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Sulfuric Acid TODAY

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Scalable energy recovery systems for sulfuric acid plants

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Sulfuric acid plants as thermal plants

Contact sulfuric acid plants operate with exothermal unit operations–sulfur burning at the furnace, contact catalytic oxidation of SO_2 to SO_3 at the converter, and SO_3 absorption with acid at the absorption towers. Typically a sulfuric acid plant will recover heat from the furnace and the converter, then transform it into high pressure steam–roughly two thirds of all generated heat is recovered.

Unfortunately, the remaining one third of the generated heat, the portion that originates at the absorption towers, is transformed into heat waste and disposed through the cooling water. This loss is due to the low temperature of the returning concentrated acid, typically between 100°C and 120°C, which is too low to be efficiently recovered through steam.

Some technologies changed operating temperatures to increase the available energy recovery from the acid, ranging from 180°C to 240°C, but this affected materials and operational conditions, and incurred disadvantages such as increased corrosion and H_2 production.

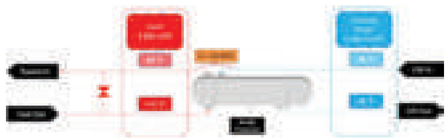


Fig. 1: Typical heat loss for 3,000 MTPD sulfuric acid plant.

Clark Solutions designed an isolated system to retrieve lost energy without compromising operation. This safe heat recovery system (SAFEHR™ BFW) can increase plant revenue and reduce operational costs.

Energy recovery system

A sulfuric acid plant of 3,000 MTPD can generate up to 200 MW of heat, with 135 MW recovered through steam and 65 MW lost at the cooling water. A scalable and isolated recovery unit was designed by Clark Solutions to partially recover lost heat. The system consists of plate heat exchangers to minimize temperature approach at the hot sides and a water closed circuit to transfer heat from the acid heat exchanger to the boiler feed water heat exchanger.

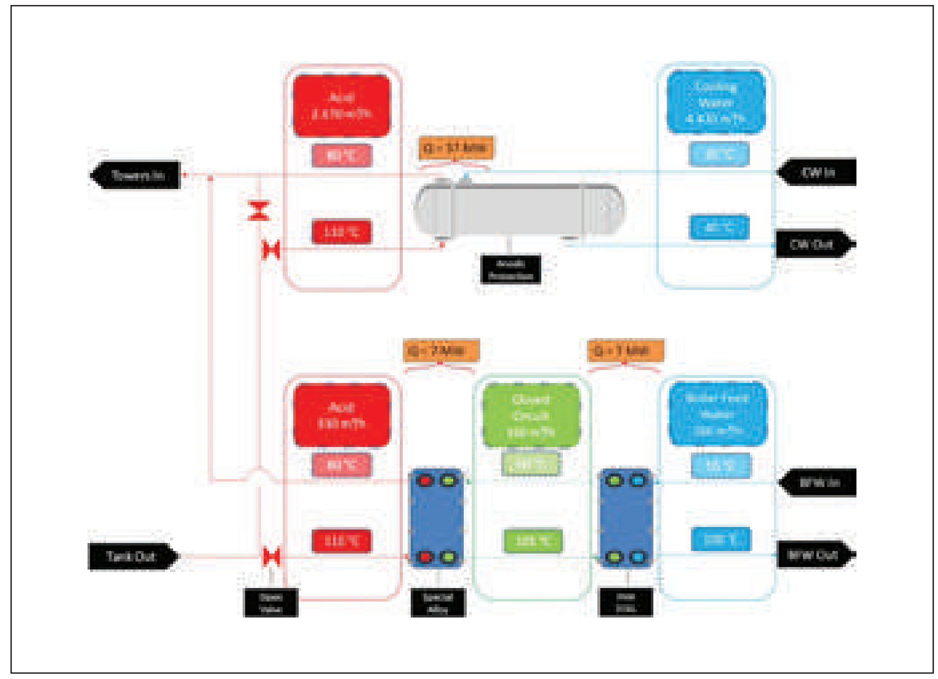


Fig. 2: SAFEHR™ BFW schematic.

Operating this way, there is control over any eventual leaks with instrumentation at the closed circuit. The closed circuit also prevents process contamination with acid and could be applied to heat not only the boiler feed water but also other plant utilities. Heating boiler feed water debottlenecks steam capacity.

A schematic of all lost heat at the shell and tube heat exchanger can be observed in Fig. 1, which also shows the average use of cooling water.

The schematic from Fig. 2 shows an increase in recovered energy; roughly 10 percent of lost heat is saved in this particular case. This recovery can be increased depending on plant steam capacity and auxiliary utilities, as well as heat necessities from other surrounding plants. Fig. 2 also shows the decrease in cooling water when the SAFEHR™ BFW is operational.

Fig. 3 depicts a 3D schematic of the SAFEHR™ BFW. The system can be adapted to fit the needs of any facility, providing heat to water or special fluids, such as electrolyte solutions as a case example.

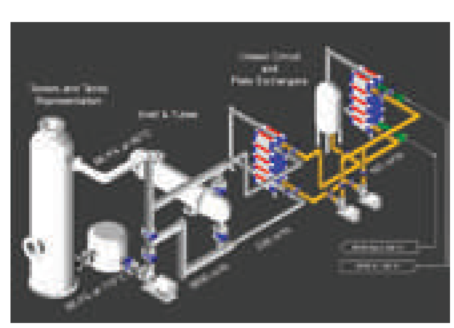


Fig. 3: 3D schematic representation of the SAFEHR™ BFW.

Parameter	Savings	
Plant Capacity	3000	MTPD
Cooling Water	-500	m³/h
Make-Up	-10	m³/h
Heat Recovery	+7	MW
Energy Income	+700k	USD/year

Table 1: Revenue and savings overview for the SAFEHR™ BFW.

Economics

The SAFEHR™ BFW can provide further savings and revenue. Table 1 shows approximate savings for a recently designed system. Payback will depend upon plant capacity and energy prices, but estimates are between 2 and 3 years on recent case assessments for energy income–without considering decrease of cooling water, make-up, and water treatment costs.

Conclusion

Process improvements are constantly sought to increase revenue and decrease costs. Clark Solutions' low profile safe heat recovery (SAFEHR™ BFW) system is an easy-to-install, easy-to-operate unit that can increase energy output and reduce cooling-water related operational costs without affecting operation.

For more information, please visit www.clarksolutions.com.br. SAFEHR™ is a registered trademark of Clark Solutions in Brazil. ❑

11th Chilean Roundtable of Sulfuric Acid Plants held in October

Representatives from facilities around the globe attended the Mesa Redonda de Plantas de Ácido Sulfúrico, taking advantage of this opportunity to share information, knowledge, and best practices with others in their field. Organized by Holtec, Ltd., the event was held at the beautiful Rosa Agustina Conference Resort in Olmué, Chile. This three-day meeting, held from October 23-27, 2016, included presentations from the sponsoring companies and producing plants in attendance.

Represented plants included: Acidos y Minerales de Venezuela C.A., Akzonobel, Codelco Chuquicamata, Codelco DMH, Codelco El Salvador, Codelco El Teniente, Codelco Ventanas, Enami, ENAP, Fluoder, Glencore, ISUSA, Monomeros, Noracid, Pequiven, and Southern Peru Copper Corp.

Sponsors included: Acid Piping Technology, AWS, Babcock & Wilcox MEGTEC, BASF, Begg Cousland Envirotec, Chemetics, Clark Solutions, DIDIER Corrosion Engineering, DuPont MECS Inc., Epas Limitada, Fibra, Flexim, GEA Bischoff, Haldor Topsøe, Hugo Petersen, Ingal, Invenio, JH Pump, Koch Knight LLC, MB Consultores, Nicolaides, NORAM Engineering and Consulting, Outotec, Panamerican Consulting International, Sagita

Dirk van der Werff, Holtec Ltda., greets attendees of the 11th Mesa Redonda de Plantas de Ácido Sulfúrico in Olmué, Chile.

SpA, SMA, SNC Lavalin, STEULER-KCH GmbH, Sulfuric Acid Today, Sulphurnet, Tetramet, TPI, W.L. Gore, and Weir Minerals Lewis Pumps.

The 3-day meeting focused on presentations from the sponsoring companies and producing plants. Sessions on maintenance, operational practices, new technology, new projects, engineering, catalyst, acid market, sulfur management, SO_2 emissions control, and safety allowed for the sharing of ideas with a global audience.

Presentations included:

—"External Corrosion of an Acid Tank Floor," by Carlos Lama of SPCC.

—"Acid Plant Maintenance," by David Olmedo of Codelco DMH.

—"Formation of Iron Sulfate," by Adriana Jimenez of Pequiven.

—"Maintenance as an Instrument to Ensure the Operation of a Sulfuric Acid Plant," by Alberto Matos of STEULER-KCH GmbH.

Nearly 150 participants from around the globe meet in Olmué, Chile, for the 11th Mesa Redonda de Plantas de Ácido Sulfúrico.

—"Absorption Tower Bottom Cleaning and Actions for Plant No. 1," by Pedro Sandoval of Codelco El Teniente.

—"Common Problems with Vertical Pumps in Sulfuric Acid Plants and Prevention Guidelines," by Martha Villaseñor of Weir Minerals Lewis Pumps.

—"Planning and Execution of Maintenance of MM2," by Elio Barraza of Noracid.

—"Myths and Legends in Sulfuric Acid Plants," by Steve Puricelli of MECS Inc.

—"Influence on the Operational Control of the Cooling Towers and the Corrosion of the Drying Tower Circuits," by Mabel Parra of Codelco El Teniente.

—"The Versatility of the Analysis of the Measurement of SO_2 Concentration in Sulfuric Acid Plants," by Viviana Rojas of Holtec Ltda.

—"Maintenance Challenges, Solutions and Results," by Claudio Diaz of Codelco Ventanas.

—"Anodic Protection Stainless Cooler vs. Alloy Cooler - Making an Informed Decision," by James Spath of Chemetics.

—"Sulfuric Acid Plant Modernization Projects: Project Execution Strategy and

Use of Improved Technologies," by Andres Mahecha of NORAM Engineering and Constructors.

—"Novel Design of WSA Technology for Smelter and Roaster Applications," by Torben Christensen of Haldor Topsøe.

—"Options for Lower Cost and Higher Availability from Wet Electrostatic Precipitators for Sulfuric Acid Plants," by Ralph Casale of Babcock and Wilcox.

—"Behaviors of Austenitic Steel Welds," by John Burke of DuPont and Axel Alfaro, TPI.

—"Single to Double Absorption in Plant No. 3," by Jose Flores of Glencore.

—"SuperOX Peroxide Technology for Reduction of SO_2 Emissions–A Case Study at Codelco Ventanas," by Victor Lopez of Hugo Petersen.

Claudio Diaz of Codelco Ventanas explains his company's maintenance challenges, solutions and results during the 11th Mesa Redonda de Plantas de Ácido Sulfúrico.

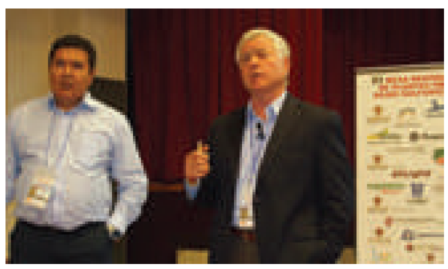
Fun was had by all at the biannual soccer match between producers and sponsors attending the 11th Mesa Redonda de Plantas de Ácido Sulfúrico.

—"Operation of Recuperative Boilers in the Acid Plant," by Marcelo Green of Glencore.

—"Harvesting Energy in an Acid Plant," by Florencia Alavarez of ISUSA.

—"Condensation of Exhaust Steam from Turbines," by Rogelio Grisales of Industrias Basicas.

—"Catalyst Solutions for Non-Steady State Conditions," by Osman Chaundhry of Haldor Topsøe.

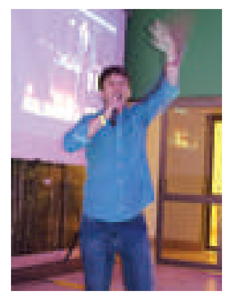


Mario Beer, right, of MB Consultores, explains the challenges of conducting a start-up of a sulfuric acid plant without exceeding emission limits with Severino Aprigio de Silva of Nitroquimica during their presentation.

—"Sulfuric Acid Market in Chile, Perspectives and Balance Towards the Year 2025," by Cristian Cifuentes of Cochilco.

—"Receipt and Solidification of Liquid Sulfur," by Brayaham Villa of Monomeros.

—"Sulfuric Acid Towers," by Vitor Sturm of Clark Solutions.



Sharim Hamer of Codelco DMH shared his singing talent with the group during karaoke night.

—"FRP Pipes and Ducts for Application," by Rodrigo Gumucio of Fibra.

—"Control of Chemical Spills in Plants," by Viviana Mena of Sagita.

—"Treatment of Wash Water from Copper Smelters," by Jochen Schumacher of Eisenmann.

—"How to Cope with Declining Ore Grades–Gas Cleaning Technology and Project Cases," by Rodolfo Muñoz of Outotec.

—"Choosing the Right Drying Tower Mist Eliminator," by Graeme Cousland of Begg Cousland Envirotec.

—"Challenges for Conducting a Start-up of a Sulfuric Acid Plant without Exceeding Emission Limits," by Severino Aprigio de Silva of Nitroquimica.

—"Fiber Bed Mist Eliminator Fundamentals vs. Real World," by Douglas Azwell of DuPont MECS Inc.

—"Transformation of No. 3 and 4 to Double Absorption," by Sergio Rojas of Codelco Chuquicamata.

—"Chemical and Thermal Burns," by Alexandra Bustamante of Sagita.

All work and no play makes for a dull conference, though. With that in mind, organizers of the Mesa Redonda de Plantas de Ácido Sulfúrico arranged a variety of interesting events to complement the programming. Fun was had by all at the biannual soccer match between Producers and Sponsors, in addition to hospitality and networking opportunities and dinners each night. Participants were also given the opportunity to share their talent with the group during karaoke night.

The XII Mesa Redonda de Plantas de Ácido Sulfúrico will be held in 2018. For updates, please visit the event's website at www.mesaredondachile.com. ❑