

APPENDIX G

RANKING OF PROCESSES

G-1: TABULATIONS:

VARIABLE 1: BY CAPITAL COSTS/ANNUAL MT L.S.

VARIABLE 2: BY IRON UNIT COSTS/MT I.U.

VARIABLE 3: BY OPERATING COST/MT L.S.

VARIABLE 4: BY INTERNAL RATE OF RETURN

VARIABLE 5: BY TOTAL ELECTRICAL POWER REQUIRED

**VARIABLE 6: BY TOTAL CUMULATIVE CO₂ EMISSIONS -
PROCESS ONLY**

**VARIABLE 7: BY TOTAL CUMULATIVE CO₂ EMISSIONS -
TOTAL INCLUDING ELECTRICAL POWER
GENERATION**

**G-2: VISUAL GROUPINGS OF SORTED AND
RANKED VARIABLES**

Appendix G: Rankings Of Processes

G-1 Ranking by Variables

The Sorted Variable tables in Appendix F were used for a Ranking procedure for the various Alternative Ironmaking Processes. The procedures followed for this Ranking Analysis were as followed:

- Each of the sequenced lists by the index variables above for each of the Alternative Ironmaking Processes were represented by the sorted sequence rankings (i.e. from 1 to 21).
- These sequence ratings (i.e. from 1 to 21) were summed in the following manner.
- The variable rankings based on costs (i.e. variables 1-4 of CAPEX, OPEX I.U., OPEX L.S. and I.R.R.) were summed.
- Similarly, the energy and emissions variable rankings (i.e. variables 5-7 of Electric Power, Process CO₂ and Total CO₂) were summed by process.
- In addition all of the ranking variables were summed (i.e. variables 1-7).
- Based on these summation totals, additional sorts of these grouping totals (1-4, 5-7 and 1-7) were done. That is, the lowest sum of the grouped ranking variables was first, the highest last, etc.
- Again, the sorted Ranking Variable Groups for the processes were arranged into a Lowest Group, A Middle Group and a Highest Group.
- It should be noted that the Ranking Exercise was done for each of the Steel Scrap Price values, i.e. \$100, \$120 and \$140 respectively.

These sorted Ranking Variable Groupings, thus, provide some additional insights into the most attractive Ironmaking Process Alternatives and those that are less attractive. With the added dimension of the independent Steel Scrap Price variable and the impacts on the ultimate Refined Liquid Steel costs, some of the significant impacts of this key variable can be seen more clearly in evaluating the various Ironmaking Processes.

The tables of the Ranked Variables and summation groupings discussed are also provided in this section.

G-2 Sorted and Ranked Process Groupings

As an alternative way of visualizing the Sorted Variable and Ranked Process Groupings, visual representations of each are provided in this section with the members of each process summarized in highlighted bullets.

RANKING OF IRONMAKING PROCESSES - RESEQUENCED ORDER

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$100/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
1	100% DRI, 1.0% C, MIDREX	20	14	20	20	21	9	17	74	121	47	20	20	18
2	100% STEEL SCRAP	1	1	1	1	8	1	1	4	14	10	1	1	1
3	30% DRI, 1.0% C/70% SCRAP	5	15	13	8	18	2	2	41	63	22	11	5	7
4	H.Y.L.S.A. IVM	19	12	18	19	20	7	14	68	109	41	19	19	14
5	30% BF H.M./70% SCRAP CP COKE	9	18	14	11	6	4	6	52	68	16	15	9	3
6	30% MINI-BF H.M.	4	17	15	4	7	5	7	40	59	19	10	3	6
7	30% BF H.M./70% SCRAP NR COKE	8	11	5	5	2	8	4	29	43	14	18	4	2
8	30% COLD PIG IRON/70% SCRAP	10	19	19	15	17	6	9	63	95	32	4	17	9
9	30% TECNORED H.M. W/ COGEN	3	13	3	2	1	13	3	21	38	17	2	2	4
10	30% TECNORED H.M. W/O COGEN	2	21	17	3	3	12	8	43	66	23	21	21	8
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	13	7	20
12	HISMELT 32.7% H.M.	12	16	16	14	10	3	5	58	76	18	17	11	5
13	REDSMELT	16	10	11	18	4	17	11	55	87	32	16	16	11
14	MAUMEE BRIQUETTE DR/ EAF	14	3	2	10	14	11	13	29	67	38	5	8	13
15	ITMK3 DR SHOT TO EAF	15	4	6	13	9	18	18	38	83	45	3	13	16
16	CIRCORED/HBI/EAF	6	6	10	6	11	14	12	28	65	37	8	6	12
17	CIRCOFER/HBI/SAF/EAF	7	8	12	9	5	19	19	36	79	43	7	12	15
18	FINMET/HBI/EAF	13	7	9	12	12	10	10	41	73	32	12	10	10
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	4	16	15	15	16	40	86	46	9	15	17
20	GENERIC I.C. (40%)/SAF/EAF	11	9	7	7	19	16	15	34	84	50	6	14	19
21	SL/RN ROTARY KILN	17	5	8	17	16	20	20	47	103	56	14	18	21

RANKING OF IRONMAKING PROCESSES - RESEQUENCED ORDER

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$120/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
1	100% DRI, 1.0% C, MIDREX	20	14	18	20	21	9	17	72	119	47	20	20	18
2	100% STEEL SCRAP	1	1	13	1	8	1	1	16	26	10	1	1	1
3	30% DRI, 1.0% C/70% SCRAP	5	15	15	13	18	2	2	48	70	22	13	9	7
4	H.Y.L.S.A. IVM	19	12	12	19	20	7	14	62	103	41	18	19	14
5	30% BF H.M./70% SCRAP CP COKE	9	18	16	16	6	4	6	59	75	16	17	11	3
6	30% MINI-BF H.M.	4	17	17	9	7	5	7	47	66	19	12	7	6
7	30% BF H.M./70% SCRAP NR COKE	8	11	11	7	2	8	4	37	51	14	9	3	2
8	30% COLD PIG IRON/70% SCRAP	10	19	20	18	17	6	9	67	99	32	19	18	9
9	30% TECNORED H.M. W/ COGEN	3	13	9	2	1	13	3	27	44	17	5	2	4
10	30% TECNORED H.M. W/O COGEN	2	21	19	11	3	12	8	53	76	23	15	13	8
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	21	21	20
12	HISMELT 32.7% H.M.	12	16	14	14	10	3	5	56	74	18	16	10	5
13	REDSMELT	16	10	8	17	4	17	11	51	83	32	14	15	11
14	MAJUMEE BRIQUETTE DRI/EAF	14	3	1	5	14	11	13	23	61	38	3	5	13
15	ITMK3 DR SHOT TO EAF	15	4	3	8	9	18	18	30	75	45	6	12	16
16	CIRCORED/HBI/EAF	6	6	6	3	11	14	12	21	58	37	2	4	12
17	CIRCOFER/HBI/SAF/EAF	7	8	7	4	5	19	19	26	69	43	4	8	15
18	FINMET/HBI/EAF	13	7	5	6	12	10	10	31	63	32	7	6	10
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	2	12	15	15	16	34	80	46	8	14	17
20	GENERIC I.C. (40%)/SAF/EAF	11	9	10	10	19	16	15	40	90	50	10	16	19
21	SL/RN ROTARY KILN	17	5	4	15	16	20	20	41	97	56	11	17	21

RANKING OF IRONMAKING PROCESSES - RESEQUENCED ORDER

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$140/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
1	100% DRI, 1.0% C, MIDREX	20	14	10	19	21	9	17	63	110	47	19	20	18
2	100% STEEL SCRAP	1	1	15	9	8	1	1	26	36	10	4	1	1
3	30% DRI, 1.0% C/70% SCRAP	5	15	16	17	18	2	2	53	75	22	13	10	7
4	HYLSA IVM	19	12	9	18	20	7	14	58	99	41	17	18	14
5	30% BF H.M./70% SCRAP CP COKE	9	18	19	14	6	4	6	60	76	16	18	12	3
6	30% MINI-BF H.M.	4	17	18	15	7	5	7	54	73	19	14	9	6
7	30% BF H.M./70% SCRAP NR COKE	8	11	13	10	2	8	4	42	56	14	11	4	2
8	30% COLD PIG IRON/70% SCRAP	10	19	21	20	17	6	9	70	102	32	20	19	9
9	30% TECNORED H.M. W COGEN	3	13	12	6	1	13	3	34	51	17	8	2	4
10	30% TECNORED H.M. W/O COGEN	2	21	20	13	3	12	8	56	79	23	15	15	8
11	COREX/MIDREX WITH 60% H.M.	21	20	17	21	13	21	21	79	134	55	21	21	20
12	HISMELT 32.7% H.M.	12	16	14	16	10	3	5	58	76	18	16	13	5
13	REDSMELT	16	10	8	12	4	17	11	46	78	32	12	14	11
14	MAUMEE BRIQUETTE DRI/EAF	14	3	1	3	14	11	13	21	59	38	2	5	13
15	ITMK3 DR SHOT TO EAF	15	4	3	5	9	18	18	27	72	45	5	8	16
16	CIRCORED/HBI/EAF	6	6	5	1	11	14	12	18	55	37	1	3	12
17	CIRCOFER/HBI/SAF/EAF	7	8	7	2	5	19	19	24	67	43	3	7	15
18	FINMET/HBI/EAF	13	7	4	4	12	10	10	28	60	32	6	6	10
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	2	7	15	15	16	29	75	46	7	11	17
20	GENERIC I.C. (40%)/SAF/EAF	11	9	11	11	19	16	15	42	92	50	10	17	19
21	SL/RN ROTARY KILN	17	5	6	8	16	20	20	36	92	56	9	16	21

RANKING OF IRONMAKING PROCESSES - SORTED ON RANKING SUM (5-7)

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$120/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD														
2	100% STEEL SCRAP	1	1	13	1	8	1	1	16	26	10	1	1	1
7	30% BF H.M./70% SCRAP NR COKE	8	11	11	7	2	8	4	37	51	14	9	3	2
5	30% BF H.M./70% SCRAP CP COKE	9	18	16	16	6	4	6	59	75	16	17	11	3
9	30% TECNORED H.M. W COGEN	3	13	9	2	1	13	3	27	44	17	5	2	4
12	HISMELT 32.7% H.M.	12	16	14	14	10	3	5	56	74	18	16	10	5
6	30% MINI-BF H.M.	4	17	17	9	7	5	7	47	66	19	12	7	6
3	30% DRI, 1.0% C/70% SCRAP	5	15	15	13	18	2	2	48	70	22	13	9	7
MIDDLE THIRD														
10	30% TECNORED H.M. W/O COGEN	2	21	19	11	3	12	8	53	76	23	15	13	8
8	30% COLD PIG IRON/70% SCRAP	10	19	20	18	17	6	9	67	99	32	19	18	9
18	FINMET/HBI/EAF	13	7	5	6	12	10	10	31	63	32	7	6	10
13	REDSMELT	16	10	8	17	4	17	11	51	83	32	14	15	11
16	CIRCORED/HBI/EAF	6	6	6	3	11	14	12	21	58	37	2	4	12
14	MAUMEE BRIQUETTE DR/EAF	14	3	1	5	14	11	13	23	61	38	3	5	13
4	HYLSA IVM	19	12	12	19	20	7	14	62	103	41	18	19	14
HIGHEST THIRD														
17	CIRCOFER/HBI/SAF/EAF	7	8	7	4	5	19	19	26	69	43	4	8	15
15	ITMK3 DR SHOT TO EAF	15	4	3	8	9	18	18	30	75	45	6	12	16
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	2	12	15	15	16	34	80	46	8	14	17
1	100% DRI, 1.0% C, MIDREX	20	14	18	20	21	9	17	72	119	47	20	20	18
20	GENERIC I.C. (40%)/SAF/EAF	11	9	10	10	19	16	15	40	90	50	10	16	19
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	21	21	20
21	SL/RN ROTARY KILN	17	5	4	15	16	20	20	41	97	56	11	17	21

RANKING OF IRONMAKING PROCESSES - SORTED ON RANKING SUM(1-4)

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$100/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD														
2	100% STEEL SCRAP	1	1	1	1	8	1	1	4	14	10	1	1	1
9	30% TECNORED H.M. W COGEN	3	13	3	2	1	13	3	21	38	17	2	2	4
16	CIRCORED/HBI/EAF	6	6	10	6	11	14	12	28	65	37	3	6	12
7	30% BF H.M./70% SCRAP NR COKE	8	11	5	5	2	8	4	29	43	14	4	3	2
14	MAUMEE BRIQUETTE DRI/EAF	14	3	2	10	14	11	13	29	67	38	5	8	13
20	GENERIC I.C. (40%)/SAF/EAF	11	9	7	7	19	16	15	34	84	50	6	14	14
17	CIRCOFER/HBI/SAF/EAF	7	8	12	9	5	19	19	36	79	43	7	12	15
MIDDLE THIRD														
15	ITMK3 DR SHOT TO EAF	15	4	6	13	9	18	18	38	83	45	8	13	16
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	4	16	15	15	16	40	86	46	9	15	17
6	30% MINI-BF H.M.	4	17	15	4	7	5	7	40	59	19	10	4	6
3	30% DRI, 1.0% C/70% SCRAP	5	15	13	8	18	2	2	41	63	22	11	5	7
18	FINMET/HBI/EAF	13	7	9	12	12	10	10	41	73	32	12	10	10
10	30% TECNORED H.M. W/O COGEN	2	21	17	3	3	12	8	43	66	23	13	7	8
21	SL/RN ROTARY KILN	17	5	8	17	16	20	20	47	103	56	14	18	21
HIGHEST THIRD														
5	30% BF H.M./70% SCRAP CP COKE	9	18	14	11	6	4	6	52	68	16	15	9	3
13	REDSMELT	16	10	11	18	4	17	11	55	87	32	16	16	11
12	HISMELT 32.7% H.M.	12	16	16	14	10	3	5	58	76	18	17	11	5
8	30% COLD PIG IRON/70% SCRAP	10	19	19	15	17	6	9	63	95	32	18	17	9
4	HYLSA IVM	19	12	18	19	20	7	14	68	109	41	19	19	14
1	100% DRI, 1.0% C, MIDREX	20	14	20	20	21	9	17	74	121	47	20	20	18
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	21	21	20

RANKING OF IRONMAKING PROCESSES - SORTED ON RANKING SUM (1-4)

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$120/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD														
2	100% STEEL SCRAP	1	1	13	1	8	1	1	16	26	10	1	1	1
16	CIRCORED/HBI/EAF	6	6	6	3	11	14	12	21	58	37	2	4	12
14	MAUMEE BRIQUETTE DRI/EAF	14	3	1	5	14	11	13	23	61	38	3	5	13
17	CIRCOFER/HBI/SAF/EAF	7	8	7	4	5	19	19	26	69	43	4	8	15
9	30% TECNORED H.M. W/ COGEN	3	13	9	2	1	13	3	27	44	17	5	2	4
15	ITMK3 DR SHOT TO EAF	15	4	3	8	9	18	18	30	75	45	6	12	16
18	FINMET/HBI/EAF	13	7	5	6	12	10	10	31	63	32	7	6	10
MIDDLE THIRD														
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	2	12	15	15	16	34	80	46	8	14	27
7	30% BF H.M./70% SCRAP NR COKE	8	11	11	7	2	8	4	37	51	14	9	3	2
20	GENERIC I.C. (40%)/SAF/EAF	11	9	10	10	19	16	15	40	90	50	10	16	19
21	SL/RN ROTARY KILN	17	5	4	15	16	20	20	41	97	56	11	17	21
6	30% MINI-BF H.M.	4	17	17	9	7	5	7	47	66	19	12	7	6
3	30% DRI, 1.0% C/70% SCRAP	5	15	15	13	18	2	2	48	70	22	13	9	7
13	REDSMELT	16	10	8	17	4	17	11	51	83	32	14	15	11
HIGHEST THIRD														
10	30% TECNORED H.M. W/O COGEN	2	21	19	11	3	12	8	53	76	23	15	13	8
12	HISMELT 32.7% H.M.	12	16	14	14	10	3	5	56	74	18	16	10	5
5	30% BF H.M./70% SCRAP CP COKE	9	18	16	16	6	4	6	59	75	16	17	11	3
4	HYLSA IVM	19	12	12	19	20	7	14	62	103	41	18	19	14
8	30% COLD PIG IRON/70% SCRAP	10	19	20	18	17	6	9	67	99	32	19	18	9
1	100% DRI, 1.0% C, MIDREX	20	14	18	20	21	9	17	72	119	47	20	20	18
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	21	21	20

RANKING OF IRONMAKING PROCESSES - SORTED ON RANKING SUM(1-4)

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$140/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD														
16	CIRCORED/HBI/EAF	6	6	5	1	11	14	12	18	55	37	1	3	12
14	MAUMEE BRIQUETTE DRI/EAF	14	3	1	3	14	11	13	21	59	38	2	5	13
17	CIRCOFER/HBI/SAF/EAF	7	8	7	2	5	19	19	24	67	43	3	7	15
2	100% STEEL SCRAP	1	1	15	9	8	1	1	26	36	10	4	1	1
15	ITMK3 DR SHOT TO EAF	15	4	3	5	9	18	18	27	72	45	5	8	16
18	FINMET/HBI/EAF	13	7	4	4	12	10	10	28	60	32	6	6	10
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	2	7	15	15	16	29	75	46	7	11	17
MIDDLE THIRD														
9	30% TECNORED H.M. W/ COGEN	3	13	12	6	1	13	3	34	51	17	8	2	4
21	SL/RN ROTARY KILN	17	5	6	8	16	20	20	36	92	56	9	16	21
20	GENERIC I.C. (40%)/SAF/EAF	11	9	11	11	19	16	15	42	92	50	10	17	19
7	30% BF H.M./70% SCRAP NR COKE	8	11	13	10	2	8	4	42	56	14	11	4	2
13	REDSMELT	16	10	8	12	4	17	11	46	78	32	12	14	11
3	30% DRI, 1.0% C/70% SCRAP	5	15	16	17	18	2	2	53	75	22	13	10	7
6	30% MINI-BF H.M.	4	17	18	15	7	5	7	54	73	19	14	9	6
HIGHEST THIRD														
10	30% TECNORED H.M. W/O COGEN	2	21	20	13	3	12	8	56	79	23	15	15	8
12	HISMELT 32.7% H.M.	12	16	14	16	10	3	5	58	76	18	16	13	5
4	HYLSA IVM	19	12	9	18	20	7	14	58	99	41	17	18	14
5	30% BF H.M./70% SCRAP CP COKE	9	18	19	14	6	4	6	60	76	16	18	12	3
1	100% DRI, 1.0% C, MIDREX	20	14	10	19	21	9	17	63	110	47	19	20	18
8	30% COLD PIG IRON/70% SCRAP	10	19	21	20	17	6	9	70	102	32	20	29	9
11	COREX/MIDREX WITH 60% H.M.	21	20	17	21	13	21	21	79	134	55	21	21	20

RANKING OF IRONMAKING PROCESSES - SORTED ON RANKING SUM(1-7)

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$100/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD															
2	100% STEEL SCRAP	1	1	1	1	8	1	1	4	14	10	1	1	1	1
9	30% TECNORED H.M. W/ COGEN	3	13	3	2	1	13	3	21	38	17	2	2	2	4
7	30% BF H.M./70% SCRAP NR COKE	8	11	5	5	2	8	4	29	43	14	3	3	3	2
6	30% MINI-BF H.M.	4	17	15	4	7	5	7	40	59	19	4	10	4	6
3	30% DRI, 1.0% C/70% SCRAP	5	15	13	8	18	2	2	41	63	22	11	11	5	7
16	CIRCORED/HBI/EAF	6	6	10	6	11	14	12	28	65	37	3	3	6	12
10	30% TECNORED H.M. W/O COGEN	2	21	17	3	3	12	8	43	66	23	13	13	7	8
MIDDLE THIRD															
14	MAJMEE BRIQUETTE DRI/EAF	14	3	2	10	14	11	13	29	67	38	5	5	8	13
5	30% BF H.M./70% SCRAP CP COKE	9	18	14	11	6	4	6	52	68	16	15	15	9	3
18	FINMET/HBI/EAF	13	7	9	12	12	10	10	41	73	32	12	12	10	10
12	HISMELT 32.7% H.M.	12	16	16	14	10	3	5	58	76	18	17	17	11	5
17	CIRCOFER/HBI/SAF/EAF	7	8	12	9	5	19	19	36	79	43	7	7	12	15
15	ITMK3 DR SHOT TO EAF	15	4	6	13	9	18	18	38	83	45	8	8	13	16
20	GENERIC I.C. (40%)/SAF/EAF	11	9	7	7	19	16	15	34	84	50	6	6	14	19
HIGHEST THIRD															
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	4	16	15	15	16	40	86	46	9	9	15	17
13	REDSMELT	16	10	11	18	4	17	11	55	87	32	16	16	16	11
8	30% COLD PIG IRON/70% SCRAP	10	19	19	15	17	6	9	63	95	32	18	18	17	9
21	SL/RN ROTARY KILN	17	5	8	17	16	20	20	47	103	56	14	14	18	21
4	HYLSA IVM	19	12	18	19	20	7	14	68	109	41	19	19	19	14
1	100% DRI, 1.0% C, MIDREX	20	14	20	20	21	9	17	74	121	47	20	20	20	18
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	21	21	21	20

RANKING OF IRONMAKING PROCESSES - SORTED ON RANKING SUM (1-7)

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$120/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD														
2	100% STEEL SCRAP	1	1	13	1	8	1	1	16	26	10	1	1	1
9	30% TECNORED H.M. W COGEN	3	13	9	2	1	13	3	27	44	17	5	2	4
7	30% BF H.M./70% SCRAP NR COKE	8	11	11	7	2	8	4	37	51	14	9	3	2
16	CIRCORED/HBI/EAF	6	6	6	3	11	14	12	21	58	37	2	4	12
14	MAUMEE BRIQUETTE DRI/EAF	14	3	1	5	14	11	13	23	61	38	3	5	13
18	FINMET/HBI/EAF	13	7	5	6	12	10	10	31	63	32	7	6	10
6	30% MINI-BF H.M.	4	17	17	9	7	5	7	47	66	19	12	7	6
MIDDLE THIRD														
17	CIRCOFER/HBI/SAF/EAF	7	8	7	4	5	19	19	26	69	43	4	8	15
3	30% DRI, 1.0% C/70% SCRAP	5	15	15	13	18	2	2	48	70	22	13	9	7
12	HISMELT 32.7% H.M.	12	16	14	14	10	3	5	56	74	18	16	10	5
5	30% BF H.M./70% SCRAP CP COKE	9	18	16	16	6	4	6	59	75	16	17	11	3
15	ITMK3 DR SHOT TO EAF	15	4	3	8	9	18	18	30	75	45	6	12	16
10	30% TECNORED H.M. W/O COGEN	2	21	19	11	3	12	8	53	76	23	15	13	8
19	GENERIC IRON CARBIDE (100%/EAF)	18	2	2	12	15	15	16	34	80	46	8	14	17
HIGHEST THIRD														
13	REDSMELT	16	10	8	17	4	17	11	51	83	32	14	15	11
20	GENERIC I.C. (40%/SAF/EAF)	11	9	10	10	19	16	15	40	90	50	10	16	19
21	SL/RN ROTARY KILN	17	5	4	15	16	20	20	41	97	56	11	17	21
8	30% COLD PIG IRON/70% SCRAP	10	19	20	18	17	6	9	67	99	32	19	18	9
4	H/LSA IVM	19	12	12	19	20	7	14	62	103	41	18	19	14
1	100% DRI, 1.0% C, MIDREX	20	14	18	20	21	9	17	72	119	47	20	20	18
11	COREX/MIDREX WITH 60% H.M.	21	20	21	21	13	21	21	83	138	55	21	21	20

RANKING OF IRONMAKING PROCESSES - RESEQUENCED ORDER

(BASIS: 1.00 MM mt LIQUID STEEL PER YEAR, \$140/mt STEEL SCRAP COST)

SEQ. NO.	PROCESS	CAPEX RANKING (1)	OPEX I.U. RANKING (2)	OPEX L.S. RANKING (3)	I.R.R. RANKING (4)	ELEC. RANKING (5)	PROC. CO2 RANKING (6)	TOTAL CO2 RANKING (7)	TOTALS (1-4)	TOTALS (1-7)	TOTALS (5-7)	T.S.RANK (1-4)	T.S.RANK (1-7)	T.S.RANK (5-7)
LOWEST THIRD														
2	100% STEEL SCRAP	1	1	15	9	8	1	1	26	36	10	4	1	1
9	30% TECNORED H.M. W COGEN	3	13	12	6	1	13	3	34	51	17	8	2	4
16	CIRCORED/HBI/EAF	6	6	5	1	11	14	12	18	55	37	1	3	12
7	30% BF H.M./70% SCRAP NR COKE	8	11	13	10	2	8	4	42	56	14	11	4	2
14	MAUMEE BRIQUETTE DRI/EAF	14	3	1	3	14	11	13	21	59	38	2	5	13
18	FINMET/HBI/EAF	13	7	4	4	12	10	10	28	60	32	6	6	10
17	CIRCOFER/HBI/SAF/EAF	7	8	7	2	5	19	19	24	67	43	3	7	15
MIDDLE THIRD														
15	ITMK3 DR SHOT TO EAF	15	4	3	5	9	18	18	27	72	45	5	8	16
6	30% MINI-BF H.M.	4	17	18	15	7	5	7	54	73	19	14	9	6
3	30% DRI, 1.0% C/70% SCRAP	5	15	16	17	18	2	2	53	75	22	13	10	7
19	GENERIC IRON CARBIDE (100%)/EAF	18	2	2	7	15	15	16	29	75	46	7	11	17
5	30% BF H.M./70% SCRAP CP COKE	9	18	19	14	6	4	6	60	76	16	18	12	3
12	HISMELT 32.7% H.M.	12	16	14	16	10	3	5	58	76	18	16	13	5
13	REDSMELT	16	10	8	12	4	17	11	46	78	32	12	14	11
HIGHEST THIRD														
10	30% TECNORED H.M. W/O COGEN	2	21	20	13	3	12	8	56	79	23	15	15	8
21	SL/RN ROTARY KILN	17	5	6	8	16	20	20	36	92	56	9	16	21
20	GENERIC I.C. (40%)/SAF/EAF	11	9	11	11	19	16	15	42	92	50	10	17	19
4	HYLSA IVM	19	12	9	18	20	7	14	58	99	41	17	18	14
8	30% COLD PIG IRON/70% SCRAP	10	19	21	20	17	6	9	70	102	32	20	19	9
1	100% DRI, 1.0% C, MIDREX	20	14	10	19	21	9	17	63	110	47	19	20	18
11	COREX/MIDREX WITH 60% H.M.	21	20	17	21	13	21	21	79	134	55	21	21	20