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MASTER

THE COST OF FEDERAL TAX CREDIT PROGRAMS TO DEVELOP THE MARKET FOR INDUSTRIAL SOLAR AND WIND ENERGY TECHNIQUES

VOLUME 2: APPENDICES

NOVEMBER 12, 1981

final report to

UNIVERSITY OF CALIFORNIA
LAWRENCE LIVERMORE LABORATORY
LIVERMORE, CALIFORNIA 94550

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APPENDIX A

TECHNOLOGY ECONOMIC/PENETRATION WORKSHEETS

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MGW

Arthur D Little, Inc.

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .0262 $/kWh

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE	1	2	3	4	5	6	
____ TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
x $\dot{V}$	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	123878	147666	185593	218445	245005	284512	kWh

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB														
	ROI														
PENETRATION															
25%	PB														
	ROI														
PENETRATION															
40%	PB											61.88	23.66		
	ROI											.039	.0875		
PENETRATION												.0005			
55%	PB											46.42	17.75		
	ROI											.103	.147		
PENETRATION												.0015			
70%	PB											30.94	11.83		
	ROI											.182	.222		
PENETRATION		0		0		0		0		0		.0017			

*6000 annual O+M
vs
3245 annual rev.

OK OK

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .0262 $/kWh

FUEL INFLATION: ____ 11% ✓ 17%

RESOURCE	1	2	3	4	5	6	
____ TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
x V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	123873	147666	185593	218445	245005	284512	kWh

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB														
	ROI														
PENETRATION										—		—			
25%	PB														
	ROI														
PENETRATION										—		—			
40%	PB											61.89	8.49		
	ROI											.103	.235		
PENETRATION										—		.0086			
55%	PB							-244	10.	161.	8.14	46.42	6.37		
	ROI							.118	.242	.134	.262	.157	.288		
PENETRATION								-.00		.0188		.028			
70%	PB							-162.6	6.67	107.36	5.43	30.94	4.25		
	ROI							.189	.306	.205	.325	.225	.352		
PENETRATION		0		0		0		.029		.048		.105			

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .04415 $/kWh

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE	1	2	3	4	5	6	
____ TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
x ____ V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	123878	147666	185593	218445	245005	284512	kWh

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB											20.75	12.83		
	ROI											.046	.095		
PENETRATION										—		—			
25%	PB											17.15	10.69		
	ROI											.083	.133		
PENETRATION										—		.0009			
40%	PB											13.72	8.55		
	ROI											.130	.179		
PENETRATION										—		.001			
55%	PB									14.012	8.20	10.29	6.42		
	ROI									.163	.209	.188	.236		
PENETRATION								> .001		.001		.003			
70%	PB							12.34	6.73	9.34	5.47	6.85	4.27		
	ROI							.219	.262	.236	.28	.26	.306		
PENETRATION		0		—		—		.026		.044		.096			

WON'T PAY O+M

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .04415 $/kWh

FUEL INFLATION: ____ 11% ✓ 17%

RESOURCE	1		2		3		4		5		6		
____ TOTAL	706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
____ DIRECT	899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
x V	4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)	123873		147666		185593		218445		245005		284512		kWh
TAX CREDITS (A)	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10% PB			259.8	15.85	61.53	11.03	37.04	8.22	28.02	7.46	20.57	6.15	
10% ROI			—	—	.041	.175	.067	.205	.086	.228	.111	.259	
PENETRATION			0.0		0.0		.003		.003		.007		
25% PB			216.57	13.21	51.28	9.19	30.87	7.27	23.35	6.22	17.15	5.12	
25% ROI			.039	.169	.076	.211	.101	.242	.120	.265	.145	.297	
PENETRATION			.0011		.004		.006		.015		.038		
40% PB			173.26	10.57	41.02	7.35	24.69	5.82	18.68	4.98	13.72	4.10	
40% ROI			.082	.212	.118	.254	.144	.286	.162	.309	.187	.343	
PENETRATION			.013		.011		.025		.052		.109		
55% PB			129.94	7.93	30.77	5.51	18.52	4.36	14.01	3.73	10.29	3.07	
55% ROI			.137	.264	.171	.306	.196	.339	.214	.363	.239	.397	
PENETRATION	—		.019		.042		.093		.1419		.182		
70% PB	-84.78	7.28	86.63	5.28	20.51	3.67	12.35	2.91	9.34	2.49	6.86	2.05	
70% ROI	.184	.298	.207	.328	.238	.37	.262	.403	.279	.427	.304	.462	
PENETRATION	.024		.052		.149		.1907		.202		.2109		

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .05513 $/kWh

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE	1	2	3	4	5	6	
____ TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
x V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	123878	147666	185593	218445	245005	284512	kWh

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB					31.90	18.10	22.34	13.72	17.98	11.47	~~13.94~~	~~4.67~~		
	ROI					.01	.059	.039	.087	.059	.109	~~.148~~	~~.309~~		
PENETRATION						0		0		.0009		0			
25%	PB					26.58	15.09	18.62	11.43	14.98	9.56	11.62	7.69		
	ROI					.048	.096	.076	.126	.097	.146	.123	.175		
PENETRATION						.001		.0009		.0009		.001			
40%	PB					21.27	12.07	14.89	9.15	11.98	7.65	9.29	6.15		
	ROI					.095	.142	.123	.172	.143	.193	.169	.222		
PENETRATION						.001		.001		.001		.0011			
55%	PB					15.95	9.05	11.17	6.86	8.99	5.73	6.97	4.61		
	ROI					.155	.200	.181	.228	.201	.250	.227	.279		
PENETRATION						.001		.001		.014		.0712			
70%	PB					10.64	6.04	7.45	4.57	5.99	3.82	4.64	3.07		
	ROI					.228	.271	.253	.298	.271	.319	.297	.348		
PENETRATION		0		0		.034		.078		.129		.169			

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TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .05513 $/kWh

FUEL INFLATION: ____ 11% ✓ 17%

RESOURCE		1		2		3		4		5		6			
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR	
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR	
x V		4.9		5.3		5.9		6.4		6.8		7.4		M/S	
ENERGY SAVINGS(C)		123878		147666		185593		218445		245005		284512		kWh	
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	162.7	14.66	63.06	11.13	31.91	8.04	22.34	6.49	17.98	5.61	13.98	4.67		
	ROI	.0125	.143	.041	.174	.077	.217	.104	.250	.123	.274	.148	.309		
PENETRATION		.007		.004		.0034		.0087		.016		.081			
25%	PB	135.64	12.22	52.55	9.28	26.58	6.71	18.62	5.40	14.99	4.67	11.62	3.89		
	ROI	.046	.178	.074	.209	.111	.254	.138	.287	.157	.313	.184	.348		
PENETRATION		.008		.004		.0096		.0265		.060		.122			
40%	PB	106.5	9.78	42.03	7.42	21.27	5.36	14.89	4.32	11.99	3.74	9.29	3.11		
	ROI	.087	.22	.117	.253	.153	.298	.180	.333	.20	.359	.226	.396		
PENETRATION		.009		.011		.036		.088		.1396		.179			
55%	PB	81.38	7.33	31.53	5.67	15.95	4.02	11.17	3.24	8.99	2.80	6.99	2.34		
	ROI	.144	.273	.17	.305	.205	.351	.23	.387	.252	.414	.278	.452		
PENETRATION		.02		.041		.1198		.174		.192		.205			
70%	PB	54.26	4.89	21.02	3.71	10.63	2.68	7.45	2.16	5.99	1.87	4.64	1.56		
	ROI	.213	.337	.059	.369	.271	.416	.297	.452	.316	.478	.342	.518		
PENETRATION		.067		.142		.197		.2089		.214		.218			

A

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .07432 $/kWh

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE		1		2		3		4		5		6		
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
x V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		123878		147666		185593		218445		245005		284512		kWh
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB			27.14	16.01	17.32	11.12	13.99	8.79	11.06	7.52	8.92	6.18	
	ROI			.023	.071	.063	.113	.092	.143	.113	.165	.141	.195	
PENETRATION		0		.0009		.0009		.0009		.0009		.001		
25%	PB	35.08	18.42	22.61	13.34	14.43	9.27	10.99	7.32	9.21	6.27	7.43	5.16	
	ROI	.029	.078	.06	.108	.101	.150	.130	.181	.151	.204	.179	.235	
PENETRATION		.001		.0009		.009		.001		.001		.002		
40%	PB	28.07	14.73	18.09	10.67	11.55	7.41	8.79	5.86	7.37	5.01	5.94	4.13	
	ROI	.077	.124	.107	.155	.147	.197	.176	.228	.197	.252	.226	.284	
PENETRATION		.001		.001		.001		.001		.016		.096		
55%	PB	21.05	11.05	13.57	8.00	8.66	5.56	6.60	4.40	5.53	3.76	4.46	3.09	
	ROI	.137	.182	.166	.213	.205	.254	.234	.285	.255	.309	.284	.341	
PENETRATION		.001		.001		.015		.083		.127		.163		
70%	PB	14.03	7.37	9.05	5.34	5.78	3.71	4.39	2.93	3.68	2.51	2.97	2.06	
	ROI	.212	.253	.239	.283	.275	.323	.303	.355	.323	.378	.352	.411	
PENETRATION		.015		.048		.137		.174		.187		.201		

B

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .07432 $/kWh

FUEL INFLATION: _____ 11% ✓ 17%

RESOURCE	1	2	3	4	5	6	
____ TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
x V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	123878	147666	185593	218445	245005	284512	kWh

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	92.1	9.31	27.14	7.32	17.32	5.46	13.19	4.48	11.06	3.91	8.91	3.29		
	ROI	.06	.18	.088	.23	.126	.279	.154	.316	.175	.344	.202	.384		
PENETRATION		.003		.005		.023		.066		.111		.166			
25%	PB	35.08	7.76	22.61	6.10	14.43	4.55	10.99	3.73	9.21	3.26	7.43	2.74		
	ROI	.095	.233	.123	.268	.161	.318	.189	.357	.211	.387	.239	.428		
PENETRATION		.006		.015		.065		.134		.169		.193			
40%	PB	28.07	6.21	18.09	4.88	11.55	3.64	8.79	2.98	7.37	2.61	5.94	2.19		
	ROI	.137	.277	.165	.312	.203	.364	.232	.405	.254	.435	.282	.479		
PENETRATION		.022		.055		.146		.185		.198		.207			
55%	PB	21.05	4.66	13.56	3.66	8.66	2.73	6.59	2.24	5.53	1.95	4.46	1.64		
	ROI	.189	.330	.217	.366	.255	.419	.284	.461	.306	.492	.336	.538		
PENETRATION		.075		.149		.195		.207		.212		.217			
70%	PB	14.03	3.10	9.04	2.44	5.77	1.82	4.40	1.49	3.69	1.30	2.97	1.09		
	ROI	.255	.392	.282	.43	.319	.484	.348	.527	.369	.559	.40	.60		
PENETRATION		.182		.203		.214		.218		.220		.223			

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .0853 $/kWh

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE		1		2		3		4		5		6			
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR	
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR	
x V		4.9		5.3		5.9		6.4		6.8		7.4		M/S	
ENERGY SAVINGS (C)		123878		147666		185593		218445		245005		284512		kWh	
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	29.56	17.09	20.47	12.78	13.73	9.11	10.68	7.29	9.06	6.28	7.39	5.21		
	ROI	.016	.065	.048	.076	.087	.138	.117	.169	.138	.193	.167	.225		
PENETRATION		.0009		.0009		.0009		.0009		.001		.001			
25%	PB	24.63	14.24	17.06	10.65	11.44	7.59	8.9	6.08	7.55	5.23	6.16	4.34		
	ROI	.054	.102	.084	.134	.125	.176	.155	.209	.177	.233	.207	.266		
PENETRATION		.001		.0009		.001		.001		.002		.044			
40%	PB	19.71	11.40	13.65	8.52	9.15	6.07	7.12	4.86	6.04	4.19	4.93	3.47		
	ROI	.100	.148	.131	.180	.172	.223	.201	.259	.224	.281	.255	.315		
PENETRATION		.001		.001		.001		.018		.082		.140			
55%	PB	14.78	8.55	10.23	6.39	6.87	4.55	5.34	3.65	4.53	3.14	3.69	2.60		
	ROI	.159	.205	.189	.237	.229	.280	.259	.314	.281	.339	.312	.373		
PENETRATION		.001		.003		.074		.135		.161		.182			
70%	PB	9.85	5.70	6.82	4.26	4.58	3.04	3.56	2.43	3.02	2.09	2.46	1.74		
	ROI	.232	.277	.260	.306	.298	.349	.328	.383	.351	.408	.380	.443		
PENETRATION		.039		.098		.171		.189		.200		.211			

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .0853 $/kWh

FUEL INFLATION: ____ 11% ✓ 17%

RESOURCE		1		2		3		4		5		6		
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
X V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		123878		147666		185593		218445		245005		284512		kWh
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB	29.56	7.7	20.51	6.13	13.76	4.62	10.68	3.80	9.06	3.33	7.39	2.81	
	ROI	.082	.223	.111	.259	.150	.311	.178	.351	.200	.381	.230	.424	
PENETRATION		.003		.009		.059		.127		.164		.191		
25%	PB	24.63	6.42	17.09	5.11	11.46	3.85	8.90	3.17	7.55	2.77	6.16	2.34	
	ROI	.116	.260	.145	.298	.185	.351	.215	.392	.237	.424	.266	.470	
PENETRATION		.014		.039		.125		.176		.192		.205		
40%	PB	19.71	5.13	13.67	4.09	9.17	3.08	7.12	2.54	6.04	2.22	4.93	1.87	
	ROI	.159	.305	.187	.343	.227	.398	.258	.442	.280	.475	.312	.522	
PENETRATION		.047		.110		.181		.200		.207		.214		
55%	PB	14.78	3.85	10.26	3.07	6.88	2.31	5.34	1.90	4.53	1.67	3.69	1.41	
	ROI	.211	.359	.240	.398	.280	.454	.311	.500	.334	.534	.365	.583	
PENETRATION		.133		.182		.206		.213		.216		.220		
70%	PB	9.85	2.57	6.84	2.04	4.59	1.54	3.56	1.27	3.02	1.11	2.46	.937	
	ROI	.277	.423	.304	.462	.344	.520	.374	.566	.397	.602	.429	.652	
PENETRATION		.200		.211		.218		.221		.223		.225		

TABLE 3-17

WIND TURBINE PERCENTAGE PENETRATIONS

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .1063 $/kWh

FUEL INFLATION: ✓ 11% ___ 17%

RESOURCE		1		2		3		4		5		6			
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR	
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR	
x V		4.9		5.3		5.9		6.4		6.8		7.4		M/S	
ENERGY SAVINGS(C)		123878		147666		185593		218445		245005		284512		kWh	
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	18.83	11.92	13.92	9.22	9.83	6.77	7.84	5.50	6.73	4.78	5.57	4.00		
	ROI	.055	.104	.086	.136	.128	.181	.159	.215	.182	.241	.213	.276		
PENETRATION		.0009		.0009		.001		.001		.004		.068			
25%	PB	15.69	9.94	11.60	7.68	8.19	5.64	6.53	4.58	5.61	3.98	4.64	3.33		
	ROI	.092	.141	.123	.175	.166	.220	.198	.256	.221	.282	.254	.319		
PENETRATION		.0009		.001		.001		.018		.089		.143			
40%	PB	12.56	7.95	9.28	6.15	6.56	4.52	5.23	3.67	4.49	3.18	3.71	2.66		
	ROI	.139	.188	.17	.222	.212	.269	.245	.305	.270	.332	.302	.370		
PENETRATION		.001		.001		.049		.128		.155		.178			
55%	PB	9.42	5.96	6.96	4.61	4.92	3.38	3.92	2.75	3.37	2.39	2.78	1.99		
	ROI	.196	.245	.227	.279	.269	.327	.302	.363	.327	.391	.361	.430		
PENETRATION		.009		.071		.150		.176		.191		.205			
70%	PB	6.28	3.98	4.64	3.07	3.28	2.26	2.61	1.83	2.24	1.59	1.86	1.33		
	ROI	.267	.315	.297	.348	.340	.395	.371	.433	.396	.461	.43	.501		
PENETRATION		.118		.169		.195		.208		.214		.219			
										✓		✓			

TECHNOLOGY: WIND TURBINE - 100 kW

INVESTMENT (D): $150,000.

ENERGY VALUE (B): .1063 $/kWh

FUEL INFLATION: ____ 11% ✓ 17%

RESOURCE		1		2		3		4		5		6		
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
x ____ V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		123878		147666		185593		218445		245005		284512		kWh
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB	18.83	5.79	13.92	4.66	9.83	3.56	7.84	2.95	6.74	2.60	5.57	2.20	
	ROI	.119	.269	.148	.309	.189	.366	.220	.411	.244	.446	.276	.495	
PENETRATION		.015		.048		.144		.185		.198		.208		
25%	PB	15.69	4.82	11.60	3.89	8.19	2.97	6.53	2.46	5.61	2.16	4.64	1.83	
	ROI	.153	.308	.184	.348	.226	.409	.258	.455	.281	.492	.315	.544	
PENETRATION		.054		.123		.185		.202		.208		.214		
40%	PB	12.56	3.86	9.28	3.11	6.56	2.37	5.23	1.97	4.49	1.73	3.71	1.47	
	ROI	.195	.353	.226	.396	.269	.458	.302	.508	.327	.545	.361	.599	
PENETRATION		.127		.180		.204		.212		.216		.219		
55%	PB	9.42	2.89	6.96	2.33	4.92	1.78	3.92	1.48	3.37	1.30	2.78	1.10	
	ROI	.248	.408	.278	.452	.322	.516	.355	.567	.38	.61	.416	.663	
PENETRATION		.189		.205		.215		.219		.221		.223		
70%	PB	6.28	1.93	4.64	1.55	3.28	1.19	2.61	.985	2.24	.866	1.86	.73	
	ROI	.312	.473	.342	.518	.386	.584	.419	.637	.445	.677	.48	.73	
PENETRATION		.213		.218		.222		.224		.225		.226		
								✓		✓		✓		

TECHNOLOGY: SOLAR PONDS - 50000 SQ.FT.

INVESTMENT (D): $750,000

ENERGY VALUE (B): x $7.22/10^6 BTU

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE	1	2	3	4	5	6	
x TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
____ V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	15009.4	13579.9	12150.45	10721	9291.5	n/a	BTU

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	8.61	6.0	9.92	6.82	11.69	7.91	14.24	9.40	18.2	11.59				
	ROI	0.145	~~0.06~~ .180	0.127	~~0.08~~ .169	0.11	~~0.06~~ .154	0.08	~~0.076~~ .148	0.06	~~0.028~~ .120				
PENETRATION		0.0011		0.001		0.0010		0.0009		0.0009					
25%	PB	7.18	5.0	8.27	5.68	9.74	6.59	11.87	7.83	15.17	9.66				
	ROI	0.18	0.24	0.16	0.22	0.144	0.20	0.12	0.17	0.10	0.14				
PENETRATION		0.004		0.0012		0.001		0.001		0.0010					
40%	PB	5.74	4.0	6.61	4.55	7.79	5.27	9.49	6.27	12.13	7.73				
	ROI	0.23	0.269	0.21	0.27	0.19	0.24	0.17	0.22	0.142	0.19				
PENETRATION		0.105		0.042		0.006		0.0011		0.0011					
55%	PB	4.31	3.0	4.96	3.41	5.85	3.95	7.12	4.70	9.10	5.80				
	ROI	0.29	0.35	0.27	0.32	0.25	0.30	0.225	0.28	0.199	0.248				
PENETRATION		0.167		0.148		0.114		0.067		0.009					
70%	PB	2.87	2.0	3.31	2.27	3.90	2.63	4.75	3.13	6.07	3.86				
	ROI	0.36	0.42	0.34	0.39	0.32	0.37	0.29	0.34	0.27	0.32				
PENETRATION		0.203		0.194		0.18		0.167		0.126					

TABLE 3-10

SOLAR POND MARKET PENETRATION : 11% INFLATION

E

TECHNOLOGY: SOLAR PONDS - 50000 SQ.FT.

INVESTMENT (D): $750,000

ENERGY VALUE (B): x $7.22/10 BTU

FUEL INFLATION: 11% ✓ 17%

RESOURCE		1		2		3		4		5		6			
x TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR	
DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR	
V		4.9		5.3		5.9		6.4		6.8		7.4		M/S	
ENERGY SAVINGS(C)		15009.4		13579.9		12150.45		10721		9291.5		n/a		BTU	
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	8.61	3.19	9.92	3.58	11.69	4.08	14.24	4.74	18.20	5.65				
	ROI	0.20	.391	0.188	.364	0.168	.335	0.15	.30	0.12	.273				
PENETRATION		.171		.157		.099		.046		.016					
25%	PB	7.18	2.66	8.27	2.99	9.74	3.40	11.87	3.95	15.17	4.71				
	ROI	0.244	0.435	0.224	0.41	0.204	0.38	0.181	0.34	0.156	0.312				
PENETRATION		0.196		0.184		0.161		0.118		0.0581					
40%	PB	5.74	2.13	6.61	2.39	7.79	2.72	9.49	3.16	12.13	3.77				
	ROI	0.287	0.486	0.27	0.46	0.247	0.425	0.223	0.393	0.198	0.357				
PENETRATION		0.209		0.203		0.1944		0.177		0.137					
55%	PB	4.31	1.60	4.96	1.79	5.85	2.04	7.12	2.37	9.10	2.83				
	ROI	0.34	0.54	0.32	0.515	0.299	0.482	0.276	0.448	0.251	0.412				
PENETRATION		0.217		0.215		0.211		0.204		0.191					
70%	PB	2.87	1.06	3.31	1.19	3.90	1.36	4.75	1.58	6.07	1.88				
	ROI	0.405	0.614	0.38	0.58	0.36	0.55	0.34	0.514	0.315	0.477				
PENETRATION		0.2233		0.222		0.220		0.217		0.213					

TABLE 3-4

REPRESENTATIVE RESULTS

TECHNOLOGY: FLAT PLATES - 50000 SQ.FT.

INVESTMENT (D): $1,250,000

ENERGY VALUE (B): x .$7.22/ 10^6 BTJ

FUEL INFLATION: ✓ 11% ____ 17%

D' = .23

D = .

RESOURCE	1	2	3	4	5	6	
x TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
____ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
____ V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	15009.4	13579.9	12150.45	10721	9291.5	n/a	BTU

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	19.274	12.16	23.41	14.25	29.82	17.21	41.05	21.72	65.85	29.43				
	ROI	0.053	0.102	0.035	0.084	0.016	0.064	.000	.00	.000	.00				
PENETRATION		0.000933		0.00094		0.00098		0.0045		0.0031					
25%	PB	16.06	10.13	19.51	11.87	24.85	14.34	34.21	18.10	54.87	24.52				
	ROI	0.091	0.139	0.073	0.121	0.053	0.102	0.031	0.08	10.0	0				
PENETRATION		0.00098		0.00098		0.0010		0.0011		0.0039					
40%	PB	12.85	8.11	15.61	9.50	19.88	11.47	27.37	14.48	43.899	19.62				
	ROI	0.137	0.186	0.119	0.167	0.10	0.148	0.078	0.126	0.053	0.101				
PENETRATION		0.0011		0.0010		0.0011		0.0011		0.0013					
55%	PB	9.64	6.08	11.71	7.12	14.91	8.60	20.52	10.86	32.92	14.71				
	ROI	0.194	0.243	0.177	0.224	0.159	0.205	0.138	0.184	0.116	0.160				
PENETRATION		0.006		0.0012		0.0012		0.0012		0.0013					
70%	PB	6.425	4.053	7.80	4.75	9.94	5.74	13.68	7.24	21.94	9.81	—			
	ROI	0.266	0.312	0.25	0.29	0.23	0.276	0.214	0.255	.193	.234				
PENETRATION		0.1124		0.0688		0.03887		0.0183		.0024					

(A)

TECHNOLOGY: FLAT PLATES - 50000 SQ.FT.

INVESTMENT (D): $1,250,000

ENERGY VALUE (B): x $7.22/ 10^6 BTU

FUEL INFLATION: ___ 11% ✓ 17%

RESOURCE	1	2	3	4	5	6	
x TOTAL	706324	639055	571786	504517	437248	----	BTU/Ft^2 - YR
___ DIRECT	899871	771318	642765	514212	385659	321382	BTU/Ft^2 - YR
___ V	4.9	5.3	5.9	6.4	6.8	7.4	M/S
ENERGY SAVINGS(C)	15009.4	13579.9	12150.45	10721	9291.5	n/a ?	BTU

TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991		
10%	PB	19.27	5.88	23.41	6.68	29.82	7.74	41.05	9.195	65.85	11.32				
	ROI	0.116	0.266	0.10	0.244	0.082	0.223	0.062	0.198	0.04	0.172				
PENETRATION		0.0146		0.0083		0.0034		0.0035		0.0042					
25%	PB	16.06	4.90	19.51	5.57	24.85	6.45	34.20	7.663	54.87	9.43				
	ROI	0.151	0.305	0.134	0.283	0.116	0.259	0.095	0.234	0.073	0.208				
PENETRATION		0.044		0.0246		0.0139		0.0061		0.00463					
40%	PB	12.85	3.92	15.61	4.46	19.88	5.16	27.37	6.13	43.90	7.55				
	ROI	0.193	0.351	0.177	0.328	0.158	0.304	0.138	0.278	0.115	0.251				
PENETRATION		0.1224		0.080		0.0462		0.0226		0.0111					
55%	PB	9.64	2.94	11.71	3.34	14.91	3.87	20.52	4.60	32.92	5.66				
	ROI	0.245	0.405	0.228	0.382	0.21	0.358	0.191	0.33	0.169	0.303				
PENETRATION		0.181		0.169		0.132		0.0784		0.0389					
70%	PB	6.42	1.96	7.80	2.23	9.94	2.58	13.68	3.065	21.95	0.143				
	ROI	0.31	0.47	0.293	0.446	0.276	0.421	0.257	0.395	0.236	0.367				
PENETRATION		0.212		0.208		0.19976		0.1835		0.142					

(B)

TECHNOLOGY: EVACUATED TUBES - 50000 SQ.FT.

INVESTMENT (D): $1,750,000

ENERGY VALUE (B): x $7.22/$10^6$ BTU

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE		1		2		3		4		5		6		
x TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
____ DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
____ V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		17481.5		15816.6		14151.7		12486.8		10821.9		n/a		BTU
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB	28.02	16.41	35.64	19.64	48.95	24.46	78.14	32.43	193.63	48.07			
	ROI	0.02	~~-0.005~~	~~0.99~~	0.0	~~0.99~~	0.0	~~0.99~~	0.0	~~9.99~~	0.0			
PENETRATION		0.0010		0.00~~1~~		0.00~~14~~		0.00~~14~~		0.00~~18~~				
25%	PB	23.35	13.67	29.70	16.37	40.79	20.39	65.12	27.02	161.36	40.06			
	ROI	0.06	0.11	0.04	0.09	0.02	0.07	9.99	0.0	9.99	0.0			
PENETRATION		0.001		0.001		0.0011		0.0034		0.0022				
40%	PB	18.68	10.94	23.76	13.09	32.63	16.31	52.10	21.62	129.09	32.05			
	ROI	0.10	0.15	0.09	0.135	0.07	0.12	0.05	0.09	0.02	0.07			
PENETRATION		0.001		0.0011		0.0012		0.0014		0.0022				
55%	PB	14.01	8.20	17.82	9.82	24.47	12.23	39.07	16.21	96.81	24.04			
	ROI	0.16	0.21	0.15	0.19	0.13	0.17	0.11	0.15	0.08	0.13			
PENETRATION		0.0012		0.0012		0.0012		0.0014		0.0023				
70%	PB	9.34	5.47	11.88	6.55	16.32	8.15	26.05	10.81	64.54	16.02			
	ROI	0.24	0.28	0.22	0.26	0.205	0.25	0.19	0.23	0.17	0.21			
PENETRATION		0.044		0.025		0.0082		0.0016		0.0025				

TECHNOLOGY: EVACUATED TUBES - 50000 SQ.FT.

INVESTMENT (D): $1,750,000

ENERGY VALUE (B): x $7.22/$10^6$ BTU

FUEL INFLATION: 11% ✓ 17%

RESOURCE		1		2		3		4		5		6		
x TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		17481.5		15816.6		14151.7		12486.8		10821.9		n/a		BTU
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB	28.02	7.46	35.64	8.55	48.95	10.0	78.15	12.05	193.63	15.15			
	ROI	0.086	~~-0.10~~ 0	0.07	~~-0.08~~ 0	0.05	~~-0.07~~ 0	0.03	~~-0.054~~ 0	0.009	~~-0.04~~ 0			
PENETRATION		0.00~~8~~		0.00~~8~~		0.00~~7~~		0.00~~6~~		0.00~~5~~				
25%	PB	23.35	6.22	29.70	7.12	40.79	8.33	65.12	10.04	161.36	12.62			
	ROI	0.12	0.26	0.104	0.24	0.09	0.22	0.07	0.20	0.043	0.174			
PENETRATION		0.015		0.009		0.004		0.005		0.00~~4~~				
40%	PB	18.68	4.98	23.76	5.70	32.63	6.67	52.10	8.03	129.1	10.1			
	ROI	0.16	0.31	0.15	0.29	0.13	0.27	0.11	0.24	0.086	0.22			
PENETRATION		0.05		0.03		0.016		0.008		.00102				
55%	PB	14.01	3.73	17.82	4.27	24.47	5.00	39.07	6.02	96.81	7.57			
	ROI	0.21	0.36	0.178	0.34	0.18	0.32	0.16	0.29	0.14	0.27			
PENETRATION		0.142		0.099		0.058		0.0315		0.02				
70%	PB	9.34	2.49	11.88	2.85	16.32	3.33	26.05	4.02	64.54	5.05			
	ROI	0.28	0.43	0.26	0.41	0.25	0.38	0.23	0.36	0.21	0.333			
PENETRATION		0.202		0.192		0.17		0.123		0.06				

(H)

TECHNOLOGY: PARABOLIC TROUGHS - 50000 SQ.FT.

INVESTMENT (D): $1,750,000

ENERGY VALUE (B): x $7.22/ 10^6 BTU

FUEL INFLATION: ✓ 11% ____ 17%

RESOURCE		1		2		3		4		5		6		
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
x DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
____ V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		12508.2		10721.3		8934.45		7147.55		5360.65		4467.2		BTU
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB	77.55	32.29	212.6	49.52	-286.71	106.14	-85.62	-739.9	-50.33	-82.47	-41.72	-57.10	
	ROI	0.001	0	9.99	0	9.99 0.0	0	9.99 0.0	0 0.0	9.999 0.0	0	0.0	0.0	
PENETRATION		0.0028		0.00175		0.00078		0.25 0.0		~~0.249~~ 0.0		~~0.249~~ 0.0		
25%	PB	64.63	26.91	177.18	41.26	-238.93	88.45	-71.35	-616.59	-41.94	-68.73	-34.77	-47.59	
	ROI	9.99	0	9.99	0	9.99	9.99	9.99	9.99	9.999	9.999	9.999	9.999	
PENETRATION		0.0035		0.0021		0.00094		0.25		0.249		0.248		
40%	PB	51.70	21.53	141.74	33.01	-191.14	70.76	-57.08	-493.27	-33.55	-54.98	-27.82	-38.07	
	ROI	0.046	0.09	0.018	0.068	9.99	0	0.0 ~~9.99~~	0.0 ~~9.99~~	0.0 9.999	0.0 9.999	0.0 9.999	0.0 9.999	
PENETRATION		0.0013		0.0024		0.0012		0.0 ~~0.25~~ 0.0		~~0.249~~ 0.0		~~0.248~~ 0.0		
55%	PB	38.77	16.14	106.31	24.76	-143.36	53.07	-42.81	-369.9	-25.16	-41.24	-20.86	-28.55	
	ROI	0.11	0.15	0.084	0.129	0.05	0.099	~~9.99~~ 0.0	0.0	~~9.999~~ 0.0	~~9.999~~ 0.0	~~9.999~~ 0.0	~~9.999~~ 0.0	
PENETRATION		0.0014		0.0025		0.000003		0.25 0.0		~~0.248~~ 0.0		~~0.2476~~ 0.0		
70%	PB	25.85	10.76	70.87	16.51	-95.57	35.38	-28.54	-246.6	-16.77	-27.49	-13.91	-19.03	
	ROI	0.187	0.227	0.17	0.205	0.141	0.179	0.111	0.148	0.067	0.109	0.032	0.082	
PENETRATION		0.0016		0.0027		0.000005		0.0005		0.0005		0.0005		

C

TECHNOLOGY: PARABOLIC TROUGHS - 50000 SQ.FT.

INVESTMENT (D): $1,750,000

ENERGY VALUE (B): x $7.22/ 10^6 BTU

FUEL INFLATION: ____ 11% ✓ 17%

RESOURCE		1		2		3		4		5		6		
____ TOTAL		706324		639055		571786		504517		437248		----		BTU/Ft^2 - YR
x DIRECT		899871		771318		642765		514212		385659		321382		BTU/Ft^2 - YR
____ V		4.9		5.3		5.9		6.4		6.8		7.4		M/S
ENERGY SAVINGS(C)		12508.2		10721.3		8934.45		7147.55		5360.65		4467.2		BTU
TAX CREDITS (A)		1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	1981	1991	
10%	PB	77.55	12.02	212.61	15.39	-286.71	21.39	-85.62	35.08	-50.33	97.38	-41.72	869.47	
	ROI	0.03	~~-0.05~~ 0	09.99	0.0	09.99	0.0	09.99	0.0	09.99	0.0	09.99	0.0	
PENETRATION		0.0046		0.007		0.0046		0.0026		0.00085		0.000092		
25%	PB	64.63	10.01	177.18	12.82	-238.93	17.83	-71.35	29.23	-41.94	81.15	-34.77	724.56	
	ROI	0.07	0.20	0.04	0.17	0.012	0.14	09.99	0.0	09.99	0.0	09.99	0.0	
PENETRATION		0.005		0.01		0.00		0.0031		0.001		0.00011		
40%	PB	51.7	8.01	141.74	10.26	-191.14	14.26	-57.08	23.39	-33.55	64.92	-27.82	579.65	
	ROI	0.11	0.24	0.08	0.22	0.055	0.18	0.02	0.15	09.99	0.0	09.99	0.0	
PENETRATION		0.008		0.011		0.00		0.00		0.0013		0.00014		
55%	PB	38.77	6.01	106.31	7.69	-143.36	10.70	-42.81	17.54	-25.16	48.69	-20.86	434.74	
	ROI	0.16	0.29	0.14	0.27	0.112	0.24	0.08	0.20	0.03	0.15	09.99	0.0	
PENETRATION		0.032		0.019		0.00004		0.00		0.00		0.0002		
70%	PB	25.85	4.005	70.87	5.13	-95.57	7.13	-28.54	11.69	-16.77	32.46	-13.91	289.82	
	ROI	0.23	0.36	0.21	0.33	0.18	0.30	0.16	0.26	0.12	0.224	0.096	0.20	
PENETRATION		0.124		0.041		0.003		0.0002		0.00		0.00		

-13.91 is ok D

APPENDIX B

MARKET PENETRATION AND ECONOMIC ANALYSIS PROGRAM WITH TEST

WRITTEN FOR TI-59 PROGRAMMABLE CALCULATOR WITH PRINTER

Documentation: MARKET PENETRATION PROGRAM

Program to Estimate Market Potential, Substitution, and Penetration as a Function of Economics

I. INPUT DATA

'DATA FOR MARKET PENETRATION

```
• LBL B'                    'INPUT YEARS TO RUN, FORMAT:
  STO 23                    '1981. 1991
  INT STO 22                '1981.
  (RCL 23 INV - INT.        '.1991 • 1000 - 1981 = 10
  • 1000 - RCL 22)
  STO 23                    '10
  R/S

• LBL C'                    'INNOVATIVE INDEX
  STO 24
  R/S

• LBL D'                    'REQUIRED ROI
  STO 25
  R/S

• LBL E'                    'INPUT INITIAL PENETRATION
  STO 29                     STORE FOR FIRST YEAR RETAIN
  STO 15                     ORIGINAL VALUE
  R/S
```

```
'DATA FOR ECONOMIC ANALYSIS
  • LBL A                    'TAX CREDIT
    STO 11
    R/S

  • LBL B                    'VALUE OF ENERGY SAVED
    STO 12
    R/S

  • LBL C                    'AMOUNT OF ENERGY SAVED
    STO 13
    R/S

  • LBL D                    'AMOUNT OF INVESTMENT
    STO 14
    R/S
```

II. ECONOMIC ANALYSIS

```
  • CBL E                    'BEGIN PROGRAM EXECUTION
    2ND - RAD                'IF E ALREADY HIT
    IF FLG 02 "EXC"           ONCE, GO TO "EXC"
    STF 02                   'OTHERWISE, SET FLAG 02,

'FIRST, PRINT ALL INPUTS      AND PRINT INPUTS WITH LABELS
    45 17 13 35  2-OP-04     '"YEAR"
    (RCL 22      2-OP-06     'FIRST YEAR, PRINT
    + RCL 23)    2-OP-06     'LAST YEAR, PRINT
   {00 00 00 24 24  2-OP-04  'INITIAL INVESTMENT
```

```
RCL 24        2-OP-06}      'PRINT "II"
35 35 32 24   2-OP-04       '"RROI"
RCL 25        2-OP-06       'PRINT
24 36 41 14   2-OP-04       '"I SUB"
RCL 15        2-OP-06       'PRINT INITIAL SUBSTITUTION
00 00 37 15   2-OP-04       '"TC"
RCL 11        2-OP-06       'PRINT TAX CREDIT
00 62 63 54   2-OP-04       '"¢/e"
RCL 12        2-OP-06       'PRINT $ PER UNIT OF ENERGY
00 17 20 36   2-OP-04       '"E - S"
RCL 13        2-OP-06       'PRINT ENERGY SAVINGS
00 24 31 42   2-OP-04       '"INV"
RCL 14        2-OP-06       'PRINT INVESTMENT
R/S                         'STOP:  OPERATOR EXAMINE

• LBL 'EXC'                 'IF INPUTS OK, HIT E, ARRIVE HERE
  .009    PGM 08 A          'INPUTS TO SEARCH PROGRAM:
  1       PGM 08 B          'A, B:  ROOTS FROM .009 to 1.
  .05     PGM 08 C          'C   :  SAMPLING INCREMENT
  .001    PGM 08 D          'D   :  ACCURACY.  POSSIBLE
                                    INSTABILITIES
                            'IF A OR C CHANGED.


'CALCULATE PAYBACK
    ((1 - RCL 11) ÷ (RCL 13
    · RCL 12 ÷ RCL 14 - .04))
```

```
IFF 03 "LNX"            'IF FLAG 03, THIS IS SECOND TIME
                         THRU. OTHERWISE:
STO 16                  'STORE IN 1981 PAYBACK
STO 26                  'STORE FOR FIRST YEAR PRINT
SBR TAN 1/X PRD 29      'USING DISPLAY VALUE, CALCULATE
                         POTENTIAL.  DIVIDE FIRST YEARS
                         PENETRATION BY POTENTIAL TO GET
                         SUBSTITUTION AND STORE
GTO PGM                 'GO TO 'PGM' TO CALCULATE ROI

'SECOND TIME PAYBACK CALCULATED
● LBL "LNX"
  (CE - RCL 16) STO 18  'STORE CHANGE IN PAYBACK IN 18

'CALCULATE RETURN ON INVESTMENT
● LBL "PGM"
  PGM 08 E              'EXECUTE SEARCH PROGRAM:  FINDS
                         ROOTS TO FUNCTION OF LABEL
                         A': f(A') = 0 AT THESE ROOTS
  IFF 03 "P/R"          'RETURN FROM 08 WITH ROOT IN
                         DISPLAY.  IF SECOND TIME THRU,
                         GO TO "P/R".
  STO 17 STO 27         'OTHERWISE, STORE ROI FOR 1981
                         IN 17 AND 27 (27 FOR FIRST
                         YEAR PRINT)
```

```
    1.11 SBR INT   PRD 12        'AND ALLOW VALUE OF ENERGY TO
                                  GROW EXPONENTIALLY FOR THE
                                  NUMBER OF YEARS OF ANALYSIS,
    1.08 SBR INT   PRD 14        'AND ALLOW COST OF EQUIPMENT
                                  TO GROW EXPONENTIALLY FOR THE
                                  NUMBER OF YEARS OF ANALYSIS
    STF 03 E                     'SET FLAG 03 (ONCE THRU) AND GO
                                  BACK TO LBL E

'FUNCTION DESCRIBING NPV
 AS F (DISCOUNT RATE)
  • LBL A'                       'PRESENT DISCOUNT RATE
    STO 10                        TRIAL VALUE
  ((((.0432 ÷ (RCL 10 - .08))
  • (1- 1.08 ÷ 1 + RCL 10))
  Y^X 20)                        'NUMERATOR
  + 2 - 2 • RCL 11 ÷ (1 + RCL
  10) - .25 ÷ RCL 10 1/X
  + ((1 - (( 1 + RCL 10) Y^X 7
  + 1 - 1)) ÷ (RCL 10 X^2 •
  28)))
  ÷                              'DIVIDED BY
  ((1.11 ÷ RCL 10 - .11)) •      'DENOMINATOR
  ((1 - (1.11 ÷ (1 + RCL 10))
  Y^X 20)))
  -                              'MUST EQUAL ANNUAL VALUE.
  RTN                            'END OF NPV
```

III. MARKET PENETRATION ESTIMATION

'CLEAN UP ECONOMICS, PRINT FIRST YEAR

• LBL "P/R"	'ARRIVE HERE WITH ROI & END OF ANALYSIS PERIOD IN DISPLAY
(CE - RCL 17) STO 19	'STORE CHANGE IN ROI in 19
0 STO 20	'INITIALIZE YEAR COUNTING REGISTER
2 - FIX 4	FOR LATER ARCTAN FUNCTION. PRINT ONLY 4 DIGITS
GTO SBR	'GO TO THE PRINTING FUNCTION IN THE "PRT" SUBROUTINE TO PRINT FIRST YEAR

'FIND PAYBACK AND ROI FOR THIS YEAR

• LBL "π"	
RCL 23 X ÷ T RCL 20	'IS YEAR JUST DONE (20) ≥
2 ≤ X ≥ t? "ADV"	LAST YEAR FOR ANALYSIS? IF SO, GAME OVER: GO TO "ADV"
1 SUM 20	'OTHERWISE, INCREMENT YEAR
(RCL 16 + RCL 23 1/X	'FIND PB OF YEAR IN 20:
• RCL 18 • RCL 20)	$PB_{1981} + \frac{\Delta PB(1991 - 1981) \cdot \Delta YRS}{(1991 - 1981)}$
STO 26	STORE in 26
(RCL 17 + RCL 23 1/X	'FIND ROI OF YEAR IN 20:
• RCL 19 • RCL 20)	$ROI_{1981} + \frac{\Delta ROI(1991 - 1981) \cdot \Delta YRS}{(1991 - 1981)}$

```
STO 27                    'STORE IN 27
X:T                       'PUT THIS YEARS ROI IN T REGISTER
                           FOR TEST
RCL 25                    'RECALL REQUIRED ROI
INV - X ≥ R? "COS"        'IS REQUIRED ROI ≤ ROI, THIS YEAR?
GTO "PRT"                  IF SO, GO TO "COS".  OTHERWISE,
                           GO TO PRINT WITHOUT CHANGING
                           SUBSTITUTION
```

'CALCULATE THIS YEARS SUBSTITUTION

```
• LBL "COS"
  (RCL 27 • .53 ÷ RCL     'CALCULATE "P":  (.53 • ROI/
  25 + RCL 24)             ROI_REQUIRED + INNOVATIVE INDEX)
  INV LNX STO 21          'EXP (P), STORE IN 21
  (RCL 29 • RCL 21        'FIND THIS YEARS SUBSTITUTION
  ÷ (1 + RCL 29 •(RCL 21   FROM INCREMENTAL FORMULA:
  - 1)))
```

$$F(i) = \frac{F(i-1) \cdot EXP(P)}{1-F(i-1)+F(i-1) \cdot EXP(P)}$$

```
  STO 29                  'STORE FOR PRINT SUBPROGRAM
```

'PRINT RESULTS

```
• LBL "PRT"               'ARRIVE FOLLOWING PROCESSING OF
                           "COS" OR BECAUSE ROI THIS YEAR
                           IS LESS THAN REQUIRED ROI, AND
                           SUBSTITUTION UNCHANGED
```

```
IFF 01 SBR                    'IF FLAG 01 IS SET, PRINT ALL
                               YEARS.  OTHERWISE, TEST:
RCL 23 X:T RCL 20             'IS PRESENT YEAR GREATER THAN OR
2 - X ≥ T? "SBR"               EQUAL TO LAST YEAR?  IF SO,
                               PRINT RESULTS
GTO π                         'OTHERWISE, GO CALCULATE NEXT
                               YEAR.

• LBL "SBR"                   'THE ACTUAL PRINTING FUNCTION
  ADV                         'MORE PAPER
  45 17 13 35  2-OP-04        '"YEAR"
  (RCL 22 + RCL 20)  2-OP-06  'PRINT THIS YEAR
  00 00 33 14  2-OP-04        '"PB"
  RCL 26       2-OP-06        'PRINT PAYBACK OF THIS YEAR
  00 33 32 37  2-OP-04        '"POT"
  RCL 26 SBR TAN STO 28       'TAKE PAYBACK OF THIS YEAR AND
                               GO TO SUBROUTINE 'TANGENT' TO
                               CALCULATE MARKET POTENTIAL.
                               STORE THE RESULT
  2-OP-06                     'AND PRINT IT
  00 35 32 24  2-OP-04        '"ROI"
  RCL 27       2-OP-06        'PRINT ROI OF THIS YEAR
  00 36 41 14  2-OP-04        '"SUB"
  RCL 29                      'PRINT SUBSTITUTION OF THIS YEAR
  00 33 17 31  2-OP-04        '"PEN"
  (RCL 29 • RCL 28)
               2-OP-06        'PRINT PENETRATION OF THIS YEAR
```

```
GTO π                          'RETURN TO "π" TO CALCULATE
                                NEXT YEARS RESULTS
```

IV. ALL YEAR'S RESULTS PRINTED

```
• LBL "ADV"
  ADV ADV                      'SPACE BETWEEN RUNS
  RCL 15 STO 29                'RE-INITIALIZE PENETRATION
  INV STF 03                   'RESTORE 'TWICE THRU'
  1.11 SBR INT 1/X PRD 12       FLAG
  1.08 SBR INT 1/X PRD 14      'ALL DONE.  AWAIT NEW COMMANDS
```

V. SUBPROGRAM TO CALCULATE POTENTIAL

```
• LBL "TAN"                    'ARRIVE WITH PAYBACK IN DISPLAY
  ((( CE - 5) INV TAN          'AN "S" SHAPED FUNCTION WHICH
  ÷ π) ± +.5)                   PREDICTS 50% ACCEPTANCE OF A
  RTN                           5 YEAR PAYBACK, 80% ACCEPTANCE
                                OF A 3 YEAR PAYBACK, 15% OF A
                                7 YEAR PAYBACK, 6% OF A 10 YEAR
                                PAYBACK.
```

VI. SUBPROGRAM TO CALCULATE GYPONENTIAL INCREASE

```
• LBL "INT"
  (CE Y^X RCL 23)
  RTN
```

STORAGE REGISTERS - MARKET PENETRATION PROGRAM

1 - 10	-	USED IN SEARCH PROGRAM
11	-	TC
12	-	K
13	-	E_S
14	-	I
15	-	INITIAL PENETRATION
16	-	PAYBACK, 1981
17	-	MAXIMUM ROI OF 1981
18	-	Δ IN PAYBACK FROM 1981
19		Δ IN ROI FROM 1981
20	-	COUNTER OF YEARS: 29 TO 59
21	-	INTERMEDIATE JUNK STORAGE
22	-	FIRST YEAR OF MARKET PENETRATION
23	-	YEARS TO RUN
24	-	INNOVATIVE INDEX
25	-	REQUIRED ROI
26	-	CURRENT PB
27	-	CURRENT ROI
28	-	PRESENT POTENTIAL
29	-	SUBSTITUTION IN THIS YEAR
30	-	INITIAL PENETRATION ÷ POTENTIAL = SUBSTITUTION

INSTRUCTIONS FOR MARKET PENETRATION PROGRAM

I. DATA ENTRY

A. YEARS TO RUN:

EXAMPLE: 1981 to 1991

ENTER: 1981 • 1991

PRESS: 2ND - B[1]

B. INNOVATIVE INDEX:

EXAMPLE: 0.0

ENTER: 0

PRESS: 2ND - C[1]

C. REQUIRED ROI:

EXAMPLE: 25%

ENTER: .25

PRESS: 2ND - D[1]

D. INITIAL PENETRATION:

EXAMPLE: .01

ENTER: .01

PRESS: 2ND - E[1]

E. TAX CREDIT

EXAMPLE: 25%

ENTER: .25

PRESS: A

F. VALUE OF ENERGY SAVED

EXAMPLE: $6.50/MILLION BTU; $.05/KWH

ENTER: 6.50 ; .05

PRESS: B ; B

NOTE - THIS MUST BE RE-INPUT WITH EACH RUN

G. AMOUNT OF ENERGY SAVED

EXAMPLE: 4980 MILLION BTU ; 10000 KWH

ENTER: 4980 ; 10000

PRESS: C ; C

H. INVESTMENT IN DEVICE

EXAMPLE: $261000

ENTER: 261000

PRESS: D

NOTE - THIS MUST BE RE-INPUT WITH EACH RUN

II. PRINT CONTROL

A. FOR FULL PRINT

WHILE THE CALCULATOR IS NOT PROCESSING,

PRESS: 2ND - ST FLG (THE RST BUTTON) - 1.

B. TO END FULL PRINT

PRESS: INV - 2ND - ST FLG - 1.

C. TO PRINT CURRENT DATA

- IF YOU HAVEN'T RECEIVED CURRENT DATA FOLLOWING A RUN, PRESS 'E'

- IF YOU HAVE ALREADY SEEN DATA ONCE, PRESSING 'E' WILL CAUSE PROGRAM TO CONTINUE. SO, PRESS 'E'. PRESSING "INV - 2ND - ST FLG - 2" CAN NEVER CAUSE A PROBELM; WHEN IN DOUBT, PRESS IT.

III. PROCESSING

A. TO CAUSE EXECUTION OF PROGRAM

- PRESS 'E'
  - CURRENT DATA WILL PRINT
  - IF ERRORS, CORRECT BY RE-INPUTTING
  - IF OK, PRESS E AGAIN
  - TO REVIEW ERROR CORRECTION, PRESS "INV - 2ND - ST FLG - 2 - E." THEN, PRESS E, WHEN SATISFIED, TO FINISH PROCESSING

B. CASES TO BE DONE

1. SOLAR SYSTEMS
   - SOLAR PONDS

     B = 6.50

     D = 750000

     A,C = VARY

     THE PROGRAM NEEDS TO BE RUN FOR 5 x 5 = 25 VARIATIONS OF RESOURCE LEVEL BY THE TAX CREDIT LEVEL.

   - FLAT PLATES

     B = 6.5

D = 1,250,000

A,C = VARY

25 RUNS

- EVACUATED TUBES

B = 6.5

D = 1,750,000

A,C = VARY

25 RUNS

- PARABLOIC TROUGHS

B = 6.5

D = 1,750,000

A,C = VARY

25 RUNS

2. WIND SYSTEMS

UNLIKE SOLAR SYSTEMS, THE VALUE OF THE WIND GENERATED ELECTRICITY (B) VARIES. THEREFORE, THERE IS MORE THAN ONE WORK SHEET FOR WIND TURBINES. 25 RUNS PER SHEET ARE REQUIRED.

Test of Economic Model

Using:

1) $M(R) = C_s 1I = OMPI + (CRF(R,N)/(1-T)\cdot(1-(TC/(1+R)) - T\cdot DEP)$

Where=

$$OMPI = CRF(R,N) \cdot ((1+g)/(R-g)) \cdot (1-((1+g)/(1+R))^N) \cdot OMPI_0$$

$$DEP = (2/DP(DP+L)\ R) \cdot (DP-1/CRF(R,DP))$$

NOTE: These are simplifications of Eq. (1), (G-1), (G-3) from reference (1). The simplifications are made possible by the following assumptions.

f: 'fraction financed' = 0

M(tc): No component replacement

S: Salvage value is 0

2) $LG(R) = CRF(R,N) \cdot ((1+g^1)/(R-g^1)) \cdot (1-((1+g^1)/(1+R))^N)$

3) $M(R)\ L\ LF(R) - P_{fo} \cdot E_s/I = 0$

Solve for R.

EXAMPLES

$T = .5$	$g^1 = .11$	$OMPI_o = .04$	$DP = 7$
$g = .08$	$Tc = .2$	$N = 20$	$I = 261000$
$E_s = 4980$	$P_{fo} = 6.5$	$q = .11$	

$R = .1805$ 'From ADL Program

Test:

CRF (R,N)	= .18728	M (R)	= .25967	
OMPI	= .06692	LF (R)	=2.08813	'CRF (R,7) + .262734
DEP	= .63195	$P_{fo} \cdot E_s/I$	= .12402	

$M(R)/LF(R) - P_{fo} \cdot E_s/I = .000335$ 'Close to 0

Test:

TC	= .4	R	= .22267
CRF	= .226738	OMPI	= .062915
DEP	= .57877	M (R)	= .23680
LF (R)	=1.91069	$P_{fo} \cdot E_s/I$	= .12402

$M(R)/LF(R) - P_{fo} \cdot E_s/I = -.0000826$ 'Close to 0

APPENDIX C

STATE DATA SHEETS

STATE Wyoming AVERAGE $/KWH .0282

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	108.77 POND	374.25 PLATES	156.19 TUBES	1459. HOT!	357.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.69	.31			
DIRECT SOLAR		.45	.55				
WIND	.02		.102	.506	.325	.046	

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Wisconsin AVERAGE $/KWH .0469

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1111.5	10145.56	3310.82	98950.	11773.3

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR				.15	.85		
WIND	.03	.597	.373				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE West Virginia AVERAGE $/KWH .0429

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	24.56	2368.56	10.56	18313.	9838.3

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.76	.24		
DIRECT SOLAR					.71	.29	
WIND	.198	.473	.262	.058	.009		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Washington AVERAGE $/KWH .0234

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	751.62	4855.96	1316.88	54621.	28015.7

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.30	.70		
DIRECT SOLAR				.16	.66	.18	
WIND	.183	.155	.013	.564	.085		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Virginia AVERAGE $/KWH .0458

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	984.86	9577.09	1183.54	60192.	9985.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.98	.02		
DIRECT SOLAR					1.00		
WIND	.398	.393	.196	.014			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Vermont AVERAGE $/KWH .0490

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	2.17	102.65	14.13	2739.	757.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					1.00		
WIND				.666	.334		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Utah AVERAGE $/KWH .0462

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	55.4	501.66	67.34	3679.	1952.9

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR		.38	.28	.34			
DIRECT SOLAR	.26	.72	.02				
WIND	.189	.023	.143	.116	.528		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Texas AVERAGE $/KWH .0465

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1832.59	29720.72	2169.71	183488.	50839.7

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR	.07	.37	.56				
DIRECT SOLAR		.23	.26	.43	.08		
WIND	.47	.319	.159	.035	.016		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Tennessee AVERAGE $/KWH .0420

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1473.62	9886.	1725.94	72818.	32745

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				1.00			
DIRECT SOLAR				.26	.74		
WIND	.76	.204	.036				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE South Dakota AVERAGE $/KWH .0432

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	0.68	453.98	17.34	1804.	355.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.96	.04		
DIRECT SOLAR			.55	.45			
WIND			.351	.649			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE South Carolina AVERAGE $/KWH .0400

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	249.64	13157.32	347.	52313.	16108.7

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.52	.48			
DIRECT SOLAR				.46	.54		
WIND	.853	.045	.102				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Rhode Island AVERAGE $/KWH .0727

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	54.41	1496.41	212.17	3375.	1486.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					1.00		
WIND	.882		.118				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Pennsylvania AVERAGE $/KWH .0533

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1525.2	38624.59	2495.1	91267.	35595.6

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					.58	.42	
WIND	.359	.207	.30	.134			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Oregon AVERAGE $/KWH .0303

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	235.69	1965.81	333.01	33261	14039

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.89	.11		
DIRECT SOLAR		.01	.48	.29	.11	.01	
WIND	.233	.043	.246	.478			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Oklahoma AVERAGE $/KWH .0379

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	106.22	15212.24	183.24	27892.	5440

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR		.05	.95				
DIRECT SOLAR		.07	.41	.52			
WIND		.213	.659	.120	.007		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Ohio AVERAGE $/KWH .0494

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1733.68	47226.41	2486.22	141242.	61278.5

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.08	.92		
DIRECT SOLAR					.90	.10	
WIND	.16	.632	.190	.018			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE No Dakota AVERAGE $/KWH .0398

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	165.03	250.67	193.31	4610.	399.8

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.86	.14		
DIRECT SOLAR				1.00			
WIND			.218	.782			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE No. Carolina AVERAGE $/KWH .0402

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	434.13	17202.92	902.59	76173	22401.8

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.36	.64			
DIRECT SOLAR				.13	.87		
WIND	.837	.048	.009	.064	.043		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE New York AVERAGE $/KWH .0759

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1394.51	16080.43	8921.05	83725.	30792.6

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					.58	.42	
WIND	.389	.311	.073	.165	.062		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE New Mexico AVERAGE $/KWH .0583

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	80.54	258.32	78.76	1056.	981.7

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR	.74	.26					
DIRECT SOLAR	.31	.69					
WIND		.674	.279	.016	.031		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE New Jersey AVERAGE $/KWH .0853

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	949.87	12168.08	2691.89	52153.	15459.6

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.45	.55		
DIRECT SOLAR					1.00		
WIND	.961	.039					

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE New Hampshire AVERAGE $/KWH .0772

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	49.25	778.09	125.91	10478.14	1371.3

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					1.00		
WIND	.297	.403	.079	.220			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Nevada AVERAGE $/KWH .0548

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	52.74	169.48	39.78	692.	933.3

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR	.30	.33	.19	.18			
DIRECT SOLAR	.11	.88	.01				
WIND	.074	.026	.279	.60	.021		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Nebraska AVERAGE $/KWH .0489 (1.15-2.037)

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	2534.6	1494.06	91.34	10630.	2456.5

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				1.0			
DIRECT SOLAR			.85	.15			
WIND			.883	.117			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Montana AVERAGE $/KWH .0308

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	161.85	401.78	226.37	4862.	4421.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.68	.32		
DIRECT SOLAR			.25	.70	.05		
WIND	.067		.298	.115	.438	.081	

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Missouri AVERAGE $/KWH .0445

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1771.08	5982.24	1888.68	23690.	10944.4

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				1.00			
DIRECT SOLAR				1.00			
WIND	.124	.846	.029				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Mississippi AVERAGE $/KWH .0532

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	131.28	2948.84	206.66	34702.	6041.5

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.46	.54			
DIRECT SOLAR				.66	.34		
WIND	1.0						

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Minnesota AVERAGE $/KWH .0458

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	847.84	4403.73	2225.66	42526.	6618

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR				.47	.53		
WIND	.01	.64	.177	.173			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Michigan AVERAGE $/KWH .0483

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	3506.85	28841.75	1874.61	85416.	28895.7

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR				.15	.85		
WIND	.015	.463	.435	.087			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Massachusetts AVERAGE $/KWH .0724

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	145.78	6141.78	1483.44	33598.	7604.6

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					1.00		
WIND	.46	.22	.136	.184			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Maryland AVERAGE $/KWH .05401

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	801.9	2778.28	1443.82	23919.	8143.3

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.73	.27		
DIRECT SOLAR					100%		
WIND	.447	.465	.081	.006			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE MAINE AVERAGE $/KWH .0534

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1.16	2048.56	319.28	45433.	2806.1

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					1.00		
WIND	.099	.301	.042	.095	.463		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Louisiana AVERAGE $/KWH .0394

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	427.28	15904.48	895.24	144559.	21748.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.93	.07			
DIRECT SOLAR				.44	.36		
WIND	.953	.044	.002				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Kentucky AVERAGE $/KWH .0390

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	669.4	4226.7	1892.9	25335.	31264.6

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				1.00			
DIRECT SOLAR				.03	.97		
WIND	.79	.181	.029				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Kansas AVERAGE $/KWH .0483

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	791.52	3589.5	986.98	25758.	5234.9

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.59	.41			
DIRECT SOLAR		.12	.60	.28			
WIND		.119	.479	.398	.004		

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Iowa AVERAGE $/KWH .0453

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	4392.31	5871.9	1418.79	30003.	6857.4

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.62	.38		
DIRECT SOLAR				1.00			
WIND		.18	.558	.262			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Indiana AVERAGE $/KWH .0432

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	2371.82	16475.58	1786.6	46058.	25632.6

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.35	.65		
DIRECT SOLAR					1.00		
WIND	.227	.773					

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Illinois AVERAGE $/KWH .0502

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	5189.92	12536.48	4222.6	102110.	30650.1

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.94	.06		
DIRECT SOLAR				.98	.02		
WIND	.113	.887					

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Idaho AVERAGE $/KWH .0306

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	1.52	917.56	1828.92	13307.	4430.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				.96	.04		
DIRECT SOLAR		.16	.58	.16	.10		
WIND	.17	.264	.195	.196	.149	.025	

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Georgia AVERAGE $/KWH .0509

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	533.62	12732.28	910.1	72675.	14402.5

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.66	.34			
DIRECT SOLAR				.39	.61		
WIND	.89	.101	.008				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Florida AVERAGE $/KWH .0536

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	304.87	4952.82	2289.31	49286.	9501.7

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR		.49	.51				
DIRECT SOLAR				1.00			
WIND	.275	.419	.306				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

TABLE 3-12

FLORIDA DATA TABLE

X3

STATE Delaware AVERAGE $/KWH .0569

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	256.	1545.78	20.22	9843.	2383.8

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR				1.00			
DIRECT SOLAR					1.00		
WIND	.833			.167			

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Connecticut AVERAGE $/KWH .0713

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	278.23	4057.02	360.75	15214.	5735.4

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR					1.00		
WIND	.548	.137	.316				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Colorado AVERAGE $/KWH .0452

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	3084.	1159.46	542.54	12216.	3197.8

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR	.01	.29	.50	.20			
DIRECT SOLAR	.	.92	.08				
WIND	.042	.546	.065	.073	.072	.202	

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE California AVERAGE $/KWH .0624

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	2368.45	16773.48	6251.07	100199.	37394.5

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR	.26	.38	.26	.10			
DIRECT SOLAR	.03	.33	.55	.09			
WIND	.102	.334	.456	.023	.062	.023	

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Arkansas AVERAGE $/KWH .0369

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	186.32	4388.68	442.	55616.	4567.4

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.17	.83			
DIRECT SOLAR				1.00			
WIND	.682	.129	.188				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Arizona AVERAGE $/KWH .0684

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	36.16	781.7	200.14	2466.	3058.4

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR	.89	.11					
DIRECT SOLAR	.47	.53					
WIND	.981	.005	.015				

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Alaska AVERAGE $/KWH .062 (1.15² + .047)

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	57.42	81.2	86.38	697.	232.2

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR					1.00		
DIRECT SOLAR						1.00	
WIND	.139	.092	.628	.085	.047	.01	

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

STATE Alabama AVERAGE $/KWH .0567

ENERGY USE DATA

	70 - 140°F	140 - 160°F	160 - 212°F	212 - 400°F	ELECTRICITY
	227.36	5745.6	94.04	85707.	22590.3

ENERGY RESOURCE DATA

CLASS	1	2	3	4	5	6	7
TOTAL SOLAR			.48	.52			
DIRECT SOLAR				.51	.49		
WIND	1.0						

MARKET PENETRATION

TAX CREDIT	SOLAR PONDS	FLAT PLATES	EVACUATED TUBES	PARABOLIC TROUGHS	WIND TURBINES
10%					
25%					
40%					
55%					
77%					

APPENDIX D

ENERGY USE PROCESSING PROGRAM

WRITTEN FOR TI-59 PROGRAMMABLE CALCULATOR WITH PRINTER

Documentation: DATPROII

Program To Assign Energy Use to Collector Type

```
'Build Data Base
    • LBL A'                    'Enter Location-30 Start
      Sto 0  R/S                'Intialize Count Register
    • LBL B'
      Print                     'Prints Display ="2011010203"
      STO 2-IND 0               'Stores in Register, #Stored in Ø
      RCL 0  PRT  ADV           'Develops Listing of Data Base
      1  INV  SUM  0            'Decrements Register 0
      R/S                       'Next Command

'Print Data Base
    • LBL C'
      30  STO  0                'Start at Top
    • LBL "2-PRT"
      RCL 2-IND 0  PRT          'RCL First Entry, Print
      RCL 0  PRT  ADV           'RCL Location, Print
      2-DSF 00 "2-PRT"          'Next Position
      R/S                       'Next Command
```

```
'Input SIC-Specific Data

    • LBL A     • LBL B     • LBL C     • LBL D     • LBL E
      STO 40      STO 41      STO 42      STO 43      STO 44
      INV         INV         INV         INV         INV
      2-ST FLG    2-ST FLG    2-ST FLG    2-ST FLG    2-ST FLG
      01          01          01          01          01
      R/S         R/S         R/S         R/S         R/S

'Process Data of ABCDE

    • LBL E'
      2-IF FLG  01  "RCL"        'Second Time Thru?  To "RCL"
      2-ST FLG  01               'First Time Thru
      RCL  40  PRT               'Print ABCDE
      RCL  41  PRT
      RCL  42  PRT
      RCL  43  PRT
      RCL  44  PRT
      ADV      R/S               'Ok?  If So, E'.  If No, Change

'Find Data Base Contents For SIC - A

    • LBL "RCL"
      30  STO  00                'Initialize Counter
      RCL  40                    'RCL  SIC -"A"
      X :T
      LBL  "X:T"
```

```
(RCL  2-IND  0                 'RCL Contents of Counter
 ÷  1000000)                    Location and Examine
 2 - INT                        First Four Digits.  If
 2 - X=T?                       Equal SIC- "A", Go To
 "/"                            Label "/"
 2 - DS2  ØØ  "X:T"            'Otherwise, Decrement Counter
 71  2-OP  04                   and return to "X:T."
 RCL  40                       'Print SIC, "?", If Not Found.
 2-OP  06
 R/S                           'If hit R/S, do below

(RCL 42 + RCL 43) Sum 57       'Adds C + D to trough
 RCL  44  Sum  55              'Adds hot air to plate
 GTO "Y^X"                     'GOTO  "Yes"
```

```
'Put Data Base Contents in Right Form
    • LBL "/"
     (RCL  2-IND 0                  'Now have 2011010203
      ÷ 1000000)(                   '2011.010202
      INV -2 -INT                   'Discard SIC
      X  100)                       '01.02 03
      STO  50                       '0102 03
     (2 - INT                       'α1 *100 = 01.
      ÷ 100)                        '.01
      STO  51                       'STO α1 in 51:  .01
      RCL  50                       '01.02 03
      INV -2 -INT                   'Discard α1 :  .02 03
      X 100                         '02.03
      STO  50                       '02.03

     (2 - INT                       'Discard α3 :  02
      ÷ 100)                        '.02
      STO  52                       '.02
      RCL  50                       '02.03
      INV -2 -INT                   'Dicard x α2: .03
      STO  53                       '.03
      .01  X:T                      'Test for "100%"
     (RCL  51 + RCL 52 + RCL 53)    'If Sum = .01, "100%"
      2 - X = T? "Fix"              'If = .01, Go to "Fix"
      GTO "SUM"                     'Otherwise, Ok, Go to "Sum"
```

```
● LBL "Fix"
 (RCL  51 ÷ .01) STO  51        'All "0"'s Remain,
 (RCL  52 ÷ .01) STO  52         But ".01" Changes to
 (RCL  53 ÷ .01) STO  53         "1".
  GTO  "Sum"                    'Go to "Sum"

'Accumulate Energy Use by Collector Type
● LBL  "Sum"
 (RCL 41 x RCL 51)  Sum  54     'Sums to 54 - Pond
 (RCL 41 x RCL 52 + RCL 44)     'Sums to 55 - Plate
  Sum 55
 (RCL 41 x RCL 53) Sum  56      'Sums to 56 - Tube
 (RCL 42 + RCL 43) Sum  57      'Sums to 57 - trough
  LBL  "Y^X"
  2 - OP 00 4517360071 2 -      'Processing Finished,
 OP  04

  2 - OP  05                    'Print  "Yes?"
  R/S                           'Next Instruction

'Begin New State, Print Old
● LBL  D'
  ADV                           'Print Line
  0033323116 2 - OP 04          'Label  'Pond'
  RCL  54  2 - OP  06           'Print Statewide Use
  3327133717 2 - OP  04         'Label  'Plate'
  RCL  55  2 - OP  06           'Print Use
```

```
0037411417 2 - OP  04        'Label  'Tube'

RCL  56 2 -  OP  06          'Print Use

3735324121  2 - OP  04       'Label  'Proof'

RCL  57 2 - OP  06           'Print Use

ADV  ADV

00/STO  54 STO  55  STO 56   'Zero Accumulators
 STO  57

R/S                          'Next Instructions
```

Instructions For Use Of "DATPROII"

To Change or Write Data Base

- Enter location; 30 is maximum and any location down to 1 may be used
- Press '2nd - A''
- Enter data base entry

  Example: 2011000100

  - The first four digits are the SIC code
  - The next two are the percent of the energy used below 212°F used between 70-140°F
  - The next two digits are the % used between 140-160°F
  - The next two are the % used between 160-212°F

  - Error? Press "CE" and re-enter

- Press "2nd - B'"

  - Prints: 2022040096
    30
    (blank)

  - If wrong, enter "30" (or whatever), press 2nd - A'. Enter "2022040096" (or whatever), press 2nd - A'.

- If changing data base, proceed as for preceding error correction. Otherwise:
- If building data base, program automatically has stepped to next location (29 in example)

  So:
- Enter data base entry - see preceding instructions
- To review data base contents, press "2nd - C'". Press "R/S" to stop review

<u>To Process a State</u>

- Press '2nd - D''
  - This is the 'Done' key: calculations are complete for preceding state, and results are printed. It should always be pressed before beginning a new state
- Input data from industrial energy use data base
  - Enter SIC code; press "A"
  - Enter billion BTU less than 212°F from SERI Industrial Energy Use Data Base; press "B"
  - Enter billion BTU, 212-300°F; press "C"
  - Enter any other SIC code with same first two digits for codes like, "20XX."

- Enter billion BTU, 300-400°F; press "D"
- Enter billion BTU, Hot Air less than 150°F; press "E"

- Begin Execution
  - Press "2nd - E'"
  - Examine data
    - If ok, press E' again
    - If wrong, enter correct data, and press A,B,C,D, or E as appropriate; then E'

- If no data base available for SIC code A, error message printed. Examine data base contents and fix or add to data base, enter different SIC code, or "R/S"
- If "R/S", C + D added to trough; E added to plate
- When processing of this SIC code is finished, program asks, "yes?". This shows that it is impatiently awaiting more data. Enter the SIC code and energy use as previously described

<u>To Finish a State</u>

- Press D'
- Label results: write state name on tape in blue pencil

- Proceed with new state
- Note: When D' is pushed, the registers accumulating energy usage are set to zero. This means that if D' is used to examine intermediate results, say, five SIC codes worth of input, those results will not be included in the future results. When D' is pushed, the program believes the state is finished.

<u>To End</u>

- To store data base, write program to magnetic cards, sides 1,2,3,4, as per TI-59 conventions

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