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Economic Feasibility Study of an Acid Hydrolysis-Based Ethanol Plant

A Subcontract Report

Badger Engineers, Inc.
Cambridge, MA

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SERI Technical Monitor:
J. D. Wright

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Design Case I

SERI E-0461

BADGER

Date: 20-Sep-

ANALYSIS OF REVENUES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34

PRODUCT VOLUMES	Unit																			
Ethanol	MMGals	0.00	0.00	0.00	13.75	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	13.75
Furfural	MMLBS	0.00	0.00	0.00	65.10	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	65.10
Electricity	MMWh	0	0	0	88000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	88000
Landfill	metr Tons	0	0	0	31667	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	31667

SELLING PRICES	$/.....																			
Ethanol	MMGals	1.23	1.33	1.45	1.57	1.70	1.85	2.01	2.18	2.36	2.56	2.78	3.02	3.27	3.55	3.85	4.18	4.54	4.92	5.34
Furfural	MMLbs	0.15	0.16	0.18	0.19	0.21	0.23	0.24	0.27	0.29	0.31	0.34	0.37	0.40	0.43	0.47	0.51	0.55	0.60	0.65
Electricity	MMWh	50.00	54.25	58.86	63.86	69.29	75.18	81.57	88.51	96.03	104.19	113.05	122.66	133.08	144.40	156.67	169.99	184.44	200.11	217.12
Landfill	metr Tons	-5.50	-5.97	-6.47	-7.03	-7.62	-8.27	-8.97	-9.74	-10.56	-11.46	-12.44	-13.49	-14.64	-15.88	-17.23	-18.70	-20.29	-22.01	-23.88

REVENUES	MM$																			
Ethanol		0.0	0.0	0.0	21.6	46.9	50.9	55.2	59.9	65.0	70.5	76.5	83.0	90.0	97.7	106.0	115.0	124.8	135.4	73.4
Furfural		0.0	0.0	0.0	12.5	27.1	29.4	31.9	34.6	37.5	40.7	44.2	47.9	52.0	56.4	61.2	66.4	72.0	78.2	42.4
Electricity		0.0	0.0	0.0	5.6	12.2	13.2	14.4	15.6	16.9	18.3	19.9	21.6	23.4	25.4	27.6	29.9	32.5	35.2	19.1
Landfill		0.0	0.0	0.0	-0.2	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.8	-0.9	-0.9	-1.0	-1.1	-1.2	-1.3	-1.4	-0.8
TOTALS		0.0	0.0	0.0	39.5	85.7	92.9	100.8	109.4	118.7	128.8	139.7	151.6	164.5	178.5	193.7	210.1	228.0	247.4	134.2

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF COSTS OF SALES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availibility	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
RAW MATERIALS QUANTITIES																			
wood chips (metr Tons)	0	0	0	295200	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	295200
sulfuric acid (metr Tons)	0	0	0	9078	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	9078
lime (metr Tons)	0	0	0	9192	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	9192
other cats & chems	0.00	0.00	0.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil (Gals)	0	0	0	5000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	5000
gasoline (MMgals)	0.00	0.00	0.00	0.66	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	0.66
UNIT COSTS ($.....)																			
wood chips (metr Tons)	42.00	45.57	49.44	53.65	58.21	63.15	68.52	74.35	80.67	87.52	94.96	103.03	111.79	121.29	131.60	142.79	154.93	168.10	182.38
sulfuric acid (metr Tons)	65.00	70.53	76.52	83.02	90.08	97.74	106.05	115.06	124.84	135.45	146.96	159.46	173.01	187.72	203.67	220.98	239.77	260.15	282.26
lime (metr Tons)	35.00	37.98	41.20	44.71	48.51	52.63	57.10	61.95	67.22	72.93	79.13	85.86	93.16	101.08	109.67	118.99	129.11	140.08	151.99
other cats & chems (/Yr)	609800	661633	717872	778891	845097	916930	994869	1079433	1171185	1270735	1378748	1495941	1623096	1761059	1910750	2073163	2249382	2440580	2648029
diesel oil (Gallon)	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
gasoline (Gallon)	0.85	0.92	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.09	2.26	2.45	2.66	2.89	3.14	3.40	3.69
TOTALS (MM$)																			
wood chips	0.0	0.0	0.0	15.8	34.4	37.3	40.5	43.9	47.6	51.7	56.1	60.8	66.0	71.6	77.7	84.3	91.5	99.2	53.8
sulfuric acid	0.0	0.0	0.0	0.8	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.4	3.7	4.0	4.4	4.7	2.6
lime	0.0	0.0	0.0	0.4	0.9	1.0	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	2.4	2.6	1.4
other cats & chems	0.0	0.0	0.0	0.4	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.1	2.2	2.4	1.3
diesel oil	0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline	0.0	0.0	0.0	0.7	1.5	1.7	1.8	2.0	2.1	2.3	2.5	2.7	3.0	3.2	3.5	3.8	4.1	4.5	2.4
TOTAL VARIABLE COSTS	0.0	0.0	0.0	18.1	39.3	42.6	46.3	50.2	54.5	59.1	64.1	69.6	75.5	81.9	88.8	96.4	104.6	113.5	61.6
FIXED COSTS (Units, unit rates; MM$)																			
labor (MM$/yr, 1.48)	0.00	0.00	0.00	0.95	2.05	2.23	2.41	2.62	2.84	3.08	3.35	3.63	3.94	4.27	4.64	5.03	5.46	5.92	3.21
supervision (MM$/yr, 0.06)	0.00	0.00	0.00	0.04	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.22	0.24	0.13
subt 1	0.00	0.00	0.00	0.98	2.13	2.32	2.51	2.73	2.96	3.21	3.48	3.78	4.10	4.45	4.83	5.24	5.68	6.16	3.34
direct overhead (% subt 1, 40)	0.00	0.00	0.00	0.39	0.85	0.93	1.00	1.09	1.18	1.28	1.39	1.51	1.64	1.78	1.93	2.09	2.27	2.47	1.34
maintenance (% capital, 4)	0.00	0.00	0.00	3.57	7.75	8.41	9.12	9.93	10.74	11.65	12.64	13.72	14.88	16.15	17.52	19.01	20.62	22.38	12.14
insur & taxes (% capital, 2)	0.00	0.00	0.00	1.79	3.87	4.20	4.56	4.95	5.37	5.83	6.32	6.86	7.44	8.07	8.76	9.50	10.31	11.19	6.07
royalty ($/yr, 250000)	0.00	0.00	0.00	0.16	0.35	0.38	0.41	0.44	0.48	0.52	0.57	0.61	0.67	0.72	0.78	0.85	0.92	1.00	0.54
depreciation, (book)	0.00	0.00	0.00	5.62	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	5.62
TOTAL FIXED COSTS	0.00	0.00	0.00	12.51	26.19	27.46	28.84	30.34	31.96	33.73	35.64	37.71	39.96	42.40	45.05	47.93	51.05	54.43	29.05
TOTAL COSTS OF SALES	0.00	0.00	0.00	30.62	65.49	70.10	75.10	80.53	86.42	92.81	99.74	107.27	115.43	124.29	133.90	144.32	155.63	167.91	90.61

Design Case II

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF REVENUES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
PRODUCT VOLUMES — Unit																			
Ethanol — MMGals	0.00	0.00	0.00	13.75	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	13.75
Furfural — MMLbs	0.00	0.00	0.00	46.57	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	46.57
Electricity — MWHrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landfill — metr Tons	0	0	0	31667	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	31667
SELLING PRICES — $/....																			
Ethanol — MMGals	1.65	1.79	1.94	2.11	2.29	2.48	2.69	2.92	3.17	3.44	3.73	4.05	4.39	4.77	5.17	5.61	6.09	6.60	7.17
Furfural — MMLbs	0.15	0.16	0.18	0.19	0.21	0.23	0.24	0.27	0.29	0.31	0.34	0.37	0.40	0.43	0.47	0.51	0.55	0.60	0.65
Electricity — MWHrs	50.00	54.25	58.86	63.86	69.29	75.18	81.57	88.51	96.03	104.19	113.05	122.66	133.08	144.40	156.67	169.99	184.44	200.11	217.12
Landfill — metr Tons	-5.50	-5.97	-6.47	-7.03	-7.62	-8.27	-8.97	-9.74	-10.56	-11.46	-12.44	-13.49	-14.64	-15.88	-17.23	-18.70	-20.29	-22.01	-23.88
REVENUES — MM$																			
Ethanol	0.0	0.0	0.0	29.0	62.9	68.2	74.0	80.3	87.1	94.6	102.6	111.3	120.8	131.0	142.2	154.3	167.4	181.6	98.5
Furfural	0.0	0.0	0.0	8.9	19.4	21.0	22.8	24.7	26.8	29.1	31.6	34.3	37.2	40.3	43.8	47.5	51.5	55.9	30.3
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landfill	0.0	0.0	0.0	-0.2	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.8	-0.9	-0.9	-1.0	-1.1	-1.2	-1.3	-1.4	-0.8
TOTALS	0.0	0.0	0.0	37.7	81.8	88.7	96.3	104.4	113.3	122.9	133.4	144.7	157.0	170.4	184.9	200.6	217.6	236.1	128.1

B A D G E R

ANALYSIS OF COSTS OF SALES

Year Start:		Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :		-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability		0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor		0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation,																				
effect on operating costs:		1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
RAW MATERIALS QUANTITIES																				
wood chips	metr tons	0	0	0	264000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	264000
sulfuric acid	metr tons	0	0	0	12950	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	12960
lime	metr tons	0	0	0	11255	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	11255
other cats & chems		0.00	0.00	0.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil	mals	0	0	0	5000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	5000
gasoline	MMGals	0.00	0.00	0.00	0.66	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	0.66
UNIT COSTS	$/....																			
wood chips	metr tons	42.00	45.57	49.44	53.65	58.21	63.15	68.52	74.35	80.67	87.52	94.96	103.03	111.79	121.29	131.60	142.79	154.93	168.10	182.38
sulfuric acid	metr tons	65.00	70.53	76.52	83.02	90.08	97.74	106.05	115.06	124.84	135.45	146.96	159.46	173.01	187.72	203.67	220.98	239.77	260.15	282.26
lime	metr tons	35.00	37.98	41.20	44.71	48.51	52.63	57.10	61.95	67.22	72.93	79.13	85.86	93.16	101.08	109.67	118.99	129.11	140.08	151.99
other cats & chems	/yr	550000	596750	647474	702509	762222	827011	897307	973578	1056332	1146121	1243541	1349242	1463927	1588361	1723372	1869859	2028797	2201244	2388150
diesel oil	Gallon	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
gasoline	Gallon	0.85	0.92	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.09	2.26	2.45	2.66	2.89	3.14	3.40	3.69
TOTALS	MM$																			
wood chips		0.0	0.0	0.0	14.2	30.7	33.3	36.2	39.3	42.6	46.2	50.1	54.4	59.0	64.0	69.5	75.4	81.8	88.8	48.1
sulfuric acid		0.0	0.0	0.0	1.1	2.3	2.5	2.7	3.0	3.2	3.5	3.8	4.1	4.5	4.9	5.3	5.7	6.2	6.7	3.7
lime		0.0	0.0	0.0	0.5	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.9	3.2	1.7
other cats & chems		0.0	0.0	0.0	0.4	0.8	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	1.2
diesel oil		0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline		0.0	0.0	0.0	0.7	1.5	1.7	1.8	2.0	2.1	2.3	2.5	2.7	3.0	3.2	3.5	3.8	4.1	4.5	2.4
TOTAL VARIABLE COSTS		0.0	0.0	0.0	16.8	36.5	39.4	42.9	46.6	50.6	54.9	59.5	64.4	70.1	76.0	82.5	89.5	97.1	105.3	57.2
FIXED COSTS	Units, unit rates	MM$																		
labor	MM$/yr 1.48	0.00	0.00	0.00	0.45	2.05	2.23	2.41	2.62	2.84	3.08	3.35	3.63	3.94	4.27	4.64	5.03	5.46	5.92	3.21
supervision	MM$/yr 0.05	0.00	0.00	0.00	0.04	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.22	0.24	0.13
	subt 1	0.00	0.00	0.00	0.98	2.13	2.32	2.51	2.73	2.96	3.21	3.48	3.78	4.10	4.45	4.83	5.24	5.68	6.16	3.34
direct overhead	% subt 1 40	0.00	0.00	0.00	0.39	0.85	0.93	1.00	1.09	1.18	1.28	1.39	1.51	1.64	1.78	1.93	2.09	2.27	2.47	1.34
maintenance	% capital 4	0.00	0.00	0.00	3.45	7.48	8.11	8.80	9.55	10.36	11.24	12.20	13.24	14.36	15.58	16.91	18.34	19.90	21.59	11.71
insur & taxes	% capital 2	0.00	0.00	0.00	1.72	3.74	4.06	4.40	4.78	5.18	5.62	6.10	6.62	7.18	7.79	8.45	9.17	9.95	10.80	5.86
royality	$/yr 250000	0.00	0.00	0.00	0.16	0.35	0.38	0.41	0.46	0.48	0.52	0.57	0.61	0.67	0.72	0.78	0.85	0.92	1.00	0.54
depreciation, (book)		0.00	0.00	0.00	5.42	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	5.42
TOTAL FIXED COSTS		0.00	0.00	0.00	12.13	25.39	26.63	27.97	29.43	31.00	32.72	34.58	36.60	38.79	41.16	43.74	46.53	49.57	52.86	28.22
TOTAL COSTS OF SALES		0.00	0.00	0.00	28.94	61.87	66.21	70.91	76.02	81.56	87.57	94.09	101.17	108.85	117.18	126.22	136.02	146.66	158.21	P

Design Case III

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF REVENUES

Year Start:		Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :		-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availibility		0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor		0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:		1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
PRODUCT VOLUMES	Unit																			
Ethanol	MMGals	0.00	0.00	0.00	2.75	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	2.75
Furfural	MMLbs	0.00	0.00	0.00	13.02	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	13.02
Electricity	MWHrs	0	0	0	17600	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	17600
Landfill	metr Tons	0	0	0	6332	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	6332
SELLING PRICES	$/....																			
Ethanol	MMGals	1.42	1.54	1.67	1.81	1.97	2.14	2.32	2.51	2.73	2.96	3.21	3.48	3.78	4.10	4.45	4.83	5.24	5.68	6.17
Furfural	MMLbs	0.55	0.60	0.65	0.70	0.76	0.83	0.90	0.97	1.06	1.15	1.24	1.35	1.46	1.59	1.72	1.87	2.03	2.20	2.39
Electricity	MWHrs	50.00	54.25	58.86	63.86	69.29	75.18	81.57	88.51	96.03	104.19	113.05	122.66	133.08	144.40	156.67	169.99	184.44	200.11	217.12
Landfill	metr Tons	-5.50	-5.97	-6.47	-7.03	-7.62	-8.27	-8.97	-9.74	-10.56	-11.46	-12.44	-13.49	-14.64	-15.88	-17.23	-18.70	-20.29	-22.01	-23.88
REVENUES	MM$																			
Ethanol		0.0	0.0	0.0	5.0	10.8	11.7	12.7	13.8	15.0	16.3	17.7	19.2	20.8	22.6	24.5	26.6	28.8	31.3	17.0
Furfural		0.0	0.0	0.0	9.1	19.8	21.5	23.4	25.4	27.5	29.8	32.4	35.1	38.1	41.4	44.9	48.7	52.8	57.3	31.1
Electricity		0.0	0.0	0.0	1.1	2.4	2.6	2.9	3.1	3.4	3.7	4.0	4.3	4.7	5.1	5.5	6.0	6.5	7.0	3.8
Landfill		0.0	0.0	0.0	.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2
	TOTALS	0.0	0.0	0.0	15.2	33.0	35.8	38.9	42.2	45.8	49.6	53.9	58.4	63.4	68.8	74.6	81.0	87.9	95.3	51.7

SERI E-0461

B A D G E R

Date: 20-Sep-84

ANALYSIS OF COSTS OF SALES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availibility	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
RAW MATERIALS QUANTITIES																			
wood chips (metr tons)	0	0	0	59040	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	59040
sulfuric acid (metr tons)	0	0	0	1816	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	1816
lime (metr tons)	0	0	0	1839	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	1839
other cats & chems	0.00	0.00	0.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil (Gals)	0	0	0	1000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1000
gasoline (MMGals)	0.00	0.00	0.00	0.13	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.13
UNIT COSTS ($/....)																			
wood chips (metr tons)	42.00	45.57	49.44	53.65	58.21	63.15	68.52	74.35	80.67	87.52	94.96	103.03	111.79	121.29	131.60	142.79	154.93	168.10	182.38
sulfuric acid (metr tons)	65.00	70.53	76.52	83.02	90.08	97.74	106.05	115.06	124.84	135.45	146.96	159.46	173.01	187.72	203.67	220.98	239.77	260.15	282.26
lime (metr tons)	35.00	37.98	41.20	44.71	48.51	52.63	57.10	61.95	67.22	72.93	79.13	85.86	93.16	101.08	109.67	118.99	129.11	140.08	151.99
other cats & chems (/Tr)	366760	397935	431759	468459	508278	551481	598357	649217	704401	764275	829230	899724	976200	1059177	1149207	1246890	1352875	1467870	1592639
diesel oil (Gallon)	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
gasoline (Gallon)	0.85	0.92	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.09	2.26	2.45	2.66	2.89	3.14	3.40	3.69
TOTALS (MM$)																			
wood chips	0.0	0.0	0.0	3.2	6.9	7.5	8.1	8.8	9.5	10.3	11.2	12.2	13.2	14.3	15.5	16.9	18.3	19.8	10.8
sulfuric acid	0.0	0.0	0.0	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	0.9	0.5
lime	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.3
other cats & chems	0.0	0.0	0.0	0.2	0.5	0.6	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.1	1.2	1.4	1.5	0.8
diesel oil	0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline	0.0	0.0	0.0	0.1	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.5
TOTAL VARIABLE COSTS	0.0	0.0	0.0	3.8	8.2	8.9	9.6	10.5	11.4	12.3	13.4	14.5	15.7	17.1	18.5	20.1	21.8	23.7	12.8
FIXED COSTS (Units, unit rates; MM$)																			
labor (MM$/yr, 1.05)	0.00	0.00	0.00	0.67	1.46	1.58	1.71	1.86	2.02	2.19	2.37	2.58	2.79	3.03	3.29	3.57	3.87	4.20	2.28
supervision (MM$/yr, 0.06)	0.00	0.00	0.00	0.04	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.22	0.24	0.13
subt 1	0.00	0.00	0.00	0.71	1.54	1.67	1.81	1.96	2.13	2.31	2.51	2.72	2.95	3.21	3.48	3.77	4.09	4.44	2.41
direct overhead (% subt 1, 40)	0.00	0.00	0.00	0.28	0.62	0.67	0.72	0.79	0.85	0.93	1.00	1.09	1.18	1.28	1.39	1.51	1.64	1.78	0.96
maintenance (% capital, 4)	0.00	0.00	0.00	1.78	3.87	4.20	4.55	4.94	5.36	5.82	6.31	6.85	7.43	8.06	8.75	9.49	10.30	11.17	6.06
insur & taxes (% capital, 2)	0.00	0.00	0.00	0.89	1.93	2.10	2.28	2.47	2.68	2.91	3.16	3.42	3.71	4.03	4.37	4.74	5.15	5.59	3.03
royalty ($/yr, 250000)	0.00	0.00	0.00	0.16	0.35	0.38	0.41	0.44	0.48	0.52	0.57	0.61	0.67	0.72	0.78	0.85	0.92	1.00	0.54
depreciation, (book)	0.00	0.00	0.00	2.81	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	5.61	2.81
TOTAL FIXED COSTS	0.00	0.00	0.00	6.63	13.91	14.62	15.39	16.22	17.12	18.10	19.16	20.31	21.56	22.91	24.38	25.98	27.71	29.59	15.81
TOTAL COSTS OF SALES	0.00	0.00	0.00	10.41	22.11	23.51	25.03	26.68	28.48	30.42	32.53	34.82	37.30	39.99	42.91	46.08	49.52	53.26	28.65

Design Case IV

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF REVENUES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availibility	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
PRODUCT VOLUMES — Unit																			
Ethanol — MMGals	0.00	0.00	0.00	2.75	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	2.75
Furfural — MMLbs	0.00	0.00	0.00	13.02	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	13.02
Electricity — MWHrs	0	0	0	16400	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	16400
Landfill — metr Tons	0	0	0	6332	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	6332
SELLING PRICES — $/....																			
Ethanol — MMGals	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34	4.71	5.11	5.54	6.01	6.52	7.08
Furfural — MMLbs	0.55	0.60	0.65	0.70	0.76	0.83	0.90	0.97	1.06	1.15	1.24	1.35	1.46	1.59	1.72	1.87	2.03	2.20	2.39
Electricity — MWHrs	-60.00	-65.10	-70.63	-76.64	-83.15	-90.22	-97.89	-106.21	-115.24	-125.03	-135.66	-147.19	-159.70	-173.28	-188.00	-203.98	-221.32	-240.14	-260.55
Landfill — metr Tons	-5.50	-5.97	-6.47	-7.03	-7.62	-8.27	-8.97	-9.74	-10.56	-11.46	-12.44	-13.49	-14.64	-15.88	-17.23	-18.70	-20.29	-22.01	-23.88
REVENUES — MM$																			
Ethanol	0.0	0.0	0.0	5.7	12.4	13.5	14.6	15.9	17.2	18.7	20.3	22.0	23.9	25.9	28.1	30.5	33.1	35.9	19.5
Furfural	0.0	0.0	0.0	9.1	19.8	21.5	23.4	25.4	27.5	29.8	32.4	35.1	38.1	41.4	44.9	48.7	52.8	57.3	31.1
Electricity	0.0	0.0	0.0	-1.3	-2.7	-3.0	-3.2	-3.5	-3.8	-4.1	-4.4	-4.8	-5.2	-5.7	-6.2	-6.7	-7.3	-7.9	-4.3
Landfill	0.0	0.0	0.0	.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2
TOTALS	0.0	0.0	0.0	13.6	29.4	32.0	34.7	37.6	40.8	44.3	48.0	52.1	56.6	61.4	66.6	72.2	78.4	85.0	46.1

ANALYSIS OF COSTS OF SALES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34

RAW MATERIALS QUANTITIES

wood chips	metr tons	0	0	0	59040	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	59040
sulfuric acid	metr tons	0	0	0	1816	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	1816
lime	metr tons	0	0	0	1839	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	1839
other cats & chems		0.00	0.00	0.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil	Gals	0	0	0	1000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1000
gasoline	MMGals	0.00	0.00	0.00	0.13	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.13

UNIT COSTS $/....

wood chips	metr tons	42.00	45.57	49.44	53.65	58.21	63.15	68.52	74.35	80.67	87.52	94.96	103.03	111.79	121.29	131.60	142.79	154.93	168.10	182.38
sulfuric acid	metr tons	65.00	70.53	76.52	83.02	90.08	97.76	106.05	115.06	124.84	135.45	146.96	159.46	173.01	187.72	203.67	220.98	239.77	260.15	282.26
lime	metr tons	35.00	37.98	41.20	44.71	48.51	52.63	57.10	61.95	67.22	72.93	79.13	85.86	93.16	101.08	109.67	118.99	129.11	140.08	151.99
other cats & chems	/Yr	346760	397935	431759	468459	508278	551481	598357	649217	704401	764275	829258	899724	976200	1059177	1149207	1246890	1352875	1467870	1592639
diesel oil	Gallon	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.08	2.26	2.45	2.66	2.89	3.13	3.40	3.69	4.00	4.34
gasoline	Gallon	0.85	0.92	1.00	1.09	1.18	1.28	1.39	1.50	1.63	1.77	1.92	2.09	2.26	2.45	2.66	2.89	3.14	3.40	3.69

TOTALS MM$

wood chips	0.0	0.0	0.0	3.2	6.9	7.5	8.1	8.8	9.5	10.3	11.2	12.2	13.2	14.3	15.5	16.9	18.3	19.8	10.8
sulfuric acid	0.0	0.0	0.0	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	0.9	0.5
lime	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.3
other cats & chems	0.0	0.0	0.0	0.2	0.5	0.6	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.1	1.2	1.4	1.5	0.8
diesel oil	0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline	0.0	0.0	0.0	0.1	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.5
TOTAL VARIABLE COSTS	0.0	0.0	0.0	3.8	8.2	8.9	9.6	10.5	11.4	12.3	13.4	14.5	15.7	17.1	18.5	20.1	21.8	23.7	12.8

FIXED COSTS

	Units, unit rates		MM$																		
labor	MM$/yr	1.05	0.00	0.00	0.00	0.67	1.46	1.58	1.71	1.86	2.02	2.19	2.37	2.58	2.79	3.03	3.29	3.57	3.87	4.20	2.28
supervision	MM$/yr	0.06	0.00	0.00	0.00	0.04	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.22	0.24	0.13
		subt 1	0.00	0.00	0.00	0.71	1.54	1.67	1.81	1.96	2.13	2.31	2.51	2.72	2.95	3.21	3.48	3.77	4.09	4.44	2.41
direct overhead	% subt 1	40	0.00	0.00	0.00	0.28	0.62	0.67	0.72	0.79	0.85	0.93	1.00	1.09	1.18	1.28	1.39	1.51	1.64	1.78	0.96
maintenance	% capital	4	0.00	0.00	0.00	1.48	3.22	3.50	3.79	4.12	4.47	4.85	5.26	5.70	6.19	6.72	7.29	7.91	8.58	9.31	5.05
insur & taxes	% capital	2	0.00	0.00	0.00	0.74	1.61	1.75	1.90	2.06	2.23	2.42	2.63	2.85	3.09	3.36	3.64	3.95	4.29	4.65	2.52
royalty	$/yr	250000	0.00	0.00	0.00	0.16	0.35	0.38	0.41	0.44	0.48	0.52	0.57	0.61	0.67	0.72	0.78	0.85	0.92	1.00	0.54
depreciation, (book)			0.00	0.00	0.00	2.34	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	2.34
TOTAL FIXED COSTS			0.00	0.00	0.00	5.72	12.01	12.63	13.31	14.04	14.84	15.70	16.64	17.66	18.76	19.96	21.26	22.67	24.20	25.86	13.83
TOTAL COSTS OF SALES			0.00	0.00	0.00	9.49	20.21	21.53	22.96	24.51	26.20	28.03	30.01	32.17	34.50	37.04	39.79	42.77	46.01	49.52	26

Annual Revenues and Cost of Sales (Badger)

Design Case I

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF REVENUES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	50%	65%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	108%	180%
Inflation + Escalation, effect on operating costs:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PRODUCT VOLUMES — Unit																			
Ethanol — MMGals	0.00	0.00	0.00	6.88	17.86	24.75	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	13.75
Furfural — MMLbs	0.00	0.00	0.00	32.55	84.63	117.18	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	130.20	65.10
Electricity — MWhrs	0	0	0	44000	114400	158400	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	176000	88000
Landfill — metr Tons	0	0	0	15833	41166	57000	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	31667
SELLING PRICES — $/....																			
Ethanol — MMGals	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Furfural — MMLbs	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Electricity — MWHrs	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Landfill — metr Tons	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50
REVENUES — MM$																			
Ethanol	0.0	0.0	0.0	12.4	32.2	44.6	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	24.8
Furfural	0.0	0.0	0.0	4.9	12.7	17.6	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	9.8
Electricity	0.0	0.0	0.0	2.2	5.7	7.9	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	4.4
Landfill	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2
TOTALS	0.0	0.0	0.0	19.4	50.4	69.7	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	38.7

SERI E-0441

BABGER

Date: 20-Sep-8

ANALYSIS OF COSTS OF SALES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	50%	45%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

RAW MATERIALS QUANTITIES

wood chips	metr Tons	0	0	0	147600	383760	531360	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	590400	295200
sulfuric acid	metr Tons	0	0	0	4539	11801	16340	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	18155	9078
lime	metr Tons	0	0	0	4596	11949	16545	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	18383	9192
other cats & chems		0.00	0.00	0.00	0.25	0.65	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil	Gals	0	0	0	2500	6500	9000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	5000
gasoline	MMGals	0.00	0.00	0.00	0.35	0.85	1.18	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	0.66

UNIT COSTS $/....

wood chips	metr Tons	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00
sulfuric acid	metr Tons	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00
lime	metr Tons	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
other cats & chems	/Yr	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800	609800
diesel oil	Gallon	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
gasoline	Gallon	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

TOTALS MM$

wood chips	0.0	0.0	0.0	6.2	16.1	22.3	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	12.4
sulfuric acid	0.0	0.0	0.0	0.3	0.8	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.6
lime	0.0	0.0	0.0	0.2	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3
other cats & chems	0.0	0.0	0.0	0.2	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3
diesel oil	0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline	0.0	0.0	0.0	0.3	0.7	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.6
TOTAL VARIABLE COSTS	0.0	0.0	0.0	7.1	18.4	25.5	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	14.2

FIXED COSTS

	Units, unit rates		MM$																			
labor	MM$/yr	1.48	0.00	0.00	0.00	0.74	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	0.74
supervision	MM$/yr	0.06	0.00	0.00	0.00	0.03	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.03
		subt 1	0.00	0.00	0.00	0.77	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	0.77
direct overhead	% subt 1	40	0.00	0.00	0.00	0.31	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.31
maintenance	% capital	4	0.00	0.00	0.00	2.80	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	2.80
insur & taxes	% capital	2	0.00	0.00	0.00	1.40	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	1.40
royalty	$/yr	250000	0.00	0.00	0.00	0.13	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.13
depreciation, (book)			0.00	0.00	0.00	4.51	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	9.02	4.51
TOTAL FIXED COSTS			0.00	0.00	0.00	9.91	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	9.91
TOTAL COSTS OF SALES			0.00	0.00	0.00	16.97	38.24	45.33	48.16	48.16	48.16	48.16	48.16	48.16	48.16	48.16	48.16	48.16	48.16	48.16	48.16	24.[illegible]

Design Case II

SERI E-0461

BADGER

Date: 20-Sep-

ANALYSIS OF REVENUES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	50%	45%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PRODUCT VOLUMES — Unit																			
Ethanol — MMGals	0.00	0.00	0.00	6.88	17.86	24.75	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	13.75
Furfural — MMLbs	0.00	0.00	0.00	23.29	60.54	83.83	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	93.14	46.57
Electricity — MMWs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landfill — metr tons	0	0	0	15833	41166	57000	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	63333	31667
SELLING PRICES — $/.....																			
Ethanol — MMGals	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
Furfural — MMLbs	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Electricity — MMWs	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Landfill — metr tons	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50
REVENUES — MM$																			
Ethanol	0.0	0.0	0.0	15.3	39.7	54.9	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	30.5
Furfural	0.0	0.0	0.0	3.5	9.1	12.6	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	7.0
Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landfill	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2
TOTALS	0.0	0.0	0.0	18.7	48.5	67.2	74.7	74.7	74.7	74.7	74.7	74.7	74.7	74.7	74.7	74.7	74.7	74.7	37.3

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF COSTS OF SALES

Year Start:		Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :		-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availibility		0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor		0%	0%	0%	50%	65%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
RAW MATERIALS QUANTITIES																				
wood chips	metr Tons	0	0	0	132000	343200	475200	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	528000	264000
sulfuric acid	metr Tons	0	0	0	6480	16847	23327	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	25919	12960
lime	metr Tons	0	0	0	5627	14631	20256	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	22509	11255
other cats & chems		0.00	0.00	0.00	0.25	0.65	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil	Gals	0	0	0	2500	6500	9000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	5000
gasoline	MMGals	0.00	0.00	0.00	0.33	0.85	1.18	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	0.66
UNIT COSTS	$/....																			
wood chips	metr Tons	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00
sulfuric acid	metr Tons	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00
lime	metr Tons	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
other cats & chems	/Yr	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000	550000
diesel oil	Gallon	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
gasoline	Gallon	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
TOTALS	MM$																			
wood chips		0.0	0.0	0.0	5.5	14.4	20.0	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	11.1
sulfuric acid		0.0	0.0	0.0	0.4	1.1	1.5	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	0.8
lime		0.0	0.0	0.0	0.2	0.5	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4
other cats & chems		0.0	0.0	0.0	0.1	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3
diesel oil		0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline		0.0	0.0	0.0	0.3	0.7	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.6
TOTAL VARIABLE COSTS		0.0	0.0	0.0	6.6	17.1	23.7	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	13.2
FIXED COSTS	Units, unit rates	MM$																		
labor	MM$/yr 1.48	0.00	0.00	0.00	0.74	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	0.74
supervision	MM$/yr 0.06	0.00	0.00	0.00	0.03	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.03
	subt 1	0.00	0.00	0.00	0.77	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	0.77
direct overhead	% subt 1 40	0.00	0.00	0.00	0.31	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.31
maintenance	% capital 4	0.00	0.00	0.00	2.70	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	2.70
insur & taxes	% capital 2	0.00	0.00	0.00	1.35	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	1.35
royalty	$/yr 250000	0.00	0.00	0.00	0.13	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.13
depreciation, (book)		0.00	0.00	0.00	4.35	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	8.70	4.35
TOTAL FIXED COSTS		0.00	0.00	0.00	9.60	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	19.20	9.60
TOTAL COSTS OF SALES		0.00	0.00	0.00	16.18	36.31	42.89	45.52	45.52	45.52	45.52	45.52	45.52	45.52	45.52	45.52	45.52	45.52	45.52	22.76

Design Case III

SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF REVENUES

Year Start:		Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :		-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availibility		0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor		0%	0%	0%	50%	65%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PRODUCT VOLUMES	**Unit**																			
Ethanol	MMGals	0.00	0.00	0.00	1.38	3.58	4.95	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	2.75
Furfural	MMLbs	0.00	0.00	0.00	6.51	15.9[illegible]	23.44	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	13.02
Electricity	MWHrs	0	0	0	8800	22880	31680	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	35200	17600
Landfill	metr Tons	0	0	0	3166	8232	11398	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	6332
SELLING PRICES	**$/....**																			
Ethanol	MMGals	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83
Furfural	MMLbs	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Electricity	MWHrs	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Landfill	metr Tons	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50
REVENUES	**MM$**																			
Ethanol		0.0	0.0	0.0	3.9	10.1	14.0	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	7.8
Furfural		0.0	0.0	0.0	3.6	9.3	12.9	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	7.2
Electricity		0.0	0.0	0.0	0.4	1.1	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.9
Landfill		0.0	0.0	0.0	.0	.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	.0
	TOTALS	0.0	0.0	0.0	7.9	20.5	28.4	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	15.8

BADGER

ANALYSIS OF COSTS OF SALES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	50%	65%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, affect on operating costs:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
RAW MATERIALS QUANTITIES																			
wood chips — metr tons	0	0	0	29520	76752	106272	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	59040
sulfuric acid — metr tons	0	0	0	908	2360	3268	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	1816
lime — metr tons	0	0	0	919	2390	3309	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	1839
other cats & chems	0.00	0.00	0.00	0.25	0.65	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil — Gals	0	0	0	500	1300	1800	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1000
gasoline — MMGals	0.00	0.00	0.00	0.07	0.17	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.13
UNIT COSTS — $/....																			
wood chips — metr tons	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00
sulfuric acid — metr tons	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00
lime — metr tons	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
other cats & chems — /Yr	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760
diesel oil — Gallon	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
gasoline — Gallon	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
TOTALS — MM$																			
wood chips	0.0	0.0	0.0	1.2	3.2	4.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.5
sulfuric acid	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
lime	0.0	0.0	0.0	.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
other cats & chems	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
diesel oil	0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
TOTAL VARIABLE COSTS	0.0	0.0	0.0	1.5	3.8	5.1	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	3.0
FIXED COSTS — Units, unit rates	MM$																		
labor — MM$/yr 1.05	0.00	0.00	0.00	0.53	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.53
supervision — MM$/yr 0.06	0.00	0.00	0.00	0.03	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.03
subt 1	0.00	0.00	0.00	0.56	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	0.56
direct overhead — % subt 1 40	0.00	0.00	0.00	0.22	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.22
maintenance — % capital 4	0.00	0.00	0.00	1.40	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	1.40
insur & taxes — % capital 2	0.00	0.00	0.00	0.70	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	0.70
royalty — $/yr 250000	0.00	0.00	0.00	0.13	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.13
depreciation, (book)	0.00	0.00	0.00	2.25	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	2.25
TOTAL FIXED COSTS	0.00	0.00	0.00	5.25	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	5.25
TOTAL COSTS OF SALES	0.00	0.00	0.00	6.72	14.16	15.62	16.41	[illegible]	16.41	16.41	16.41	16.41	16.41	16.41	16.41	16.41	16.41	16.41	8

Design Case IV

ANALYSIS OF REVENUES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	50%	65%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PRODUCT VOLUMES — Unit																			
Ethanol — MMGals	0.00	0.00	0.00	1.38	3.58	4.95	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	2.75
Furfural — MMLbs	0.00	0.00	0.00	4.51	14.73	23.44	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	26.04	13.02
Electricity — MMkWh	0	0	0	8200	21320	29520	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	32800	16400
Landfill — metr. Tons	0	0	0	3166	8232	11398	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	12664	6332
SELLING PRICES — $/....																			
Ethanol — MMGals	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85
Furfural — MMLbs	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Electricity — MMkWh	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00	-60.00
Landfill — metr Tons	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50	-5.50
REVENUES — MM$																			
Ethanol	0.0	0.0	0.0	3.9	10.2	14.1	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	7.8
Furfural	0.0	0.0	0.0	3.6	9.3	12.9	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	7.2
Electricity	0.0	0.0	0.0	-0.5	-1.3	-1.8	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-1.0
Landfill	0.0	0.0	0.0	.0	.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	.0
TOTALS	0.0	0.0	0.0	7.0	18.2	25.2	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	14.0

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SERI E-0461

BADGER

Date: 20-Sep-84

ANALYSIS OF COSTS OF SALES

Year Start:	Jan-84	Jan-85	Jan-86	Jan-87	Jan-88	Jan-89	Jan-90	Jan-91	Jan-92	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99	Jan-2000	Jan-2001	Jan-2002
Year No. :	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plant availability	0%	0%	0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%
Stream factor	0%	0%	0%	50%	65%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Inflation + Escalation, effect on operating costs:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
RAW MATERIALS QUANTITIES																			
wood chips metr Tons	0	0	0	29520	76752	106272	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	118080	59040
sulfuric acid metr Tons	0	0	0	908	2360	3268	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	3631	1816
lime metr Tons	0	0	0	919	2390	3309	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	3677	1839
other cats & chems	0.00	0.00	0.00	0.25	0.65	0.9[illegible]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
diesel oil Gals	0	0	0	500	1300	1800	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1000
gasoline MMGals	0.00	0.00	0.00	0.07	0.17	0.23	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.13
UNIT COSTS $/....																			
wood chips metr Tons	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00
sulfuric acid metr Tons	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00
lime metr Tons	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
other cats & chems /Yr	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760	366760
diesel oil Gallon	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
gasoline Gallon	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
TOTALS MM$																			
wood chips	0.0	0.0	0.0	1.2	3.2	4.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.5
sulfuric acid	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
lime	0.0	0.0	0.0	.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
other cats & chems	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
diesel oil	0.0	0.0	0.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
gasoline	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
TOTAL VARIABLE COSTS	0.0	0.0	0.0	1.5	3.8	5.3	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	3.0
FIXED COSTS Units, unit rates MM$																			
labor MM$/yr 1.05	0.00	0.00	0.00	0.53	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.53
supervision MM$/yr 0.06	0.00	0.00	0.00	0.03	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.03
subt 1	0.00	0.00	0.00	0.56	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	0.56
direct overhead % subt 1 40	0.00	0.00	0.00	0.22	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.22
maintenance % capital 4	0.00	0.00	0.00	1.16	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	1.16
insur & taxes % capital 2	0.00	0.00	0.00	0.58	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	0.58
royalty $/yr 250000	0.00	0.00	0.00	0.13	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.13
depreciation, (book)	0.00	0.00	0.00	1.88	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	1.88
TOTAL FIXED COSTS	0.00	0.00	0.00	4.52	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	9.04	4.52
TOTAL COSTS OF SALES	0.00	0.00	0.00	6.00	12.89	14.36	14.96	14.96	14.96	14.96	14.96	14.96	14.96	14.96	14.96	14.96	14.96	14.96	7.48