VENTURE

VISION

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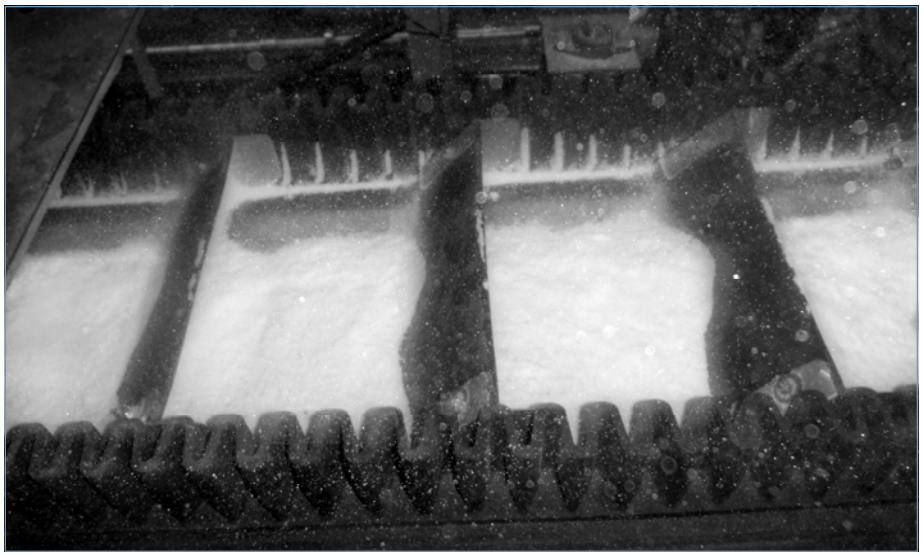
Frac Water Processing Becoming Reality



First run of salt produced from AOP Clearwater's frac water treatment facility is conveyed to storage.

AOP Clearwater has constructed a plant for processing 5000 bbls/day of flowback generated from slick water fracturing of the Marcellus Shale in Fairmont, West Virginia. Venture was tasked with re-engineering elements of the design, construction management, and commissioning.

Specific Venture tasks included:

- Development of functional description for programming by Equipment and Controls, Inc.
- Piping stress analysis using Caesar II
- Process Modeling
- Process Re-Engineering
- Various equipment improvements
- Procurement
- Construction management
- Training

The process is a multiple effect evaporation system. Salt concentration increases from one effect to the next, until saturation conditions are achieved, and the salts drop out of solution to form crystals. Dewatering and drying follows. The salt and water streams are recyclable.

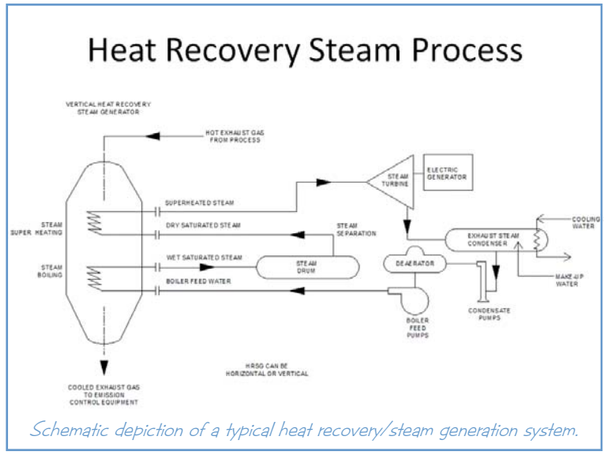
Venture received authorization to proceed at 6:00 p.m., and a team of four was on-site by 8:00 a.m. the following day. A team of up to ten people was on-site, plus home office support. Construction was accelerated to the point that commissioning of the first two effects began 6 weeks later.

Currently the plant is completing start-up, and Plant 2 is on the drawing board.

In this Issue:

Have Heat? Co-Gen!

The obvious co-generation opportunities of the past -- where “free heat” and high electric bills or incoming power limitations made co-generation a good investment -- have mostly been exercised. The electricity from byproduct heat or steam that couldn’t pass the payback hurdles then is now due for a second look, thanks to rising electric rates and the carbon footprint or CO_2 tax cloud over industry.



Schematic depiction of a typical heat recovery/steam generation system.

When you realize cooling 12,000 SCFM of 1900°F hot gas to 400°F can get you approximately 20,000 pph of 600 psig superheated steam and a net electric output approaching 1,500 kW, your plant’s specific conditions may come to mind. It isn’t cheap kilowatts, but the new environmental concerns, rising electric rates and your site specific conditions may make it a good investment.

Venture Engineering studied the options for co-generation at similar industrial facilities in two states. The client has waste heat at over 1500F from multiple sources. That hot gas is currently cooled and cleaned before release to the atmosphere. If economical, the exhaust gas would pass through an intervening heat recovery steam generator before the final gas clean-up equipment. The recovered heat would reduce the current cooling load and be used to produce high pressure steam for a steam turbine generator. Electricity produced would be used inside the fence to supplement power from the utility and would reduce the plant’s carbon footprint.

Key components of the co-gen facility include:

- Heat Recovery Steam Generator (HRSG)
- Steam Turbine Generator (STG)
- Turbine Exhaust Steam Condenser
- Condenser Cooling (Wet or Dry Tower, Plant Process or Waste Water)
- Improved Water Treatment for Water/Steam Meant for the Steam Turbine

Like most 20th century production facilities, the process modifications and the addition of emission control devices has left only minimal room for new equipment. The resulting space constraints will require the steam turbine generator to be on an elevated platform with the condenser hanging below. The heat recovery boilers will be of a vertical design, also due to space constraints. A partial turbine bypass for supplemental process steam is also included.

Economic considerations include the capital and operating cost of the new equipment, and the cost of lost production during tie-ins, versus the current electric cost and the cost of an expanded electrical system. Space availability is the first hurdle for the project and if satisfied, the economics would be considered second. Preliminary equipment sizes, layout options and present worth analysis were performed.

The bottom line: For the two facilities that Venture looked at, a steam co-generation plant has a four year payback at an electricity cost of 10¢ per Kw/hr. If more real estate were available, a more favorable return would be possible. Consider cogeneration if your facility has the potential to generate 5-20 MW or more.

For more information on steam co-generation, contact Robert Gambon at (412) 231-5890 ext. 311.

Typical Waste Heat High Temperature Sources

Types of Device	Degrees F
Zinc Refining Furnace	1800
Steel Heating Furnaces	1800
Cement Kiln (dry process)	1300
Glass melting Furnace	2500
Solid Waste Incinerators	1600
Fume Incinerators	2200

Typical Waste Heat Medium Temperature Sources

Types of Device	Degrees F
Steam Boiler Exhausts	750
Gas Turbine Exhausts	900
Heat Treating Furnaces	1100
Drying and Baking Ovens	1000
Catalytic Crackers	1100
Annealing Furnaces Cooling Systems	1100

Co-generation Considerations

When considering co-generation, some key decisions to be made include:

- Vertical versus horizontal HRSG, as a function of space availability and access requirements.
- Synchronous versus induction generator, which has several impacts, but most importantly whether or not the generator is self exciting and can be used as stand-alone power source during power outages. At some sizes the choice is made for you because the generators are only synchronous.
- Condensing turbine versus back-pressure turbine – a back pressure turbine simply acts as a pressure reducing valve. A condensing turbine uses a condenser at vacuum conditions to maximize pressure drop and thereby the energy recovered from the steam. The condensing turbine has more stages and generates more power in comparable steam inlet conditions.
- If using a condensing turbine, water cooled versus air cooled condenser, which has several impacts, including gross electric production and property required.
- Power export to the utility grid, or not, which has several impacts, affecting the electrical gear and system control.
- Use of vendor provided stand-alone controls, and degree of integration and monitoring to and with the plant control system.
- HRSG operating conditions: Metallurgy of the HRSG and associated piping changes with increasing temperature and pressure conditions.
- Water conditioning and treatment that may be needed to address the quality requirements of cogeneration steam, which is usually higher pressure and temperature than plant process steam.
- Foundation requirements, i.e. piles, floating slab, integration with existing
- Coordination with facility environmental staff is also important to determine the impact of the project on plant permits.

3D Modeling Gains Traction and Streamlines Projects

The future of plant layout is moving towards three dimensional modeling of equipment and piping systems thanks to powerful new modeling design software packages. Venture Engineering has both the software and expertise to design complex plant layouts using Autodesk Inventor 2010.

Recently we were hired by a manufacturer of wastewater treatment systems to support their design effort. Venture’s task was to develop, in 3D, the equipment and piping layout of a treatment plant that processes wastewater from a cheese production facility.


Wastewater treatment system designed by Venture with AutoCAD Inventor

Venture prepared the layout by first creating a three dimensional model of the facility using the Autodesk Inventor 2010 software. Working from client supplied Piping and Instrumentation (P&ID) drawings and cut sheets on all major pieces of equipment, Venture’s designer was able to model the complete treatment plant system with accurate dimensions on all piping runs and locations of all major pieces of equipment.

Three dimensional modeling has significant advantages over conventional two dimensional layouts that include:

- The use of this model allowed our client to review in detail how all pieces of the plant were laid out.
- Properly applied, 3D modeling eliminates the interferences before the project heads to the field for construction.
- The model can be manipulated to show views from any angle, so construction personnel can zoom in on areas of complete geometry or dense piping. Auto-Desk provides a free downloadable viewer (Inventor View 2010) for Inventor to allow on-site users the ability to view and manipulate the model without investing in the design tool.
- The locations of walls, equipment nozzles, equipment appurtenances such as ladders, platforms and pipe supports are built into the model and clearly shown on the resulting flat file drawings.

This approach to the design of the wastewater treatment plant was new to both our client and to their ultimate client. As a result, there was a bit of uncertainty as to what to expect at first. However, both clients have grown to see the benefits that three dimensional modeling can provide and plan to use it again on projects of similar scope and complexity.

For another example of the versatility of this powerful tool, see the rendering provided for a proposed landfill gas system, back page.

Venture's Growth in Landfill Gas Continues

Landfill gas projects have become an increasingly important portion of Venture's business. 2009 saw the addition of several new landfill gas customers for installation engineering services, and the first sales of our landfill gas conditioning systems that are designed to remove NMOC's, moisture and siloxanes. Highlights of the year include:

- Installation of our first gas conditioning system at a Walker Industries landfill in Canada, and orders for several more. Over a 10 month interval, the Walker Industries installation maintained total siloxanes (measured as silicon) below 75 ppbv, Si! (with raw gas siloxane concentrations >50 mg/m3) , and NMOC removal efficiencies of >90%, with final average dew point of –40°F.

- Field testing of the Siloxane Sentry, an in-line siloxane monitoring device for process control developed in partnership with Photovac, Inc. The first Sentry will be used integral to the Ameresco Chicopee Gas Conditioning System.

The above 3D rendering is superimposed on a photograph of a landfill site, prepared by Venture in support of a bid by customer Enpower.

- Addition of industry giants such as Waste Management and Ameresco to our client list, as well as Canada's largest natural gas retailer, Enbridge.

- Ongoing work with QuestAir (now Xebec) in the design of high Btu (pipeline quality) landfill gas systems.

- Ongoing work with developers such as DCO Energy in Mays Landing, New Jersey, and work with new clients such as Enpower in San Ramon, California and Ridgewood Power in Johnston, RI and Brea, California.

- Our first operations contract is with Enpower, where Venture is providing operations staff at a 2500 SCFM high BTU gas plant during the change in ownership from Timberline to Enpower.

Project sites are near Los Angeles, San Francisco, Las Vegas, Montreal, Cincinnati, Ottawa, Rhode Island, Massachusetts, and Niagara Falls, to name but a few.

Landfill gas is unique among green energy solutions in that it makes sense with or without government inducements. As cap and trade looms, landfill gas is a viable option for off-setting carbon releases cost effectively (see Venture Vision, Issue Four).

Contact Travis Buggey at 412-231-5890 ext 325, or Dave Moniot at ext 301 for more information.

VENTURE

Venture News

Welcome New Employees

Michael Kennedy
Zach Maisner
Doug Mathews
Luke Potter
Tom Stock

Employee News

Congratulations!

Matt DeStefano and his wife, Angela, became parents on January 7, 2010. Angela gave birth to Jacob Peter.

Happy Birthday!

February
Dan Cook
Dave Todd

March
Paul Collins
Alyson Holler
Doug Mathews

April
Kurt Albert
Luke Potter