCALE DEPLOYMENT</b></p>	

# Field DSU Summary

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- Spec changes will create large increase in demand for resid desulphurization
- Field DSU is a unique, lower cost technology for sulphur removal from resid
- Demonstrated to desulphurize 6% S resid to ISO spec bunkers with <0.5% S
- Expected to desulphurize 2% S resid to ISO spec bunkers with <0.1% S
- Significant reduction of metals, acids, viscosity, density
- Commercial 50,000 TPA plants available by 2020

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# THANK YOU!

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