



# Maximise Heavy Oil Blending Profits

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As the world's sweet crude reserves decline and the demand for inexpensive feed stocks continues to grow, crude blends and the world's Heavy Oil or Bitumen reserves are likely to play a key role in supplying global energy needs for the remainder of this century. Heavy Oil or Bitumen reserves are estimated to be 53% of the world's total oil reserves. Bringing such a product to market has challenges of its own, as they are carbon rich and highly viscous. But as the price of virgin crude grows, the refining of heavy oil into synthetic crude, and the blending of crudes to meet specific market demands, will become increasingly attractive based on fundamental economic principals and foreseeable demand patterns.

One of the key properties of refined synthetic crude, as with regular crude, is the sulphur content, as it directly impacts the price of the crude. Therefore, precise sulphur measurements are critical when optimising refining or blending operations. By optimising the process with a precise in-line measurement of sulphur content, costs can be minimised and maximum profitability can be achieved.

To address more rigorous refining (Heavy Oil) and blending requirements, a new 3rd generation X-ray Transmission (XRT) sulphur gauge has been introduced by Applied Rigaku Technologies: the Rigaku NEX XT. Rigaku, a global leader in X-ray analytical instrumentation, has engineered a process gauge that surpasses previous generation technology by providing reliable real-time in-line sulphur analysis, thus allowing blending operations to operate closer to the theoretical optimal levels.

## New In-line Sulphur Gauge



With uniquely engineered hardware and novel proprietary software technologies, the new Rigaku NEX XT system is faster, more sensitive and far more compact than previous generation systems, and provides continuous, reliable detection of sulphur in heavy hydrocarbons. Sulphur may be quantified from 200 parts-per-million (ppm) to high percent levels with analysis times as short as 1 second. The Rigaku NEX XT can operate as a stand-alone analyser or provide real time closed loop control when tied into a blending or plant wide automation system.

Among its other key features are a simplified user interface, reduced requirement for standards, automatic density compensation, automatic water compensation, password protection, and standard platform for communicating sulphur, density, and water content to a Distributed Control System (DCS). Due to its unique design and robust construction, sample conditioning and recovery systems are typically not required.

Profit Analysis For Crude Oil Blending						
Canada Heavy Hardisty			WTI			
High Sulphur			Low Sulphur Product			
Price/bbl (USD)	\$61.00	Price/bbl (USD)	\$72.00			
%S	3.36	%s	0.24			
Product Delivered	Target %S	Low S %	High S %	Cost	USD	Savings per 200K bbls
Low Sulphur Product	0.24	100.00	0.00	\$72.00	\$0.00	\$0
Blend A	0.44	93.59	6.41	\$71.29	\$0.71	\$141,026
Blend B	0.45	93.27	6.73	\$71.26	\$0.74	\$148,077
Blend C	0.46	92.95	7.05	\$71.22	\$0.78	\$155,128
Blend D	0.47	92.63	7.37	\$71.19	\$0.81	\$162,179
Blend E	0.48	92.31	7.69	\$71.15	\$0.85	\$169,231
Blend F	0.49	91.99	8.01	\$71.12	\$0.88	\$176,282
Blend G	0.5	91.67	8.33	\$71.08	\$0.92	\$183,333
<b>Maximum Sulphur Allowed (wt%):</b>					0.5	
<b>Delivery (bbl):</b>					200,000	
<b>Maximum Profit Potential (Blend F vs. Blend A):</b>					\$35,256	

Figure Above: The profit analysis demonstrates the maximum profit potential available under the scenario presented. Given the stability and accuracy of the Rigaku NEX XT process gauge, it is possible to blend closer to the theoretical optima than with previous generation analysers.

## Blend to Optimal Profitability

The Rigaku NEX XT in-line system provides a means to precisely blend or refine crude oil, relative to sulphur content, to achieve an end product with maximised value for a given set of input stocks. As an example, consider blending less expensive high sulphur crude (Canada Heavy Hardisty) with more expensive low sulphur crude (WTI) to achieve a blend exactly at the optimum sulphur content to make low sulphur fuels. By blending the two crudes as close as possible to the maximum allowable limit of 0.5% sulphur, significant additional value can be realised for each 200,000 bbl delivery batch in this illustration.

## Bunker Fuel Blending Also Benefits from Sulphur Gauging

In addition to crude oil, over the past year, the marine fuel oil market has seen noteworthy rises in feedstock and final product prices that have coincided with significant regulatory changes under the revised MARPOL Annex VI. Pressure on fuel quality and availability, as well as and increased competition amongst suppliers, has coincided with pressure from MARPOL to validate the quality of fuel being distributed. These seismic changes are forcing many suppliers to reevaluate and reengineer aspects of their business model in order to remain competitive.

## Analytical Performance

To demonstrate the analytical performance of the new 3rd generation X-ray Transmission process gauge from Rigaku, both long-term repeatability and relative accuracy were measured. To demonstrate repeatability (precision), the measurement protocol involved simply introducing a sample and using valves to close the sample in a static position. Repeat measurements were then acquired.

## Field Sample Analysis Compared to EDXRF (ASTM D4294)

XRF wt% Laboratory Instrument	NEX XT wt% Process Gauge	Deviation	Density
0.084	0.084	0	0.8003
0.482	0.488	0.006	0.8152
1.85	1.89	0.04	0.8504
0.37	0.39	0.02	0.8149

The following data shows Rigaku NEX XT results compared to Energy Dispersive X-ray Fluorescence (EDXRF) results for four crude oil samples collected from the field.

**Conclusion**

As change is the harbinger of opportunity, investing in state-of-the-art on-line process sulphur gauge technology - to gain commercial advantage by ensuring the flexible delivery of high quality and, certified products - is becoming an imperative for companies whose strategy is to become or remain a dominant player in the petroleum market.

While in-line blending has been around for years, older technologies are often not suitable to deliver performance to keep pace with modern needs in the petroleum industry or deliver precise enough blends to optimise profits in today's economic environment. For the reliable on-line determination of sulphur, the new Rigaku NEX XT resolves those past issues and is thus an excellent tool for sulphur measurement in the optimum blending of crude oil, bunker fuels and other heavy hydrocarbon oils.

