POWERLINE®

Graver Technologies

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POWDEX® SYSTEMS: THE MOST COST-EFFECTIVE CP FOR NGCC PLANTS

Natural gas combined cycle (NGCC) operations demand condensate polishing (CP) with filtration and ion exchange capabilities. The Powdex® system offers both, trumping standalone filtration, deep bed choices or a combination of the two. As the table on page 2 illustrates, Powdex is also *the most economical way* of providing both filtration and ion exchange. Deep bed systems plus filtration cost *significantly more than* a Powdex system.

THE HIGH COST OF NOT INSTALLING CONDENSATE POLISHING

Operating NGCC facilities without CP rings up significant expenses.

Industry experts estimate that a high quality CP system with filtration and ion exchange represents 1% or less of the total capital cost for a typical NGCC plant. The benefits and advantages of CP are numerous and clearly quantified by researchers, usage data and EPRI. Many NGCC plants, however, lack CP systems. Why?

Power generators often cite installation and operation costs as the reason. It's relatively easy to quantify the cost of a CP system – in fact, we've done so on page 2 of this issue. It's more difficult to calculate indirect costs utilities pay because they don't have CP. What are they? What might they be at a NGCC facility with an air-cooled condenser, a model that is becoming increasingly frequent worldwide?

DELAYS IN USING FULL PLANT LOAD: Frequent cycling is becoming the norm for NGCC facilities. This complicates chemistry stabilization and unstable chemistry lengthens the time before the plant attains full power.

Powdex three-vessel condensate polishing system

Buying power during this delay can cost between $25 and $35 USD per MWh – a substantial outlay each time the plant cycles. Further, chemistry fluctuations make it impossible to determine how long it will take for the plant to reach full power each time it starts, complicating budgeting for auxiliary power purchase.

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SYSTEM TYPE	TURBOGUARD® DISPOSABLE FILTRATION SYSTEM	AFA® BACKWASHABLE FILTRATION SYSTEM	POWDEX® PRECOAT CONDENSATE FILTER DEMINERALIZER SYSTEM	DEEP BED CONDENSATE POLISHING SYSTEM
SYSTEM COMPONENTS	• Three x 50% vessels (24"ø x by 9'10" straight) Each with seven 60" 5µm filters and three valves shipped loose • Manual system/no power or controls	• Two x 100% vessels (72"ø) • Skid mounted with all valves and interconnecting piping • One air surge tank (96"ø x 9'6" straight) shipped loose • One control panel (NEMA 12) shipped loose • 342 number – 70" AFA septa and internal lattice work shipped loose	• Two x 100% vessels (78"ø) skid mounted with advanced precoat system, all valves and interconnecting piping • One air surge tank (96"ø x 9'6" straight) shipped loose • One control panel (NEMA 12) shipped loose • 492 number 70" classic wound septa and internal lattice work shipped loose	• Three x 50% vessels (108" spherical) • One resin separation vessel (66"diameter x19'3"straight) • One cation regen./mix and hold vessel (66"ø x 12'9" straight) • One 50% NaOH regen. skid with heat exchanger • One 93% H_2SO_4 regen. skid • One duplex blower skid • Two rinse recycle pumps • Two sluice/regen. water pumps • One control panel (NEMA 12) All components shipped loose for field assembly
CAPITAL COST, FOB-SHIPPING POINT	$230,000	$1,325,000	$1,600,000	$3,050,000
ESTIMATED INSTALLATION COST	$34,500 (15% of equipment cost)	$331,250 (25% of equipment cost)	$400,000 (25% of equipment cost)	$1,525,000 (50% of equipment cost)
PLANT SPACE REQUIRED (FT^2)	120	900	1,000	6,700
TOTAL ANNUAL OPERATING COST* EXCLUDING LABOR	$36,400 (Elements replacement, 14 elements/4 weeks)	$14,426 (Elements replaced in 7 years + cost of water for backwash)	$24,414 (Based on 45 days precoat frequency) includes – cost of water, elements and resins	$23,683 (Based on 30 day regen. frequency) includes – cost of resin, water for rinse and backwash. (ETP load not incl.)
ANNUAL COST OF CAPITAL @10%	$23,000	$132,500	$160,000	$305,000
PROJECTED 20 YEAR COST (IN TODAY'S $)	$1,188,000	$2,944,520	$3,688,280	$6,577,660

*Costs estimated for a 660 MW air-cooled condenser facility.

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MISSED OPPORTUNITY: Many energy markets already require utilities to provide – and pay them handsomely for – short-term power supply. With increasing reliance on renewable energy, this capability is very lucrative for highly flexible plants that achieve full power quickly on short notice. As Jason Makanzi emphasized in a recent *Combined Cycle Journal* article, "Value isn't about producing energy or getting paid for capacity. It's about being able to start when you say you're going to start, putting online whatever load the balancing authority demands, and remaining online until told to shut down."

OUTAGE COSTS: Outage expenses add up in three areas: time offline, supplies and manpower/time for disassembly and cleaning. Time offline is costly at differing rates for each facility but is nonetheless substantial. Cleaning is increasingly time-consuming. As designers work toward optimum heat recovery and cycle efficiency, NGCCs with ACCs have become complicated systems – multiple pressure circuits, exotic materials and complicated piping arrangements – lengthening cleaning time and complexity. Long, multi-depth cleaning procedures tax the low manpower staffing model in place at many NGCC facilities. Higher blowdown rates also lead to increased loss of heat and water – an additional associated expense.

TIME AND MATERIALS TO STABILIZE CHEMISTRY: During cycling operations, it is nearly impossible to achieve a steady state chemistry without CP. Consequently, utilities must dedicate manpower and purchase chemicals to stabilize chemistry repeatedly. Stabilization is never a rote process, requiring adjustments, technical skill and analysis to achieve.

Right Photo: Graver Technologies deep bed condensate polisher

LONG-TERM EQUIPMENT REPLACEMENT: Plants save money short-term by shunning CP but pay long-term equipment damage and replacement fees due to corrosion. Though many NGCC plants are still relatively new, corrosion has already become nearly ubiquitous in steam boilers and heat recovery boilers in those without high quality CP systems. Further, the ACC design paradigm contributes substantial contamination to cycle water. EPRI data indicates that four of the top five causes of HRSG tube failure have been tied to cycle chemistry: flow-accelerated corrosion, corrosion fatigue, under-deposit corrosion, and pitting. Most facilities with CP greatly reduce or eliminate corrosion from poor chemistry and from contaminants by foreign intrusion.

It's time to discuss high quality CP systems for your NGCC plants. Contact your Graver representative to kick off the conversation. ■

POWDEX® SYSTEMS: GOLD STANDARD CP FOR COMBINED CYCLE PLANTS

User-Friendly, Economical Powdex® systems provide dual CP action: filtration and ion exchange

> ***Graver Water and Graver Technologies are managing approximately 80 Powdex projects for U.S. NGCCs; nearly 20 are ACC facilities.***

Graver Technologies have jointly developed equipment and powdered resins that comprise the Powdex® condensate filter demineralizer for NGCC facilities.

Graver Water, a leading CP equipment supplier for the power generation market for over 60 years, recently launched a range of standardized and cost-effective equipment lines tailored to NGCC facilities. "With a variety of technologies and pre-engineered systems, we can install condensate polishing at a cost that protects assets and provides significant ROI," says Michael O'Brien, President of Graver Water Systems.

Graver Water systems use the Graver Technologies Powdex brand of powdered resins to provide both filtration and ion exchange to remove dissolved and suspended impurities. System features and benefits include:

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EASY INSTALLATION, LOW MAINTENANCE, RELIABLE OPERATION:

Skid-mounted Powdex systems easily fit any plant footprint, new or retrofit. Minimal upkeep requirements suit low-manpower NGCC operations. Product bags are simply added to the system's precoat tank and the backwashing is nearly automatic. Resin adjustments easily accommodate chemistry changes and no dosing chemicals are necessary. Graver's Aegis® brand precoat septa typically last seven to 10 years, with many performing well beyond this timeframe.

EXCEPTIONAL PROCESS CHARACTERISTICS:

System performance depends on consistent differential pressure and even precoat deposition along the entire length of the septa. Powdex equipment design and resin formulation ensure an even precoat; less carefully controlled precoat equipment and products may demonstrate uneven powder loading that can reduce effectiveness.and products may demonstrate uneven powder loading that can reduce effectiveness.

PRODUCTS SUIT ALL NGCC SYSTEMS AND CHEMISTRIES:

Powdex systems remove iron, copper silica, activated corrosion products and salts, whether contaminants are suspended or soluble. A wide range of Powdex products are available: Ecodex® cation and anion resins blended with cellulose fiber filter aid, Powdex Premix™ anion and cation exchange resins, and Ecocote® flocced microfine fiber.

PRODUCTS DESIGNED FOR PRECISE NEEDS:

Graver manufactures Powdex in three ionic forms: hydrogen form cation, or PCH (H^+); ammonium form cation, or PCN (NH_4^+); and hydroxide form anion PAO (OH^-). In addition to Ecodex with its own wide range of fiber and charge properties, Graver also offers pre-made beds and premix options.

EXCEPTIONAL SERVICE AND ONSITE SUPPORT:

Graver Water Systems and Graver Technologies provide complete services and technical assistance to meet water chemistry requirements, run length targets, CRUD removal capacity or chemistry performance. Both companies conduct comprehensive onsite operator training and ongoing technical support.

For more information, please contact Graver Water at 1.877.GRAVERW, visit graver-ngcc.com or contact your Graver representative. ■

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