OPPORTUNITY CRUDES CONFERENCE 2010

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Technology Innovations to Satisfy Changing Market Conditions & Climate Regulations

ABSTRACTS

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PRESENTATION ABSTRACTS, DAY ONE

Monday, 25th October

Challenges and Opportunities for Reducing GHG Emissions from Canadian Oil Sands Derived Crudes

Eddy Isaacs, Alberta Innovates - Energy & Environment Solutions

Abstract

The prosperity of the Canadian Province of Alberta is closely linked to the sustainable long-term growth of its abundant energy resources including oil, natural gas, oil sands, coal and renewable energy. Advanced technology is essential factor for creating high-skilled, high-income workers and for the diversification of the energy economy to valuable products and services. The potential to add such value in the future requires an integrated and balanced approach that minimizes environmental impacts and utilizes Alberta's energy resources to optimize economic benefits.

This presentation will examine the life cycle greenhouse gas emissions (GHG) of both US domestic and imported crudes in US refineries. The focus will be on the emerging technologies and innovations that can be applied to produce and add value to the Canadian oil sands resources and products while decreasing impact on GHG emissions. The strategic approach is to stimulate next generation upgrading, gasification, and carbon capture and storage to ensure a smooth transition to a sustainable value-added economy.

Biography:

Eddy Isaacs is the CEO of Alberta Innovates - Energy & Environment Solutions (EES) with responsibility for Alberta's strategic directions and investments in energy technologies, environmental technologies and renewable and emerging resources.

He has been instrumental in promoting innovation in energy and environment across Canada and has served as co-Chair of the Energy Technology Working Group of the Canadian Council of Energy Ministers. Eddy is a Fellow of the Canadian Academy of Engineering and currently serves on the Boards of the Petroleum Technology Alliance of Canada (PTAC), NRC Institute for Fuel Cells Innovation (NRC IFCI) and NRC Institute for Chemical Process and Environmental Technology (NRC ICPET).

Eddy holds a Ph.D. from the University of Alberta and a B.Sc. from McGill University. He has over 70 publications and 6 patents in the energy field.

Crudes, Non-crudes, Demand & Climate Regulation: the Changing World before Us

Martin Tallett, EnSys Energy

Abstract

The global refining, demand and supply scene is in the middle of a period of unprecedented change and challenge. Sudden demand loss through recession, shifting production by crude type, rising supply of biofuels and other non-crudes, changing demand mixes and geographic centers of growth, advancing quality specifications are all acting to significantly change the outlook. In addition, climate change initiatives, once considered a side case sensitivity, are now center stage. This keynote paper by Martin Tallett, President of EnSys Energy, will set the scene for Opportunity Crudes 2010 by drawing on recent EnSys work to examine how these major drivers at play in the global downstream are likely to interact and impact crude oil and refining economics.

Topics covered will include: crude supply outlook and quality, non-crudes, refinery upgrading capacity requirements and implications for refining capacity and investments, margins and crude price differentials. With these as context, the paper will then focus in on climate/energy policy developments. Coverage will include the USA, Canada, Europe, Japan and Australia, will draw on the findings from EnSys' Waxman-Markey study for the American Petroleum Institute and other work and will examine the latest U.S. Senate proposals. This will include particular attention to the potential for climate legislation to "re-write" crude oil and refining economics and markets.

Biography:

Martin Tallett is President of EnSys Energy & Systems, Inc., an international petroleum consultancy specializing in refining and oil markets. He is a senior advisor to industry and government on how strategic decisions – be they regulatory, technology, market, environmental or geo-political - will impact regional and global refining and markets. His focus is on quantitative analysis and on the fundamentals that drive the industry, its activities and economics. He is a frequent speaker on these topics and his papers have been published in Petroleum Economist, Platts' Oilgram News, IPE Pipeline, Octane Week, Fuel Technology & Management and Chemical & Engineering News among others.

A graduate chemical engineer from the University of Nottingham in England, he held refinery and supply planning positions with Exxon and Amoco Europe before entering consulting in 1977.

Much of Mr. Tallett's activity centers on leading EnSys' WORLD modeling practice. This unique system for integrated "top down plus bottom up" analysis of the global petroleum downstream industry and markets has been employed by and for the US DOE, EIA, EPA, OPEC, US oil companies and other industry organizations since 1988. It is used to evaluate a wide range of issues and developments covering time frames from the present day through 2030. Recent analyses range from assessments of US climate legislation for the American Petroleum Institute and of marine fuels regulations for the EPA, International Maritime Organisation and API to the medium and long term refining outlook as part of the OPEC *World Oil Outlook* 2009 and now 2010, and from evaluation of sub-Saharan African refining for the World Bank to the impacts of alternative fuels, and the outlook for major refining catalysts and additives. Evaluation of crude oil and product developments and economics are a central part of these activities as brought together in EnSys' comprehensive DownStreamOne projection service.

Mr. Tallett also heads EnSys' development and support of the Bloomberg crude oil refining netbacks, with a major update and expansion that went online in January 2009. He has undertaken significant expert witness work for ExxonMobil, the City of New York and the States of New York and New Hampshire on refining economics issues. International experience encompasses: the USA, Caribbean, South America, UK, Europe, North Africa and Middle East.

Impact of Climate Change Legislation on Heavy Crude Values

Kurt Barrow, Purvin and Gertz

Abstract

Climate Change legislation is being written that includes the U.S. refining industry as a major source and compliance point for carbon emissions. Cap and Trade programs are intended to provide a lower cost of compliance to the overall economy but there are industries and asset owners that will benefit more than others in the forthcoming carbon accounting. Low Carbon Fuels Standards are likely to add a further constraint on refinery operations and crude slate flexibility. A refiner's crude slate, configuration and even location will affect cost of compliance. This paper will examine the potential impacts of these developments on heavy crude values and discuss how U.S. refiners might best adapt.

Biography:

Kurt began his career as an engineer at the Exxon Baytown Refinery before joining Purvin & Gertz in 1997. Kurt consults on a range of crude, refining and product market topics. After a six posting in Singapore, Kurt returned to Houston to manage Purvin & Gertz' long-range pricing and margins service. Kurt Barrow is a Vice President with Purvin & Gertz, leads the firm's climate change analysis and is the author of the recently released Residual Fuel Market Outlook study.

Charting the Road Ahead for Canadian Oil Sands Crude

Praveen Gunaseelan, Vantage Point Energy Consulting

Abstract

The U.S. refining industry is currently at a crossroads. Historically, refinery expansions fuelled by product demand growth have led to an extensive refining infrastructure that is considered amongst the most sophisticated in the world; one that has the ability to profitably refine crudes of a wide range of quality. More recently, however, market uncertainties in the wake of the financial crisis and looming U.S. regulation on greenhouse gas emissions have slowed the pace of expansion of the industry, raising the possibility of a major industry transformation, including attrition of capacity to globalization. Opportunity crudes have historically been a large part of the growth story for U.S. refining. Canada, for example, has risen from a small source of U.S. crude imports (circa 1980) to the largest exporter of crude to the U.S. since 2004.[1]

This presentation will take a fresh look at the outlook for opportunity crudes, with a focus on oil-sands based crude from Alberta. First, a retrospective look at the oil sands industry will be taken to explain how it has hitherto responded to market forces. This will be followed by a review of recent and current market developments, considering both the economic drivers for oil-sands crude, as well as the impact of greenhouse gas legislation. Based on the insights thus gained, a mid-term outlook for projects based on oil sands crude will be presented. A large portion of these imports include bitumen extracted from the oil sands in the western Canadian province of Alberta. One of the primary drivers for such growth has been the historically attractive price differential between light and heavy crudes. As this price differential has shrunk due to softened product demand in the wake of the recent global recession, it has started to impact projects across the oil sands value chain, from oil sands extraction, upgrading, pipeline transportation, to downstream refining. In addition to the economic uncertainty, increasing legislative momentum to curb industrial greenhouse gas emissions further cloud the outlook for oil sands crude.

[1] "Changing US Crude imports are driving refinery upgrades", P. Gunaseelan, C. Buehler, Oil & Gas Journal, Aug. 10, 2009.

Biography:

Praveen Gunaseelan is the founder and principal consultant of Vantage Point Energy Consulting. He is a professional chemical engineer with over a decade of energy industry experience that includes business development, product marketing, technology commercialization and process optimization. Prior to founding Vantage Point, Dr. Gunaseelan worked as a consultant at Exponent, and in a variety of technical and commercial positions at Air Products & Chemicals in its refinery hydrogen business.

Dr. Gunaseelan has extensively studied the processing of opportunity crudes in conventional refineries to assess the impact on hydrogen and energy demand and carbon footprint, and has

presented his work in leading industry conferences and trade publications. He has served on NPRA's Screening Committee for Hydroprocessing since 2009, and will serve on the Hydroprocessing expert panel at the October 2010 NPRA Q&A Meeting.

Dr. Gunaseelan holds a Doctorate in Chemical Engineering from Purdue University, and is a licensed professional chemical engineer in the state of Texas.

Real-Time Situational Awareness -The Key to Managing the Carbon Footprint from Opportunity Crudes

Craig Harclerode, OSIsoft, Inc.

Abstract

In today's global, dynamic market, companies are looking for ways to continue to both mitigate the effects of increased legislation and regulation in addition to increase value in relation to their peers. From reducing their energy usage and carbon foot print, to improving the agility and flexibility to run opportunity crudes, to optimizing their global value chain, today's leading companies are leveraging advances in technology to innovate and sustain themselves.

One component of any sustainability strategy should be the use of real-time information as a means to capture organizational knowledge, foster collaboration, enable innovation, and improve situational awareness. Leading companies believe that real time information is the currency of the next decade and the ability to monetize will be the key to sustainability. In this presentation, the audience will learn what a real-time infrastructure is and how, when combine with Microsoft tools, can form the foundation for real time situational awareness.

Several case studies in energy and carbon management, advanced collaboration, and integrated supply chain will be used to illustrate core concepts. Particular emphasis will be given to the processing of opportunity crudes and the interdependence in the management of the carbon footprint.

Biography:

Mr. Harclerode is a 30 year industry veteran in the use of automation and information technologies (IT) to improve the performance of refining and petrochemical organizations by solving associated business problems, and delivering improved business growth, profitability, and operational excellence.

Mr. Harclerode's career has included: 15 years at BP (formerly Amoco Oil) in refining operations, IT, and automation; 6 years at Honeywell Industrial Automation and Control (IAC) in global Project Operations Management; 6 years at Aspen Technologies in Global Program Operations Management. Presently, Mr. Harclerode is a Business Development Executive with OSIsoft, Inc. where he consults with refining and petrochemical companies on how the PI System real time infrastructure can add value to their organizations.

Mr. Harclerode is a regular speaker at conferences where his audiences gain perspective of how technology can be leveraged to add value and mitigate many of the challenges being faced in the global, real time market place. He holds a BS in Chemical Engineering from Texas A&M University in College Stations, Texas, USA and an MBA from Rice University in Houston, Texas, USA.

Using Innovative Technology to Optimize Profitability when Processing Opportunity Crudes

Kerlin Lobo, Doug Longtin and Bill Fahey, Baker Petrolite, a Baker Hughes Company

Abstract

Processing of opportunity crude oils leads to a wide variety of challenges in today's refinery. Problems often start before the desalter and lead to desalting upsets, fouling of heat transfer equipment, waste water treatment issues, unit corrosion, catalyst issues and many times product quality issues. The economic impacts addressing these challenges affect refinery profit margins. Advanced technologies and tools are available to manage the many risks/challenges presented when processing opportunity crudes. At the 2008 Opportunity Crudes Conference, Baker Petrolite presented a number of the challenges as well as the specialized technologies and products/programs available to manage the challenges, including the novel use of a desalter acidification program. Since the EXCALIBUR Contaminant Removal program was first developed over six years ago at the industry's request to overcome the processing challenges associated with a specific new-to-market, challenging crude, the technology has continued to be applied to help refiners reduce the risks associated with a variety of opportunity crude processing issues.

Several case histories will be presented that demonstrate the benefits refiners have experienced from the EXCALIBUR program, which can include reduced fouling/energy savings, improved corrosion control/longer equipment life, better management of wastewater treatment plant/fewer environmental exceptions, reduced catalyst makeup rates/reduced catalyst costs and optimum product value. Successful application of a contaminant removal program such as this one allows the refiner to maximize profitability when processing opportunity crudes.

Biography:

Kerlin Lobo is a Refinery Process Technical Engineer for the Industrial Group of Baker Petrolite, based in Sugar Land, Texas with extensive experience in demulsification technology including field troubleshooting, product testing/screening, and R&D projects.

Kerlin graduated from UNEFM (Universidad Nacional Experimental "Francisco de Miranda") in Venezuela with a Bachelors Degree in Industrial Engineering and is a member of American Institute of Chemical Engineers (AIChE), Crude Oil Quality Association (COQA), Canadian Crude Quality Technical Association (CCQTA), and the Society of Hispanic Professional Engineers (SHPE).

Knowing the acid crude nature

Haydée Quiroga Becerra and Carlos Mejía, Ecopetrol

Abstract

Fouling and corrosion problems are related to the presence of high contents of naphthenic acids in crude. The Total Acid Number, TAN, is a direct measurement of acid groups present in the oil. However, the TAN does not take into account the variability in the molecular structures of naphthenic acids even when the number of acidity is the same. The petroleum industry requires methods and tools for characterization and evaluation of opportunity crude with high acidity, in order to establish strategies for safely processing and achieving greater cost-benefit ratio. In this study, the concentration of naphthenic acids were determined by univariate calibration with infrared spectroscopy, and the average molecular weight and its distribution were obtained by vapor pressure osmometry (VPO) and Gel Permeation Chromatography (GPC), respectively.

Naphthenic acids from different Colombians crudes were gradually removed by catalytic decarboxylation and the influence of the removed fraction on corrosion and fouling was analyzed. Finally, some correlations are proposed to predict potential corrosiveness and fouling problems.

Biography:

Dr. Haydée Quiroga is a Chemical Engineer and works for ECOPETROL-ICP, Colombian Petroleum Institute. For the last 10 years she has been involved in research and development projects focused on corrosion control and asset integrity management for refinery's facilities. Her major concern is corrosion control caused by acid crudes through the optimization of the operational conditions, blending, removal or deactivation of naphthenic acids, inhibitors development and/or material selection.

Dr. Quiroga was a visitor research at the Center for advanced materials in Pennsylvania State University and holds her Ph.D. at the Industrial University of Santander in 1999.

Biography:

Carlos Mejia is a chemical engineer, Magister, linked to technology cooperation agreement between the Universidad Industrial de Santander and the Instituto Colombiano del Petróleo, since 2006. He has been working on issues related to assessing the impact the corrosion of the materials and reliability of processes during the processing of opportunity crudes. In the last two years Carlos Mejia has been researching about reduction process of acidity in opportunity crude to increase the profit margins of refineries.

Opportunity Crudes: Hidden Challenges that Could Cost Millions

Pat Swafford, Spiral Software Limited

Abstract

One of the keys to successfully processing opportunity crudes is to evaluate the impact of the opportunity crude on the overall crude slate of the refinery. The ability to evaluate the opportunity crude from a quality perspective in addition to an economic perspective is key to helping the refiner make good crude purchase decisions.

The economics of opportunity crudes can benefit refiners tremendously, or if the crude is not managed properly from a quality perspective, can be devastating to refiners. Opportunity crudes typically have some undesirable properties that prevent many refiners from processing the crudes “at-will”. These crudes are typically priced at below-market pricing (pricing that is consistent with the expected yields), so it is to the refiner’s benefit to maximize throughput of these crudes. However, undesirable quality characteristics of crude oil, if not properly managed, can have a devastating effect on the refinery, and erase any economic benefit that would have otherwise been gained.

This presentation will examine various techniques for evaluating opportunity crudes from both a quality and an economic perspective. Some of these techniques include:

- Evaluating the landscape of feasible operations to understand the ratio of acceptability of the opportunity crude in the overall crude slate for the refinery.
- Identifying opportunities for blending synergistic crudes with the opportunity crude to mitigate the effects of the undesirable properties of the opportunity crude.
- Combining a quality-based evaluation with economic analysis to understand the incentives and limits of processing.

Refiners that understand the quality of opportunity crudes, and how the opportunity crude will fit into their overall crude slate can take advantage of the opportunity and maximize their overall refining margins.

Biography:

Pat Swafford is a Solutions Consultant for Spiral Software with deep expertise in crude oil quality, refinery planning and scheduling, and refinery performance monitoring. Pat has over 20 years of refinery economics, optimization and scheduling experience in both operating companies and software firms. He also has an extensive knowledge of the markets for crude oil and refined products and the economic effects of these on refinery operations.

Mr. Swafford holds the MBA degree in Management from Oklahoma City University, and a BS degree from East Central University.

Optimize Crude Blending and Scheduling to Maximize the Benefits of Processing Opportunity Crudes

Louella Bensabat, Honeywell Process Solutions

Abstract

In today's environment refiners are facing an ever increasing range of crude oil qualities available for supply under both long term contracts and spot purchases. There are large economic incentives associated with the ability to better allocate crude receipts to storage and then blend the crudes prior to charging the distillation units. These benefits arise primarily from the different mix of crude oils that can be processed as a result of blending lower cost opportunity grades or specialty crude oils with limited marketability. Although crude selection, purchase, and receipt schedules are planned, sometimes many months in advance of delivery, the day-to-day schedule must be developed and updated taking into account current crude storage availability, unit operations, product inventory and other short term requirements and constraints. The movement of crude from ship or pipeline to storage, tank transfers, and blending of crudes to meet capacity and product quality requirement provides both challenges and ample ways to capture the maximum refinery margin.

Work processes for crude scheduling normally involve spreadsheets and simulation, with most decisions made manually based on experience. Largely a trial and error process, the scheduler attempts to create a feasible schedule meeting basic unit capacity capabilities, staying within safe tank operating boundaries, and targeting end product quality requirements considering crude oil charge properties. The crude oil blends needed as part of the crude schedule are usually interactively determined, trying to get the best fit within these physical system constraints. As a result of this manual process, however, there is little time or capability for analysis, acceptance and incorporation into the schedule of the alternative crude oils and various crude feed slates that come with more favorable prices.

Realizing the higher profit from increased opportunity crude oil processing requires "high confidence" analysis and commitment to their purchase, followed by effective handling of the crude oils in the crude mix at the tactical movement and blending level. Examples of specific case results will be presented to demonstrate that by taking advantage of new, proven optimization techniques, the crude scheduler can improve upon many of the manual decisions currently being made on a trial and error basis. The result of this automated and optimized analysis capability is a more flexible crude diet with increased opportunity for lower-cost crude processing. This paper will describe how the new scheduling technology enables an optimized crude blend schedule, resulting in an improved decision-making process that delivers increased profitability for refiners looking to widen their crude oil feed slate.

Biography:

Louella Bensabat is a Principal Business Consultant in the Advanced Planning and Scheduling solutions area for Honeywell Process Solutions based in Houston, Texas, USA. With a primary background in market analysis, strategic and tactical planning, business optimization and decision support software for petroleum, refining and petrochemicals, she has held positions at a number of consulting and software companies serving these industries prior to joining Honeywell in 2006. With over 25 years' experience, Ms. Bensabat commenced her career as an engineer with Mobil Oil, Inc. where she worked in a variety of engineering, planning and economics, operations and supervisory roles for nearly ten years before moving to analysis and consulting.

Ms. Bensabat holds a Bachelor of Chemical Engineering degree from the University of Melbourne, Australia, and is a member of the Institution of Chemical Engineers in the United Kingdom.

The Importance of Separation Modeling in the Evaluation of Opportunity Crudes

Dean Trierwiler and John Slaby, Haverly Systems, Inc

Abstract

The refining value of a crude oil depends on the quantity and quality of the products manufactured from it. Inversely, the quantity and quality of the products manufactured depend on the ability of the plant to fractionate the crude such that its greatest value is realized. This is no less true for opportunity crudes. With opportunity crudes, however, their distillation behavior is often less well known, making their processing a greater risk, and their separation modeling more important.

The true separation ability of a plant's distillation process must be accurately modeled in order to best determine the potential quality and quantity of any crude oil's distillates, and subsequently that crude oil's value to the refinery. If perfect separation could be achieved, distillate quality could be managed to mitigate any adverse effects. But a plant's separation is never perfect, and some degree of overlap (often substantial) exists at every distillate cut. These overlaps often contaminate adjacent cuts with undesirable components, thereby negatively impacting downstream operation and product properties. Yet, crude oils are often evaluated as if perfect separation can be achieved. This can artificially inflate the refining value of a particular crude oil, a potentially disastrous prospect should the crude already be one of opportunity.

Haverly has given this area much attention, and has developed an approach to separation modeling which allows the accurate representation of a tower's true fractionation. In addition, Haverly has developed a technique of refinery LP modeling which takes advantaged of this advanced separation modeling in the optimization of distillation cut-points and crude valuation. These technologies will be discussed in this presentation.

Biography:

John Slaby is a Senior Consultant at Haverly Systems, Inc. John holds a PhD in chemical engineering from Polytechnic Institute of New York, which he received in 1985. His career has focused on process simulation and control, having worked with such firms as Setpoint, Dot Products, Aspen Technology and now Haverly Systems. His recent developments at Haverly have been in the area of simplified separation modeling for the purposes of crude evaluation.

Biography:

Dean Trierwiler is the Director of Business Development at Haverly Systems, Inc. During his 20 years with Haverly, Dean has been involved in the development, application, support, and promotion of their planning, scheduling, and crude assay management software products. Dean spent the first 16 years of his career in the refining industry (with Citgo, Chevron, and Unocal), holding various computer support, economic planning, and engineering positions. Dean is primarily known throughout the industry as an expert in refinery LP modeling. Among his works in this area, he developed the Distributive and Adherent recursion techniques. Dean holds a BS degree in Mechanical Engineering from Washington State University.

Heavy Oil Pipeline Drag Reduction Technology

Laura Thomas and Tim Burden, ConocoPhillips Specialty Products Inc.

Abstract

ConocoPhillips Specialty Products Inc. (CSPI), a wholly owned subsidiary of ConocoPhillips, is the global leader in the science and application of drag reduction. For over 30 years, through the use of flow improvers, also known as drag reducing agents (DRAs), CSPI has provided solutions that allow pipelines to maximize their flow potential, increase operational flexibility, and increase bottom-line profit potentials.

DRAs are hydrocarbon-based materials which reduce frictional pressure loss during turbulent flow in a pipeline. DRAs, such as CSPI's LiquidPower™ and ExtremePower™ Flow Improvers products, consists of long-chain, hydrocarbon polymers that act to decrease the amount of energy lost in turbulent flow. While LiquidPower™ Flow Improvers are suitable for light and medium crude oils, ExtremePower™ Flow Improver is successful in heavy oils (less than 25° API).

CSPI's presentation at the Opportunity Crudes Conference will introduce the heavy oil DRA, ExtremePower™ Flow Improver as an efficiency improvement method for de-bottlenecking pipeline systems transporting heavy oils.

Biography:

Laura Thomas is a Sales Lead for ConocoPhillips Specialty Products, Inc (CSPI) in Houston, TX. Laura has extensive experience in project engineering and specialty chemicals. In her current role, she manages a sales team selling Drag Reducing Agents in the US and Canada. Her experience in DRA's include pipeline hydraulic analysis, economic evaluations, injection equipment design, technical support and field testing with a particular emphasis on a new CSPI DRA technology for heavy crude oils.

Laura graduated from University of New Orleans with a Bachelor's Degree in Mechanical Engineering and is a member of American Society of Mechanical Engineers (ASME) and the Crude Oil Quality Association (COQA).

Biography:

Tim Burden is a Research Engineer in the research and development group for ConocoPhillips Specialty Products, Inc (CSPI). Tim has 10 years of experience with CSPI working in the following areas: flow improver manufacturing scale-up and support, drag reduction and pipeline hydraulic analysis, flow improver injection skids, pilot plant design and operation, test loop operation, and development and testing of flow improvers in the laboratory.

Tim received his Bachelor of Science in Mechanical Engineering in 1998 and his Master of Science in Mechanical Engineering in 1999 from The University of Tulsa and is a certified Professional Engineer in the state of Oklahoma. Tim is an inventor on three U.S. patents related to drag reducers and has numerous patent applications pending.

Advances in conversion chemistry-Towards Cleaner Manufactured Crudes and Fuels Products from Canadian Bitumen

Parviz Rahimi and Edward Little, CanmetENERGY Natural Resources Canada

Abstract

Future projections of liquid hydrocarbon supply in 2030 by the International Energy Agency represent a wake-up call to the global energy community as they predict that nearly 50% of the liquid energy portfolio will be comprised of "…oil yet to be found or developed…". This is exacerbated by issues such as potential moratoriums on deep-sea conventional crude exploration and production. Moreover, predictions suggest that 4MMbbd of new oil sources must be produced globally each year to maintain the current 86MMbbd supply; that is to say, 20MMbbd of new oil production globally just to maintain 2010 production levels 5 years from now. Collectively, the prognosis gained from these future energy scans is that there will undoubtedly be an increase in the importance of heavy oil and bitumen resources globally and hence, an unequivocal need to understand the fundamentals of the conversion chemistry to reduce the processing footprint of Canada's abundant future energy resource.

In western Canada, and in particular Alberta, the sources for heavy oil and bitumen have been two-fold: mining and more recently in situ production. In 2005 the ratio of mining: in situ for bitumen production was about 60:40—in 2010, it is close to 50:50 with the latter having a significant potential growth advantage. Even considering these changes in production market percentage, the characteristics and qualities can be quite diverse, even amongst mining production. For instance, both hydrotreated naphtha and cracked naphtha are used by industry to extract bitumen from froth to produce dilbit. Today and in near future, there will be a whole range of materials between these extremes (bitumen and dilbit, synbit and other mixtures). As the production and extraction methods change with time, so too will the characteristics and properties of the produced bitumen. Presently, the challenge is how to design an upgrader that can process future bitumen feedstocks with such diverse characteristics and properties, while demonstrating sound environmental stewardship.

Research activities currently underway at the CanmetENERGY upgrading program (formerly NCUT) are focusing on advancements in the fundamental knowledge of bitumen bulk and specific properties to improve the processibility of diverse bitumen feedstocks. In this regard, the presentation will focus specifically on the fouling, corrosion and compatibility concerns of upgraders and refiners by outlining the importance of understanding the fundamental processing chemistry associated with the most problematic constituents of bitumen.

Biography:

Parviz Rahimi obtained his PhD in Chemistry from the University of Alberta in 1980 and joined Natural Resources Canada in 1981. Currently he is working as senior research scientist in the primary upgrading division of the CanmetENERGY in Devon, Alberta, Canada.

His expertise in bitumen chemistry extends beyond molecular characterization into upgrading processes including field upgrading. He has extensive knowledge of partial upgrading either using thermal conversion such as visbreaking or partial deasphalting for the purpose of reducing the required diluent for pipeline transportation. He has established an expert team to address the stability and compatibility issues related to partially upgraded bitumen and heavy oils as well as during

production and upgrading. His recently research activities include fouling and corrosion related to bitumen processing. He has established networking research into understanding bitumen/heavy oil processing with Universities, Government departments and private research organizations as well as major oil companies.

Biography:

Edward obtained his Ph.D. in Earth and Atmospheric Sciences from the University of Alberta in 2002 during which time he also served as the Quaternary Geologist for the Canada Nunavut Geoscience Office in Iqaluit, Nunavut. After nearly 4 years at the Iqaluit office, serving both as a research scientist (2.5 yrs) and as the Chief Geologist (1.5 yrs), Edward was deployed by NRCan to the Geologic Survey of Canada's Calgary office in late 2004 where he has continued to focus his research efforts on glacial geology and ice sheet dynamics as they pertain to the reduction of exploration risk in remote, extensively drift covered Arctic regions.

In addition to his research contributions while at GSCC, he was also commitment to the advancement of corporate strategies such as the Surficial Geology Steward and Surficial Science Language Steward. In 2006, Edward accepted an Actiing assignment as the GSCC Director, followed, in 2007 by his acceptance as the GSCC Acting Assistant Director. Since July of 2008, Edward has taken on the role of the Director of the National Centre of Upgrading Technology located within the CanmetENERGY-Devon Office.

PRESENTATION ABSTRACTS, DAY TWO

Tuesday, 26th October

New Catalytic Approach to Processing Feedstocks Derived from Opportunity Crudes in Ebullated Bed Hydrocrackers

David Mountainland (HTI, a subsidiary of Headwaters Incorporated), Lee Smith (HTI), Josiane M. Ginestra, Ph.D. (Criterion Catalysts & Technologies, L.P.), David E. Sherwood, Jr., Ph.D. (Criterion Catalysts & Technologies, L.P.)

Abstract

Improved catalyst performance can add significant value to many refinery units. However, feedstocks derived from Opportunity Crudes present special challenges to achieving significant improvements in catalyst performance. HTI and Criterion are tackling this challenge with a joint research and development program, focused on key objectives. HTI is optimizing its proprietary HCAT™ slurry catalyst hydrocracking technology in conjunction with Criterion's wide variety of commercially proven, solid catalysts. The effort described in this presentation focuses on combining these two complementary technologies in the area of Ebullated Bed hydrocracking.

The first major success story of this dedicated effort is the coprocessing of vacuum residues from Arabian and Russian Export Blend (REB) crudes. REB crudes are considered to be Opportunity Crudes; however, processing vacuum resid from REB crudes (e.g., Urals crudes) is extremely difficult due to sediment formation. By combining HCAT™ with the proper Criterion solid catalyst, stable coprocessing of these two feeds was demonstrated at very high resid conversion levels. Results on additional feed systems derived in whole or in part from Opportunity Crudes, will also be discussed.

Biography:

Dr. David Sherwood is Criterion's Senior Principal Scientist with world-wide responsibility for Ebullated Bed Residue Hydrocracking Catalysts and Catalysis. Starting in 1981, he held research and management positions in Texaco with primary responsibility for catalyst selection for the then-Texaco, now-Motiva Ebullated Bed unit in Convent, Louisiana, USA. For the last 26 years, Dr. Sherwood has been continuously involved in the development of Criterion's improved Ebullated Bed catalyst line. He formally joined Criterion in 1997 and oversaw the building of a world-class test facility for Ebullated Bed Catalysts and Catalysis in 1999 with expansion in 2001 at the Shell Westhollow Laboratory in Texas. Dr. Sherwood is the co-author of many patents, publications and has made many international presentations.

Dr. Sherwood has a Ph.D in Inorganic Chemistry from Texas A&M University , USA and an Undergraduate Degree from Washington University, Missouri, USA.

Biography:

Mr. Mountainland has been with Headwaters Technology Innovation (HTI) and its predecessor companies since 1986, when he came to the Hydrocarbon Research Inc. (HRI) R&D Center as a pilot plant team leader, specializing in computer-based data acquisition and analysis. His present responsibilities include supervising HTI's operations group (supervisors and chemical operators) and managing all pilot plant and process development unit operations throughout the facility. He oversees pilot unit and process development unit construction and modification projects at HTI's R&D Center. He also supports HTI's chemical engineering activities through process simulations, kinetic modeling, and commercial economic evaluations as required. He is a member of the company's safety and environmental team.

Prior to his current assignments, Mr. Mountainland was a member of several start-up teams

with HRI for numerous commercial and pilot plant projects, including 3 commercial H-Oil® Units. He provided technical service assistance on a variety of hydrotreating, isomerization, catalytic reforming, hydrocracking and hydroprocessing units, and participated in commercial plant operating data analysis and in making operating recommendations to clients. He led teams carrying out unit conformance checks, procedural and operating manual reviews, and client training programs.

Mr. Mountainland holds a B.S. degree in Chemical Engineering from Drexel University, Philadelphia, PA, USA.

When not working in the world of heavy oil upgrading, David can usually be found on ski slopes during the winter and on golf courses around the country the rest of the year.

Optimal Refinery Processing of Opportunity Crudes While Maintaining Process Integrity

Ralph Goodrich and Scott Sayles, KBC Advanced Technologies

Abstract

Opportunity crudes are available for selection by refiners. Understanding the impact of these crudes on refinery operations allows optimization of the existing equipment while maintaining Process Integrity.

This paper will briefly review the optimization techniques needed to select opportunity crudes using advanced techniques including stream monitoring, process simulators and process integrity thresholds. Establishing these parameters for crude selection prevents unplanned outages of the equipment and maximizes return.

Biography:

Ralph Goodrich is a Principal Consultant for KBC Advanced Technologies, Inc., based in Houston, Texas. He is primarily responsible for directing process teams in both profit improvement activities and process design projects for the refining and petrochemical industries. Prior to joining KBC, he was with Exxon Research and Engineering Co. where he worked in the Petroleum Department Planning and Process Design Divisions.

Mr. Goodrich holds a BS degree in chemical engineering and a BA degree in economics from Rutgers University and has over 30 years of experience in the hydrocarbon processing industry.

New Resid Conversion FCC Catalyst Technologies Enable Flexibility for Heavier Feed Processing

Joe McLean, BASF Corporation

Abstract

In today's environment of tight refining margins, refiners are continually looking for technology solutions to process heavier "opportunity" feedstocks. FCC units continue to be the primary conversion operations in most refineries. This paper presents several new FCC catalyst technologies from BASF which combine benefits of optimized porosity, coke selectivity, and contaminant metals tolerance which enable added flexibility for refiners to process these heavier feedstocks.
Specific technologies to be discussed include:

- BituPro™ - designed for processing Canadian oil sands derived feedstocks. In most cases there will be some combination of coking and hydrotreating ahead of the FCC. BituPro is designed with specific matrix technology for cracking the resulting partially saturated ring structures in these feedstocks.
- Defender™ - based on BASF's award winning DMS (Distributed Matrix Structures) technology platform, Defender contains a new Vanadium trapping technology allowing refiners to process higher levels of high metals feeds while meeting coke & gas constraints.
- Stamina™ - based on BASF's new Prox-SMZ (Proximal Stable Matrix and Zeolite) technology platform designed to meet the growing need for refiners to maximize diesel production. Stamina provides coke selective bottoms upgrading with moderate zeolite activity to maximize the yield of FCC LCO (light cycle oil) for the refinery's diesel pool.
- Aegis™ - combines the benefits of the DMS and Prox-SMZ platforms to allow the highest total yields of gasoline + distillate and flexibility to move between the two as market conditions dictate.
- Fortress™ - the first commercial product from BASF's MSRC (Multi Stage Reaction Catalysts) FCC manufacturing platform. MSRC is a breakthrough concept which features multiple catalytic stages within the FCC particle, allowing different functions as the hydrocarbon molecules diffuse through the particle. Fortress features a highly efficient metals trapping technology in the outer stage combined with a high zeolite activity DMS-based inner stage to allow maximum conversion within typical unit coke and dry gas constraints.

Laboratory testing and commercial operating data will be presented each of these technologies. Together they represent a highly flexible suite of catalytic options for refiners looking to improve margins in today's challenging environment.

Biography:

Joe McLean is Global Technology Manager for Refining Catalysts for BASF Corporation (formerly Engelhard), based in Houston. He works with refiners worldwide to implement BASF's refining technologies for their applications. He joined Engelhard in 1987, holding positions in R&D, sales, technical service, and marketing. He has more than 30 years industry experience, including positions with ARCO, Research-Cottrell, and Hydrocarbon Research, Inc. before joining Engelhard. He holds six US patents and has authored or presented over eighty publications and technical papers related to fluid catalytic cracking, residual oil conversion, synthetic fuels, and coal processing.

He holds a B.S.E. from Princeton University and a M.S. from the University of California, Berkeley, in Chemical Engineering.

Residue Upgrading Options

Steve Sock, Foster Wheeler

Abstract

Residue upgrading to maximize profitability: what technologies are available, what works best, and in what circumstances, an overview of available technologies, and a focus on delayed coking, solvent deasphalting and visbreaking, with case studies.

Biography:

Steve Sock is currently the Director of Technology Business Development for Foster Wheeler USA Corporation in Houston, Texas, USA. He has been with Foster Wheeler more than 19 years holding various technical and commercial positions including Process Engineering, Estimating, Proposals and Business Development.

Using Chemical Antifoulant and Heat Exchange Modeling Software to Minimize Fouling Costs for a Blend of Canadian Crudes

Collin W. Cross, GE Water and Process Technologies

Abstract

One of the largest consumers of energy in the process of refining crude oil is the atmospheric distillation unit. The ability to reduce overall energy consumption during this process is of prime importance today, for both refining reliability and profitability. In the future world of "carbon footprinting" it may become even more important.

Certain Crude Oils, including synthetic crude blends, can cause asphaltenic stability problems and associated aggressive fouling when blended with other crudes. A study is offered here, that shows the dramatic impact of combing a chemical antifoulant program with state-of-the-art modeling software and statistical analysis. The combination is used to provide the most cost effective way to manage the overall cost of fouling in an atmospheric distillation unit. Economics of an ongoing application are investigated, defining the realized reduction for the total cost of fouling via the combined use of chemicals and software.

The paper shows that the use of a chemical antifoulant program with heat exchanger network performance monitoring software can reduce energy consumption, extend run lengths and minimize hydraulic limitations. The sum of energy savings, maintenance cost reductions and higher charge rates for longer periods of time often can provide returns on investment of more than 400%. Additionally, the reduced energy consumption results directly in less CO_2 production and a lowered "carbon footprint".

Biography:

Collin Cross received his Ph.D. in Physical Chemistry from the University of Oklahoma in 1994. During this time he pursued studies of the computational physics of Liquid Crystals. Following this he accepted a postdoctoral fellowship with the Keck Center for Computational Biology in Houston. In 1996 Collin joined Betz/GE Water and Process Technologies as an Analytical Chemist. Since that time he has occupied roles in both the Product Development and Enabling Technologies groups supporting process chemicals. Most recently Collin has accepted a role in the Technical Marketing organization with responsibility for Corrosion Control, Antifouling and Fuel Additives.

Issues with Opportunity Crudes in Refinery Distillation Units and Related Circuits

Dr. Russell Kane-iCorrosion, Brian Chambers, Ph.D. – Honeywell Corrosion Solutions, Mark Yunovich – Honeywell Corrosion Solutions

Abstract

In the modern refining industry, the business involves opportunity crudes. It is an essential element of current day refining operations and profitability. However, refinery operators also face substantial risk of corrosion damage in the crude distillation unit (CDU), vacuum distillation unit (VDU), side cut piping, and the CDU overhead circuit. This presentation will provide an overview of the issues facing these sections of the refinery, the controlling and critical parameters, and the challenges introduced by processing opportunity crudes.

CDU and CDU overhead circuits are exposed to numerous corrosion issues that can be aggravated by the processing of low quality crudes. Opportunity crudes frequently possess higher viscosity and naphthenic acid content compared to typical

crudes; these characteristics can disrupt efficient desalter operation, resulting in heightened levels of chlorides in the CDU and CDU overhead circuits. The presence of greater concentrations of chlorides can promote several issues, including: (a) under deposit corrosion due to sublimating species such as ammonium chloride, (b) aqueous corrosion due to hydrochloric acid, and (c) fouling issues related to the interaction of filming amines with HCl.

The CDU, VDU, and side cut piping are susceptible to multiple forms of high temperature corrosion often associated with the high total acid number (TAN) or high sulfur in opportunity crudes. In this range of temperature (from 400 to 750 F) hot oil streams can be unusually corrosive from either sulfidic or naphthenic acid corrosion leading to shortened service life. Sulfidic, or sulfidation, corrosion occurs due to the activation of certain sulfur species at high temperature. Naphthenic acid corrosion results in the dissolution of both materials of construction and normally protective sulfide scales present on these materials. The presence of elevated amounts of naphthenic acid and sulfur species in opportunity crudes can promote rapid attack of materials in the distillation units and side cut piping.

The characteristics of typical opportunity crudes can lead to enhancement of several corrosion mechanisms throughout the refinery. Understanding these mechanisms, their controlling factors, and possible avenues of mitigation is essential for balancing refinery asset integrity with the financial motivations of processing opportunity crudes.

Biography:

Dr. Russell D. Kane is currently President of iCorrosion LLC. He was the Founder of InterCorr International, Inc. (Houston, Texas) that was acquired by Honeywell in July 2005. Dr. Kane is an internationally recognized corrosion and materials consultant that specializes in materials selection, corrosion prediction, evaluation and monitoring, and failure analysis.

He has been involved in a diverse range of projects involving materials selection, corrosion monitoring and testing in petroleum, refining, pipeline and petrochemical applications. These activities have included two major industry initiatives on prevention of naphthenic acid corrosion, and activities in dehydrated gas service, H_2S and CO_2 corrosion in multiphase systems, stress corrosion cracking, and corrosion under insulation.

Prior to iCorrosion, Dr. Kane was with Honeywell Process Solutions, Battelle Memorial Institute and Exxon Production Research Company.

Dr. Kane has served on numerous committees of NACE and ASTM, including the NACE Board of Directors and Executive Committee. He is currently a consultant to the API Refining Committee, Subcommittee on Corrosion & Materials Research, for Ethanol SCC.

Dr. Kane received his B.S., M.S. and Ph.D. degrees in Metallurgy and Materials Science from Case Western Reserve University in Cleveland, Ohio, and has over 250 technical publications (including five books) on corrosion and metallurgical topics.

Crude Contaminate Impacts and Management

Sam A. Lordo, Nalco Energy Services

Abstract

One way for refineries to achieve improved operating margins is through the processing of opportunity crudes. The accepted definition of opportunity crude is either a new crude with unknown or poorly understood issues, or an existing crude with a known processing issue. A discount ($/bbl) can come with running these challenging crudes, however, this profit potential can be eroded without strategies to assess and mitigate these processing issues.

Many of these crudes contain processing challenges, such as contaminates, unstable asphaltenes, higher viscosity, and conductivity, amongst others. Current refinery configurations will have difficulty in maintaining reliability and controlling operating expenses when faced with these new issues.

This paper will focus on primarily those crudes with high solids that interfere with processing in the desalter. Deterioration in desalting performance can manifest itself in numerous areas. The typical problems are:

- Oil undercarry and higher levels of oil coated solids in desalter effluent
- Stressed waste water treatment plant operations
- Solids or asphaltene stabilized emulsion layer
- Water and/or solids carryover in desalted crude
- Desalting and dehydration performance decay
- More corrosion potential in crude tower overhead systems
- Higher fouling rates in hot preheat exchanger network
- Increased energy consumption (excess water and preheat fouling)
- Negative impacts to FCC catalyst life, Coker unit operation, etc.

The presentation will detail some common problems associated with opportunity crudes with high solids and how they can be managed effectively. The discussion will highlight specific case studies to show the value refiners have received in terms of increased processing flexibility while holding the improved operating margin gain.

Biography:

Sam has over 33 years experience in refining and petrochemical industries accumulated through Exxon Chemical, Nalco/Exxon Energy Chemicals, L.P. and Nalco Energy Services. Current assignments are to support marketing activities in the North America Region and coordinate technology activities in the with super major refiners sites worldwide.

Sam is involved with desalting and corrosion control technical and technology developments. Sam has been a member of NACE for 16 years, author of several papers on corrosion control, desalting, and Opportunity Crude Processing. Sam is an active NPRA participant and was a member of the 2002 NPRA Q&A Panel.

Sam holds a bachelor's degree in chemical engineering from the University of Missouri – Columbia.

The Relevance of Slurry Phase Residue Hydrocracking to Today's Market

Mitra Motaghi, Bianca Ulrich, Anand Subramanian KBR

Abstract

While Veba Combi Cracker and slurry phase hydrocracking have been developed and practiced for many decades, it is only now that the inherent features of this technology have gained relevance. These features are expected to add significant value to the refining market today. In this article, the authors outline the changing market conditions, economics, and product qualities, and correlate their alignment with the strengths of this technology.

Biography:

Anand Subramanian is a vice president at KBR's Technology business unit and he is responsible for the VCC technology. He has 24 years of experience, including 20 years with KBR in Houston, Texas.

HTL Upgrader Produces Low Resid SCO – Compatible with FCC Refineries

Mr. Edward Koshka, Ivanhoe Energy

Abstract

Ivanhoe Energy Inc.'s proprietary heavy to light oil (HTL) upgrading technology is a short residence time thermal cracking process used to upgrade high resid content heavy oil to a SCO product that contains a high fraction of distillate and gas oil and very little resid. This product is a desirable feedstock for refiners that do not possess resid conversion capacity. HTL is designed to cost effectively process heavy oil in the field and produce a stable, upgraded synthetic crude oil along with byproduct energy which can be used to generate steam and electricity. The HTL upgrading process can virtually eliminate the need for natural gas and the product can meet pipeline density and viscosity specifications eliminating the need for expensive diluents. The HTL process can be developed at a much smaller scale and lower per barrel capital costs compared to other traditional methods for upgrading heavy crude.

Ivanhoe Energy has been developing this technology towards commercialization. Pilot and demonstration plant studies have verified the yields from various heavy crude sources including Canadian Athabasca Bitumen. This presentation provides a description of the HTL technology, the unique characteristics of the SCO and an update on Ivanhoe's plans to develop the technology.

Biography:

Ed Koshka joined Ivanhoe Energy Inc. as Vice President, Business Development in 2007, responsible for creating partnerships and opportunities for heavy oil production using Ivanhoe's HTL Upgrading technology. His duties now include leading the development of engineering, infrastructure and marketing initiatives for Ivanhoe's heavy oil projects.

Mr. Koshka has over 20 years of industry related experience. Prior to joining Ivanhoe, Mr. Koshka worked at Synenco Energy where he was responsible for business development, marketing and strategic planning activities. Prior to joining Synenco, Mr. Koshka worked at Purvin & Gertz's Calgary office, assisting clients in areas of crude oil market assessment, project economic analysis and oil sands strategy development.

Mr. Koshka's industry experience began at Petro-Canada in areas of refining, operations and planning, crude oil marketing and corporate risk management. Mr. Koshka holds a Bachelor degree in Chemical Engineering from the University of Alberta and an MBA from the University of Calgary.

SO_2 and CO_2 Emission Control with CANSOLV SO_2 and CO_2 Capture Systems

Rick Birnbaum, CANSOLV Technologies Inc.

Abstract

The 2009 recession resulted in a worldwide drop in crude demand and the disappearance of the traditional spread between sweet and sour crude prices. Environmental pressures continue to be exerted however, and refinery emission limits for both SO_2 and CO_2 are under continuous review. Product sulfur specifications also continue to tighten. In particular, the Maritime Convention on the control of Pollution in Ships (MARPOL) mandates initiatives that will reduce the allowable sulfur content of bunker in steps by 2015 and 2020, respectively.

If the sweet/sour spread in crude price returns, refiners will wish to be positioned to capitalize on it while also meeting more stringent product sulfur specifications. Strategies that upgrade the bottom of the barrel will be of great interest, but will be costly. Alternatives which involve the combustion of all or part of the bottom of the barrel, for internal energy consumption or cogeneration, should also be examined.

Combustion of resids, however, requires additional investment in NOx, SOx and possibly CO_2 capture systems downstream of the combustion source. The CANSOLV SO_2 Scrubbing System and the CANSOLV CO_2 Scrubbing System can help resolve pressures on SO_2 and CO_2. Much of the energy consumed in the SO_2 Scrubbing System can be captured and cycled to the CO_2 Capture System, to reduce overall energy penalties associated with the two capture systems.

This paper describes the CANSOLV SO_2 and CO_2 systems and explores the high level capital and operating costs that would apply to the use of these systems in an integrated fashion to treat flue gas generated from fuel, containing 2.5 wt% sulfur.

Biography:

Rick Birnbaum is a chemical engineer and has over thirty years experience in the use of amines to remove acid gas contaminants from natural gas, refinery gas and flue gas process streams. Since his graduation from McGill University in Montreal, Quebec in 1974, he held several positions in operations supervision and sales and provided technical support to the Union Carbide and Dow Chemical Company specialty gas treating products businesses.

In 2005, Rick joined CANSOLV Technologies Inc. in Montreal as Engineering Manager and then as Licensing Manager, Oil and Gas for CANSOLV's SO_2 and CO_2 Scrubbing Technology businesses.

SNOX™ Process for Cleaning of Flue Gas from Combustion of High Sulfur Petroleum Residues

Peter Schoubye and Frands Jensen, Haldor Topsoe A/S, Lyngby, Denmark, and Niels Udengaard, Haldor Topsoe Inc, Houston, USA.

Abstract

Combustion of high sulfur residues such as petcoke and RFO in utility boilers supplying the need for steam and power of a refinery is normally the largest source of CO_2 emission from the refinery. The most cost-effective ways of reducing this CO_2 emission of the refinery are (a) to increase the thermal efficiency of generating steam and power in the boilers and the power plant of the refinery and (b) to avoid use of limestone (carbonates) for flue gas desulfurization (FGD). Both are achieved by equipping the boilers with the SNOX™ process for flue gas purification.

The SNOX™ (WSA/SNOX™) process removes up to 98.5-99% of SO_2 and SO_3, up to 97-98% of NOx and essentially all particulates from flue gases with up to about 1% SO_2 in the gas. The SO_2 is oxidized to SO_3 and selectively condensed and recovered as commercial grade concentrated sulfuric acid in a proprietary air cooled falling film condenser, while NOx is reduced by NH_3 to N_2. The process increases the thermal efficiency of the boilers by recovering the heat of formation of sulfuric acid from SO_2 and utilizing the heat content of the flue gas down to 100 °C for steam generation. It consumes no water or materials except for ammonia, preferably in the form of SWS gas from the refinery, and it does not generate any secondary sources of pollution, such as waste water, slurries or solids or CO_2 from sorption processes.

SNOX™ treatment of the flue gas from boilers burning petcoke and RFO increases the production of steam and power by about 1.0 % and decreases the CO_2-emission by another 0.4 % per % of sulfur in the fuel, corresponding to 7% less CO_2 emission with fuel containing 5% S, compared to generating steam and power by burning the same fuels in boilers using limestone for flue gas desulfurization.

Also all kinds of refinery sour gases are treated advantageously in the SNOX plant whenever there is a market for the sulfuric acid. The amount of steam and power generated by combustion of H_2S and SWS-gas in SNOX-equipped boilers for acid production is much higher compared to treating the same sour gases in a Claus plant producing elemental sulfur.

In contrast to other FGD technologies, SNOX™ has the remarkable feature of being more economic attractive, the more SOx is contained in the flue gas, even before taking credit for the sales of the sulfuric acid.

Today, the SNOX™ process is used in the scale of 1 mil Nm^3/h flue gas on a coal fired and two petcoke and RFO fired power plants in Europe while two more SNOX plants are under construction in Brazil. The paper describes operating experience and plant design and how these remarkable efficiencies are achieved in the process.

Biography:

Niels R. Udengaard currently holds a position as Syngas Technology Manager at Haldor Topsoe, Inc. in Houston, Texas. He is responsible for the marketing and sale of proprietary technologies within the petrochemical, refining, power and environmental industries in North America, and interfaces with the technology and research & development organizations within the Haldor Topsoe Group. He has over 35 years of engineering and management experience in catalytic process design, pilot plant operation, and commercialization of new technologies. He received his MS in Chemical Engineering from the Technical University in Copenhagen, Denmark, and he is a licensed professional engineer of Texas.