



I^YQ Upgrading

**Technology for maximizing yield of clean fuels
from heavy oil and bitumen**

July 2018



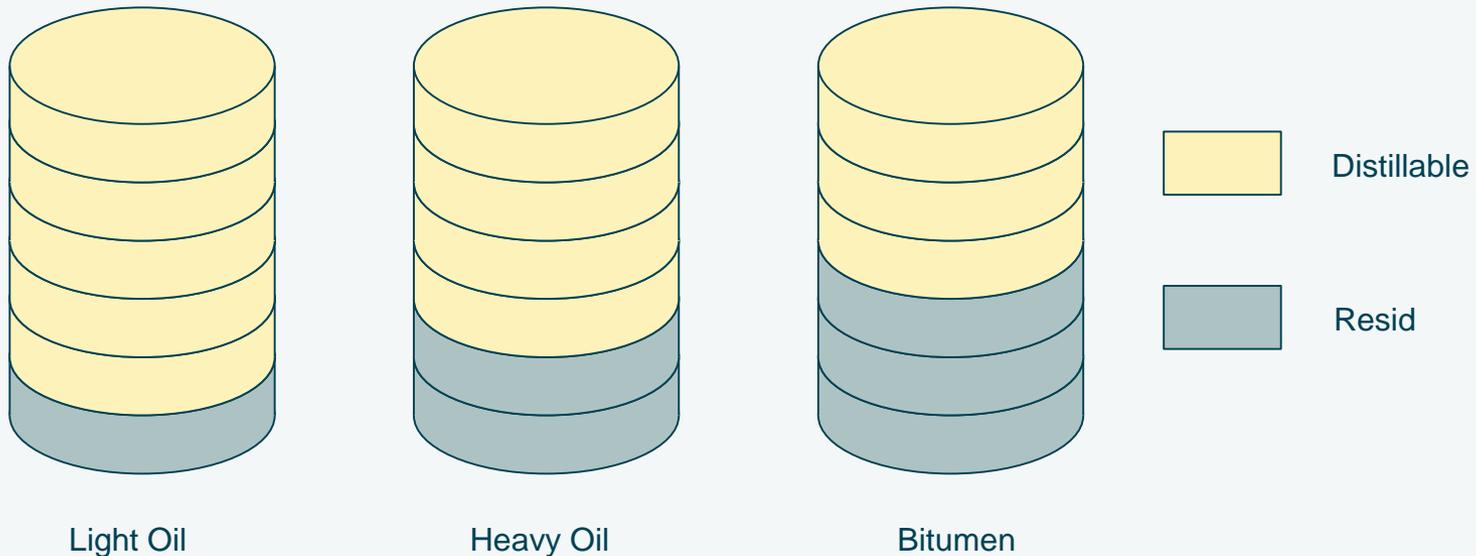
Executive Summary

- Edmonton-based refineries producing clean fuels with “deep conversion” of heavy feedstock are now some of the most profitable in the global energy space
 - Returns will only improve next year with move to 0.5% for sulfur emissions from marine bunker fuels (IMO 2020)
 - Expect IMO 2020 to usher in a new era of unprecedented investment in deep conversion capacity
- With an approach that delivers double-digit improvements in margins, I^YQ Upgrading is proprietary technology that is uniquely positioned to take advantage of new investment in deep conversion
 - Only new technology focused on a low capital approach for maximizing yield of clean fuels from heavier crudes
 - ETX owns, and has spent more than a decade on the award winning development of I^YQ Upgrading
 - Environmental impact of oil sands development is slashed when efficient processing and links to premium markets are combined with responsible disposition of by-products
- Technology Demonstration Plant (TDP) for I^YQ Upgrading now required to support full commercial rollout – recent work conducted with funding from Industry supports case for 14,000 bpd scale
 - Strategic options: ETX actively soliciting proposals by qualified 3rd parties to enable timely progress on TDP
 - Significant free cash flow and project level returns from TDP with increasing throughput
 - All proposals considered beginning Aug. 15, including potential for full transfer of IP from ETX to 3rd party
 - Government of Alberta has set aside \$1 billion for large scale demonstration of technology like I^YQ Upgrading - timing allows potential for new owners to consider application for support by Sept. 4th deadline



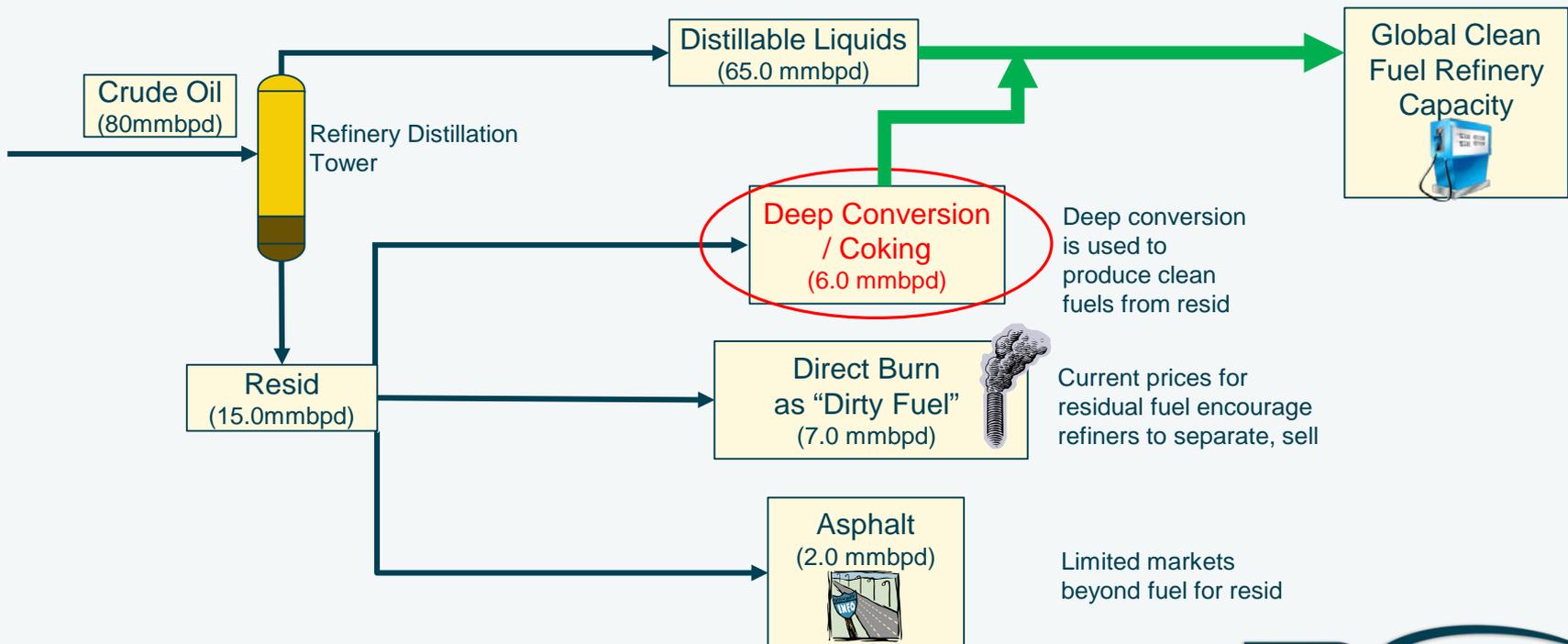
Background: Light versus Heavy Crude

- All crude oil is made up of both light and heavy components, heavy crudes have increased bias to heavy components
 - While lighter components can be removed from crude through distillation, the heavier components cannot and are thus called residual or “resid”



Background: Markets for Resid

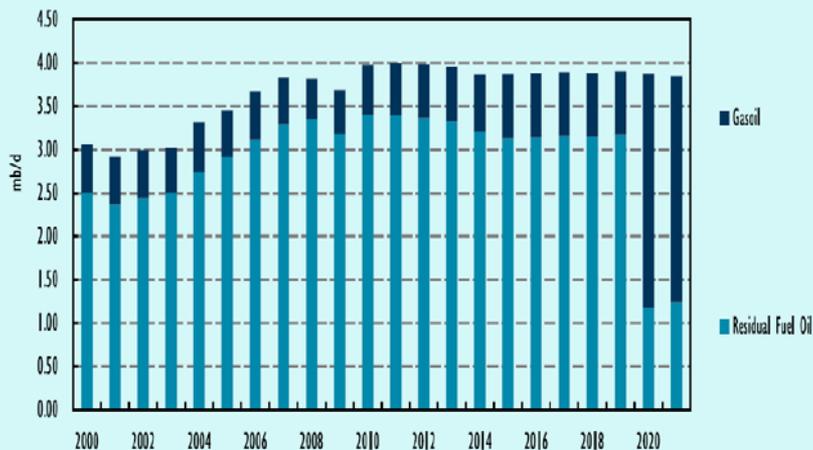
- Most demand for resid comes from markets looking to harness energy content, with limited but stable incremental demand coming from asphalt and other non-fuel markets
 - With additional processing resid can be used to support production of clean fuels - deep conversion / coking technologies produce distillable liquids that conventional refiners then convert into gasoline and diesel
 - Resid can also be sold directly as residual fuel without further processing, but resid is rich in carbon, sulfur, and other contaminants and use of this “dirty fuel” is creating significant environmental and health issues
- To date, robust demand for dirty fuels for marine bunkers has limited investment in deep conversion



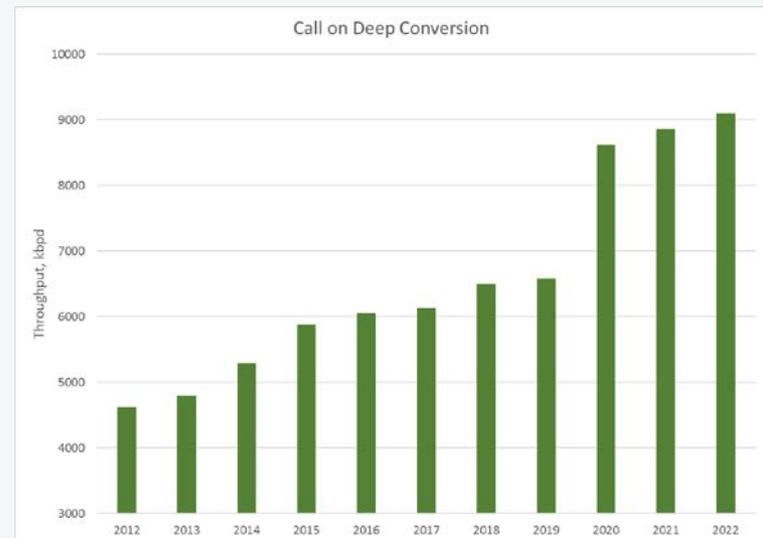
The Times, They are a Changing

- The International Maritime Organization (IMO) has recognized need to address the adverse consequences related to use of residual fuel by their industry and is making unprecedented moves
 - New 0.5% cap on sulfur emissions from marine bunkers effective Jan. 1, 2020 (IMO 2020) is expected to decimate demand for High Sulfur Fuel Oil (HSFO) with additional measures focused on GHGs beginning 2023
 - Case for new investment in deep conversion is expected to be better than it ever has been

Figure 1.12 Oil based marine fuel consumption in international navigation



From IEA Medium-Term Oil Market Report 2016



Getting More from Deep Conversion: I^YQ Upgrading

- ETX Systems has spent more than 10 years on the award winning development of I^YQ Upgrading, a proprietary process designed to get the most from deep conversion with minimum capital scope
 - Low capital approach for full conversion of resid with maximum yield of distillable liquids to minimize lifecycle GHGs
 - Eliminates need for diluent and targets end-markets closest to resource to minimize transport GHGs
 - Minimizes yield and hydrogen content of carbon-rich by-product to enable economic sequestration of this material



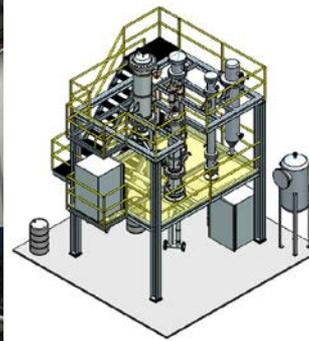
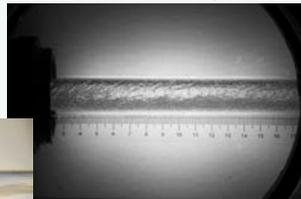
Conception

Feasibility

Process Development

Piloting

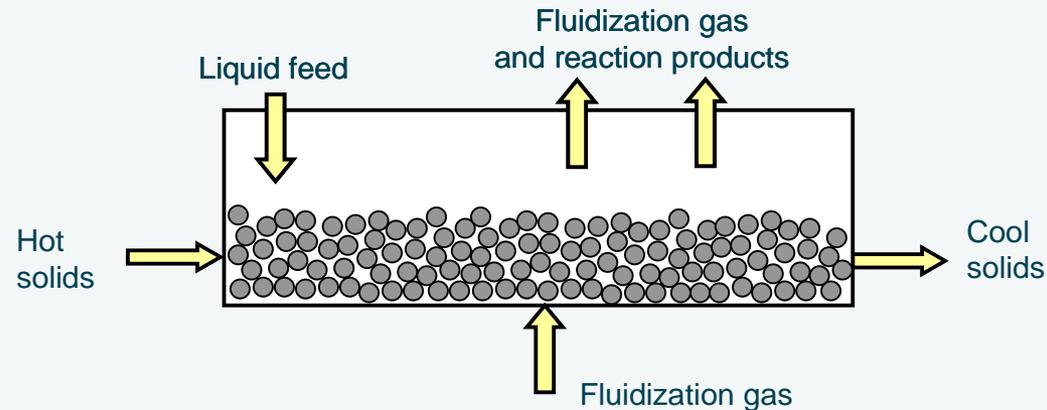
Commercialization



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I^YQ Upgrading – How We Do It

- Combination of two commercially proven technologies
 - Plug-flow dryers
 - Fluid bed coking

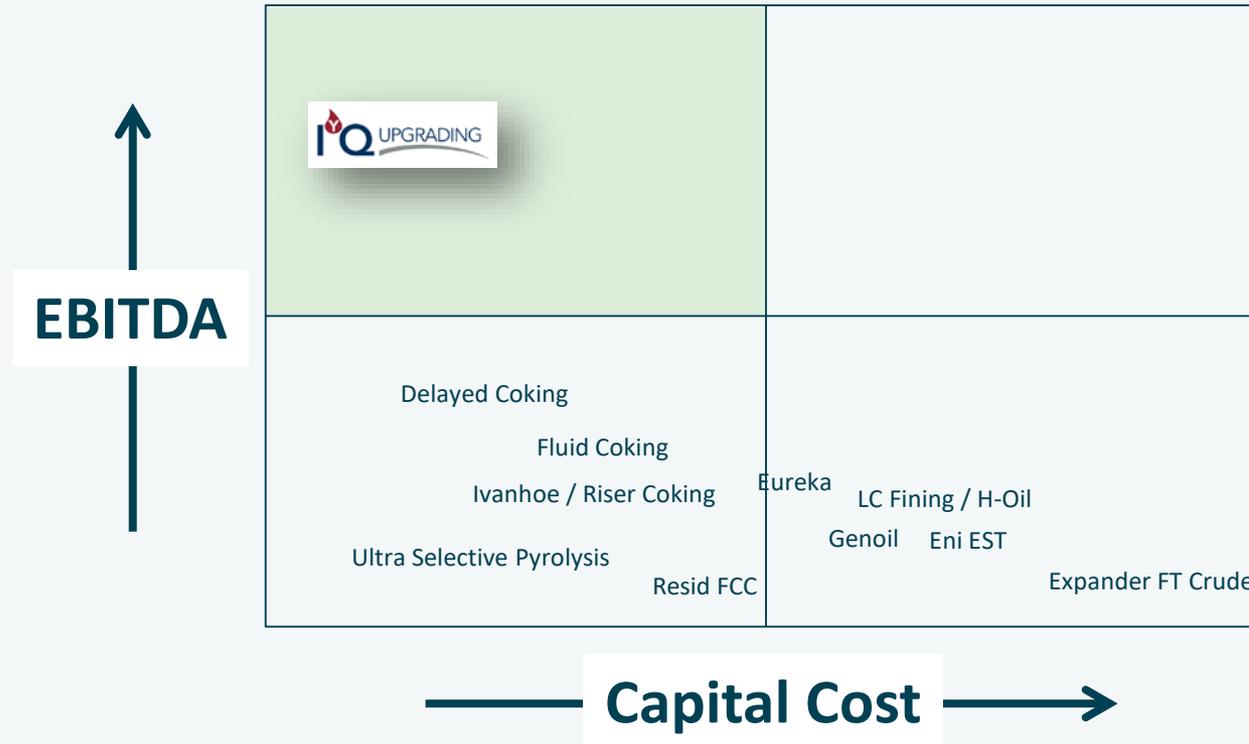


- Patented process approaches ideal deep conversion
 - Higher yield of valuable distillable liquids
 - Produces less lower value by-products
 - Enables reduced capital scope



Competitive Landscape

Focused on clean fuels, no diluent required



Increasing yield of clean fuels with less capital provides better investment returns – I^YQ Upgrading stands alone



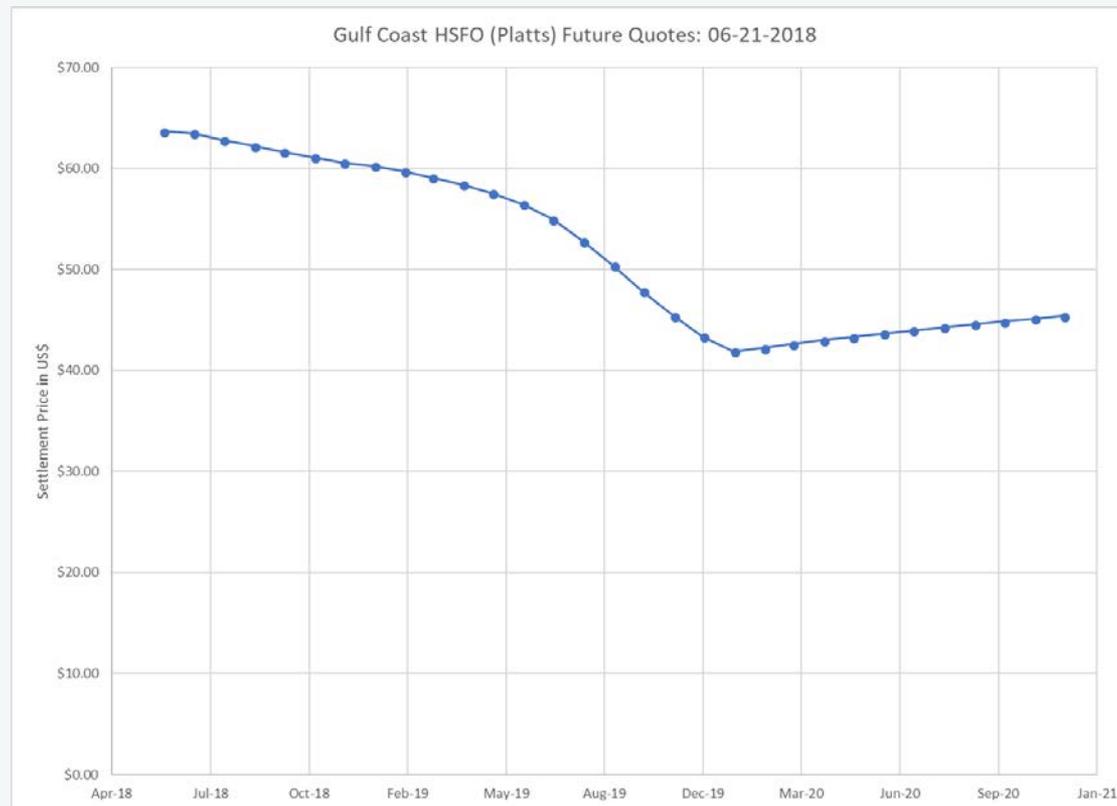
High Grading Investment in Deep Conversion: Alberta

- Unique circumstances have made Alberta the most attractive jurisdiction in the world for operation of deep conversion assets, with excellent potential for investment in new capacity
 - Technology, scale, scope, and product marketing have significant impact on returns for new investment

Opportunity	Present?	Comment
Discounts on heavy crude feedstock	✓	Quality and location / logistic considerations are combining to create massive discounts
Access to Premium markets	✓	Clean fuels receive premium value in the inland US markets closest to resource
Access to incremental barrels	✓	\$100+ billion spent to develop 2+ mmbpd of bitumen resource on non-integrated basis
Support for value-add in Province	✓	Under-employed workforce, recent work and policy to support “partial upgrading”
Mitigating environmental impact of oil sands	✓	Economic sequestration of carbon, efficient links to market, production of clean fuels

Outlook for Deep Conversion

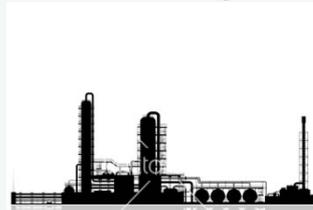
- Future markets are signalling a significant (\$20+) collapse in the price of bitumen and other typical deep conversion feedstocks over the next 18 months lending additional support to margins
 - Reflects impact of new 0.5% sulfur cap on marine bunker fuels



Technology Demonstration Plant (TDP)

- Final development step, to resolve operability inputs for full commercial rollout
 - Extensive work with Fluidization Group at Hatch Engineering (Mississauga) on reactor to reflect IP completed
 - Cold flow work at Coanda Research at ~1,000 bpd scale to develop design equations for reactor completed
 - Large scale testing of proprietary feed nozzle completed
- Previous study completed with funding from Industry to support potential for 14,000 bpd scale

Integrated with
**Crude-by-Rail
Facility**



~\$250
million

14,000 BPSD
Plant

JACOBS

Completed \$1 million
Study (2014) for
integrating with sour gas
plant

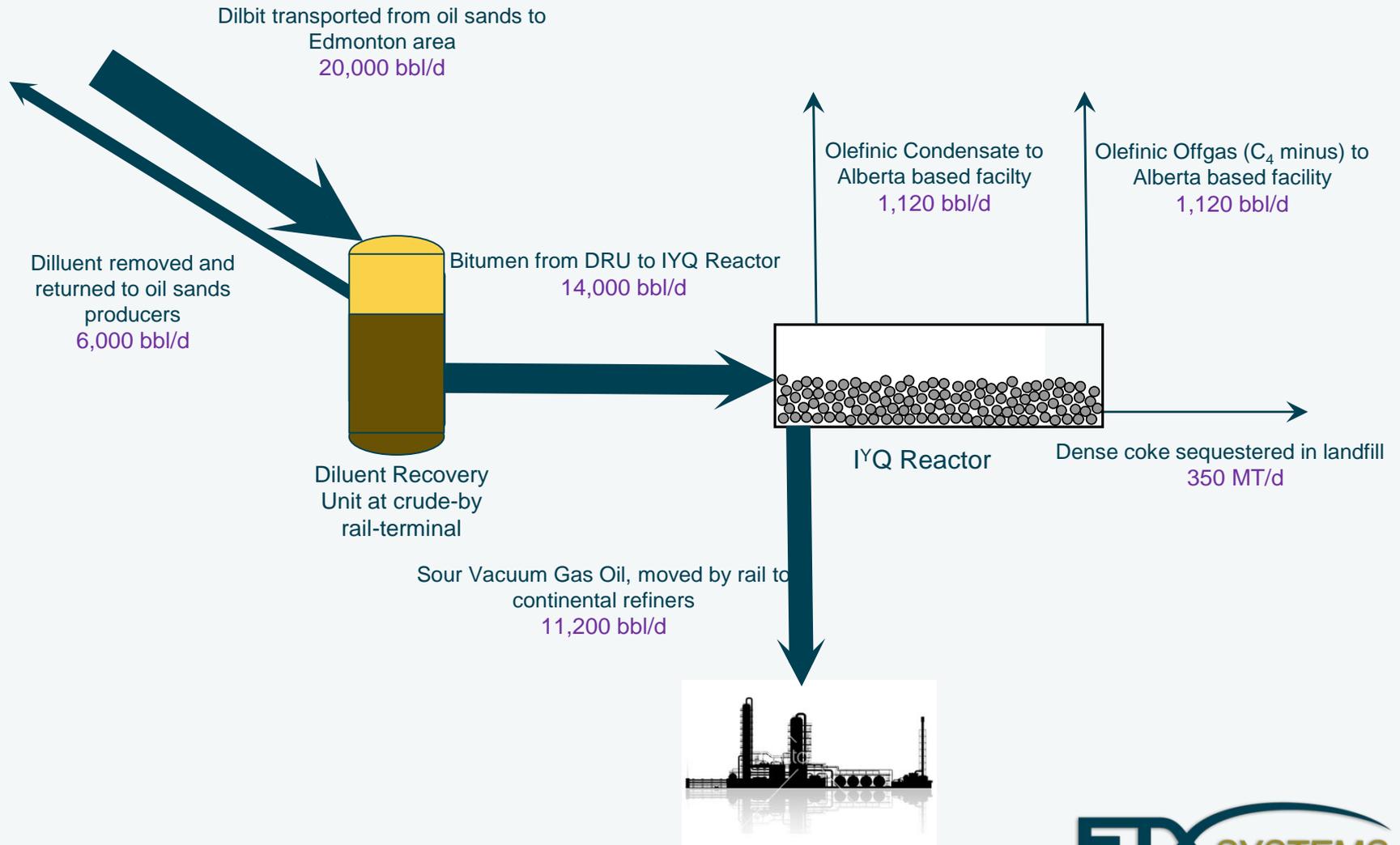
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Strategic Options for TDP, I^YQ Upgrading

- Government of Alberta has approved \$1 billion in funding for developments like TDP with Sept. 4th deadline for applications
 - ETX is looking at strategic options to ensure any application that is made for funding to advance TDP has the committed support of one or more companies with internal ability to fully fund and progress this exercise
 - To gain required support for the TDP, ETX is prepared to consider all proposals from qualified 3rd parties by August 15th including full transfer of ownership of all IP related to I^YQ Upgrading
 - ETX well prepared to support details of application based on site and input provided by interested 3rd parties



TDP Product Flow & Price Schematic



Appendix



Partial Upgrading with Partial or No Conversion

Focused on diluent rather than resid

Fractal Jet Shear
SDA
Value Creation ADC
HIQ (MEG)
Visbreaking

Aquaconversion
MSAR
Orimulision
Petrobeam
+
Others

Rival TRU
Ellycracking
Superior Upgrading
Petrosonic
Supercritical

Spending \$\$\$ To Move Heavy Barrels
To Distant Markets That Don't Want or Need It

