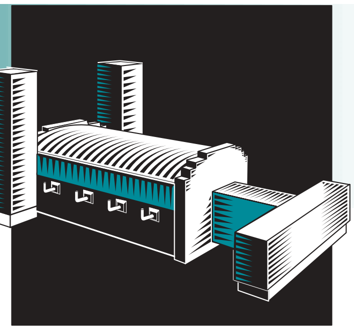
PROCESS HEATING

Cost Reduction Strategies

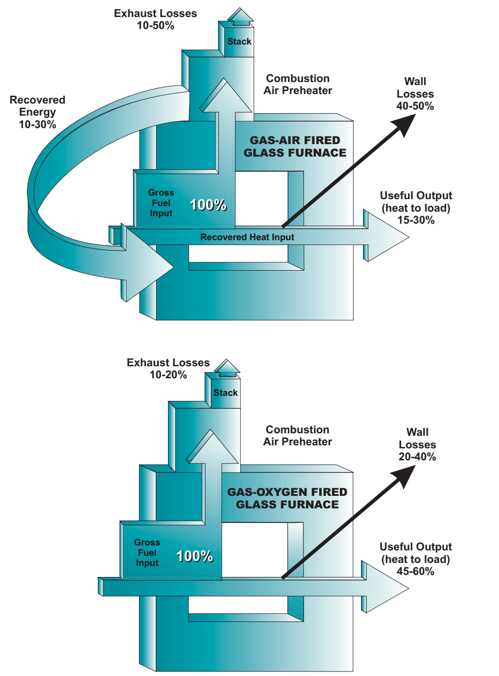


EFFICIENT OPERATIONS FOR PROCESS HEATING EQUIPMENT

Did you know...

2% excess oxygen in a 10 MMBTU/hr furnace costs $40,000 to $50,000 a year in extra fuel costs?

Virtually all glass making relies on furnaces and other process heating operations. Typically, thermal efficiency of process heating equipment in the glass industry range from 30-60% and offers major opportunities for manufacturing cost reduction. Here are some ways to help you identify and evaluate process heating improvement opportunities in your glass plant. The figure on the right illustrates the distribution for heat used and identifies pathways for losses.



Typical Distribution of Energy for Glass Industry Process Heating Equipment

Check it out

When considering the process heating system in your facility, start by looking at the equipment selection, operation, and maintenance. The table (see reverse) suggests some remedial measures.

COMBUSTION/HEATING SYSTEMS

Select appropriate burner to maximize heat transfer to load; consider conversion to oxy-fuel if economic of utilities are favorable or environmental requirements are compelling; consider oxygen or electrical boosting

FURNACE CONSTRUCTION

Utilize maximum suitable insulation and model critical areas; fully seal furnace superstructure, regenerator, recuperator and flue systems to minimize air infiltration; use seals around burners, peepholes and doors; separate regenerator chambers to improve control of air/gas ratio in individual ports; employ efficient packing design for regenerators; design furnace to minimize internal cooling and reheating in recirculating glass flows

FLUE GAS HEAT RECOVERY

Properly size heat recovery units; consider forehearth heat removal; consider forming process heat recovery; use flue gas heat for preheating combustion air or load

EFFICIENT OPERATIONS AND CONTROLS

Use proper settings for zone temperatures and furnace pressure; optimize fuel/oxidant ratio; reduce variability in fuel quality; use predictive models to optimize heating; employ advanced control systems to improve quality

MAINTENANCE AND HOUSEKEEPING

Clean fouled heat recovery units (e.g., plugged checkers, fouled recuperator surface); remove and recycle by-products; check sealed areas regularly

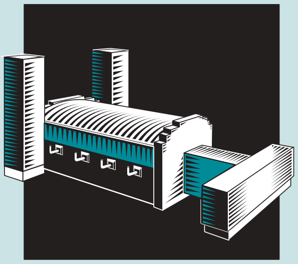
OTHER ENERGY SAVINGS AND CONTROLS

Use bubbling in melt to improve convective heat transfer; consider electrical boosting under batch blanket; minimize low throughput operation; minimize job change times and downtime

Evaluate and take action

The following table lists energy saving measures associated with process heating steps.

Improvement Area	Energy-Saving Method	Energy Saving Potential	Typical Implementation Period	Typical Payback Period
Efficient Operation of Heat Generating Equipment	Maintain minimum required free oxygen in combustion products from burners for fuel-fired process heating equipment.	2% to 10%	1 to 4 weeks	1 to 6 months
Efficient Combustion (burners)	Eliminate formation of excessive CO (more than 50 ppm) or unburned hydrocarbons through control of air-fuel ratio. Also eliminate or minimize air leakage into oxy-fuel fired furnaces.	2% to 10%	1 to 4 weeks	1 to 6 months
Flue Gas Heat Recovery	Preheat and/or dry combustion air and the batch. After-burn the combustibles (CO, H_2, etc.) from process equipment. Cascade the exhaust gas heat to the lower-temperature process heating equipment.	5% to 25%	3 to 6 months	6 to 24 months
Heat Loss Reduction	Use optimum insulation for equipment and regularly maintain the insulation. Ensure proper insulation design and maintenance for water-cooled parts. Employ proper furnace pressure control.	1% to 5%	1 to 10 weeks	3 to 12 months
Design of Furnaces and Heating Systems to Increase Heat Transfer	Select proper burner and furnace design to enhance heat transfer (via convection or radiation) to the load. Use modeling to effectively design and operate furnace.	5% to 10%	1 to 12 months	6 to 24 months
Furnace Operation	Clean heat transfer surfaces frequently for indirect heat systems (i.e., steam coils, radiant tubes).	5% to 10%	1 to 12 months	6 to 24 months
Improved Scheduling and Load Management	Wherever possilble, operate with full load; minimize idle time, shutdowns, and start-up cycles.	2% to 5%	1 to 4 weeks	3 to 18 months
Use of Process Simulation/ Design Models for Optimization	Use models to optimize temperature control settings to minimize long “soak” times or overheating.	5% to 10%	1 to 6 months	12 to 24 months
Equipment Design Materials (insulation, refractories, etc.)	Use advanced and improved materials. Design and apply advanced material containment systems.	2% to 5%	Weeks to months	3 to 24 months
Upgraded or Advanced Controls	Improved combustion efficiency through improved ratio control and/or minimized temperature requirements.	2% to 4%	6 to 12 months	6 to 12 months
Separated Checker Chambers	Individual control of combustion air flow minimizes amount of air required for system.	2% to 5%	At Furnace rebuilds or construction	6 to 24 Months
Sealed Combustion Air and Exhaust System	Minimize infiltration of cold air into pre-heated combustion air.	2% to 3%	1 to 3 months	6 to 24 months



Other Resources

OIT Clearinghouse
800-862-2086

www.oit.doe.gov/bestpractices

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