

## **APPENDIX B**

### **PROCESS COMPONENT SPREADSHEETS**

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# **APPENDIX B-1**

## **ELECTRIC POWER GENERATION - COAL, NATURAL GAS & FUEL OIL**

**D.O.E. IRONMAKING STUDY -OVERALL SUMMARY MASS BALANCES  
ELECTRIC POWER GENERATION - COAL, NATURAL GAS AND FUEL OIL**

DOEELEC2  
07-June-2000  
Rev. 2

	MM kWhr/YEAR ELECTRICAL POWER GENERATED (TARGET)	lbs/MM BTU	BTU/lb	
1.000000	MM kWhr/YEAR GR. ELEC. POWER (CALC. COAL)	68.729	14,550	NOMINAL HEAT CONTENT OF COAL
1.000000	MM kWhr/YEAR NET ELEC. POWER (CALC. COAL)	52.757	18,955	NOMINAL HEAT CONTENT OF NATURAL GAS
1.002283	MM kWhr/YEAR GR. ELEC. POWER (CALC. N.G.)	52.910	18,900	NOMINAL HEAT CONTENT OF FUEL OIL (API GRAV. 19)
1.000000	MM kWhr/YEAR NET ELEC. POWER (CALC. N.G.)	6,598.6	2,058.82	kWhr/mt NET CONTENT - COAL (Assumption)
1.008218	MM kWhr/YEAR GR. ELEC. POWER (CALC. F.O.)	8,596.4	4,380.48	kWhr/mt NET CONTENT - NATURAL GAS (Assumption)
1.000000	MM kWhr/YEAR NET ELEC. POWER (CALC. F.O.)	8,571.4	3,650.40	kWhr/mt NET CONTENT - FUEL OIL (Assumption)
<b>SUMMARY:</b>				
732.31	MT/YEAR AS-MINED COAL RESOURCE	485.71	1.071	lbs/kWhr COAL(3)
219.69	MT/YEAR MINE WASTE ROCK	228.29	0.50	lbs/kWhr N.G.(3)
512.62	MT/YEAR COAL TO PREP. PLANT	273.94	0.60	lbs/kWhr Fuel Oil (3)
486.99	MT/YEAR NET COAL TO SHIPPING			30.00% AMOUNT OF WASTE ROCK MINED
0.000912	NET CO2 EMISSIONS- mt/kWhr POWER			5.00% AMOUNT OF WASTE IN COAL CLEANING/PREP
				80.00% PERCENT CARBON IN COAL
				86.00% PERCENT CARBON IN FUEL OIL
<b>ASSUMPTIONS: (Ref. 1)</b>				
85.00%	DIESEL FUEL (COAL MINING) %C			
0.000010	SHOVEL OPERATION (hrs/mt ROCK)			
0.000020	LOADER OPERATION (hrs/mt ROCK)			
0.000012	HAUL TRUCK WASTE (hrs/mt ROCK)			
0.000029	HAUL TRUCK ORE (hrs/mt ROCK)			
102.865	TOTAL SHOVEL FUEL CONSUMPTION (kg/hr)			
188.018	TOTAL LOADER FUEL CONSUMPTION (kg/hr)			
703.024	TOTAL HAUL TRUCK FUEL CONSUMPTION (kg/hr)			
993.907	TOTAL FUEL FOR ALL ROCK (kg/hr)			
0.0007	TOTAL FUEL (kg/mt ROCK) - SHOVEL (1)			
0.0027	TOTAL FUEL (kg/mt ROCK) - LOADERS (2)			
0.0201	TOTAL FUEL (kg/mt ROCK) - TRUCKS (4)			
0.0235	TOTAL FUEL MINING (kg/mt ROCK)			
755	SHOVEL HORSEPOWER (CAT 13.75 CU YD)			
690	LOADER HORSEPOWER (CAT 992D, 14 CU YD)			
1290	HAUL TRUCK HORSEPOWER (CAT 785B, 130 TON)			
85.00%	DIESEL FUEL, HAUL TRUCK % CARBON			
0.71	COAL MINE ELECTRICAL POWER REQ'D (kWhr/mt ROCK)			
4.10	PREP PLANT ELECTRICAL POWER REQ'D (kWhr/mt COAL)			
0.101	FUEL REQUIREMENT RAW COAL TRANS. TRUCK 30 mt - (kg/mt)			
5	RAW COAL TRANSPORT DISTANCE, ONE WAY - (km)			
10.092	FUEL REQUIREMENT COAL TRANS. - (kg/mt)			
500	COAL TRANSPORT DISTANCE, ONE WAY - (km)			
10.000	ELEC. POWER REQUIRED FOR N.G. TRANS.- (kWhr/mt)			
30.000	ELEC. POWER REQUIRED FOR F.O. PIPELINE TRANS.- (kWhr/mt)			
		1.000	BTU =	0.0002930 kWhrs
		3,412.79	BTU =	1.000 kWhrs
				4.263 NOMINAL HEAT CONTENT OF COAL - kWhrs Gross/lb
				5.554 NOMINAL HEAT CONTENT N.G. - kWhrs Gross/lb
				5.538 NOMINAL HEAT CONTENT FUEL OIL - kWhrs Gross/lb
				21.90% NET EFFICIENCY FOR POWER GENERATION - COAL
				35.77% NET EFFICIENCY FOR POWER GENERATION - N.G.
				29.89% NET EFFICIENCY FOR POWER GENERATION - FUEL OIL
				<b>REFERENCES:</b>
				1) SME Mining Engineering Handbook, 2nd Edition, 1992
				2) COMPONENT BLOCK DIAGRAM: FIGURE A-1
				3) EPRI Databook, 1995
				4) Inventory of U.S. Greenhouse Gas Emissions & Sinks: 1990-1997
				5) DOE/EIA-0623, Challenges of Electric Power Industry Restructuring for Fuel Suppliers, September 1998
				<b>PERCENTAGES OF ELECTRIC POWER (USA) BY:</b>
				57.00% COAL
				10.00% NATURAL GAS
				3.00% FUEL OIL
				14.00% NUCLEAR*
				16.00% OTHER (RENEWABLE, HYDRO, WASTES, ETC.)*
				*NON-EMISSION GENERATING

**D.O.E. IRONMAKING STUDY -OVERALL SUMMARY MASS BALANCES  
ELECTRIC POWER GENERATION - COAL, NATURAL GAS AND FUEL OIL**

DOEELEC2  
07-June-2000

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (mt/YR)	LIQUID (mt/YR)	TOTAL (mt/YR)	%Fe (DRY)	Fe UNITS (mt/YR)	%C (DRY)	C UNITS (mt/YR)	CO2 (mt/YR)
COAL:									
	AS-MINED COAL/ROCK	732.31	21.97	754.28				585.850	
	WASTE ROCK	219.69	6.59	226.28				175.755	
	RAW COAL TO PREP PLANT	512.62	15.38	528.00				410.095	
	DIESEL FUEL (MINING ETC.)		0.01					0.010	0.038
	EXHAUST GASES								
	MINE ELECTRICAL POWER REQ'D	(kWhr/yr) 521.90							
	AS-MINED RAW TRANS. TO PREP PLANT		0.05					0.045	0.164
	EXHAUST GASES								
	NET PREPPED COAL TO USE	486.99	14.61	501.60				389.590	
	REJECT TAILINGS TO DISPOSAL	25.63	0.77	26.40				20.505	
	PREP. P ELECTRICAL POWER REQ'D	(kWhr/yr) 2,099.26							
	NET PREPPED COAL TO USE	486.99	14.61	501.60				389.590	
	DIESEL FUEL - COAL TRANSPORT		2.43					2.070	7.589
	EXHAUST GASES - COAL TRANS.								
	COAL: EQUIV. ELEC. POWER PRODUCED	(kWhr/yr) 1,002,621.16							
	GROSS: TOTAL ELECTRICAL POWER REQ'D COAL REQUIRED mt	(kWhr/yr) 2,621.16 5.40						4.317	15.830
	NET: NET ELEC. POWER FOR COAL:	(kWhr/yr) 1,000,000.00							mt CO2/kWhr 0.001448
	TOTAL MT COAL/1.0 MM kWhr NET TOTAL CO2 FOR 1.000 MM KWHR	485.71						388.571 395.013	1,448.382

**D.O.E. IRONMAKING STUDY -OVERALL SUMMARY MASS BALANCES  
ELECTRIC POWER GENERATION - COAL, NATURAL GAS AND FUEL OIL**

DOEELEC2  
07-June-2000

STREAM NUMBER	STREAM LABEL	GAS (mt/YR)	%Fe (DRY)	Fe UNITS (mt/YR)	%C (DRY)	C UNITS (mt/YR)	CO2 (mt/YR)
	<b>NATURAL GAS:</b>						
	ELEC. POWER FOR N.G. TRANS.	2,282.86					
	AMOUNT OF N.G. REQ'D (W/O TRANS)	228.29			72.00%	164.366	
	EQUIV. NAT. GAS FOR TRANS.	0.52			72.00%	0.375	
	NET N.G. REQUIRED (W TRANS.)	228.81				164.741	
	POWER PLANT FLUE GAS					164.741	604.050
	<b>GROSS POWER GENERATED:</b>	(kWhr/yr) 1,002,282.86					
	<b>NET POWER GENERATED:</b>	1,000,000.00					
	<b>FUEL OIL:</b>						
	ELEC. POWER FOR F.O. TRANS.	(kWhr/yr) 8,218.29					
	AMOUNT OF F.O. REQ'D (W/O TRANS)	273.94			86.00%	235.591	
	EQUIV. FUEL OIL FOR TRANS.	2.25			86.00%	1.936	
	NET F.O. REQUIRED (W TRANS.)	276.19				237.527	
	POWER PLANT FLUE GAS					237.527	870.932
	<b>GROSS POWER GENERATED:</b>	(kWhr/yr) 1,008,218.29					
	<b>NET POWER GENERATED:</b>	1,000,000.00					
	<b>U.S.A. DISTRIBUTION:</b>						
	COAL	57.00%		mt CO2/kWhr 0.001448			
	NATURAL GAS	10.00%		0.000604			
	FUEL OIL	3.00%		0.000871			
	OTHER NON-CO2 EMISSION	30.00%		0.000000			
	<b>WEIGHTED U.S.A.:</b>			0.000912			

# **APPENDIX B-2**

## **LUMP IRON ORE**

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES**  
**OVERALL SUMMARY MASS BALANCES - LUMP IRON ORE**

DOEORE  
 06-June-2000  
 Rev. 2

BASIS:

1.000 MM MT/YEAR LUMP ORE DELIVERED

**SUMMARY:**

3.163	MM MT/YEAR AS-MINED ROCK	
1.913	MM MT/YEAR WASTE ROCK	
1.250	MM MT/YEAR ORE ROCK TO PREP PLANT	60.47%
1.000	MM MT/YEAR CRUSHED LUMP ORE	
0.250	MM MT/YEAR FINE ORE REJECTS	20.00%
		PERCENT MINE WASTE ROCK
		PERCENT FINE ORE REJECTED - WT. % FEED

**ASSUMPTIONS: (Ref. 1)**

85.00%	DIESEL FUEL (ORE MINING) %C
0.006350	SHOVEL OPERATION (hrs/mt ORE)
0.012701	LOADER OPERATION (hrs/mt ORE)
0.015360	HAUL TRUCK WASTE (hrs/mt ORE)
0.010041	HAUL TRUCK ORE (hrs/mt ORE)
128.581	TOTAL SHOVEL FUEL CONSUMPTION (kg/hr)
235.022	TOTAL LOADER FUEL CONSUMPTION (kg/hr)
878.780	TOTAL HAUL TRUCK FUEL CONSUMPTION (kg/hr)
1242.383	TOTAL FUEL FOR ALL ROCK (kg/hr)
0.817	TOTAL FUEL (kg/mt ORE) - SHOVEL (1)
2.985	TOTAL FUEL (kg/mt ORE) - LOADERS (2)
22.322	TOTAL FUEL (kg/mt ORE) - TRUCKS (4)
26.124	TOTAL FUEL (kg/mt ORE)
755	SHOVEL HORSEPOWER (CAT 13.75 CU YD)
690	LOADER HORSEPOWER (CAT 992D, 14 CU YD)
1290	HAUL TRUCK HORSEPOWER (CAT 785B, 130 TON)
85.00%	DIESEL FUEL % CARBON
6.53	IRON ORE MINE ELECTRICAL POWER REQ'D (kWhr/mt ROCK)
9.26	PREP PLANT ELECTRICAL POWER REQ'D (kWhr/mt ORE)
0.028	PIPELINE ELECTRICAL POWER REQ'D (kWhr/mt ORE/km)
3000	ASSUMED LUMP ORE SHIPPING DISTANCE (km)
0.00449	FUEL REQUIREMENT - SHIPPING (kg/mt/km)
13.46	FUEL REQUIREMENT SHIPPING (kg/mt LUMP ORE)

**REFERENCES:**  
 1) SME Mining Engineering Handbook, 2nd Edition, 1992  
 2) BASE PROCESS BLOCK DIAGRAM: Figure A-4  
 3) BASE PROCESS (DRI/EAF) MASS BALANCE S.S. (APPENDIX C-1)

D.O.E. IRONMAKING STUDY-OVERALL SUMMARY MASS BALANCES  
OVERALL SUMMARY MASS BALANCES - LUMP IRON ORE

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	%Fe (DRY)	Fe UNITS (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
1001	AS-MINED ROCK (3)	3.163	0.095	3.258	35.00%	1.107	0.00%	0.000	
1002	WASTE ROCK (3)	1.913	0.057	1.970	14.94%	0.294	0.00%	0.000	
1	IRON ORE TO PREP PLANT	1.250	0.038	2.564	65.00%	0.813	0.00%	0.000	
	DIESEL FUEL REQ'D		0.0327				85.00%	0.028	0.1018
	EXHAUST GASES								
	MINE ELECTRICAL POWER REQ'D	(MM kWh/yr) 20.666							
	CRUSHED LUMP ORE TO SHIPPING	1.000	0.030	1.030	65.00%	0.650	0.00%	0.000	
	FINE ORE TO DISPOSAL	0.250	0.008	0.258	65.00%	0.163	0.00%	0.000	
	PREP. ELECTRICAL POWER REQ'D	(MM kWh/yr) 11.573							
	SHIPPING FUEL REQ'D		0.0135				85.00%	0.011	0.0419
	EXHAUST GASES, SHIPPING								
	PROCESS ELECTRIC POWER REQ'D	(MM kWh/yr) 32.24							
	TOTAL CO2 PRODUCED							0.0392	0.1437

## **APPENDIX B-3**

### **PELLETIZING BINDER - BENTONITE**

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
PELLETIZING BINDER BALANCES**

DOEBIND  
07-June-2000  
Rev. 2

**BASIS:**

1.000 MM MT/YEAR PELLETIZING BINDER (BENTONITE)  
  
2.1053 MM MT/YEAR AS-MINED BENTONITE RESOURCE  
1.0527 MM MT/YEAR MINE WASTE ROCK  
1.0527 MM MT/YEAR BENTONITE ROCK TO PREP. PLANT  
1.0000 MM MT/YEAR NET BENTONITE TO SHIPPING

**SUMMARY:**

50.00% PERCENT WASTE ROCK(1)  
5.00% PERCENT OF LOSSES IN PREP. PLANT(1)

**ASSUMPTIONS: (1)**

85.00% DIESEL FUEL (ROCK MINING) %C  
0.003553 SHOVEL OPERATION (hrs/mt ROCK)  
0.007106 LOADER OPERATION (hrs/mt ROCK)  
0.007106 HAUL TRUCK WASTE (hrs/mt ROCK)  
0.007106 HAUL TRUCK ORE (hrs/mt ROCK)  
102.865 TOTAL SHOVEL FUEL CONSUMPTION (kg/hr)  
188.018 TOTAL LOADER FUEL CONSUMPTION (kg/hr)  
703.024 TOTAL HAUL TRUCK FUEL CONSUMPTION (kg/hr)  
993.907 TOTAL FUEL FOR ALL ROCK (kg/hr)  
0.183 TOTAL FUEL (kg/mt ROCK) - SHOVEL (1)  
0.668 TOTAL FUEL (kg/mt ROCK) - LOADERS (2)  
4.996 TOTAL FUEL (kg/mt ROCK) - TRUCKS (4)  
5.846 TOTAL FUEL MINING (kg/mt ROCK)  
755 SHOVEL HORSEPOWER (CAT 13.75 CU YD)  
690 LOADER HORSEPOWER (CAT 992D, 14 CU YD)  
1290 HAUL TRUCK HORSEPOWER (CAT 785B, 130 TON)  
85.00% DIESEL FUEL % CARBON  
2.50 BENTONITE MINE ELECTRICAL POWER REQ'D (kWhr/mt ROCK)  
14.18 PREP PLANT ELECTRICAL POWER REQ'D (kWhr/mt ORE)  
0.101 FUEL REQUIREMENT RAW ROCK TRANS. TRUCK 30 mt - (kg/mt)  
5 RAW ROCK TRANSPORT DISTANCE, ONE WAY - (km)  
10.092 FUEL REQUIREMENT BENTONITE TRANS. TRUCK 30 mt - (kg/mt)  
500 BENTONITE TRANSPORT DISTANCE, ONE WAY - (km)

**REFERENCES:**

- 1) SME Mining Engineering Handbook, 2nd Edition, 1992
- 2) COMPONENT BLOCK DIAGRAM: FIGURE A-3

D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
PELLETIZING BINDER BALANCES

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	%Fe (DRY)	Fe UNITS (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	AS-MINED CLAY/ROCK	2.105	0.063	2.168			0.00%	0.000	
	WASTE ROCK	1.053	0.032	1.084			0.00%	0.000	
	BENTONITE ROCK TO PREP PLANT	1.053	0.032	1.084			0.00%	0.000	
	DIESEL FUEL (MINING ETC.)		0.0062				85.00%	0.005	
	EXHAUST GASES								0.0192
	MINE ELECTRICAL POWER REQ'D	(MM kWhr/yr) 5.262							
	AS-MINED ROCK TRANS. TO PREP PLANT		0.0005				85.00%	0.00045	
	EXHAUST GASES								0.0017
	NET PREPPED BENTONITE TO PELLET PLA	1.000	0.030	1.030			0.00%	0.000	
	REJECT TAILINGS TO DISPOSAL	0.053	0.002	0.054			0.00%	0.000	
	PREP. P ELECTRICAL POWER REQ'D	(MM kWhr/yr) 14.928							
	NET PREPPED BENTONITE TO PELLET PLA	1.000	0.030	1.030			0.00%	0.000	
	DIESEL FUEL - BENTONITE TRANS.		0.0050				85.00%	0.00425	
	EXHAUST GASES - BENTONITE TRANS.								0.0156
	TOTAL ELECTRICAL POWER	(MM kWhr/yr) 20.19							
	TOTAL CO2 PRODUCED							0.0099	0.0364

# APPENDIX B-4

COAL

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES**  
**COAL ONLY - DELIVERED TO USE**

DOECOAL  
 08-June-2000  
 Rev. 2

**BASIS:**

1.000 MM MT/YR COAL DELIVERED

**SUMMARY:**

1.5038 MM MT/YEAR AS-MINED COAL RESOURCE  
 0.4511 MM MT/YEAR MINE WASTE ROCK  
 1.0527 MM MT/YEAR COAL TO PREP. PLANT  
 1.0000 MM MT/YEAR NET COAL TO SHIPPING

**ASSUMPTIONS: (Ref. 1)**

85.00% DIESEL FUEL (COAL MINING) %C  
 0.004974 SHOVEL OPERATION (hrs/mt ROCK)  
 0.009948 LOADER OPERATION (hrs/mt ROCK)  
 0.005969 HAUL TRUCK WASTE (hrs/mt ROCK)  
 0.013927 HAUL TRUCK ORE (hrs/mt ROCK)  
 102.865 TOTAL SHOVEL FUEL CONSUMPTION (kg/hr)  
 188.018 TOTAL LOADER FUEL CONSUMPTION (kg/hr)  
 703.024 TOTAL HAUL TRUCK FUEL CONSUMPTION (kg/hr)  
 993.907 TOTAL FUEL FOR ALL ROCK (kg/hr)  
 0.358 TOTAL FUEL (kg/mt ROCK) - SHOVEL (1)  
 1.309 TOTAL FUEL (kg/mt ROCK) - LOADERS (2)  
 9.791 TOTAL FUEL (kg/mt ROCK) - TRUCKS (4)  
 11.459 TOTAL FUEL MINING (kg/mt ROCK)  
 755 SHOVEL HORSEPOWER (CAT 13.75 CU YD)  
 690 LOADER HORSEPOWER (CAT 992D, 14 CU YD)  
 1290 HAUL TRUCK HORSEPOWER (CAT 785B, 130 TON)  
 85.00% DIESEL FUEL % CARBON  
 0.29 COAL MINE ELECTRICAL POWER REQ'D (kWhr/mt ROCK)  
 1.62 PREP PLANT ELECTRICAL POWER REQ'D (kWhr/mt COAL)  
 0.101 FUEL REQUIREMENT RAW COAL TRANS. TRUCK 30 mt - (kg/mt)  
 5 RAW COAL TRANSPORT DISTANCE, ONE WAY - (km)  
 6.728 FUEL REQUIREMENT COAL TRANS. - (kg/mt)  
 500 COAL TRANSPORT DISTANCE, ONE WAY - (km)

30.00% AMOUNT OF WASTE ROCK MINED (1)  
 5.00% AMOUNT OF WASTE IN COAL CLEANING/PREP (1)

**REFERENCES:**

- 1) SME Mining Engineering Handbook, 2nd Edition, 1992
- 2) COMPONENT BLOCK DIAGRAM: FIGURE A-4

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
COAL ONLY - DELIVERED TO USE**

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	%Fe (DRY)	Fe UNITS (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	AS-MINED COAL/ROCK	1.504	0.045	1.549			0.00%	0.000	
	WASTE ROCK	0.451	0.014	0.465			0.00%	0.000	
	RAW COAL TO PREP PLANT	1.053	0.032	1.084			0.00%	0.000	
	DIESEL FUEL (MINING ETC.)		0.0121				85.00%	0.010	0.0376
	EXHAUST GASES								
	MINE ELECTRICAL POWER REQ'D	(MM kWh/yr) 0.430							
	AS-MINED RAW TRANS. TO PREP PLANT		0.0000				85.00%	0.00004	
	EXHAUST GASES								0.0001
	NET PREPPED COAL TO USE	1.000	0.030	1.030			0.00%	0.000	
	REJECT TAILINGS TO DISPOSAL	0.053	0.002	0.054			0.00%	0.000	
	PREP. P ELECTRICAL POWER REQ'D	(MM kWh/yr) 1.708							
	NET PREPPED COAL TO USE	1.000	0.030	1.030			0.00%	0.000	
	DIESEL FUEL - COAL TRANS.		0.0050				85.00%	0.00425	
	EXHAUST GASES - COAL TRANS.								0.0156
	<b>TOTAL ELEC. POWER FOR COAL:</b>	(MM kWh/yr) <b>2.1379</b>							
	<b>TOTAL CO2 FOR 1.000 MM mt/YR</b>							<b>0.0145</b>	<b>0.0533</b>

**APPENDIX B-5**  
**BURNT LIME/DOLOMITE**

DOELIME D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
 08-June-2000 BURNT LIME/DOLOMITE BALANCES

BASIS:		1.000 MM MT/YEAR BURNT LIME/DOLOMITE	
SUMMARY:			
2.780	MM MT/YEAR AS-MINED LIMESTONE/IMO ROCK	36.00%	PERCENT CARBONATE IN LIME ROCK
0.927	MM MT/YEAR MINE WASTE ROCK	33.33%	PERCENT WASTE ROCK
1.853	MM MT/YEAR LIME ROCK TO PREP. PLANT	5.00%	PERCENT OF LOSSES IN PREP. PLANT
1.761	MM MT/YEAR NET LIMESTONE TO CALCINATION	43.20%	PERCENT CO2 IN CLEANED LIME ROCK
1.000	MMM MT/YEAR TARGET CALCINED LIME		
ASSUMPTIONS: (Ref. 1)			
85.00%	DIESEL FUEL (ROCK MINING) %C		
0.002691	SHOVEL OPERATION (hrs/mt ROCK)		
0.005381	LOADER OPERATION (hrs/mt ROCK)		
0.003587	HAUL TRUCK WASTE (hrs/mt ROCK)		
0.007175	HAUL TRUCK ORE (hrs/mt ROCK)		
128.581	TOTAL SHOVEL FUEL CONSUMPTION (kg/hr)		
235.022	TOTAL LOADER FUEL CONSUMPTION (kg/hr)		
878.780	TOTAL HAUL TRUCK FUEL CONSUMPTION (kg/hr)		
1242.383	TOTAL FUEL FOR ALL ROCK (kg/hr)		
0.231	TOTAL FUEL (kg/mt LIME ROCK) - SHOVEL (1)		
0.843	TOTAL FUEL (kg/mt LIME ROCK) - LOADERS (2)		
6.305	TOTAL FUEL (kg/mt LIME ROCK) - TRUCKS (4)		
7.379	TOTAL FUEL (kg/mt LIME ROCK)		
755	SHOVEL HORSEPOWER (CAT 13.75 CU YD)		
690	LOADER HORSEPOWER (CAT 992D, 14 CU YD)		
1290	HAUL TRUCK HORSEPOWER (CAT 785B, 130 TON)		
85.00%	DIESEL FUEL % CARBON		
3.35	LIMESTONE MINE ELECTRICAL POWER REQ'D (kWhr/mt ROCK)		
19.03	PREP PLANT ELECTRICAL POWER REQ'D (kWhr/mt ORE)		
0.126	FUEL REQUIREMENT LS TRANS. TRUCK 30 mt - (kg/mt)		
5	LIMESTONE TRANSPORT DISTANCE, ONE WAY - (km)		
6.308	FUEL REQUIREMENT LIME TRANS. TRUCK 30 mt - (kg/mt)		
250	LIME TRANSPORT DISTANCE, ONE WAY - (km)		
6.18	FUEL REQUIREMENT - CALCINING (GJ/mt CALCINE)		
124.05	FUEL REQUIREMENT - CALCINING (kg N.G./mt CALCINE)		
26.5	CALCINING PLANT ELEC. POWER REQ'D (kWhr/mt FEED)		
REFERENCES:			
1) SME Mining Engineering Handbook, 2nd Edition, 1992			
2) COMPONENT BLOCK DIAGRAM: FIGURE A-5			

D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
BURNT LIME/DOLOMITE BALANCES

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	%Fe (DRY)	Fe UNITS (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	AS-MINED LIME ROCK	2.780	0.083	2.863			9.82%	0.273	
	WASTE ROCK	0.927	0.028	0.954			5.89%	0.055	
	LIME ROCK TO PREP PLANT	1.853	0.056	1.909			11.78%	0.218	
	DIESEL FUEL (MINING ETC.)		0.0137				85.00%	0.012	
	EXHAUST GASES								0.0426
	MINE ELECTRICAL POWER REQ'D	(MM kWhr/yr) 9.323							
	NET PREPPED LIME ROCK TO CALC.	1.761	0.053	1.813			11.78%	0.207	
	REJECT TAILINGS TO DISPOSAL	0.093	0.003	0.095			11.78%	0.011	
	PREP. P ELECTRICAL POWER REQ'D	(MM kWhr/yr) 35.274							
	NET PREPPED LIME ROCK TO CALC.	1.761	0.053	1.813			11.78%	0.207	
	DIESEL FUEL - LIME ROCK TRANS.		0.0002				85.00%	0.00019	
	EXHAUST GASES - LIME ROCK TRANS.								0.0007
	BURNT LIME/DOLOMITE	1.000	0.000	1.000			0.00%	0.000	
	FUEL (DRYING, CALCINATION, ETC.)		AS N.G. 0.2184				72.00%	0.157	
	CALCINATION FLUE GASES								1.3372
	CALC. ELECTRICAL POWER REQ'D	(MM kWhr/yr) 46.587							
	NET LIME/MgO SHIPPED	1.000	0.000	1.000					
	LIME TRANSPORT FUEL		0.0063				85.00%	0.005	
	EXHAUST GASES FOR LIME TRANS.								0.0197
	TOTAL ELECTRICAL POWER	(MM kWhr/yr) 91.19							
	TOTAL CO2 PRODUCED							0.3819	1.4002

# **APPENDIX B-6**

## **OXYGEN GAS**

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
BULK (CRYOGENIC) OXYGEN GAS PRODUCTION**

DOEOXY  
08-June-2000  
Rev. 2

**BASIS:**

1.000 MM Nm<sup>3</sup>/YEAR OXYGEN GAS (99%)

**SUMMARY:**

4.807 MM Nm<sup>3</sup> AIR INLET  
1.00947 MM Nm<sup>3</sup> OXYGEN INLET  
0.020 MM Nm<sup>3</sup> OXYGEN LOSSES  
0.990 MM Nm<sup>3</sup>/YEAR OXYGEN GAS (99%)  
1.000 MM Nm<sup>3</sup>/YEAR OXYGEN GAS (99%)

**ASSUMPTIONS:**

21.00% MOLE % OXYGEN IN AIR  
23.30% WT. % OXYGEN IN AIR  
98.00% PERCENT OXYGEN RECOVERED  
99.00% VOLUME PERCENT OXYGEN IN GAS  
60.0 ELECTRICAL REQUIREMENT - kWhr/1000 SFT<sup>3</sup>(Ref. 1)  
2,118.64 ELECTRICAL REQUIREMENT - kWhr/1000 Nm<sup>3</sup>

**REFERENCES:**

- 1) Perry's Chemical Engineering Handbook, 7th Edition, 1997
- 2) COMPONENT BLOCK DIAGRAM: FIGURE A-2

(MM kWhr/Nm<sup>3</sup>)  
2.12

PROCESS ELECTRIC POWER REQ'D

**APPENDIX B-7**  
**CARBON ELECTRODE**

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
CARBON GRAPHITE ELECTRODES**

DOEELCTR  
08-June-2000  
Rev. 2

<p><b>BASIS:</b></p> <p>1.000 MM MT/YR ELECTRODES DELIVERED</p> <p><b>SUMMARY:</b></p> <p>1.1500 MM MT/YEAR PETROLEUM COKE FEED 0.1500 MM MT/YEAR PITCH BINDER FEED 1.0000 MM MT/YEAR ELECTRODE PRODUCT</p> <p><b>ASSUMPTIONS: (Ref. 1)</b></p> <p>5.000 FUEL REQUIREMENT ELECTRODE TRANS. - (kg/mt) 500 TRANSPORT DISTANCE, ONE WAY - (km) 9,000.00 PREP PLANT ELECTRICAL POWER REQ'D (kW/hr/mt ELECTRODES) 0.050 PREP PLANT AUXILIARY N.G. FUEL - T/T ELECTRODES</p>	<p>1.150 AMOUNT OF PET. COKE FEED - (T/T OF ELECTRODE) 0.150 PITCH BINDER (C5H8) - (T/T ELECTRODE)</p> <p><b>REFERENCES:</b></p> <p>1) The Making, Shaping and Treating of Steel, 10th Edition, 1985 2) COMPONENT BLOCK DIAGRAM: - FIGURE A-2</p>
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DOEELCTR  
08-June-2000

D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
CARBON GRAPHITE ELECTRODES

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	%Fe (DRY)	Fe UNITS (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	PETROLEUM COKE FEED	1.150	0.000	1.150			94.00%	1.081	
	PITCH FEED	0.150	0.000	0.150			88.20%	0.132	
	TOTAL FEED TO ELECTRODES	1.300	0.000	1.300			93.33%	1.213	
	ELECTRODES PRODUCED	1.000	0.000	1.000			96.00%	0.960	
	WASTE GASES PROCESS								0.9287
	SUPPLEMENTAL FUEL		(AS GAS) 0.05				72.00%	0.0360	0.1320
	TOTAL FLUE GASES							0.2893	1.0607
	ELECTRICAL POWER REQ'D	(MM kWh/yr) 9,000.00							
	TRANS. OF ELECTRODES								
	EXHAUST GASES		0.0050					0.00425	0.0156
	TOTAL ELEC. POWER FOR ELECTRODES:	(MM kWh/yr) 9000.0000							
	TOTAL CO2 FOR 1,000 MM mt/YR							0.2935	1.0763

**APPENDIX B-8**  
**CO-PRODUCT COKE**

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
COPRODUCT COKE PRODUCTION**

DOEPCOK  
08-June-2000  
Rev. 2

**BASIS:**

1.000 MM MT/YR COPRODUCT COKE DELIVERED (TARGET)  
1.000 MM MT/YR COPRODUCT COKE DELIVERED (CALCULATED)

**SUMMARY:**

1.5873 MM MT/YEAR BITUMINOUS COAL FEED  
1.1111 MM MT/YEAR TOTAL COKE PRODUCT  
0.111 MM MT/YEAR FINE COKE BREEZE  
1.000 MM MT/YEAR SIZED COKE PRODUCT TO USE

**ASSUMPTIONS: (Ref. 1)**

5.000 FUEL REQUIREMENT COKE TRANS. - (kg/mt)  
500 TRANSPORT DISTANCE, ONE WAY - (km)  
24.50 COKE PLANT ELECTRICAL POWER REQ'D (kWhr/mt COKE)

10.00% PERCENT OF COKE PRODUCED REJECTED AS FINE BREEZE (2)

**REFERENCES:**

- 1) The Making, Shaping and Treating of Steel, 10th Edition, 1985
- 2) COMPONENT BLOCK DIAGRAM: - FIGURE A-5

D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
COPRODUCT COKE PRODUCTION

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	%Fe (DRY)	Fe UNITS (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	COAL FEED	1.587	0.000	1.587			80.00%	1.270	
	CUMULATIVE CO2 + ELEC. IN COAL	(MM kWh/yr) 3.3935						0.0533	0.0846
	COKE PRODUCT GROSS	1.111	0.000	1.111			94.00%	1.044	
	COKE BREEZE (FINES)	0.111	0.000	0.111			94.00%	0.104	
	COKE PRODUCED (NET TO SHIPMENT)	1.000	0.000	1.000			94.00%	0.940	
	WASTE GASES PROCESS (FROM CARBON)							0.209	0.7659
	COKE OVEN GAS							0.035	0.1297
	TOTAL FLUE GASES	(MM kWh/yr) 27.22						0.244	0.8956
	ELECTRICAL POWER REQ'D								
	TRANS. OF COKE		0.0056				85.00%	0.00472	
	EXHAUST GASES								0.0173
	TOTAL ELEC. POWER FOR COKE:	(MM kWh/yr) 30.6157							
	TOTAL CO2 FOR 1,000 MM mt/YR							0.2720	0.9975

## **APPENDIX B-9**

### **NON-RECOVERY COKE PROCESS WITH CO-GENERATION**

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
NON-RECOVERY COKE PRODUCTION WITH CO-GENERATION OF ELECTRICAL POWER**

DOENRCOK  
08-June-2000  
Rev. 2

BASIS:		ASSUMPTIONS:
1.000	MM MT/YR NON-RECOVERY COKE DELIVERED (TARGET)	1.00% PERCENT VOLATILES IN COKE (C5H8)
1.000	MM MT/YR NON-RECOVERY COKE DELIVERED (CALCULATED)	94.53% PERCENT CARBON IN COKE
		37.00% PERCENT CARBON IN PITCH
		63.00% PERCENT VOLATILES OTHER IN PITCH
		88.24% PERCENT CARBON IN VOLATILES (C5H8 RATIO)
		6.30% PERCENT VOLATILES IN CHAR OFF GAS
		89.30% PERCENT FIXED CARBON IN CHAR
		3.59% PERCENT ASH IN CLEANED COAL FINES
		17.85% PERCENT VOLATILES IN CLEANED COAL FINES
		78.56% PERCENT FIXED CARBON IN CLEANED COAL FINES
		9.70% PERCENT ASH IN COAL FINES (IN POND)
		16.72% PERCENT VOLATILES IN COAL FINES (IN POND)
		73.58% PERCENT FIXED CARBON IN COAL FINES (IN POND)
		11.11% PERCENT RECYCLE COKE BREEZE IN COKE FEED
		17.80% PERCENT RAW COAL FINES TO COKE FEED
		59.54% PERCENT CHAR IN COKE FEED
		11.55% PERCENT PITCH BINDER IN COKE FEED
		9.00% PERCENT OF COKE PRODUCED REJECTED AS FINE BREEZE (2)
SUMMARY:		
4.2045	MM MT/YEAR FINE COAL SLURRY RECLAIMED FROM WASTE POND	
0.0334	MM MT/YEAR COARSE REJECT SLURRY	
4.1711	NET FEED TO COAL CLEANING/CONCENTRATION	
1.2551	CLEANED COAL TO DRYER	
0.9413	MM MT/YEAR BITUMINOUS COAL FEED TO CHARRING (DRY BASIS)	
0.8256	MM MT/YEAR NET CHAR PRODUCT	
1.1541	MM MT/YEAR TOTAL COKE PRODUCT	
0.1541	MM MT/YEAR FINE COKE BREEZE	
1.0000	MM MT/YEAR SIZED COKE PRODUCT TO USE	
ASSUMPTIONS: (Ref. 1)		REFERENCES:
5.000	FUEL REQUIREMENT COKE TRANS. - (kg/mt)	1) LGE Confidential Client, Non-Recovery Coke Process Heat and Material Balances, 1998
500	TRANSPORT DISTANCE, ONE WAY - (km)	2) COMPONENT BLOCK DIAGRAM: - FIGURE A-7
14.00	COKE PLANT ELECTRICAL POWER REQ'D (kWhr/mt COKE)	
0.80%	PERCENT REJECT IN RECLAIM OF COAL FINES	
76.14%	PERCENT COAL RECOVERY IN CLEANING PLANT	
25.00%	PERCENT MOISTURE IN FEED TO DRYER	
6.00%	PERCENT MOISTURE IN FEED TO CHAR REACTORS	
87.71%	PERCENT YIELD OF COAL INTO CHAR	
86.80%	PERCENT YIELD OF GREEN COKE FEED INTO COKE (DRY BASIS)	
96.02%	NET PERCENT CARBON YIELD INTO COKE PRODUCT	
5.50	ELECTRIC POWER CONSUMMED IN RECLAIM (kWhr/MT FEED)	
7.50	ELECTRIC POWER CONSUMMED IN CLEANING (kWhr/MT COAL FD.)	
11.00	ELECTRIC POWER CONSUMMED IN CHARRING (kWhr/MT CHAR)	
12.00	ELECTRIC POWER CONSUMMED IN BRIQUET. (kWhr/MT BRIQ. FD.)	
3.2306	CHAR OFF-GAS HEAT CONTENT (MM BTU/MT CHAR)	
45.00%	CO-GENERATION EFFICIENCY (CHAR GAS)	
425.67	(kWhr/MT CHAR) ELECTRIC POWER GENERATED	
3.9124	COKE OFF-GAS HEAT CONTENT (MM BTU/MT COKE)	
45.00%	CO-GENERATION EFFICIENCY (COKE GAS)	
515.50	(kWhr/MT COKE) ELECTRIC POWER GENERATED	

DOENRCOK  
08-June-2000

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
NON-RECOVERY COKE PRODUCTION WITH CO-GENERATION OF ELECTRICAL POWER**

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	VOLATILES % (DRY)	VOLATILES (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	<b>CHAR PRODUCT</b>								
	FINE COAL SLURRY RECLAIMED	1.261	2.943	4.204	16.72%	0.211	73.58%	0.928	
	COARSE REJECTS TO POND	0.025 (MM kWh/yr)	0.008	0.033	7.93%	0.002	22.07%	0.006	
	ELECTRIC POWER IN COAL RECLAIM	6.937							
	FINE COAL TO CLEANING	1.236	2.935	4.171	16.90%	0.209	74.62%	0.923	
	COAL REJECTS FROM CLEANING	0.295 (MM kWh/yr)	2.621	2.916	13.86%	0.041	62.06%	0.183	
	ELECTRICAL POWER IN CLEANING	9.272							
	CLEANED COAL TO DRYER	0.941	0.314	1.255	17.85%	0.168	78.56%	0.740	
	DRIED COAL TO CHARRING FURNACE	0.941	0.060	1.001	17.85%	0.168	78.56%	0.740	
	CHAR PRODUCT TO BRIQUETTING	0.826	0.000	0.826	6.30%	0.052	89.30%	0.737	
	CHAR SYSTEMS TOTAL OFF-GASES								0.383
	ELECTRICAL POWER IN CHARRING	10.355 (MM kWh/yr)							
	TOTAL ELEC. THROUGH CHARRING	26.564							
	CO-GENERATED ELECTRICAL POWER	351.444							
	NET ELECTRICAL POWER GENERATED	324.880							

**D.O.E. IRONMAKING STUDY - OVERALL SUMMARY MASS BALANCES  
NON-RECOVERY COKE PRODUCTION WITH CO-GENERATION OF ELECTRICAL POWER**

DOENRCOK  
08-June-2000

STREAM NUMBER	STREAM LABEL	DRY SOLIDS (MM T/YR)	LIQUID (MM T/YR)	TOTAL (MM T/YR)	VOLATILES % (DRY)	VOLATILES (MM T/YR)	%C (DRY)	C UNITS (MM T/YR)	CO2 (MM T/YR)
	BRIQUETTING OPERATION								
	CHAR FEED TO BRIQUETTING	0.826	0.000	0.826	6.30%	0.052	89.30%	0.737	
	COAL FEED TO BRIQUETTING	0.247	0.000	0.247	17.85%	0.044	78.56%	0.194	
	RECYCLE BREEZE FEED TO BRIQUET.	0.154	0.000	0.154	1.00%	0.002	94.53%	0.146	
	PITCH FEED TO BRIQUETTING	0.160	0.000	0.160	63.00%	0.101	37.00%	0.059	
	TOTAL FEED TO BRIQUETTING	1.387	0.000	1.387	14.32%	0.199	81.93%	1.136	
	(MM kWh/yr)	16.641							
	ELECTRIC POWER IN BRIQUETTING	1.154	0.000	1.154	1.00%	0.012	94.53%	1.091	
	COKE PRODUCT GROSS	0.154	0.000	0.154	1.00%	0.002	94.53%	0.000	
	COKE BREEZE (FINES)	1.000	0.000	1.000	1.00%	0.010	94.53%	1.091	
	COKE PRODUCED (NET TO SHIPMENT)							0.210	0.7707
	WASTE GASES, COKING (FROM CARBON)								
	COKING ELECTRICAL POWER REQ'D	(MM kWh/yr)							
		16.152							
	COKE ELECT. POWER CO-GENERATED	(MM kWh/yr)							
		515.493							
	TOTAL ELECT. POWER REQUIRED COKE	(MM kWh/yr)							
		32.793							
	NET ELECT. POWER PRODUCED COKE	482.700							
	TRANS. OF COKE		0.0058				85.00%	0.00490	0.0180
	EXHAUST GASES DURING TRANSPORT								
	CUM ELEC. POWER FOR N.R. COKE:	(MM kWh/yr)							
		59.358							
	CUM NET ELEC. POWER CO-GENERATED	(MM kWh/yr)							
		866.937							
	TOTAL CO2 FOR 1.000 MM mt/YR FOR NON-RECOVERY PROCESS COKE							0.3197	1.1721

# **APPENDIX B-10**

## **RAW MATERIAL ASSUMPTIONS**

## COMPONENT ASSUMPTIONS FOR BALANCES

Page 1

COMPONENT (BASIS: 1.0 MM mt/yr)	%Fe	%C	%CO2	CUM. CO2 (MT/mt)	%OTHER	BTU/lb	CUM. POWER CONSUMP. (kW/mt)	EQUIV.* CUM. CO2 (MT/mt)
AS-MINED-ROCK	30.00%				70.00%			
RUN-OF-MINE ORE TO CONC.	50.00%			0.0409	50.00%		12.66	0.0115
LUMP IRON ORE	65.00%			0.1437	35.00%		32.24	0.0294
WASTE ROCK	16.93%				83.07%			
IRON ORE CONCENTRATE (TO PL)	68.56%			0.0695	31.44%		69.23	0.0631
IRON ORE CONC. (AFTER PL)	68.56%			0.0695	31.44%		152.57	0.1392
IRON ORE PELLETS (AT PP)	67.81%			0.1779	32.19%		225.00	0.2052
DIESEL FUEL		85.00%			15.00%	19,000		
NATURAL GAS FUEL		72.00%			28.00%	18,955		
FUEL OIL		86.00%			14.00%	18,900		
OXYGEN GAS (99%)					100.00%		(kW/mt)	(T/Nm3)
COAL (COKING)		80.00%		0.0533	20.00%	14,550	2.14	0.0020
CO-PRODUCT COKE (FROM COAL)		94.00%		0.9975	6.00%	15,970	30.62	0.0279
COAL FINES (RECLAIMED/CLEANED)		78.56%			21.44%	14,288	17.23	0.0157
NON-RECOVERY COKE (COAL FINES)		94.53%		1.1721	5.47%	16,060	59.36	0.0541
CHINA COKE (FROM COAL)		85.70%		1.0000	14.30%	14,560	(866.94)	-0.7907
PETROLEUM COKE (BY-PRODUCT)		94.00%		0.0156	6.00%	15,970	15.64	0.0143
CHARCOAL REDUCTANT		80.00%		1.0000	20.00%			
CARBON-GRAPHITE ELECTRODES		96.00%		1.0763	4.00%	16,500	9,000.00	8.2090

## COMPONENT ASSUMPTIONS FOR BALANCES

Page 2

COMPONENT (BASIS: 1.0 MM mt/yr)	%Fe	%C	%CO2	CUM. CO2 (T/t)	%OTHER	BTU/lb	CUM. POWER COMSUMP. (kW/t)	EQUIV.* CUM. CO2 (T/t)
BINDER (BENTONITE)	11.60%			0.0364	88.40%		20.19	0.0184
LIME/DOLOMITE FOR PELLET	1.61%			1.4002	98.39%		91.69	0.0836
RECYCLE EAF DUST	47.50%				52.50%			
RECYCLE DRI DUST	87.47%				12.53%			
BURNT LIME CaO (METALLURGICAL)	1.61%			1.4002	98.39%		91.69	0.0836
SiO2					100.00%			
IRON ORE PELLETS (GREEN)	68.76%				31.24%			
INDURATED IRON ORE PELLETS	67.81%			0.2051	32.19%		197.37	0.2384
DRI (HIGH C)	90.48%	2.50%			7.02%		496.94	0.3002
DRI (LOW C)	92.80%	1.00%		0.8797	6.20%		499.69	0.3018
LIQUID STEEL (100% DRI CHG)	99.70%	0.10%		0.9731	0.20%		1,326.90	83.8919
LIQUID STEEL (30% DRI CHG)	99.70%	0.10%		0.9731	0.20%		1,030.37 (MM kWhr/mt)	65.3303
CO-GEN. E.P. FROM N.R. COKE	% DISTR.						866.937 (1 MM kWhr/yr)	
ELECTRICAL POWER (COAL)	57.00%			0.001448			1.00 (1 MM kWhr/yr)	
ELECTRICAL POWER (N.G.)	10.00%			0.000604			1.00 (1 MM kWhr/yr)	
ELECTRIC POWER (FUEL OIL)	3.00%			0.000871			1.00 (1 MM kWhr/yr)	
ELECTRIC POWER (OTHER)	30.00%			0.000000			1.00 (1 MM kWhr/yr)	
ELECTRICAL POWER (NET)				0.000912			1.00 (1 MM kWhr/yr)	

D.O.E. Ironmaking Study, Revision 2 (June 2000)