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BUSINESS SYMPOSIUM

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Net Zero Approach

Together in our approach to sustainability

Custom Steam Solutions Inc

Your Steam System Integrators

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Approach to Energy Efficiency

Step 1: Optimizing Usage

- Identify plant heat and water rejects in operations and find best fit for re-utilization given various plant processes and production variations.
- Benchmark current plant utility consumption.
- Evaluation of technologies and provide design through experience.
- Supply, build, commission and prove out reduction in targeted goals.
- Assistance to available rebates/incentives and prove actual savings and ROI as promised.

Implementing Heat Recovery Technologies

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Heat Recovery Systems / Vent Condensers

Heat recovery systems capture waste heat from flue gases to improve energy efficiency in industrial processes.

- Focus on Flash and Vent Steam

Economizers and Upgrades

Economizers preheat feedwater using waste heat, enhancing boiler performance and reducing fuel consumption.

- Focus on Heat Recovery from Flu Gases

Monitoring and Controlling Energy Consumption

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Real-time Energy Tracking

Operators use real-time systems to continuously monitor energy consumption and identify usage patterns. ➔ **Identify locations for tracking**

Detecting Inefficiencies

Monitoring systems help identify energy waste and inefficiencies for targeted improvements. ➔ **Benchmarking, Steam IQ on steam traps**

Operational Adjustments

Control systems enable operators to optimize processes and reduce energy waste effectively. ➔ **Prove out savings**

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Vent Condenser on Vented Flash Steam

Vent Condenser

- Recovers all flash steam vented from vent lines on feed water tanks, condensate surge tanks in boiler house or even smaller condensate pumps in process.
- Recovers associated water (condensate) from associated vented steam.
- Reduces chemical feed and make up on boilers.
- Pre-heats make-up water or process water at point of use.
- Great savings and ideal for optics associated with plume of vented steam.

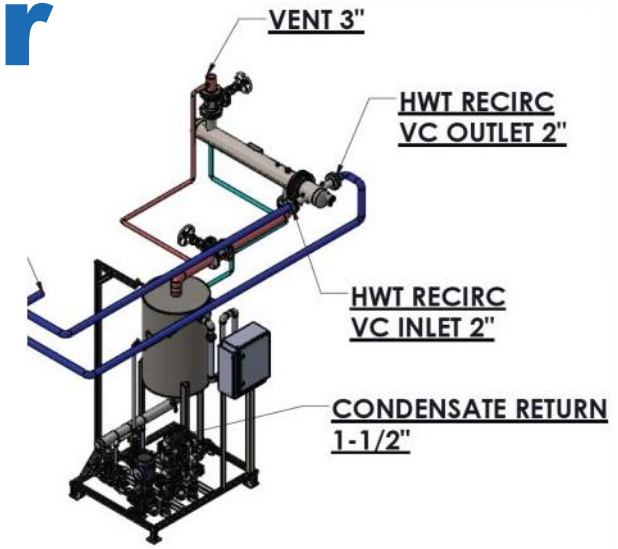
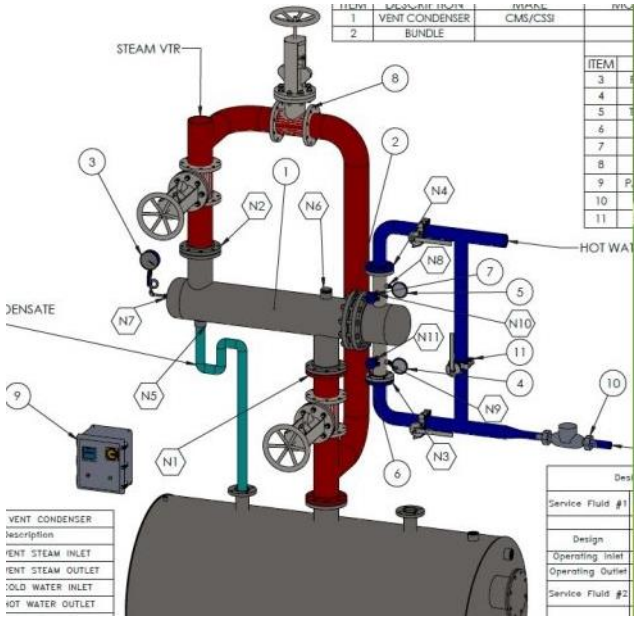


Table 12: Percent Flash

Steam Pressure psig	Atmosphere 0	Flash Tank Pressure 2	5	10	15	20	30	40	60	80	100
5	1.7	1.0	0								
10	2.9	2.2	1.4	0							
15	4.0	3.2	2.4	1.1	0						
20	4.9	4.2	3.4	2.1	1.1	0					
30	6.5	5.8	5.0	3.8	2.6	1.7	0				
40	7.8	7.1	6.4	5.1	4.0	3.1	1.3	0			
60	10.0	9.3	8.6	7.3	6.3	5.4	3.6	2.2	0		
80	11.7	11.1	10.3	9.0	8.1	7.1	5.5	4.0	1.9	0	
100	13.3	12.6	11.8	10.6	9.7	8.8	7.0	5.7	3.5	1.7	0
125	14.8	14.2	13.4	12.2	11.3	10.3	8.6	7.4	5.2	3.4	1.8
160	16.8	16.2	15.4	14.1	13.2	12.4	10.6	9.5	7.4	5.6	4.0
200	18.6	18.0	17.3	16.1	15.2	14.3	12.8	11.5	9.3	7.5	5.9
250	20.6	20.0	19.3	18.1	17.2	16.3	14.7	13.6	11.2	9.8	8.2
300	22.7	21.8	21.1	19.9	19.0	18.2	16.7	15.4	13.4	11.8	10.1
350	24.0	23.3	22.6	21.6	20.5	19.8	18.3	17.2	15.1	13.5	11.9
400	25.3	24.7	24.0	22.9	22.0	21.1	19.7	18.5	16.5	15.0	13.4

Percent flash for various initial steam pressures and flash tank pressures.



Vent From Blowdown and Condensate Tank

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Before
Implementation of Vent Condensers & Steam Trap Survey

After
Implementation of Vent Condensers & Steam Trap Survey

- Typical payback under 3 years
- Recovers heat + water
- Install within system is ideal integration

Example: Food Plant

- Boilers:
  - 800 HP Hurst Boiler
  - 800 HP Cleaver Brooks
- Boiler efficiency: 80%
- Plant Pressure: 120 psig
- Plant Operations:
  - 16 Hours per day (2 Shifts)
  - 5 Days a week
  - 12 Holidays per year
  - 251 Working days per year

- Condensate return: 37,536 lb/hr @ 30 psig
- Vent loss: 2,441.40 lb/hr steam
- Fuel cost: $5.50/MMBtu
- Daily loss: 39,062.40 lb/day
- Annual Loss = 9,804,662.40 lb/yr
- Annual Flash Steam Loss = $53,925.64

ROI & Payback

- Installed Cost (Est.): $35,000
- Annual Savings: $53,925.64
- Payback Period ≈ 6.5 months
- Year 1 ROI ≈ 154%

Additional Benefits

- Reduced makeup water demand
- Lower chemical treatment costs
- Reduced CO_2 & NOx emissions
- Eliminates visible steam clouds
- Improves workplace safety and comfort

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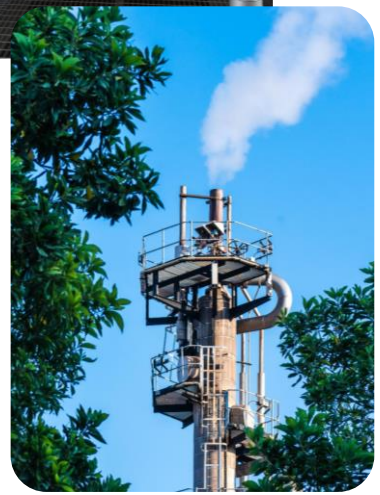
Economizers in Boiler House Operations

Principles and Function of Economizers

- **Heat Recovery Process**
  Economizers capture residual heat from exhaust gases to improve energy efficiency in boiler systems.
- **Feedwater Preheating**
  Preheating boiler feedwater reduces fuel consumption and enhances overall thermal efficiency.

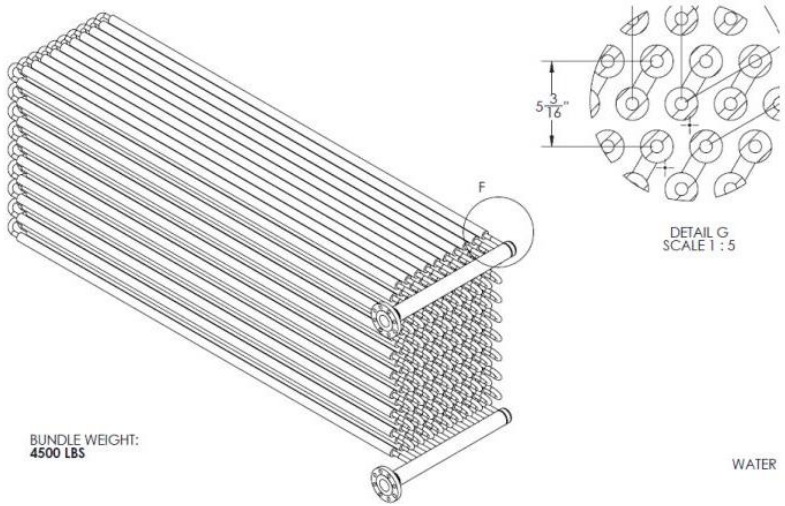
Environmental Impact

- **Efficiency Improvement**
  Economizers enhance system efficiency by recovering waste heat, reducing energy consumption and resource use.
- **Emission Reduction**
  Proper use of economizers leads to lower emissions, supporting environmental protection efforts.



Economizers - Primary

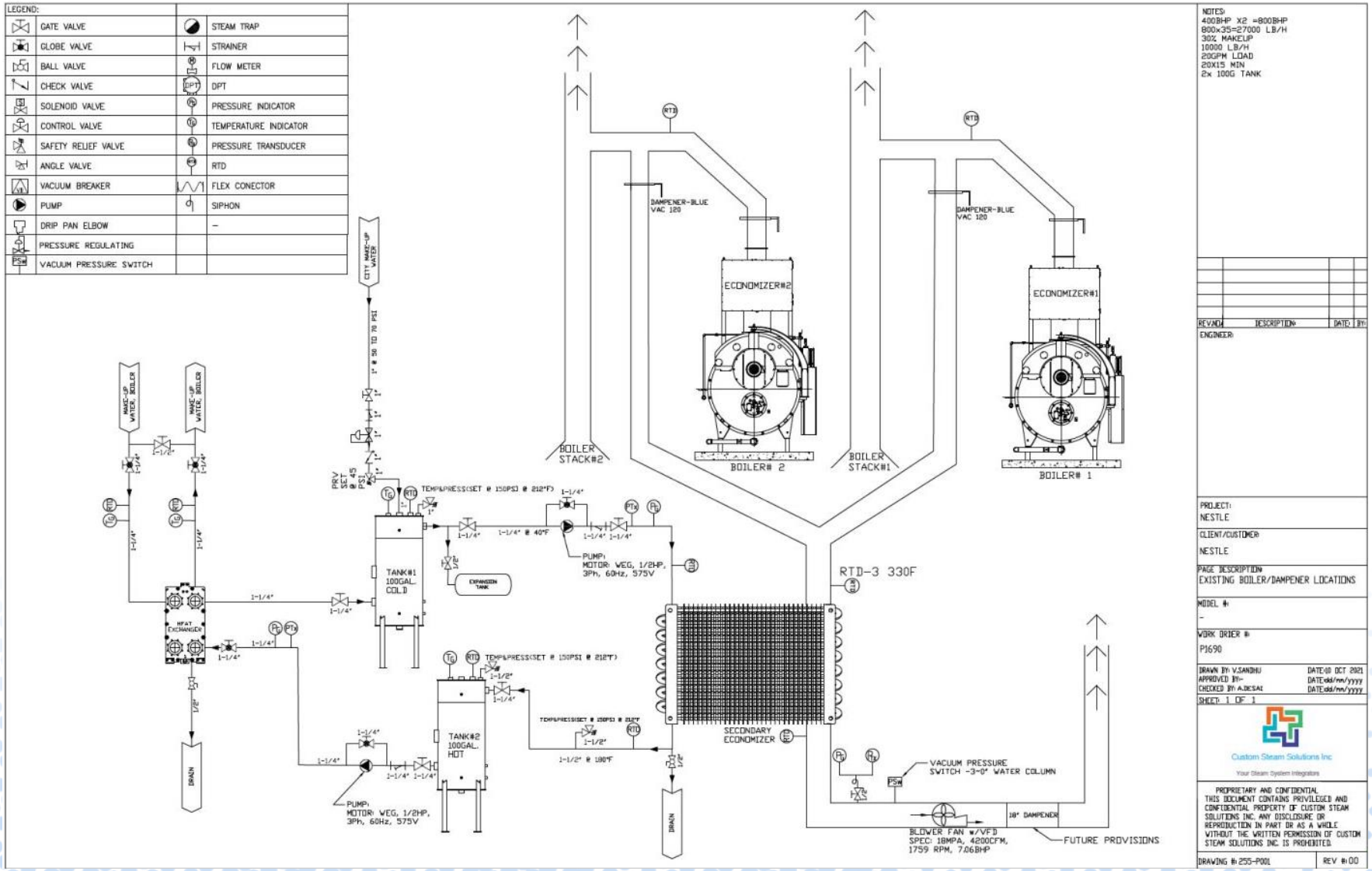
- 3% savings on total fuel bill
- Flue gas temperatures as low as 220 deg F on outlet
- Ideal for boiler feed water
- Design is all SS316 with 4 pass or more design for higher efficiency
- Welded finned tube technology
- Needs good water treatment or can be designed in SS duplex



Economizers - Secondary

- Efficiency gain 9 to 12%
- Recovery of 12-14% hot water (requires treatment)
  - One part of NG after combustion produces over 2 parts of water by weight
- Exhaust temperatures of 20 deg F above ambient
- Design MOC – special alloys/polymers
- May require induced draft and interlock with boiler.
- Can be used for inter-system heat sink ➔ ideal for heating water in process or steady application of hot water.
- Water quality needs to be chloride free or use Duplex SS.
- Inline stack design available for smaller boilers up to 300 BHP.

Economizers – Secondary (Condensing)



Example: Manufacturing Facility

- Boiler: 800 HP × 33,475 BTU/hr = 26,780,000 BTU/hr = 26.78 MMBtu/hr.
- Project Cost: Economizer + install = $110,000
- Fuel input (before economizer) = 26.78 MMBtu/hr ÷ 0.80 = 33.475 MMBtu/hr.
- Fuel input (after economizer) = 26.78 MMBtu/hr ÷ 0.84 = 31.780 MMBtu/hr.
- Fuel saved (per hour) = 33.475 − 31.780 = 1.695 MMBtu/hr.
- 8,000 operating hours/yr
  - Annual fuel saved = 1.695 × 8,000 = 12,752 MMBtu/yr
  - Annual fuel cost saved = 12,752 × $5.50 = $70,138 /yr
  - Annual savings = $70,138 /yr
  - Simple payback - $115,000 ÷ $70,138 = 1.64 years