

## **ROLLING MILL OPPORTUNITY PORTFOLIO**

### Description of Operation

12" by 14" and 10" by 10" blooms are trucked in from the caster. The blooms are then loaded hot or cold into the 32 1 MMBTU/hr rated reheat walking beam furnace and heated to 2300 degrees F. The heated blooms are rolled out the side of the furnace onto a transfer table. The transfer table moves the blooms onto a roll table, which rolls the blooms through the 40-inch reversing mill and the deseamer. The blooms are then moved across the transfer table to the six-stand mill and reduced further. From the six-stand mill most of the product is transported on roll tables where it is cut to length, stamped and then transferred onto the cooling beds where conditioning inspects the product for defects and grinds the steel accordingly. If the steel needs to be reduced further after the six-stand mill, the steel is moved across the transfer table and rolled through the four-stand mill. After the four-stand mill, the bloom is then cut to length, stamped, and transferred onto the cooling beds. Finished products are then loaded into rail cars and delivered to the other mills and/or customers.

### Losses Due to Excessive Natural Gas Use

Approximately \$437,986 in purchased natural gas is lost annually due to excessive natural gas use in the 32 1 MMBTU/hr Rolling Mill walking beam reheat furnace.

\$202,284 in excessive natural gas is used annually due to the current heating strategies used for the type steel being charged and not using any type of delay strategy.

\$169,570 in excessive natural gas is used annually due to the current operation of using mixed gas, controlling the furnace with the current PID loops and the impulse lines which control the combustion air being installed in the wrong locations.

\$66. 1 32 in excessive natural gas is lost annually due to inefficient hot charging to the Rolling Mill Reheat furnace. Raising the average temperature of charged steel by fifteen degrees could generate this amount of savings in natural gas.

### Description of Operation

The Rolling Mill reheat furnace is used to reheat 12 x 14 inch and 10 x 10 inch hot or cold blooms from 100 degrees F to 2300 degrees F. The furnace is a Salem walking beam furnace that is designed to reheat blooms at a rate of 200 tons per hour hot charge or 150 tons per hour with cold charge. The furnace currently burns mixed gas with a 705 BTU/SCF heating value and then mixed with 800 degrees F combustion air, which has been preheated through a recuperator. The furnace consists of six control zones which all use preheated combustion air with the exception of the top soak zone. The top soak zone is supplied air from a separate blower and consists of 18, 1 MMBTU/hr burners. Cooling water is supplied by a 5500 gpm @ 30 psi pump which pumps 82 degrees F service water in and discharges at 89 degrees F.

## Rolling Mill Annual Natural Gas Cost

\$3,371,400 in natural gas is burned in the 321 MMBTU/hr rolling mill reheat furnace per year.

### Cause 1 — Excessive Natural Gas Use Due to Limited Heating / Delay Strategies

\$202,284 per year excess gas is being used due to limited heating strategies and absence of any delay strategies. Currently, one heating practice is used for the majority of the different types of steel with exception of some high carbon and alloy steel. Set points for each zone is assigned on the heating practices sent from QA. The operators adjust their set points accordingly for each zone. These heating strategies have the same assigned set points each time. Since different steels require different heat rates to achieve the target temperature of 2300 degrees F, the firing rates should be adjusted to follow. This will not only save fuel but will reduce scale build up in the furnace.

The furnace is also operated at the designated set points when the mill is in delay. It has been noticed that in many instances, the mill does not communicate delays to the furnace operators and the furnace remains at the designated firing rate.

#### Recommendations

Determine the best heating strategy for each grade of steel and program the Allen Bradley PLC accordingly. The estimated cost for this is \$5,000. This will allow the operators to adjust heating strategies easily and efficiently without having to change the individual set points. The same can be accomplished with a delay strategy. When a delay occurs in the mill, the mill would report the estimated time of delay to the furnace operator who in turn would enter the delay into the AB. The AB would be programmed to ramp down the furnace and back up again according to the estimated time entered. If the delay estimate is changed, the operator should be notified and enter this into the AB.

### Cause 2 — Excess Natural Gas Use Due to Using Mixed Gas, Improper Impulse Line Installation and PID Loops Out of Adjustment.

\$168,570 per year excess gas is being used due to using mixed gas instead of natural gas, improper installation of the combustion air impulse lines and the current PID loops. These three items contribute to poor furnace control, which is resulting in off-ratio combustion. Two oxygen readings have been taken in the stack to verify that perfect combustion is not being achieved during operation of the furnace.

#### Recommendations

Eliminate the mixing station and reprogram the PLC to adjust to the proper ratio. This cost is estimated at \$5,000. Mixed gas is currently being mixed at a mixing station by adding 3.72% oxygen from air. This is decreasing the BTU value down to 705 BTU/SCF. There is currently no way to monitor this BTU rating, as the FARM at the mixing station is not in operation. The valves are therefore opened and closed as to what looks good and there is not any way to measure the accuracy.

Install the impulse lines properly and adjust transmitters and PLC accordingly. This should be performed at no cost by contractor due to improper installation. The impulse lines that control the combustion air are currently installed improperly. This is sending bogus readings to the PLC. This results in poor combustion control and therefore loss of efficiency.

Adjust the PID loops so they can properly hold temperature without exceeding the set point. This estimated cost is \$5,000. The operators constantly have to put different control zones in manual operation and adjust the gas and airflow to control furnace temperature. The furnace constantly gets high temperature alarms when the zones are set to their proper settings. This is due to poor timing in the PID loops.

### Cause 3 — Excess Natural Gas Use Due to Inefficient Hot Charging

Approximately \$66,132 is lost annually in natural gas expenses due to inefficient hot charging of steel into the rolling mill reheat furnace. Better hot charging of steel into the reheat furnace will decrease gas usage and increase production. The above estimated saving is based on raising the charged steel temperature fifteen degrees.

Hot charging is currently part of the process but due to the current scheduling, transportation, and storage methods, the steel loses a substantial amount of useful heat. Numerous observations have been made during the charging process where the wrong steel has been delivered to the furnace or the steel has been marked incorrectly. This takes time to verify the correct steel or return the steel back to the caster and the proper steel delivered. The steel is also delivered in open bed trucks, which lose heat during transportation. The same problem exists with the storage of the steel when the steel is not charged into the furnace immediately after the casting process.

### Recommendations

Scheduling the caster with the rolling mill, improving storage methods, improving the transportation of the steel, and eliminating the identification errors will increase the charging temperature by an estimated 15 degrees. This will amount to a yearly saving of \$66,132. This amount of savings is calculated from the assumptions listed below.

Annual Production Rate	600,00 tons
Cost of Natural Gas	\$3.34 / MMBTU
Delta T	15 degrees
Specific Heat of Steel	0.11 BTU / (lb * deg F)

## **BOP SHOP OPPORTUNITY PORTFOLIO**

### Description of Operation

The BOP operations receive molten iron from the blast furnaces by the use of subladle cars. The BOP Shop then processes the metal to the correct specifications and transports the produced steel to the two casters. The handling of the steel is done with 220-ton ladles that must be preheated to the proper temperature. These ladles are preheated by vertical ladle heating units. The ladle preheaters are in need of calibration and repair. The to be 4380 hr/yr out of 8760 hr/yr total

Assuming the heater runs at 10% rated capacity on average for drying and 70% rated capacity for preheating, the time for preheating and drying are roughly the same, so on average there are seven units in this process. SSC has conducted extensive time studies on six of the seven heating units and graphed the resulting heating profiles. These heaters are operating inefficiently and should be improved.

After being blown with oxygen in the vessel, the steel is then processed in one of two ladle metallurgical furnaces. These furnaces should be tuned to improve their electrical efficiency. SSC has analyzed data from these two units and has found that one is operating better than the other is. In comparison to results found from previous clients' operation of similar units, there is room for improvement in terms of operating efficiency. Additional savings will result from improved motor efficiency and operational improvements in seven dust collectors associated with the operation.

### Losses Due to Excessive Natural Gas Use

Approximately \$674,330 in purchased natural gas is lost annually due to excessive natural gas use in the BOP Shop. This amount of natural gas savings could be realized by improving the design and combustion control on six of the seven ladle preheaters. The Global Heat heater that was installed a few months ago is used exclusively for drying and it has good combustion control, thus is not considered for improvement. It appears that the system is in good condition, and it uses much less natural gas than the other ladle heaters. For these reasons SSC does not recommend making any changes to this system.

### BOP Shop Annual Natural Gas Cost

Average Natural Gas Cost for 1/97 to 6/97	\$3.26/MMBTU
Estimated Annual Metered Use for 8/96 to 7/97	574,292 MMBTU
Estimated Annual Natural Gas Cost for the Total BOP Shop (Based on Previous Metered Use Prior to Failure of Meter)	\$1,872,192

The seven ladle heaters in the BOP Shop comprise 44% of BOP total natural gas use. Other natural gas users in BOP total include the iron ladle dryer, two mixer burners, scrap preheating, and area heaters.

### Cause 1 — Excessive Natural Gas Use in the Ladle Heaters

#### Description of Operation

The ladle preheaters are used for drying refractory with the prescribed methods and for preheating ladles to 2100-2300 degrees F for use in operation. The preheater systems are tuned and checked on an annual basis.

Improving the design of the ladle preheaters can save an estimated \$555,330 of natural gas. This is calculated as a 70% improvement in efficiency over the current use of natural gas in six ladle preheaters.

Improving the combustion control of the ladle preheaters can save an estimated \$119,000 of natural gas. This is calculated as a 1 5% improvement in efficiency over the current use of natural gas in six ladle preheaters.

Additional benefits to the recommended improvements include increased refractory life due to better drying practices, possible production improvements due to ladles heating faster, and electricity use may decrease in LMFs due to decreased loss of steel heat to the ladles.

#### Recommendations

Option 1: Improving the heaters with oxygen-fuel-air burners, better control, and improving the lids for better closure can save an estimated 70% in natural gas use. Once SSC has at least two months of readings from the new gas meter, which was replaced in the beginning of September, SSC recommends installing one of the improved heaters initially. Once this unit demonstrates the expected results, which can be proven with time studies and measured gas usage, the other units can be installed.

Option 2: Checking and tuning the systems monthly and improvements in control can save an estimated 1 5% in natural gas use.

#### Cost Justification for Option 1:

Initial Cost of Equipment = 6 * \$65,300 =	\$391,800
Estimated Cost of Installation = 6 * \$10,000 =	\$ 60,000
Total Initial Cost =	\$451,800

#### Cost Justification for Option 2:

Estimated Cost:	
Labor = 6 * 1 * 12 times/yr * \$35/hr =	\$2520/yr
Parts =	\$3000/yr
Estimated Annual Cost	\$5520

#### Annual Cost for Increased Oxygen Use:

For 6 ladle heater systems with 15 MMBTU/hr rated oxy-fuel-air burners  
Heater operating hours, assuming on average the heater runs  $\sqrt{2}$  the time, are estimated to be 4380 hr/yr out of 8760 hr/yr total

Assuming the heater is drying 25% of the operating time using an average of 500 MCF/hr of oxygen, and the heater is heating and holding temperature for 75% of the operating time using an average of 6,500 MCF/hr of oxygen.

= 6 4380 hr/yr * (ft25 * 500 SCF/hr + 75 6,500 SCF/hr) =	31,400,000 SCF
Estimated Annual Oxygen Use	131,400 MCF
Average Oxygen Cost for 1/97 to 6/97	\$1.99/MCF
Estimated Annual Oxygen Cost	\$261,486

#### Losses Due to Excessive Electricity Use

Approximately \$645,641 in purchased electricity is lost annually due to excessive electricity use in the BOP Shop. Improvements in the baghouse control and maintenance, motor testing, and LMF tuning would generate this amount of savings.

#### BOP Shop Annual Electricity Cost

Average Electricity Cost for 1/97 to 6/97	\$46.01/MkWh
Annual Electricity Use for the Total BOP Shop	146,688 MkWh
Annual Electricity Cost for the Total BOP Shop	\$6,749,115
Measured Annual Electricity for the BOP Shop Area Excluding the LMF Use:	
Annual Electricity Use for the BOP Shop Area	84,420 MkWh
Annual Electricity Cost for the BOP Shop Area	\$3,884,164
(Based on Average Monthly Electricity Use for 1/96 to 7/97)	

#### Cause 1 — Excessive Electricity Used on the Baghouses Description of Operation

The BOP baghouses include the AQC baghouse, desulfur baghouse, LMF #1 baghouse, LMF #2 baghouse, CAB baghouse, flux unloading baghouse, and the trimmer baghouse. The leaded steel baghouse is not included in these recommendations because it is used only occasionally. Most of the fans of these baghouses run continuously at full load. All maintenance work on the baghouses is outsourced and all of these baghouses are in poor condition.

Improving the baghouses can save an estimated \$87,309 in electricity. This is calculated as a 10% improvement in efficiency over the current use of electricity in seven baghouses.

#### Calculated Electricity Cost for BOP Baghouses

Based on 2,905 Hp in motors in use on average	
2,905 Hp * 0.7457 kW/HP * 8760 hr/yr	18,976,000 kWh/yr
Estimated Annual Electricity Cost	\$873,086

### Recommendations

Controlling the use of the baghouses to match the needs of the respective areas will generate a large amount of savings. Better cleaning of the baghouses, repair of air locks, repairing air lines and valves, replacing torn, burnt, and clogged bags, and general improved maintenance can generate an estimated 10% savings on the electricity use of these baghouses.

An Additional benefit to the recommended improvements is improved air quality in the BOP Shop areas.

### Cost Justification

Estimated Annual Cost for maintenance and maintenance parts \$50,000/yr

### Cause 2 Excessive Electricity Use in Large Motors

#### Description of Operation

Large motors are used for LSP ID fans, LSP cooling tower pumps and fans, hood cooling pumps, eight baghouses, and pumps for two other cooling towers.

The majority of these motors are tested for vibration monthly, the larger ones are tested weekly, and some are tested only every 3 months. Oil analysis is also done regularly on the largest gearboxes. Motor alignment with dial indicators is usually done for installation only, and thermography has been done sporadically. Measurement of amp loads is done regularly on the majority of these motors.

Increasing the motor testing can save an estimated \$290,935 in electricity. This is calculated as a 1 % improvement in efficiency over the current use of electricity in the large motors at the BOP Shop.

Additional benefits to the recommended improvements include savings in overall maintenance costs for replacement and repair of destroyed motors and savings from reducing production losses due to motor failure.

### Calculated Electricity Cost for BOP Motors

#### Calculated Electricity Use For All Large-Sized, Highly Used AC Motors

Based on 12,100 Hp in motors (+/- 10%), Estimated 80% Utilization Factor

12,100 Hp * 0.7457 kW/HP * 8760 hr/yr. * 0.80 =	63,233,000 kWh
Estimated Annual Electricity Use	63,233 MWh
Estimated Annual Electricity Cost	\$2,909,350

### Recommendations

Regular testing by all methods listed above (vibration, spectrographic oil analysis, laser alignment, and thermography) should be done at least monthly on all motors with a power rating of 100 Hp or greater, and for all smaller motors that have a utilization factor of 50% or greater.

USS/KOBE can either continue to outsource these services or develop the means to do such testing and record keeping in house. SSC's current recommendation is to continue outsourcing until such a time when USS/KOBE has the proper equipment and trained personnel to conduct the tests in house, which may happen at a later date.

#### Cost Justification

Vibration Testing 50 additional points \$10/point * 12 mo/yr. =	\$ 6,000
Thermography \$750/visit 12 visits/yr. =	\$ 9,000
AC Motor Winding Testing \$750/visit * 12 visits/yr. =	\$ 9,000
Additional Oil Testing \$700/mo. * 12 mo/yr =	\$ 8,400
Total Annual Cost	\$32,000

#### Cause 3 — Excessive Electricity Use in LMF #1 and LMF #2

##### Description of Operation

The LMFs are used on every heat to further refine the steel and to reheat the steel for the casters. Generally, LMF #1 supplies the billet caster and LMF #2 supplies the bloom caster. The electrode manufacturer tunes both LMFs quarterly to improve power factor. An independent company that works with SSC can tune the furnaces to improve energy efficiency. This company also trains the operators to run the LMFs more efficiently.

Average kWh use for LMF #1 (based on Jan-97 to Jul-97)	31.11 kWh/Ton
Average kWh use for LMF #2 (based on Jan-97 to Jul-97)	44.85 kWh/Ton

Tuning both LMFs can save an estimated \$267,397 in electricity. This is calculated as a 2 kWh/ton improvement in efficiency for LMF #1 and a 5 kWh/ton improvement in efficiency for LMF #2. These savings are conservative because additional savings will be made when USS/KOBE reaches its goal of 30 heats per day.

Additional benefits to the recommended improvements include improved refractory life on ladles and possible savings in electrodes and deltas.

##### Annual Savings for LMF #1:

0.002 MkWh/ton \* 82,075 tons/mo. \* 12 mo./yr. \* \$46.01/MkWh = \$ 90,630

##### Annual Savings for LMF #2:

0.005 MkWh/ton \* 64,032 tons/mo. \* 12 mo./yr. \* \$46.01/MkWh = \$176,767

Total Annual Savings \$267,397

(Based on average production rates from Jan-97 to Jul-97)

##### Calculated Electricity Cost for LMFs

Measured Use in LMF #1 = 2,558 MkWh/mo. * 12 mo./yr.	30,696
Estimated Annual Electricity Cost	\$1,412,323
Measured Use in LMF #2 = 2,811 MkWh/mo. * 12 mo./yr.	33,732
Estimated Annual Electricity Cost	\$1,552,009

Estimated Annual Electricity Cost in Both LMFs \$2,964,332  
(Based on average monthly use from Jan-97 to Jul-97)

**Recommendations**

Tuning of both furnaces and more frequent adjustment of the electrodes to be at the same height will prevent unbalanced currents and will generate electrical savings at both LMFs.

**Cost Justification**

Estimated Annual Cost: \$40,000

## **POWERHOUSE**

### Description of operation

The “powerhouse” is actually four buildings providing a variety of services/utilities to iron making and general plant operations. The buildings are new boiler house, steam powerhouse, gas engine house, and old boiler house. Utilities provided are 25 cycle AC electricity, 250 volt DC electricity, 900 & 250 pound steam, blast furnace wind, service and recycle water, and compressed air.

25 cycle electricity is generated by #2 High-Pressure Turbo Generator, peak output 17.5 Megs. 250 pound steam powers this generator, which acts as a system buffer for the steam loop, steam is first made to service its production then to make wind thirdly to generate 25 cycle power. If there are any problems in the steam loop the generator is the first 25-cycle electrical generation provides two base benefits to the plant. First, as an independent power source for river pumps, dc generation, boiler fans, its own injector pump, and as back up power to blast furnace pumps. Secondly, it provides a cost avoidance opportunity for electrical service by converting the 25-cycle electricity to 60-cycle electricity at #4 Bloom Mill’s frequency changer. The 60-cycle electricity is distributed through the “Clinton” grid, resulting in a reduction of purchased power from Ohio Edison. Direct users of 25-cycle electricity include 250-volt DC generation, through either a motor generator set or a single field rotary AC-DC converter, servicing iron making. (Back up DC is provided by House Set #2, a 250-pound steam powered DC generator.) 3 & 4 Blast Furnace stand-by pumps, #5 injector at #2 HPT, #1 circuit to Frequency Changer, and #2 pump house.

Ladd boilers #7, #8 and #9 in the Old Boiler House produce 250-pound steam. 250 pound steam supplies the #5 turbo blower to create wind for the #3 furnace, #2 high-pressure turbo generator for 25-cycle electric generation, power plant auxiliaries and the plant steam system. Water to these boilers is provided by the recycle system.

900-pound steam is only produced in the New Boiler house and supplies steam to #6 turbo blower, generating wind for #4 Blast furnace. Feed water is condensate from interconnected condensers in powerhouse and iron making; make up comes from the treated water system. As a back up #6 Turbo Blower can use either 900 or 250-pound steam. In case of a turbo blower failure the #4 Turbo Blower can service either furnace, using 250 pound steam. Service water is river water that comes into the site by two methods, either from #2 and #3 pump houses or the lower tunnel. The pump houses lift river water to the main plant header while the lower tunnel draws water directly from the Black River to the powerhouse at the \$30 Million Hole.

Compressed air produced at the power house services iron making. It can also supply the plant wide system if needed. Back up for #6 and #7 Ingersoll Rand compressors is provided by the PAP, a steam system driven air compressor.

Losses Due to Excessive Electric Use

### Cause 1 — Water in the Blast Furnace Gas Description of Operation

Approximately \$230,400 excess purchased electricity is used annually through reduced fuel efficiency at the boilers in the Powerhouse. This amount of electric savings could be realized by removing water from the blast gas

Blast gas is the primary fuel for Powerhouse boilers. The current problem with blast gas results from the high temperature blast gas used to fire the boilers. Since March of 1996 the average blast gas temperature has been 112 degrees Fahrenheit. This is greater than the previous average temperature of 96 degrees Fahrenheit. The increase in temperature is due to saturated water in the blast gas, which is an indicator of a larger problem. Saturated water in the blast gas causes combustion inefficiencies for the boilers. The water must be removed by heat before the fuel can burn effectively. What exists is a vicious loop. Fuel expends energy to evaporate moisture, reducing combustion efficiency. The result is that the boiler requires additional inefficient fuel, hence reducing steam output. Reduced output means less steam to the turbo-generator. The reason for this is the inadequacy of the WQC system. It can not cool down the cleansing water enough to remove the moisture from the Blast.

There are several reasons why the system has not been improved. There are isolation problems within the gas-cleaning loop; work can only be done during Blast Furnace outages. The isolation valves on either side of the strainer can't close completely precluding its' being cut out of the loop for repair. During the last double outage the repair was attempted but a Well valve failed flooding the system curtailing any attempt to open the system.

### Recommendations

The solution to this problem is threefold. First, new hot well strainers are needed to stop contaminants and sludge entering the WQC system. Second, the cooling tower cells and spray deflectors must be cleaned. Finally, increase the capacity of the WQC system. Originally, the WQC pumping was designed to provide 9,000 gallons per minute, but the current requirement to clean blast gas is 11,000 to 12,000 gallons per minute. For every degree the blast gas temperature is lowered, there is an estimated savings of \$1200 per month.

### Cost Justification

Annual Savings = 16 degrees x \$1200 x 12 month =	\$230,400
Engineering fees	\$ 9,500
Cost of pumps	\$ 75,000
Tower cleaning	\$ 13,000
Strainer	\$ 30,000
Construction (Substation)	\$ 75,000
Total Initial Cost	\$202,500

## Losses Due to Excessive Electricity Use

### Cause 1 — Excessive Electricity Used for Producing Compressed Air

Approximately \$337,500 in purchased electric is lost annually due to excessive electrical draw in the compressed air system.

\$256,000 in excess electricity is used throughout the plant due to leaks in the compressed air system.

\$56,700 in excess electricity is used in the “B” Sub-station area due to compressed air leaks in and about the sub-station itself.

\$ 14,100 in excess electricity is used in the #4 Bloom Mill Motor Room due to compressed air being used to cool a bearing.

\$7,900 in excess electricity is used in the #3 Bloom Mill due to a broken valve on a disused line transiting the area.

\$2,814 in excess electricity is used in the “B” Sub-station due to the need to run #7 booster compressor (150#) because of the Joy’s inefficiency.

These losses are due to leaks in the compressed air system, inappropriate uses, and inefficient equipment. At this point in time the current system is believed adequate, as the plant always has compressed air. Non-withstanding the need for “portable compressors” in different mills and rentals to replace down compressors.

### Estimated Electricity Cost for Compressed Air

Annual cost of compressed air	\$1,360,000
Losses due to leaks, misuse, and inefficiency	\$ 337,500
Reduced electrical draw for compressed air	\$1,022,500
Savings of 24% of cost of compressed air draw (Based on 1996 Energy Distribution Reports)	

### Recommendations

Develop and implement an on-going compressed air PM program to maintain integrity and efficiency

Complete a compressed air balance for the entire plant and determine equipment needed to service the operation

Develop Sops concerning proper use and maintenance of the compressed air system to define proper air use for users

Design, develop, and implement an energy management system that can track energy performance of the compressed air system and use this information to manage the compressed air system and its maintenance.

## Cause 2 — Excessive Electricity Used in the Production of 25-Cycle Electricity

Approximately \$90,200 in extra purchased electricity is used annually due to unneeded draw on the 25cycle system.

Excess generated electricity is used by the #5 injector at #2 High Pressure Turbo generator to bring service water into the condenser. This loss is actually a loss of cost avoidance, taking 25cycle electricity from the frequency changer and using it as motive power. This power could be used to offset the Ohio Edison Bill for an annual reduction of \$90,200.

### Recommendations

Replace the #5 injector motor with another motive power source.

The most readily available power source is condensate water from the #5 Turboblower. This will allow the cost avoidance at Ohio Edison's meter

## **GENERAL PLANT OPPORTUNITY PORTFOLIO**

### Losses Due to Excessive Natural Gas Use

#### Cause 1 Excessive Natural Gas is Consumed

The systems used to dry refractory in the subladle cars are basically open gas lines with a tee and aspirator tips used on full fire to heat the subladles. There is no combustion control or temperature control. Improvements in control can save an estimated 40% in natural gas use.

#### Recommendations

The recommended system will have both combustion controls and temperature controls. An additional benefit to the recommended improvements includes increased refractory life due to better drying practices.

#### Cause 2 Excessive Natural Gas is Consumed in Area Heaters

These heaters are used for keeping personnel and equipment heated in cold weather. The gas heaters are used mostly for heating areas and people.

Usually the heaters are placed appropriately when they are needed in the Fall. From Fall through Spring, these heaters usually run continuously even on days which are warm enough to turn them off and for purposes that become obsolete. A minor amount of monitoring of the heaters can go a long way to produce energy savings. Replacement of heaters with more effective and more efficient alternatives can also create energy savings.

#### Recommendations

Scheduling of heater use and monitoring the heaters daily to turn off/ remove heaters when unnecessary will save an estimated 5% in natural gas use.

#### Cause 3 — Excessive Natural Gas is Consumed Heating Hot Water for Showers

Excessive natural gas is used to heat hot water for the locker room located on the first floor of the Rolling Mill office building. This 84 gallon hot water heater is set at 160 degrees F. This high temperature is not only a waste of natural gas but could also burn someone who is not careful.

Sometimes showers are left running continuously, which is a loss of city water and of natural gas used to heat that water.

#### Recommendations

Reduce thermostats in all showers to 95-115 degrees F or install a programmable thermostat that will heat the water at a higher temperature for peak periods and maintain a lower off peak temperature. Insure that showers do not run continuously.

### Losses Due to Excessive Electricity Use

#### Cause 1 — Excessive Electricity is Consumed With Infrared Heaters

These heaters are used for keeping personnel and equipment heated in cold weather. The electric heaters are used mostly for prevention of pipe freezing and equipment heating.

Usually the heaters are placed appropriately when they are needed in the Fall. From Fall through Spring, these heaters usually run continuously even on days which are warm enough to turn them off and for purposes that become obsolete. A minor amount of monitoring of the heaters can go a long way to produce energy savings. Replacement of heaters with more effective and more efficient alternatives can also create energy savings.

#### Recommendations

Scheduling of heater use and monitoring the heaters daily to turn off! remove heaters when unnecessary will save an estimated 5% in area electricity use. Appropriate replacement of some infrared heaters with thermostatically controlled electrical heat tape will save an estimated additional 5% in electricity.

#### Cause 2 — Outdoor Lighting is on During Daylight Hours

#### Recommendations

Install photocells on all outside lamps and keep photocell clean

#### Cause 3 Cooling Water Runs Continuously Even When System is Cool

#### Recommendations

Install thermostatic control on cooling pumps

#### Cause 4 Fans on Water Cooling Towers Run Continuously

#### Recommendations

Install thermostatic control on fans for water cooling towers

#### Cause 5 — Air Compressors Use Excessive Electricity Due to Desiccant Dryers

#### Recommendations

Install chiller dryer system to remove majority of water from compressed air and use the desiccant to remove the remaining water.

#### Cause 6 — Air Conditioners Have Clogged and Dirty Condensers Filters

#### Recommendations

Replace filters and clean system regularly

Cause 7 — Excessive Electricity is Used To Run Unneeded Equipment Monitor areas regularly to shut off unnecessary equipment

#### Cause 8 — Electric Motors Are Operated with V-Belts

Change system to direct drive or cog belt

## Losses Due to Excessive Steam Use

### Cause 1 — Excessive Steam Production Due to Various Leaks

Approximately \$ 1 61 ,000 is lost annually in excess steam production due to leaks due to 3 types of leaks. The breakdown of leaks is as follows: \$ 1 06,000 is due to line leaks, \$39,000 is due to gasket and flange leaks, and \$16,000 is due to valves.

Maintenance management has not provided sufficient resources to implement a planned program for reducing steam leaks. Steam leaks are very low priority and are not normally repaired unless they are severe enough to cause a production outage.

Annual cost to produce steam at the boilers	\$1,461,000
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Recommendation: Repair the leaks as soon as possible

### Cost Justification

Required steam production cost	\$1,300,000
Total annual loss	\$ 161,000
Estimated cost of repair to the system	\$ 3,500

Cause 2 — Excessive Steam Production Due to Unnecessary Steam Distribution In the Rolling Mill, excessive steam is being used to heat a lubrication shanty located west of the 40-inch pulpit. This building is heated to 95+ degrees F during summer months when heat is not necessary.

Live steam lines extend to various buildings and for steam tracing in the LSP area of the BOP Shop. Many of the uses of this steam line no longer exist or the steam is used only for heating in the cooler months.

### Recommendations

Turn the steam off to these lines. For the necessary heating needs that the current steam line provide, replace with electric heaters or heat tape. For example, if grease needs to be warmer than the ambient temperature, an electric barrel or band heater could be used to obtain the desired temperature. Band heaters can be used all year, eliminating the steam all together.

## Losses Due to City Water Use

### Cause — Excessive City Water Used in Restrooms

Excessive city water is used in the restrooms due to leaking flush valves on urinals and toilets. Water runs continuously through the leaking valves, which is a loss of city water cost and sewer charges. For example, in the Rolling Mill, there are leaking flush valves on four urinals

### Recommendations

Repair existing defective valves, inspect water systems monthly and repair accordingly.



**SHARED SAVINGS CONTRACTS, INC.  
MARKET MULTIPLES OF COMPARABLE COMPANIES AS OF JUNE 30, 1999  
EXHIBIT A**

<u>COMPANY</u>	<u>MVIC SALES</u>	<u>MVIC EBITDA</u>	<u>MVIC EBIT</u>	<u>WEIGHTINGS</u>
Metzier Group	4.0x	24.8x	28.1x	25%
Thomas Group, Inc. (1)	0.9x	24.4x	66.8x	30%
Diamond Technology Partners	3.7x	20.6x	22.1x	15%
Profit Recovery Group International	5.8x	25.8x	36.3x	30%
Mean	4.5x	23.9x	28.8x	
Median	4.0x	24.6x	28.1x	
St. Deviation	1.1x	2.3x	7.1x	
Weighted Average Multiple	4.7x	24.3x	30.3x	

**(1) Thomas Group Inc. data was excluded from MVIC/Sales and MVIC[EBIT multiple calculations. Weightings are adjusted accordingly.**