

Charting a Course to Energy Independence

Providence, RI
August 9-12, 2009





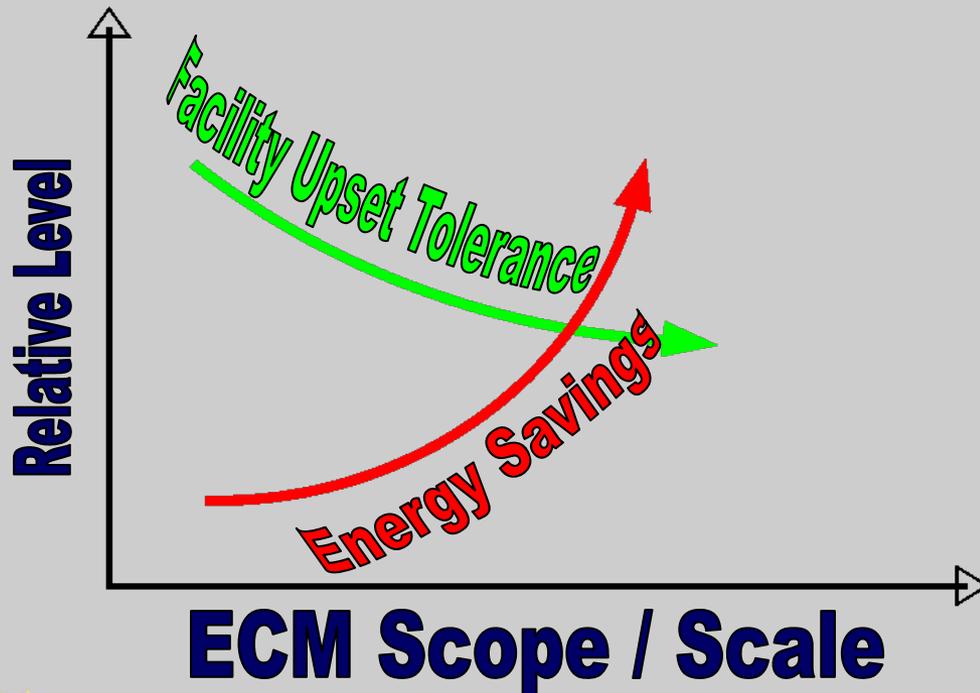
Agenda

- Industrial Energy Savings “Conundrum”
- Major Industrial Uses of Energy
- Industrial Savings Oppty #1
 - Simple / Integrated
- Industrial Savings Oppty #2
 - Simple / Integrated
- Questions



Industrial Plant “Process Rules”

- Process / Throughput is “King”
 - Energy and distribution infrastructure are “lifeblood” of the facility
 - Energy quality, availability & stability are “cornerstone” of production

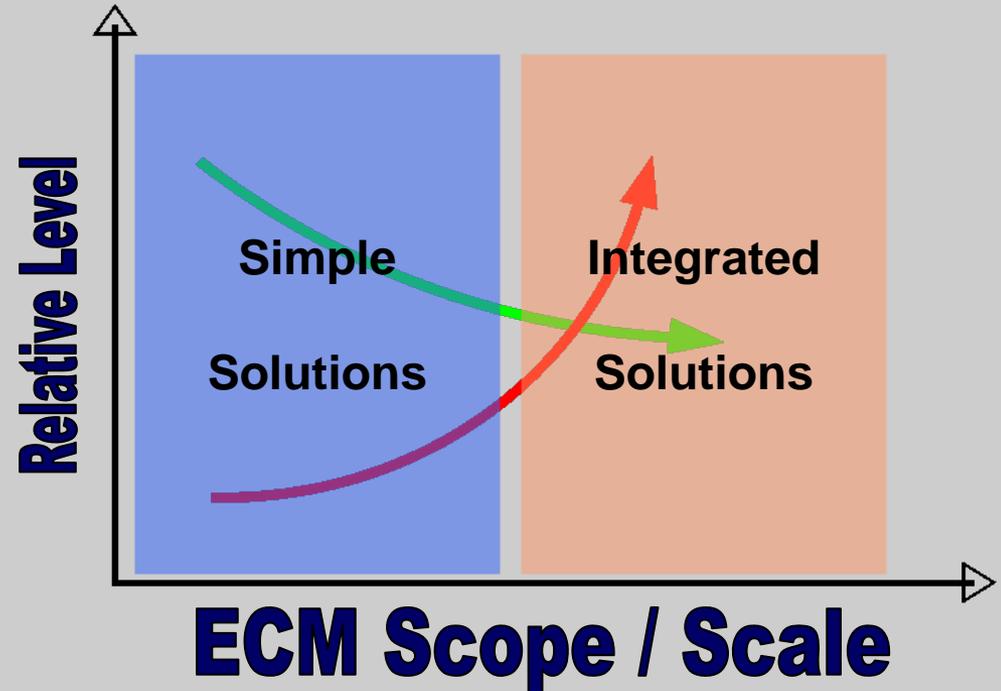


**Industrial
Energy Savings
"Conundrum"**



Presentation Focus

- Bookend Project Examples
 - Simple Solutions
 - Integrated Solutions



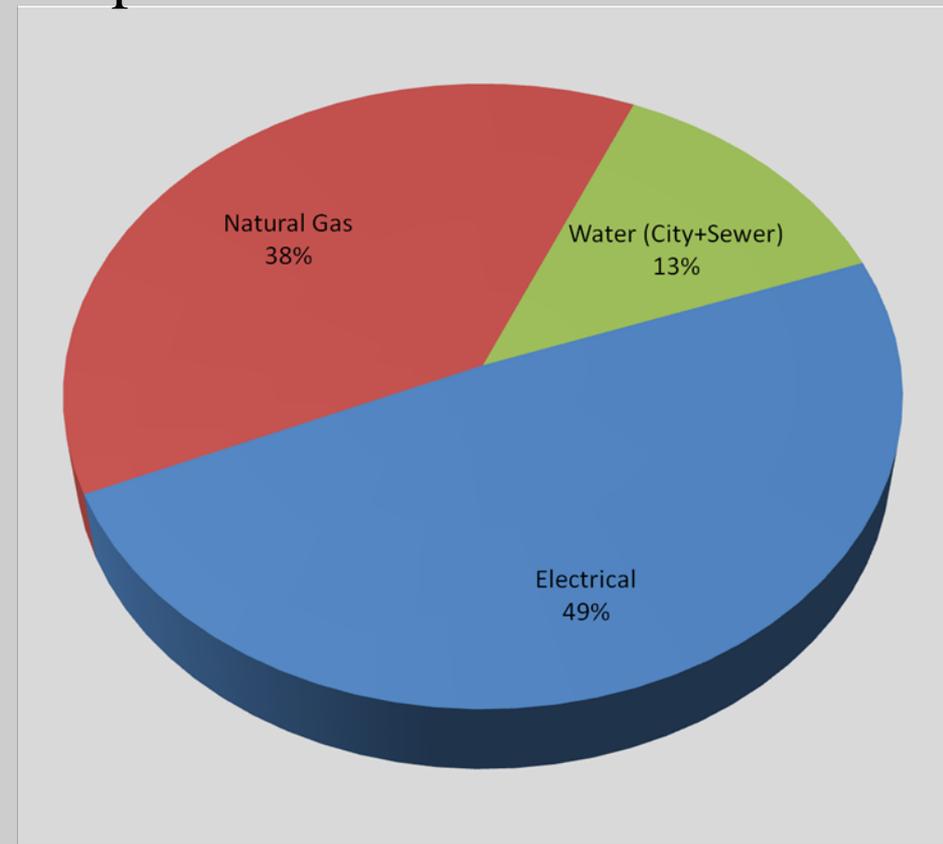


Presentation Focus

- Industrial Facility Utility Consumption Profiles

- Electrical – 49%
- Gas – 38%
- Water – 13%

- Process Steam Augmentation
- Process Heat Recovery





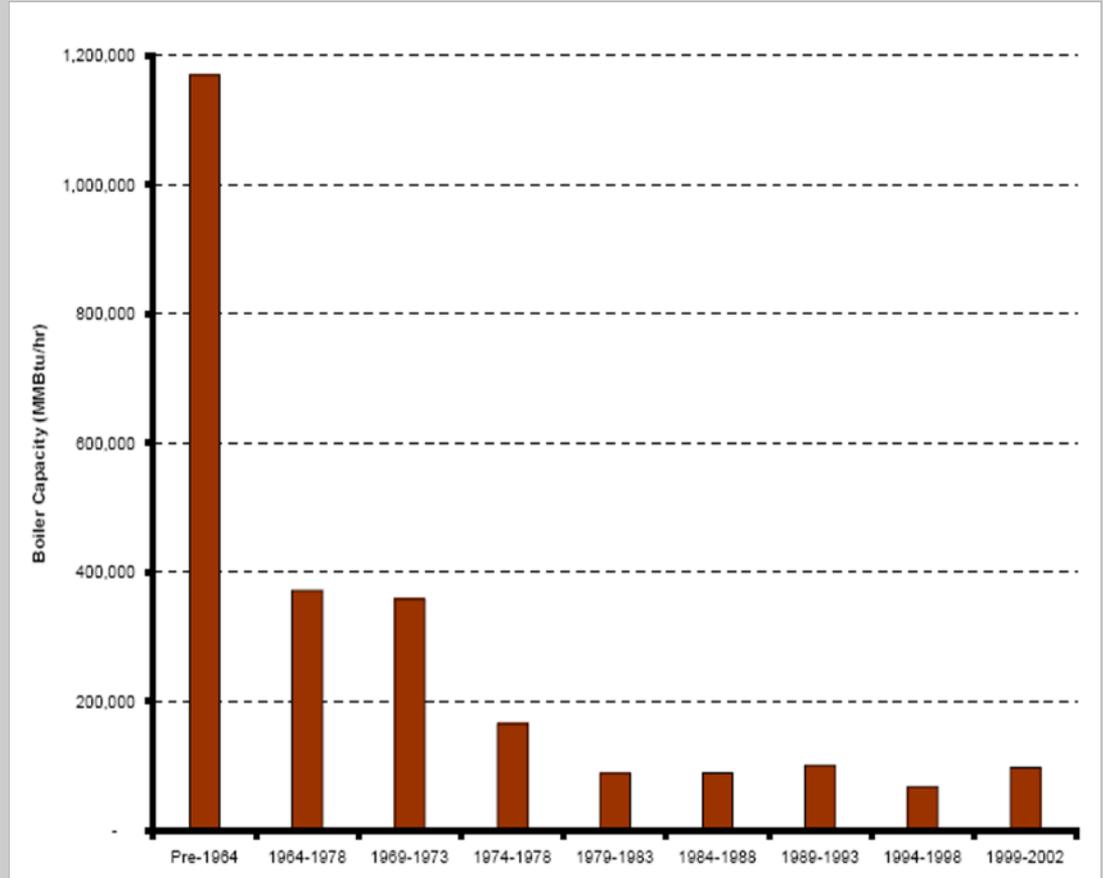
Boiler Trivia

- Industrial and commercial sectors use boilers primarily for steam and hot water production.
- **Question** - What is the annual US energy consumption for these boilers?
 - A) 100 TBtu (100,000,000,000,000)
 - B) 1,000 TBtu (1,000,000,000,000,000)
 - C) 10,000 TBtu (10,000,000,000,000,000)



Boiler Trivia

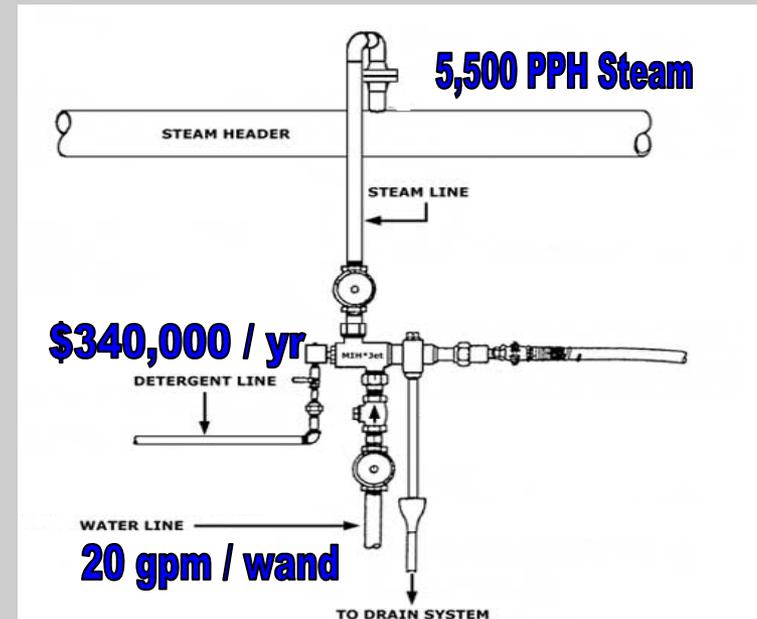
- 8,100 TBtu
- Industrial Sector
 - 43,000 Boilers
 - 1.6 million MMBtu/hr
- Age Distribution
 - >10 MMBtu/hr
 - 47% >40 years old
- Huge Savings Opportunities





Steam Optimization ECM - Simple

- Industrial Cleaning Operations (previously)
 - 2 X 3.35 MMBtu Steam Boilers
 - Continuous 60 - 120 gpm potable water
 - Off-use safety concerns

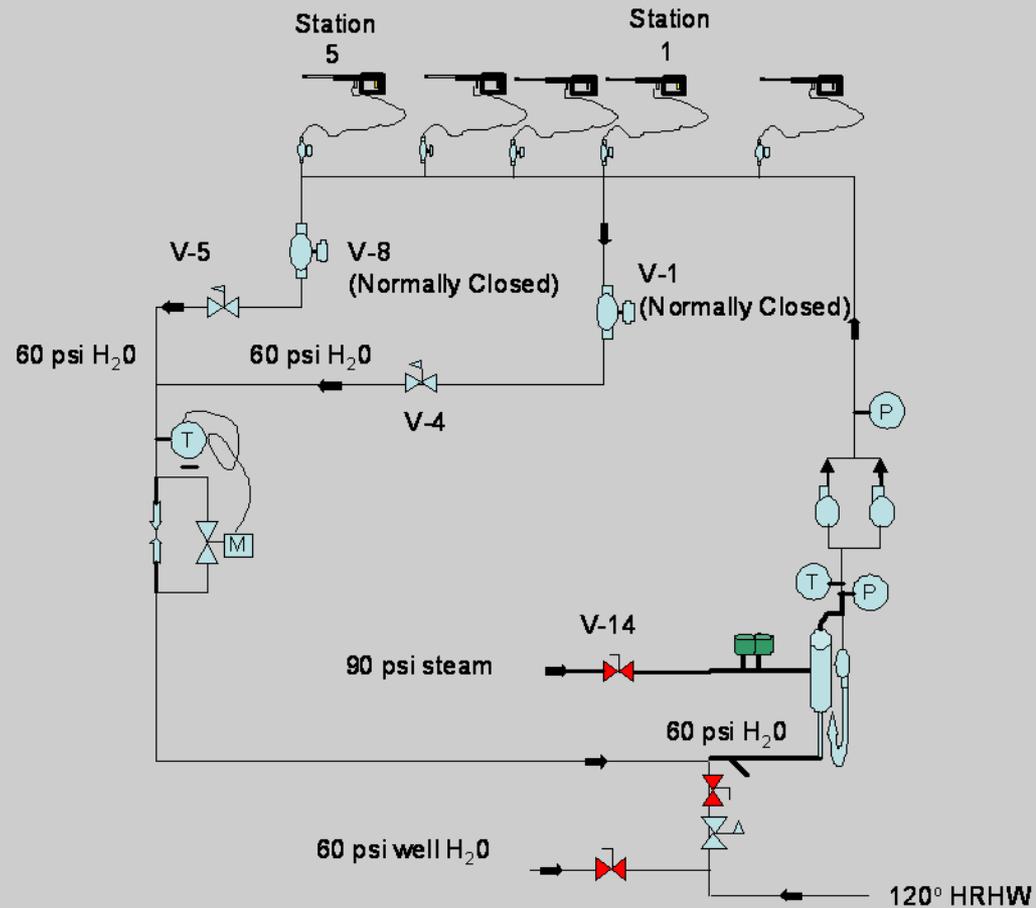




Steam Optimization ECM - Simple

Cleaning Operations (Upgrade)

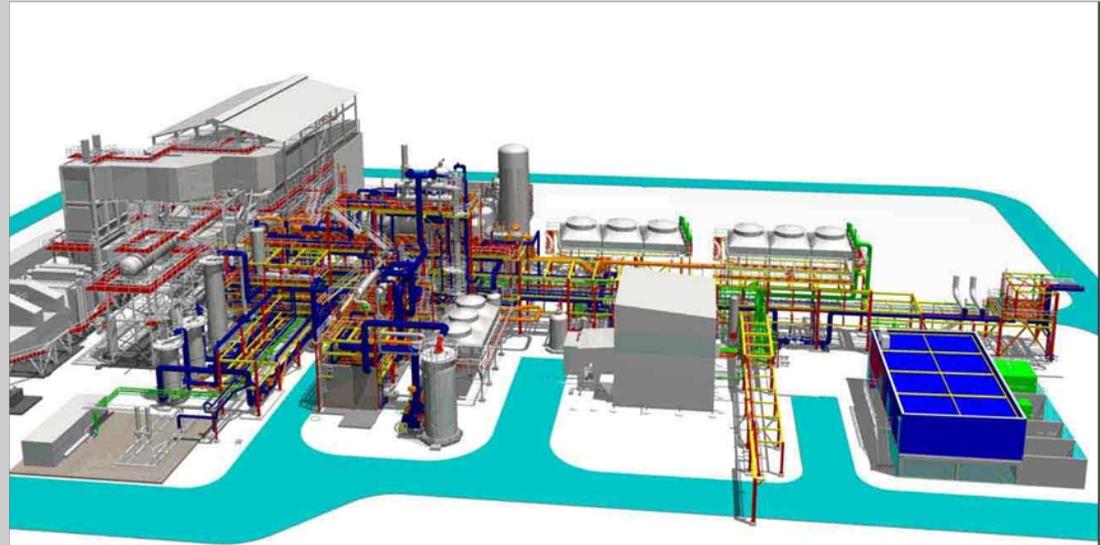
- New spraygun
- Isolation capability
- Utilizes recovered thermal energy (from compressed air system)
- 87% Natural Gas Consumption
- 93% Water Reduction
- \$300,000 / yr de-greaser savings
- IWTP virtually obsolete





Steam Optimization ECM - Simple

- Industrial Steam Infrastructure - Existing
 - Losses up to 60%
 - Steam losses exceed loads during summer operation
 - Run at 40% higher pressure
 - Aged / Unreliable
 - Interwoven
 - Highly Distributive





Steam Optimization ECM - Simple

- Steam Decentralization

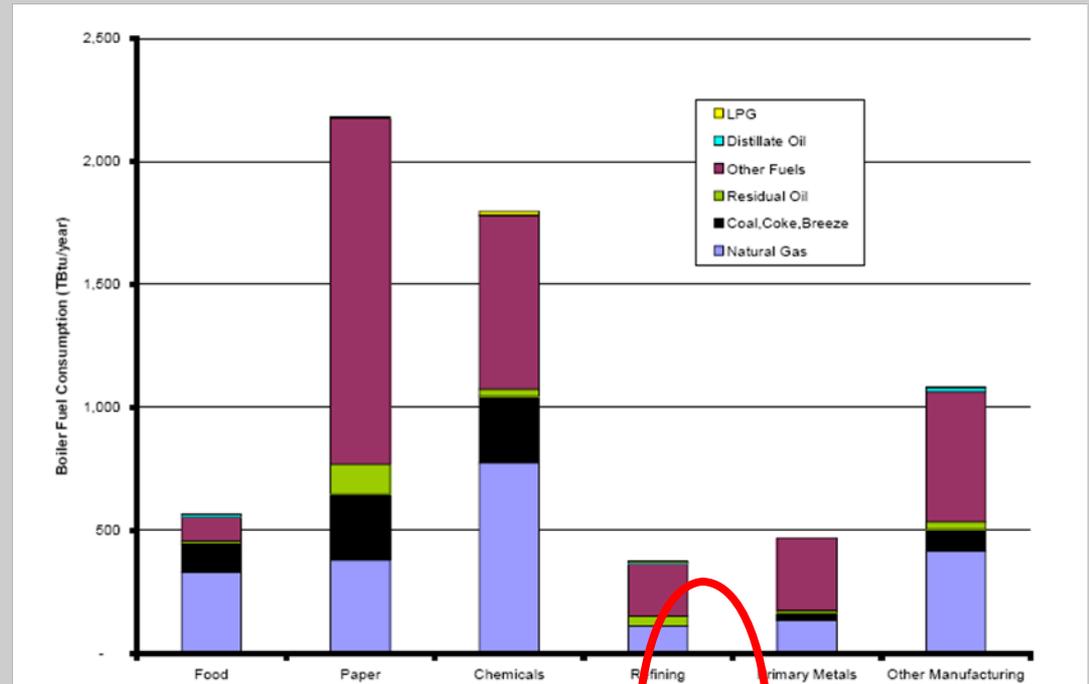
- Shut down central steam plant seasonally / completely
- Switch to cleaner fuel
- Replace single high pressure steam plant with distributed low pressure plants located near loads
- Utilize modular systems
- Higher efficiency systems





Steam Optimization ECM - Integrated

- Industrial Boilers by Sector
 - Production tied to efficient energy production
 - Invested interests in renewables and effective steam production

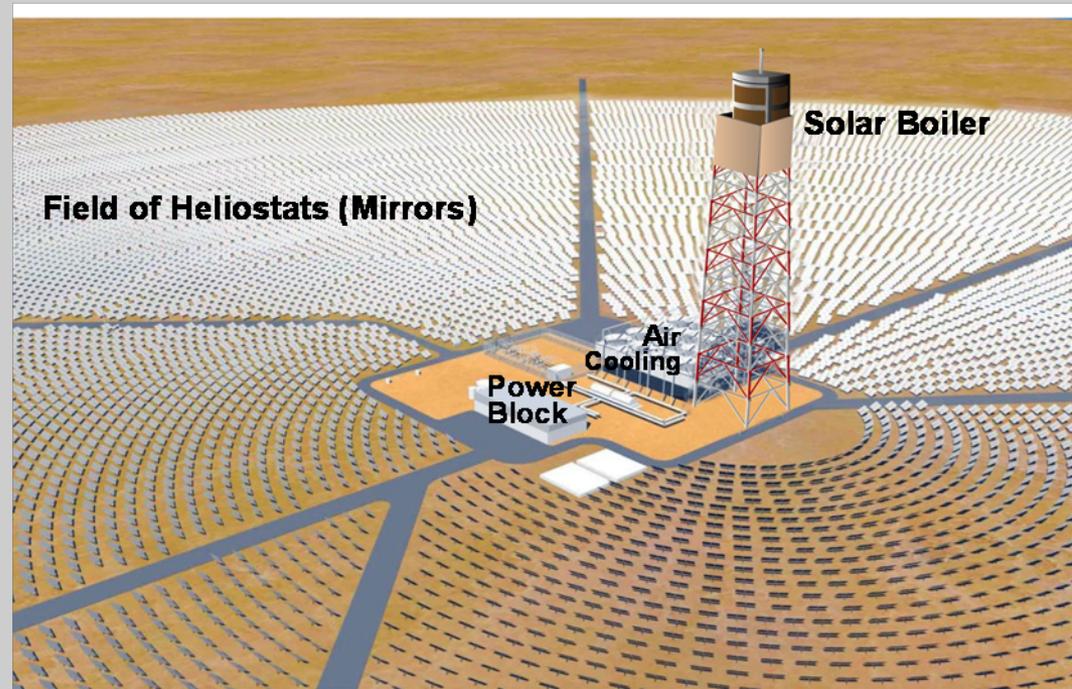




Steam Optimization ECM - Integrated

Concentrating Solar Steam Generators

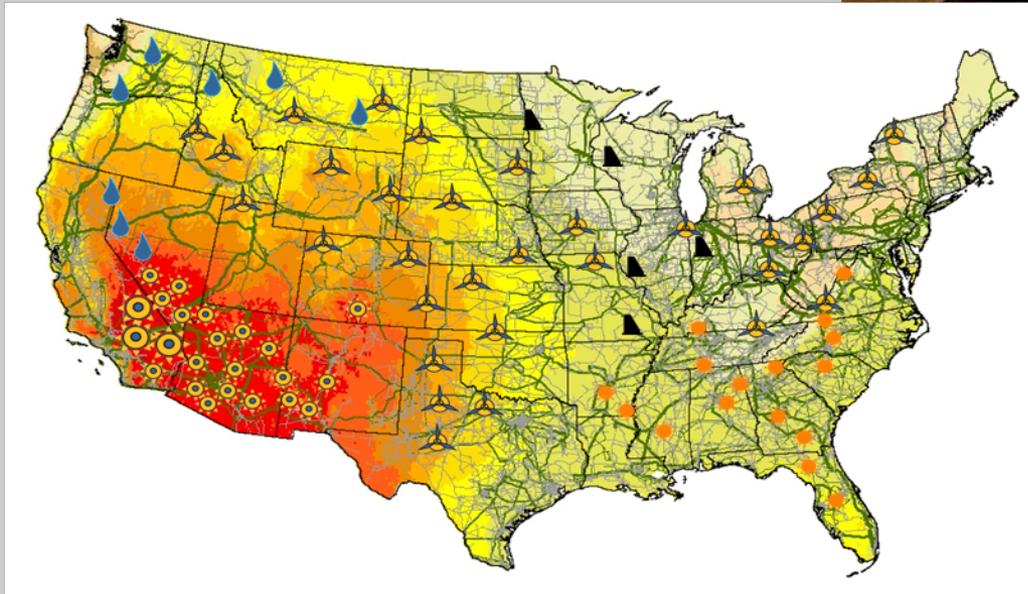
- Direct Solar-to-Steam
- Low Parasitic Load
- Uses Commodity Materials
 - Flat Glass
 - Minimum Concrete
 - Minimum Steel
- Air Cooled Power Block
- Uses Direct Sunlight to Generate Super Heated Steam





Steam Optimization ECM - Integrated

- Power Towers
 - Less Water Consumption
 - Scalable
 - Augment existing production





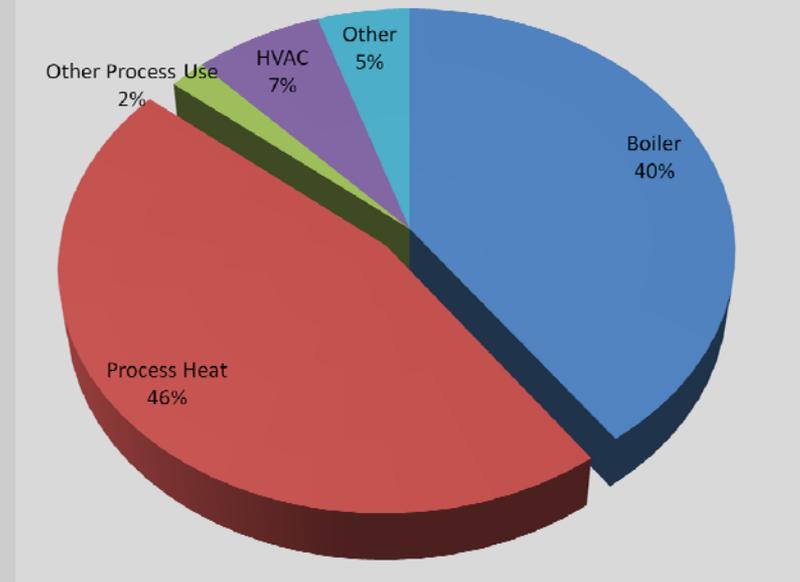
Industrial Process Heat Use

Industrial Sector

- High Heat Density
- Recovery & Reuse
- Renewables



Industrial Facility Natural Gas Consumption *US - DOE*



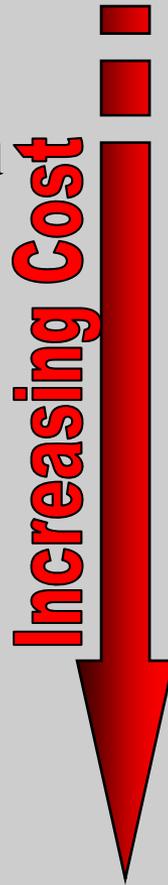


Industrial Natural Gas Use

Process Heat ECM's

- Quality vs Quantity
- Paybacks inversely proportional to recovered temps

Industrial Facility Waste Heat Quality

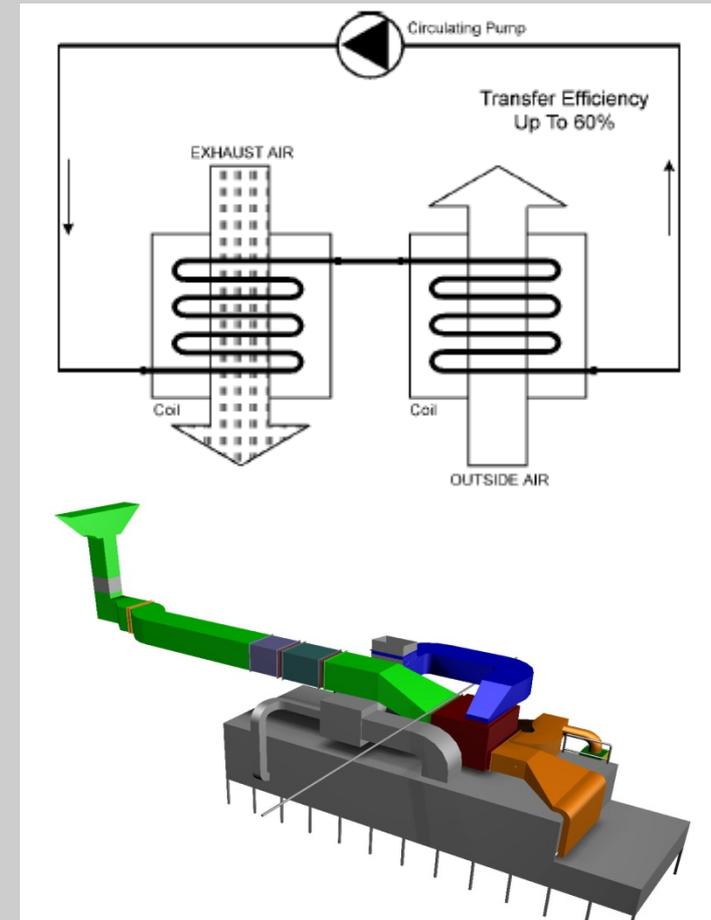


	Type of Industrial Process	Temp Range (°F)	
		Low	High
High Temp	Open hearth furnace	1,202	1,292
	Hydrogen plants	1,202	1,832
	Solid waste incinerators	1,202	1,832
	Cement kiln (Dry process)	1,148	1,346
	Heat treatment furnace	797	1,202
	Annealing furnace cooling systems	797	1,202
	Gas turbine exhaust	698	1,004
	Reciprocating engine exhaust	599	1,112
	Medium Temp	Steam boiler exhaust	446
Drying & baking ovens		446	1,112
Drying, baking and curing ovens		199	446
Annealing furnaces		151	446
Internal combustion engines		151	248
Low Temp	Process steam condensate	131	190
	Cooling water from: Furnace doors	90	131
	Bearings	90	190
	Welding machines	90	190
	Air conditioning and refrigeration condensers	90	109
	Hot processed liquids	90	450
	Air compressors	81	122
	Pumps	81	190



Process Heat Recovery ECM - Simple

- Run around coil exchanger
 - Heat transfer from hot to colder fluid via heat transfer fluid
 - Effective for 100% outside air process systems
 - 30% energy savings
 - Wide facility applicability
 - Paint Operations
 - Remanufacturing
 - Plating Facilities
 - Labs
 - Cleanrooms
 - Data Centers





Process Heat Recovery ECM - Integrated

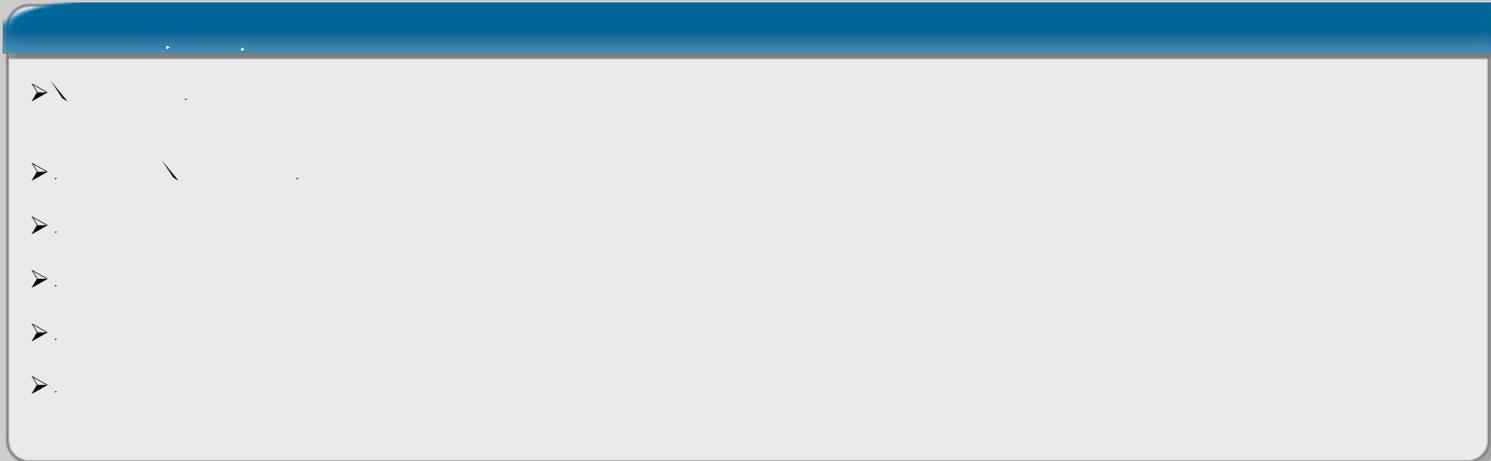
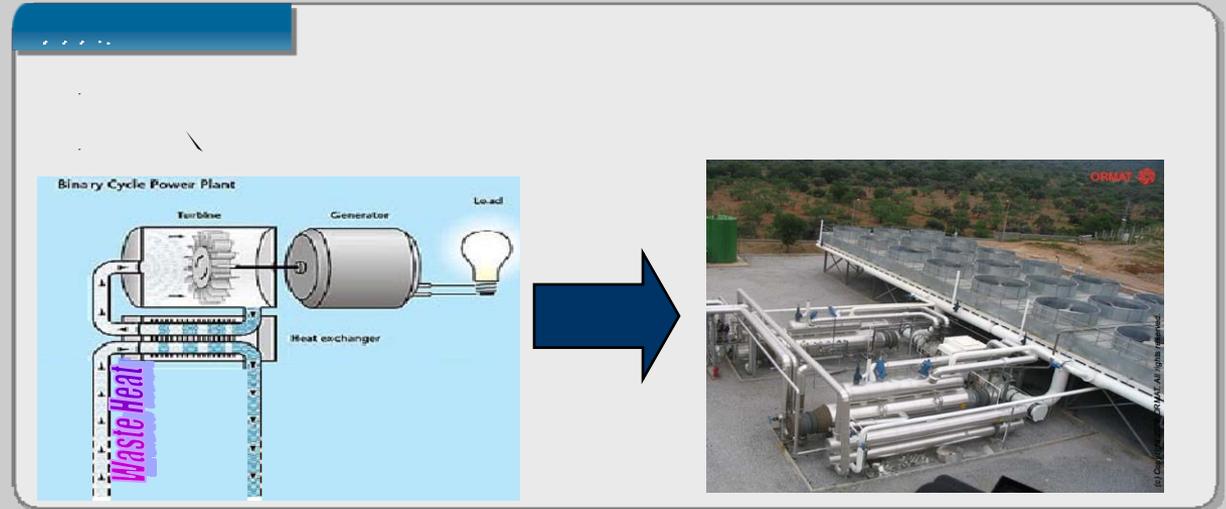
Waste Heat Recovery from Industrial Plants (Hydrocarbon Production) Potential in US

State	Total Processed Water, 2004 (bbl)	Power, MW @ 140°C (285)°F
Alabama	203,223,404	47
Arkansas	258,095,372	59
California	5,080,065,058	1169
Florida	160,412,148	37
Louisiana	2,136,572,640	492
Mississippi	592,517,602	136
Oklahoma	12,423,264,300	2860
Texas	12,097,990,120	2785
Total	32,952,140,644 bbl	7,585 MW



Process Heat Recovery ECM - Integrated

- Organic Rankine Cycle (ORC)

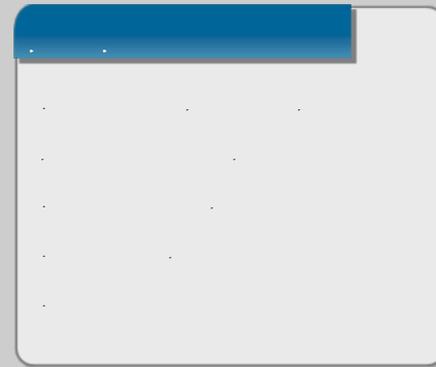
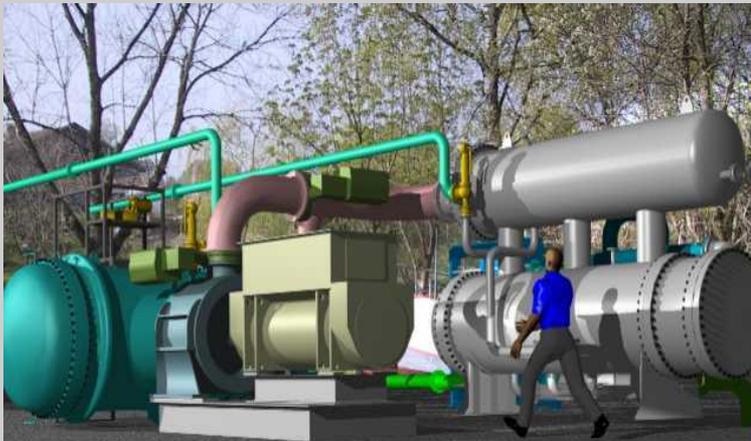




Process Heat Recovery ECM - Integrated

- Potential Use Opportunities

- Large volumes (>100,000 gpd) of hot (165 F -200 F min) produced fluids
- Reduce or eliminate more costly and higher maintenance traditional fluid cooling methods (fin-fans/cooling towers)
- Build renewable, base load green power energy source
- Reduce carbon footprint and allow expansion of operations





Would you like to know more about this session?

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