Ventilation Air Methane (VAM)
Introduction to Gulf Coast Environmental Engineering & Manufacturing Company

• Industrial Air Pollution Control
• Waste To Energy Development
  • Ventilation Air Methane (VAM)
• Thermal Processing
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Introduction to VAM

• Ventilation Air Methane
Ventilation Air Methane

- GCES has the experience and expertise to develop VAM projects in the coal mine sector.
- A feasibility study developed by MIMOSA, comparing GCES technology versus our competitors, confirmed that GCES VAM solutions are superior in quality and performance.
- Power Generation projects with GCES technology are more valuable than any other technology available in the market.
- We assist clients in capitalizing on energy development revenues, carbon credit trading and fine avoidance.
Ventilation Air Methane

- Coal Mine vent shafts emit many tons of methane each year.
- Carbon credit programs to incentivize methane destruction rather than venting are set to begin in 2021 under the current ETS system.
- Poland mines: methane is 0.3% to 0.4% concentration in air

- VAM + Coal Mine Methane (CMM) injection = viable power generation.
- VAM oxidation + power generation = ROI.
Ventilation Air Methane

- If Methane is greater than 0.25%
- RTO self-sustaining
- Excess heat
- Hot gas bypassed to boiler
- Boiler generates steam
- Steam runs turbine generator
Safety Logic  Multi-Level Safety Systems

- Isolation valves
- Methane sensors
- LFL/LEL sensors
- Pressure sensors
- Temperature sensors
- Fire suppression
- Flame/detonation arrestors
- Integrated control & safety system
- Automated
- Remote monitoring
- Fail-to-safe system

Summary:
- The size of duct installed above the exhauster is dependent on the number of VAM RTOs installed.
- Ventilation air flow for demo unit is 30,000 cfm, production scale unit is 50,000 cfm.
- Methane concentration minimum: 0.5%, maximum: 1.2%.
- Units can be stacked to minimize footprint.
- Units must be installed greater than 200 feet away from surface fan.
CH4 RTO (VAM)

Coal Mine Ventilation
Air Methane Destruction

• Gob gas is usually 25-50% methane.
• Combustible range for methane is 5-15% concentration.
• Ventilation air is diluted to <5% methane to stay below the lower explosive limit (LEL).

Technical Competitive Advantages

• Low electric power consumption
  — Fan rated at 140kW (vs. > 180kW)
• Small footprint minimizes disruption to mine site
  — Entire unit is 8’ x 50’
• Ease of assembly
  — Components pre-fabricated offsite, designed for fast onsite installation
• Low up front capital costs
  — 20% below competing units
• Short time-to-value
  — < 6 months from inception to fully operational
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Introduction to RTO (Regenerative Thermal Oxidizer)

- RTO
- 2-Canister RTO Systems
- RTO Operation
Regenerative Thermal Oxidizer (RTO)

- Process stream flows through heat recovery chambers (HRC).
- HRCs utilize ceramic media to provide up to 95%-97% heat recovery.
- Process cycles to maximize heat recovery.
- Highly efficient.
- 95%-99.9% DRE.
- Higher CAPEX, lower OPEX.
- Typical combustion temperatures 1400-1600°F.
RTO Operation
2-Canister RTO Systems
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Introduction to Power Generation
Heat Recovery Steam Generators

Processing and Power Generation

Gulf Coast Environmental Systems
Layouts: Single Pressure Low Temp HRSG <1700° F

Schematic Layout of a Single Pressure System HRSG
HRSG: Single Pressure

- Bypass Stack
- Steam Outlet
- Bypass Stack
- Economizer
- Slant HRSG
- Feedwater inlet
- Bypass Silencer
- Combustion Gas Turbine Inlet
- Bypass Diverter
- Duct Burner
- Combustion Chamber
MODULAR HRSG w/ Integral DA

- Fired HP Steam Flow
  - 120 kpph @ 800°F & 700 psig
- LP Steam Flow
  - 20k pph @ 80 psi
- SS Condensate Htr
Energy Recovery: Modular Series

190,000 lb/hr 750°F & 760 psig – Modular HRSG – 50 MWe GT
Industrial Steam Turbines
Steam Turbine

A standardized single-casing geared steam turbine with customized reaction blading for mechanical or generator drive

Technical data

- Power output up to 50 MW
- Speed up to 12,000 rpm
- Live steam conditions
  - Pressure up to 120 bar / 1,740 psi
  - Temperature up to 520°C / 968°F
- Bleed: Pressure up to 60 bar / 870 psi
- Controlled extraction (single or double)
  - Pressure up to 45 bar / 655 psi
  - Temperature up to 400°C / 750°F
- Exhaust steam pressure
  - Back pressure up to 16 bar / 232 psi
  - District heating up to 3 bar / 43 psi
  - Condensing up to 0.3 bar / 4.4 psi

(All data are approximate and project-related.)
Modular Package Concept

Modular package concept for the SST-300

- Back-pressure exhaust
- Condensing exhaust
- Exhaust area 0.28 – 1.6 m² (3.0 – 17.2 sq. ft)
- Gears
- Generators
- Base frames

Standard modules:
- Turbine casing
- Exhaust
- Gearbox
- Generator
- Base frame

Customized modules:
- Steam path (reaction blading)
• Single stage gland steam condenser
• Cooled by cooling water or main condensate
• Auxiliary fan, AC driven (1,5 kW)
Automatic Drain System

Pneumatic shut-off valve

Thermostatic steam trap

To the condenser
Steam Turbine

- Output 30, 15 MW
- Steam Inlet: 85 bar a, 510 °C, 113t/h
- Extraction: 4.1 bar, 57t/h
- Exhaust: 0.51 bar a,
- E.D.: 11.2010
- EXW.: 02.2012
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About Gulf Coast Environmental Systems

• Gulf Coast Environmental Systems (GCES) is your custom solutions provider for pollution control systems, Ventilated Air Methane systems, engineering and field support worldwide.
• GCES unique approach is to analyze your process stream and business objectives and propose an ideal solution or range of options to help you optimize these objectives.
• GCES provides in house engineering services, manufacturing, installation, commissioning and ongoing support.
• GCES broad base of expertise and vast global installations, we are well-positioned to solve your pollution control issues while maximizing your ROI.
• Headquartered in the Houston, Texas area, with 3 additional US located offices, 2 Mexico offices, offices in China and Poland (coming soon) and representatives throughout the globe, GCES is always close at hand to solve your pollution problem.
GCES, A Solutions Provider

Most of our products are designed and manufactured in our US facility, however, based on your location, infrastructure and specific national requirements and cost considerations, we can work with local fabricators and/or equipment manufacturers to further reduce your cost and lead times, as well as satisfying local content requirements.
Typical Industries & Markets

- Adhesive Coating
- Aerospace Painting
- Bakeries / Food Processors
- Coal Mining
- Fiberglass / Molding
- Flexible Pac
- Graphic Arts
- Laminating / Treating
- Micro-Electronics
- NOX & CO Abatement

- Paint Finishing Plastics
- Petrochemicals/Chemical Processing
- Pharmaceuticals
- Processing Refinery Off-gas
- Pulp and Paper
- Rendering
- Semi-Conductor
- Soil Remediation (Vapor Extraction)
- Tube Coating
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- Installation, Commissioning, Start-up
- Maintenance Plans
- Training
- Preventative/Predictive Maintenance
- Media Change-Out
- Insulation Repairs
- Refractory Replacement & Repair
- System Relocation
- Capacity Expansion
- Combustion System Optimization
- System Operational Cost Review
- Inspections and Evaluations
- System Tune-up
- Media Wash Out
- Fan Services
Conclusion

• GCES has the experience and expertise to develop VAM projects in the coal mine sector.
• A feasibility study developed by MIMOSA, comparing our technology versus our competitors, confirms that GCES is the best option for the coal sector.
• VAM projects with our technology are profitable utilizing three revenue streams.
• Power Generation with GCES technology is more valuable than any other technology available in the market.
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