

ATTACHMENT 1A IOWA UTILITIES BOARD

Customer Type/Sub-Group	Technology Configuration	Simple Payback (yrs)	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Commercial Retail - Small	Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	29	Solar PV	None	1	33	0
Commercial Schools - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	Wind Turbine	None	660	24	0
Commercial Schools - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8	Wind Turbine	None	250	24	0
Commercial Schools - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10	Wind Turbine	None	100	24	0
Commercial Schools - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	11	Stirling Engine	Nat. Gas	52	90	50
Commercial Schools - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	14	Stirling Engine	Nat. Gas	25	90	50
Commercial Schools - Large	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	15	Wind Turbine	None	30	24	0
Commercial Schools - Large	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	17	Wind Turbine	None	10	24	0
Commercial Schools - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	21	Stirling Engine	Nat. Gas	52	50	50
Commercial Schools - Large	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	22	Wind Turbine	None	1	24	0
Commercial Schools - Large	Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	23	Micro-Turbine	Nat. Gas	75	90	50
Commercial Schools - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	26	Stirling Engine	Nat. Gas	25	50	50
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	6	Stirling Engine	Nat. Gas	52	90	50
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	Stirling Engine	Nat. Gas	25	90	50
Commercial Schools - Medium	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8	Wind Turbine	None	250	24	0
Commercial Schools - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Wind Turbine	None	100	24	0
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	10	Micro-Turbine	Nat. Gas	75	90	50
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10	Stirling Engine	Nat. Gas	52	50	50
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	13	Micro-Turbine	Nat. Gas	60	90	50
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	13	Stirling Engine	Nat. Gas	25	50	50
Commercial Schools - Medium	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Wind Turbine	None	30	24	0
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	16	Micro-Turbine	Nat. Gas	30	90	50
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	16	Micro-Turbine	Nat. Gas	45	90	50
Commercial Schools - Medium	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Wind Turbine	None	10	24	0
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	19	Micro-Turbine	Nat. Gas	75	50	50
Commercial Schools - Medium	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Wind Turbine	None	1	24	0
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	25	Micro-Turbine	Nat. Gas	60	50	50
Commercial Schools - Small	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	Stirling Engine	Nat. Gas	25	90	50
Commercial Schools - Small	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8	Wind Turbine	None	100	24	0
Commercial Schools - Small	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	10	Micro-Turbine	Nat. Gas	30	90	50
Commercial Schools - Small	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10	Stirling Engine	Nat. Gas	52	50	50
Commercial Schools - Small	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	11	Wind Turbine	None	30	24	0
Commercial Schools - Small	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	12	Stirling Engine	Nat. Gas	25	50	50
Commercial Schools - Small	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	13	Wind Turbine	None	10	24	0
Commercial Schools - Small	Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	14	Reciprocating Engine	Nat. Gas	10	90	50
Commercial Schools - Small	Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	16	Micro-Turbine	Nat. Gas	60	50	50
Commercial Schools - Small	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	16	Wind Turbine	None	1	24	0
Commercial Schools - Small	Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	19	Micro-Turbine	Nat. Gas	45	50	50
Commercial Schools - Small	Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	20	Micro-Turbine	Nat. Gas	30	50	50
Commercial Schools - Small	Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	28	Solar PV	None	1	33	0
Commercial Schools - Small	Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	30	Reciprocating Engine	Nat. Gas	10	50	50
Commercial Services - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	6	Wind Turbine	None	660	24	0
Commercial Services - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	9	Stirling Engine	Nat. Gas	52	90	50
Commercial Services - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	Wind Turbine	None	250	24	0
Commercial Services - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	11	Stirling Engine	Nat. Gas	25	90	50
Commercial Services - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	Wind Turbine	None	100	24	0
Commercial Services - Large	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	Wind Turbine	None	30	24	0
Commercial Services - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	17	Stirling Engine	Nat. Gas	52	50	50
Commercial Services - Large	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	20	Wind Turbine	None	10	24	0
Commercial Services - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	21	Stirling Engine	Nat. Gas	25	50	50
Commercial Services - Large	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	25	Wind Turbine	None	1	24	0
Commercial Services - Large	Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	27	Micro-Turbine	Nat. Gas	75	90	50
Commercial Services - Medium	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	Wind Turbine	None	250	24	0
Commercial Services - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	Wind Turbine	None	100	24	0
Commercial Services - Medium	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	Wind Turbine	None	30	24	0
Commercial Services - Medium	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	19	Wind Turbine	None	10	24	0
Commercial Services - Medium	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	24	Wind Turbine	None	1	24	0
Commercial Services - Small	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Wind Turbine	None	10	24	0
Commercial Services - Small	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	19	Wind Turbine	None	1	24	0
Government - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	Wind Turbine	None	250	24	0
Government - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	Wind Turbine	None	100	24	0
Government - Large	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	Wind Turbine	None	30	24	0
Government - Large	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	19	Wind Turbine	None	10	24	0
Government - Large	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	24	Wind Turbine	None	1	24	0
Government - Medium	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Wind Turbine	None	30	24	0
Government - Medium	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Wind Turbine	None	10	24	0
Government - Medium	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Wind Turbine	None	1	24	0
Government - Small	Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	7	Reciprocating Engine	Nat. Gas	10	50	50
Government - Small	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	7	Wind Turbine	None	30	24	0
Government - Small	Reciprocating Engine, Diesel fuel, 11 kW, 50 CF, 50 WHF	8	Reciprocating Engine	Diesel	11	50	50
Government - Small	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	9	Wind Turbine	None	10	24	0
Government - Small	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	10	Wind Turbine	None	1	24	0
Government - Small	Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	18	Solar PV	None	1	33	0
Government - Small	Reciprocating Engine, Bio-Diesel fuel, 11 kW, 50 CF, 50 WHF	20	Reciprocating Engine	Bio-Diesel	11	50	50
Residential - Electric Heat	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	16	Wind Turbine	None	1	24	0
Residential - Electric Heat	Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	27	Solar PV	None	1	33	0
Residential - Gas Heat	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	16	Wind Turbine	None	1	24	0
Residential - Gas Heat	Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	27	Solar PV	None	1	33	0

ATTACHMENT 1B

30 YEAR PAYBACK OR BETTER - SORTED BY PAYBACK & THEN BY TECHNOLOGY

Technology Configuration	Simple Payback (yrs)	Customer Type/Sub-Group	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	3	C/I Wholesale Trade - Medium	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	3	C/I Wholesale Trade - Medium	Stirling Engine	Nat. Gas	52	90	50
Fuel Cell, Nat. Gas fuel, 200 kW, 90 CF, 50 WHF	4	Commercial Housing	Fuel Cell	Nat. Gas	200	90	50
Fuel Cell, Nat. Gas fuel, 250 kW, 90 CF, 50 WHF	4	Commercial Housing	Fuel Cell	Nat. Gas	250	90	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	4	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	4	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	4	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	60	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	4	C/I Wholesale Trade - Medium	Reciprocating Engine	Nat. Gas	10	90	50
Reciprocating Engine, Nat. Gas fuel, 61 kW, 90 CF, 50 WHF	4	C/I Wholesale Trade - Medium	Reciprocating Engine	Nat. Gas	61	90	50
Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	4	Agriculture - Large	Stirling Engine	Bio-Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	4	Commercial Health Care - Medium	Stirling Engine	Nat. Gas	25	90	50
Micro-Turbine, Bio-Gas fuel, 75 kW, 90 CF, 50 WHF	5	Agriculture - Large	Micro-Turbine	Bio-Gas	75	90	50
Stirling Engine, Bio-Gas fuel, 25 kW, 90 CF, 50 WHF	5	Agriculture - Large	Stirling Engine	Bio-Gas	25	90	50
Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	5	C/I Sewerage Systems	Stirling Engine	Bio-Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	5	Commercial Assembly - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	5	Commercial Hotel / Motel - All Electric	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	5	Commercial Health Care - Medium	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	5	C/I Wholesale Trade - Medium	Stirling Engine	Nat. Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	5	Commercial Health Care - Medium	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	5	C/I Wholesale Trade - Medium	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	Commercial Health Care - Large	Wind Turbine	None	660	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	Commercial Retail - Large	Wind Turbine	None	660	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	Commercial Schools - Large	Wind Turbine	None	660	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	C/I Warehouse - Large	Wind Turbine	None	660	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	C/I Manufacturing - Large	Wind Turbine	None	660	24	0
Fuel Cell, Nat. Gas fuel, 1000 kW, 50 CF, 50 WHF	6	Commercial Housing	Fuel Cell	Nat. Gas	1000	50	50
Fuel Cell, Nat. Gas fuel, 2000 kW, 50 CF, 50 WHF	6	Commercial Housing	Fuel Cell	Nat. Gas	2000	50	50
Micro-Turbine, Bio-Gas fuel, 45 kW, 90 CF, 50 WHF	6	Agriculture - Large	Micro-Turbine	Bio-Gas	45	90	50
Micro-Turbine, Bio-Gas fuel, 60 kW, 90 CF, 50 WHF	6	Agriculture - Large	Micro-Turbine	Bio-Gas	60	90	50
Micro-Turbine, Bio-Gas fuel, 75 kW, 90 CF, 50 WHF	6	C/I Sewerage Systems	Micro-Turbine	Bio-Gas	75	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	6	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	75	50	50
Reciprocating Engine, Nat. Gas fuel, 27 kW, 90 CF, 50 WHF	6	C/I Wholesale Trade - Medium	Reciprocating Engine	Nat. Gas	27	90	50
Stirling Engine, Bio-Gas fuel, 25 kW, 90 CF, 50 WHF	6	C/I Sewerage Systems	Stirling Engine	Bio-Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	6	C/I Wholesale Trade - Medium	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	6	Commercial Housing	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	6	C/I Wholesale Trade - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	6	Commercial Health Care - Large	Stirling Engine	Nat. Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	6	Commercial Schools - Medium	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	6	C/I Wholesale Trade - Medium	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	6	Commercial Services - Large	Wind Turbine	None	660	24	0
Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	6	C/I Manufacturing - NEC	Wind Turbine	None	660	24	0
Fuel Cell, Nat. Gas fuel, 250 kW, 50 CF, 50 WHF	7	Commercial Housing	Fuel Cell	Nat. Gas	250	50	50
Micro-Turbine, Bio-Gas fuel, 30 kW, 90 CF, 50 WHF	7	Agriculture - Large	Micro-Turbine	Bio-Gas	30	90	50
Micro-Turbine, Bio-Gas fuel, 45 kW, 90 CF, 50 WHF	7	C/I Sewerage Systems	Micro-Turbine	Bio-Gas	45	90	50
Micro-Turbine, Bio-Gas fuel, 60 kW, 90 CF, 50 WHF	7	C/I Sewerage Systems	Micro-Turbine	Bio-Gas	60	90	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	7	Commercial Health Care - Medium	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	7	Commercial Health Care - Medium	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	7	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	60	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	7	C/I Wholesale Trade - Medium	Reciprocating Engine	Nat. Gas	10	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	7	Government - Small	Reciprocating Engine	Nat. Gas	10	50	50
Reciprocating Engine, Nat. Gas fuel, 61 kW, 50 CF, 50 WHF	7	C/I Wholesale Trade - Medium	Reciprocating Engine	Nat. Gas	61	50	50
Stirling Engine, Bio-Gas fuel, 52 kW, 50 CF, 50 WHF	7	Agriculture - Large	Stirling Engine	Bio-Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	7	Commercial Health Care - Medium	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	Commercial Health Care - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	Commercial Schools - Medium	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	Commercial Schools - Small	Stirling Engine	Nat. Gas	25	90	50
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	7	Commercial Health Care - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	7	C/I Wholesale Trade - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	7	Government - Small	Wind Turbine	None	30	24	0
Fuel Cell, Nat. Gas fuel, 200 kW, 50 CF, 50 WHF	8	Commercial Housing	Fuel Cell	Nat. Gas	200	50	50
Micro-Turbine, Bio-Gas fuel, 30 kW, 90 CF, 50 WHF	8	C/I Sewerage Systems	Micro-Turbine	Bio-Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	8	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	8	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	8	C/I Wholesale Trade - Medium	Micro-Turbine	Nat. Gas	45	50	50
Reciprocating Engine, Diesel fuel, 11 kW, 50 CF, 50 WHF	8	Government - Small	Reciprocating Engine	Diesel	11	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	8	Commercial Hotel / Motel - All Electric	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	8	Commercial Hotel / Motel - Gas Heat	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	8	Commercial Retail - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	8	Commercial Assembly - Large	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	8	Commercial Hotel / Motel - All Electric	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	8	C/I Warehouse - Large	Stirling Engine	Nat. Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	8	C/I Manufacturing - Large	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8	Commercial Assembly - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8	Commercial Schools - Small	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8	C/I Wholesale Trade - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8	Commercial Retail - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8	Commercial Schools - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8	Commercial Schools - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8	Agriculture - Large	Wind Turbine	None	250	24	0
Micro-Turbine, Bio-Gas fuel, 75 kW, 50 CF, 50 WHF	9	Agriculture - Large	Micro-Turbine	Bio-Gas	75	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	9	Commercial Assembly - Large	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	9	Commercial Health Care - Medium	Micro-Turbine	Nat. Gas	75	50	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	9	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	75	90	50
Reciprocating Engine, Nat. Gas fuel, 770 kW, 90 CF, 50 WHF	9	Commercial Health Care - Large	Reciprocating Engine	Nat. Gas	770	90	50
Stirling Engine, Bio-Gas fuel, 52 kW, 50 CF, 50 WHF	9	C/I Sewerage Systems	Stirling Engine	Bio-Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	9	C/I Warehouse - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	9	C/I Manufacturing - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	9	Commercial Housing	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	9	Commercial Services - Large	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	9	Government - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Health Care - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Health Care - Medium	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Hotel / Motel - All Electric	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Hotel / Motel - Gas Heat	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Housing	Wind Turbine	None	100	24	0

ATTACHMENT 1B

Technology Configuration	Simple Payback (yrs)	Customer Type/Sub-Group	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Retail - Medium	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	Commercial Schools - Medium	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	Commercial Services - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	Commercial Services - Medium	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	C/ Sewerage Systems	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	C/ Warehouse - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	C/ Manufacturing - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	Government - Large	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	9	C/ Wholesale Trade - Medium	Wind Turbine	None	30	24	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	10	Commercial Schools - Small	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	10	C/ Wholesale Trade - Large	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	10	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	10	C/ Wholesale Trade - Large	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	10	Commercial Schools - Medium	Micro-Turbine	Nat. Gas	75	90	50
Reciprocating Engine, Diesel fuel, 11 kW, 90 CF, 50 WHF	10	C/ Wholesale Trade - Medium	Reciprocating Engine	Diesel	11	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	10	Commercial Health Care - Medium	Reciprocating Engine	Nat. Gas	10	90	50
Reciprocating Engine, Nat. Gas fuel, 255 kW, 90 CF, 50 WHF	10	Commercial Health Care - Large	Reciprocating Engine	Nat. Gas	255	90	50
Stirling Engine, Bio-Gas fuel, 25 kW, 50 CF, 50 WHF	10	Agriculture - Large	Stirling Engine	Bio-Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	10	Commercial Assembly - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	10	C/ Wholesale Trade - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	10	Commercial Hotel / Motel - Gas Heat	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10	Commercial Health Care - Large	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10	Commercial Schools - Medium	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10	Commercial Schools - Small	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10	C/ Wholesale Trade - Large	Stirling Engine	Nat. Gas	52	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	10	Government - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	10	C/ Wholesale Trade - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10	Commercial Retail - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10	Commercial Schools - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10	C/ Manufacturing - Medium	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10	Agriculture - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	10	C/ Manufacturing - NEC	Wind Turbine	None	250	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	10	Commercial Assembly - Small	Wind Turbine	None	30	24	0
Micro-Turbine, Bio-Gas fuel, 60 kW, 50 CF, 50 WHF	11	Agriculture - Large	Micro-Turbine	Bio-Gas	60	50	50
Micro-Turbine, Bio-Gas fuel, 75 kW, 50 CF, 50 WHF	11	C/ Sewerage Systems	Micro-Turbine	Bio-Gas	75	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	11	Commercial Housing	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	11	Commercial Hotel / Motel - Gas Heat	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	11	Commercial Housing	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	11	Commercial Health Care - Medium	Micro-Turbine	Nat. Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	11	C/ Wholesale Trade - Large	Micro-Turbine	Nat. Gas	60	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	11	C/ Wholesale Trade - Large	Micro-Turbine	Nat. Gas	75	90	50
Reciprocating Engine, Nat. Gas fuel, 27 kW, 50 CF, 50 WHF	11	C/ Wholesale Trade - Medium	Reciprocating Engine	Nat. Gas	27	50	50
Stirling Engine, Bio-Gas fuel, 25 kW, 50 CF, 50 WHF	11	C/ Sewerage Systems	Stirling Engine	Bio-Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	11	Commercial Housing	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	11	Commercial Services - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	11	Commercial Retail - Medium	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	11	Commercial Hotel / Motel - All Electric	Stirling Engine	Nat. Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	11	Commercial Schools - Large	Stirling Engine	Nat. Gas	52	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	11	C/ Wholesale Trade - Large	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	Commercial Services - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	Commercial Services - Medium	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	C/ Sewerage Systems	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	C/ Warehouse - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	C/ Manufacturing - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	11	Government - Large	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	11	Commercial Schools - Small	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	11	C/ Wholesale Trade - Small	Wind Turbine	None	30	24	0
Micro-Turbine, Bio-Gas fuel, 45 kW, 50 CF, 50 WHF	12	Agriculture - Large	Micro-Turbine	Bio-Gas	45	50	50
Micro-Turbine, Bio-Gas fuel, 60 kW, 50 CF, 50 WHF	12	C/ Sewerage Systems	Micro-Turbine	Bio-Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	12	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	60	90	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	12	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	60	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	12	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	75	50	50
Reciprocating Engine, Diesel fuel, 68 kW, 90 CF, 50 WHF	12	C/ Wholesale Trade - Medium	Reciprocating Engine	Diesel	68	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	12	Commercial Assembly - Small	Reciprocating Engine	Nat. Gas	10	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	12	Commercial Assembly - Large	Reciprocating Engine	Nat. Gas	10	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	12	Commercial Retail - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	12	Commercial Schools - Small	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	12	C/ Manufacturing - NEC	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	12	C/ Wholesale Trade - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	12	Commercial Assembly - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	12	Commercial Assembly - Large	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	12	Commercial Housing	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	12	C/ Wholesale Trade - Large	Wind Turbine	None	30	24	0
Micro-Turbine, Bio-Gas fuel, 30 kW, 50 CF, 50 WHF	13	Agriculture - Large	Micro-Turbine	Bio-Gas	30	50	50
Micro-Turbine, Bio-Gas fuel, 45 kW, 50 CF, 50 WHF	13	C/ Sewerage Systems	Micro-Turbine	Bio-Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	13	Commercial Health Care - Medium	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	13	Commercial Health Care - Medium	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	13	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	13	Commercial Schools - Medium	Micro-Turbine	Nat. Gas	60	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	13	C/ Wholesale Trade - Large	Micro-Turbine	Nat. Gas	75	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	13	Commercial Health Care - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	13	Commercial Retail - Medium	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	13	Commercial Schools - Medium	Stirling Engine	Nat. Gas	25	50	50
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	13	Commercial Schools - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	13	C/ Manufacturing - NEC	Wind Turbine	None	100	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Commercial Health Care - Large	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Commercial Health Care - Medium	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Commercial Hotel / Motel - All Electric	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Commercial Hotel / Motel - Gas Heat	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Commercial Retail - Medium	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Commercial Schools - Medium	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	C/ Manufacturing - Small	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Agriculture - Small	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	13	Government - Medium	Wind Turbine	None	30	24	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	14	Commercial Retail - Large	Micro-Turbine	Nat. Gas	30	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	14	Commercial Hotel / Motel - Gas Heat	Reciprocating Engine	Nat. Gas	10	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	14	Commercial Schools - Small	Reciprocating Engine	Nat. Gas	10	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	14	Commercial Schools - Large	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	14	C/ Manufacturing - NEC	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	14	Commercial Retail - Large	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	14	C/ Warehouse - Large	Stirling Engine	Nat. Gas	52	50	50

ATTACHMENT 1B

Technology Configuration	Simple Payback (yrs)	Customer Type/Sub-Group	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	14	C/I Manufacturing - Large	Stirling Engine	Nat. Gas	52	50	50
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	14	Commercial Assembly - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	14	Commercial Office	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	14	Commercial Retail - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	14	C/I Warehouse - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	14	C/I Wholesale Trade - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	14	C/I Wholesale Trade - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	14	Commercial Retail - Large	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	14	C/I Manufacturing - Medium	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	14	Agriculture - Large	Wind Turbine	None	30	24	0
Micro-Turbine, Bio-Gas fuel, 30 kW, 50 CF, 50 WHF	15	C/I Sewerage Systems	Micro-Turbine	Bio-Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	15	Commercial Hotel / Motel - Gas Heat	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	15	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	15	Commercial Retail - Medium	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	15	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	45	90	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	15	C/I Manufacturing - Medium	Stirling Engine	Nat. Gas	25	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	15	Commercial Assembly - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	15	Commercial Health Care - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	15	Commercial Health Care - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	15	Commercial Hotel / Motel - Gas Heat	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	15	Commercial Housing	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	15	Commercial Schools - Large	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	15	C/I Warehouse - Large	Wind Turbine	None	30	24	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	16	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	16	Commercial Schools - Medium	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	16	Commercial Assembly - Large	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	16	Commercial Hotel / Motel - All Electric	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	16	Commercial Hotel / Motel - Gas Heat	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	16	Commercial Schools - Medium	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	16	Commercial Schools - Small	Micro-Turbine	Nat. Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	16	C/I Wholesale Trade - Large	Micro-Turbine	Nat. Gas	60	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	16	C/I Wholesale Trade - Large	Reciprocating Engine	Nat. Gas	10	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	16	Commercial Hotel / Motel - Gas Heat	Stirling Engine	Nat. Gas	52	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	16	Residential - Electric Heat	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	16	Residential - Gas Heat	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	16	Commercial Schools - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Commercial Health Care - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Commercial Hotel / Motel - All Electric	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Commercial Services - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Commercial Retail - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Commercial Retail - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Commercial Schools - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	C/I Manufacturing - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	C/I Manufacturing - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Agriculture - Small	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	16	Government - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	Commercial Services - Large	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	Commercial Services - Medium	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	C/I Sewerage Systems	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	C/I Manufacturing - Large	Wind Turbine	None	30	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	16	Government - Large	Wind Turbine	None	30	24	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	17	Commercial Assembly - Large	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	17	C/I Warehouse - Large	Micro-Turbine	Nat. Gas	75	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	17	Commercial Hotel / Motel - All Electric	Reciprocating Engine	Nat. Gas	10	90	50
Reciprocating Engine, Nat. Gas fuel, 255 kW, 50 CF, 50 WHF	17	C/I Wholesale Trade - Large	Reciprocating Engine	Nat. Gas	255	50	50
Reciprocating Engine, Nat. Gas fuel, 770 kW, 50 CF, 50 WHF	17	Commercial Health Care - Large	Reciprocating Engine	Nat. Gas	770	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	17	C/I Warehouse - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	17	C/I Manufacturing - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	17	Commercial Services - Large	Stirling Engine	Nat. Gas	52	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	17	Commercial Assembly - Large	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	17	Commercial Office	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	17	Commercial Retail - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	17	C/I Warehouse - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	17	C/I Wholesale Trade - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	17	Commercial Schools - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	17	Agriculture - Large	Wind Turbine	None	10	24	0
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	18	Commercial Retail - Large	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	18	Commercial Hotel / Motel - Gas Heat	Micro-Turbine	Nat. Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	18	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	75	50	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	18	Government - Small	Solar PV	None	1	33	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	18	Commercial Health Care - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	18	Commercial Housing	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	18	C/I Wholesale Trade - Large	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	18	C/I Warehouse - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	18	C/I Manufacturing - NEC	Wind Turbine	None	30	24	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	19	C/I Wholesale Trade - Large	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	19	Commercial Schools - Small	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	19	C/I Wholesale Trade - Large	Micro-Turbine	Nat. Gas	45	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	19	Commercial Hotel / Motel - Gas Heat	Micro-Turbine	Nat. Gas	45	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	19	Commercial Retail - Large	Micro-Turbine	Nat. Gas	75	50	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	19	Commercial Schools - Medium	Micro-Turbine	Nat. Gas	75	50	50
Reciprocating Engine, Nat. Gas fuel, 255 kW, 50 CF, 50 WHF	19	Commercial Health Care - Large	Reciprocating Engine	Nat. Gas	255	50	50
Reciprocating Engine, Nat. Gas fuel, 61 kW, 90 CF, 50 WHF	19	C/I Wholesale Trade - Large	Reciprocating Engine	Nat. Gas	61	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	19	Commercial Retail - Medium	Stirling Engine	Nat. Gas	52	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	19	Commercial Health Care - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	19	Commercial Hotel / Motel - Gas Heat	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	19	Commercial Services - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	19	C/I Manufacturing - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	19	Agriculture - Small	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	19	Commercial Services - Medium	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	19	C/I Sewerage Systems	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	19	C/I Manufacturing - Large	Wind Turbine	None	10	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	19	Government - Large	Wind Turbine	None	10	24	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	20	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	20	Commercial Schools - Small	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 508 kW, 90 CF, 50 WHF	20	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	508	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	20	Commercial Hotel / Motel - Gas Heat	Micro-Turbine	Nat. Gas	75	50	50
Micro-Turbine, Nat. Gas fuel, 848 kW, 50 CF, 50 WHF	20	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	848	50	50
Reciprocating Engine, Bio-Diesel fuel, 11 kW, 50 CF, 50 WHF	20	Government - Small	Reciprocating Engine	Bio-Diesel	11	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	20	Commercial Housing	Reciprocating Engine	Nat. Gas	10	50	50

ATTACHMENT 1B

Technology Configuration	Simple Payback (yrs)	Customer Type/Sub-Group	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Commercial Health Care - Large	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Commercial Hotel / Motel - All Electric	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Commercial Retail - Large	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Commercial Retail - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Commercial Schools - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	C/I Manufacturing - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	20	Government - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	20	Commercial Services - Large	Wind Turbine	None	10	24	0
Reciprocating Engine, Diesel fuel, 11 kW, 50 CF, 50 WHF	21	C/I Wholesale Trade - Medium	Reciprocating Engine	Diesel	11	50	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	21	C/I Wholesale Trade - Medium	Solar PV	None	1	33	0
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	21	Commercial Services - Large	Stirling Engine	Nat. Gas	25	50	50
Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	21	C/I Manufacturing - Medium	Stirling Engine	Nat. Gas	25	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	21	Commercial Schools - Large	Stirling Engine	Nat. Gas	52	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	21	Agriculture - Large	Wind Turbine	None	1	24	0
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	22	Commercial Retail - Large	Micro-Turbine	Nat. Gas	60	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	22	Commercial Health Care - Medium	Reciprocating Engine	Nat. Gas	10	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	22	Commercial Schools - Large	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	22	C/I Manufacturing - NEC	Wind Turbine	None	10	24	0
Fuel Cell, Bio-Gas fuel, 250 kW, 50 CF, 50 WHF	23	C/I Sewerage Systems	Fuel Cell	Bio-Gas	250	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	23	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	23	Commercial Retail - Medium	Micro-Turbine	Nat. Gas	60	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	23	Commercial Retail - Large	Micro-Turbine	Nat. Gas	60	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	23	Commercial Retail - Medium	Micro-Turbine	Nat. Gas	75	50	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	23	Commercial Schools - Large	Micro-Turbine	Nat. Gas	75	90	50
Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	23	C/I Manufacturing - NEC	Stirling Engine	Nat. Gas	52	50	50
Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	23	Commercial Retail - Large	Stirling Engine	Nat. Gas	52	90	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	23	C/I Sewerage Systems	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	23	C/I Warehouse - Large	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	23	C/I Manufacturing - Large	Wind Turbine	None	1	24	0
Fuel Cell, Nat. Gas fuel, 250 kW, 90 CF, 50 WHF	24	Commercial Health Care - Large	Fuel Cell	Nat. Gas	250	90	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	24	Commercial Retail - Large	Micro-Turbine	Nat. Gas	75	90	50
Reciprocating Engine, Diesel fuel, 68 kW, 50 CF, 50 WHF	24	C/I Wholesale Trade - Medium	Reciprocating Engine	Diesel	68	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	24	Commercial Services - Medium	Wind Turbine	None	1	24	0
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	24	Government - Large	Wind Turbine	None	1	24	0
Micro-Turbine, Nat. Gas fuel, 60 kW, 50 CF, 50 WHF	25	Commercial Schools - Medium	Micro-Turbine	Nat. Gas	60	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	25	C/I Wholesale Trade - Small	Reciprocating Engine	Nat. Gas	10	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	25	Commercial Services - Large	Wind Turbine	None	1	24	0
Fuel Cell, Bio-Gas fuel, 200 kW, 50 CF, 50 WHF	26	C/I Sewerage Systems	Fuel Cell	Bio-Gas	200	50	50
Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	26	C/I Warehouse - Large	Micro-Turbine	Nat. Gas	60	90	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	26	Commercial Assembly - Large	Reciprocating Engine	Nat. Gas	10	50	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	26	Commercial Assembly - Small	Solar PV	None	1	33	0
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	26	Commercial Schools - Large	Stirling Engine	Nat. Gas	25	50	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	27	Commercial Retail - Large	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	27	Commercial Services - Large	Micro-Turbine	Nat. Gas	75	90	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	27	Residential - Electric Heat	Solar PV	None	1	33	0
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	27	Residential - Gas Heat	Solar PV	None	1	33	0
Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	27	C/I Manufacturing - NEC	Stirling Engine	Nat. Gas	25	50	50
Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	27	C/I Manufacturing - NEC	Wind Turbine	None	1	24	0
Fuel Cell, Nat. Gas fuel, 200 kW, 90 CF, 50 WHF	28	Commercial Health Care - Large	Fuel Cell	Nat. Gas	200	90	50
Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	28	C/I Manufacturing - Medium	Micro-Turbine	Nat. Gas	30	90	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	28	Commercial Retail - Large	Micro-Turbine	Nat. Gas	45	50	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	28	Commercial Schools - Small	Solar PV	None	1	33	0
Micro-Turbine, Nat. Gas fuel, 30 kW, 50 CF, 50 WHF	29	Commercial Retail - Medium	Micro-Turbine	Nat. Gas	30	50	50
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	29	Commercial Retail - Medium	Micro-Turbine	Nat. Gas	45	50	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	29	Commercial Retail - Small	Solar PV	None	1	33	0
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	29	C/I Wholesale Trade - Small	Solar PV	None	1	33	0
Micro-Turbine, Nat. Gas fuel, 45 kW, 50 CF, 50 WHF	30	Commercial Health Care - Large	Micro-Turbine	Nat. Gas	45	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	30	Commercial Hotel / Motel - Gas Heat	Reciprocating Engine	Nat. Gas	10	50	50
Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	30	Commercial Schools - Small	Reciprocating Engine	Nat. Gas	10	50	50
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	30	Commercial Assembly - Large	Solar PV	None	1	33	0
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	30	Commercial Office	Solar PV	None	1	33	0
Solar PV, None fuel, 1 kW, 33 CF, 0 WHF	30	C/I Warehouse - Small	Solar PV	None	1	33	0

ATTACHMENT 2A

ECONOMIC POTENTIAL - 5 YEAR PAYBACK OR BETTER (10%, 25% and 100%)

Assumptions:

- Only those applications for technologies showing paybacks of 5 years or less are considered viable
- Load shapes used for "Typical Customers" serves as proxy load shape for entire customer group
- The viable DG units identified from each customer group will be assumed installed equally over the group (i.e., for a customer sub-group where 3 unit types have paybacks all 5 years or less, kW is estimated by assuming 1/3 from each unit type)
- # of customers for each "Typical" customer group are from load shape data provided by Alliant and correspond to Billing Premises.
- Due to capital-intensive nature of DG investments (& divergence from customer's key business line), only 10% of those meeting above criteria are estimated as likely to be installed, however, 10%, 25% & 100% are presented
- Economic potential estimates will vary greatly depending on the assumptions used in the screening model to calculate simple payback (note: paybacks are calculated using numerous simplifying assumptions regarding utility rates, fuel costs, technology in

Customer Type/Sub-Group	Technology Configuration	Simple Payback (yrs)	# of Customers	Average Unit Size (kW)	Average Customer Group Load (kW)	Potential # of Units Installed	Total Installed Capacity (kW)	Economic Potential 10%	Economic Potential 25%	Economic Potential 100%	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Agriculture - Large	Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	4	5	51	170	3.4	850	85	213	850	Stirling Engine	Bio-Gas	52	90	50
Agriculture - Large	Micro-Turbine, Bio-Gas fuel, 75 kW, 90 CF, 50 WHF	5									Micro-Turbine	Bio-Gas	75	90	50
Agriculture - Large	Stirling Engine, Bio-Gas fuel, 25 kW, 90 CF, 50 WHF	5									Stirling Engine	Bio-Gas	25	90	50
Agriculture - Small	fuel, kW, CF, WHF	None	15	-	37	-	-	-	-	-					
C/I Manufacturing - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	14	660	963	1.5	13,482	1,348	3,371	13,482	Wind Turbine	None	660	24	0
C/I Manufacturing - Medium	fuel, kW, CF, WHF	None	23	-	208	-	-	-	-	-					
C/I Manufacturing - NEC	fuel, kW, CF, WHF	None	5	-	10,354	-	-	-	-	-					
C/I Manufacturing - Small	fuel, kW, CF, WHF	None	76	-	56	-	-	-	-	-					
C/I Sewerage Systems	Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	5	2	52	241	4.6	482	48	121	482	Stirling Engine	Bio-Gas	52	90	50
C/I Warehouse - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	1	660	946	1.4	946	95	237	946	Wind Turbine	None	660	24	0
C/I Warehouse - Small	fuel, kW, CF, WHF	None	6	-	10	-	-	-	-	-					
C/I Wholesale Trade - Large	fuel, kW, CF, WHF	None	5	-	540	-	-	-	-	-					
C/I Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	3	23	65	750	11.5	17,250	1,725	4,313	17,250	Stirling Engine	Nat. Gas	25	90	50
C/I Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	3									Stirling Engine	Nat. Gas	52	90	50
C/I Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	4									Micro-Turbine	Nat. Gas	30	90	50
C/I Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	4									Micro-Turbine	Nat. Gas	45	90	50
C/I Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	4									Micro-Turbine	Nat. Gas	60	90	50
C/I Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	4									Reciprocating Engine	Nat. Gas	10	90	50
C/I Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 61 kW, 90 CF, 50 WHF	4									Reciprocating Engine	Nat. Gas	61	90	50
C/I Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	5									Stirling Engine	Nat. Gas	52	50	50
C/I Wholesale Trade - Medium	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	5									Wind Turbine	None	250	24	0
C/I Wholesale Trade - Small	fuel, kW, CF, WHF	None	64	-	41	-	-	-	-	-					
Commercial Assembly - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	5	7	25	152	6.1	1,054	106	266	1,054	Stirling Engine	Nat. Gas	25	90	50
Commercial Assembly - Small	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	10	17	30	39	1.3	663	66	166	663	Wind Turbine	None	30	24	0
Commercial Health Care - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	4	660	1,880	2.8	7,520	752	1,880	7,520	Wind Turbine	None	660	24	0
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	4	13	43	127	3.0	1,651	165	413	1,651	Stirling Engine	Nat. Gas	25	90	50
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	5									Stirling Engine	Nat. Gas	52	50	50
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	5									Stirling Engine	Nat. Gas	52	90	50
Commercial Health Care - Small	fuel, kW, CF, WHF	None	19	-	15	-	-	-	-	-					
Commercial Hotel / Motel - All Electric	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	5	3	25	189	7.6	567	57	142	567	Stirling Engine	Nat. Gas	25	90	50
Commercial Hotel / Motel - Gas Heat	fuel, kW, CF, WHF	None	5	-	114	-	-	-	-	-					
Commercial Housing	Fuel Cell, Nat. Gas fuel, 200 kW, 90 CF, 50 WHF	4	7	225	180	0.8	1,260	126	315	1,260	Fuel Cell	Nat. Gas	200	90	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 250 kW, 90 CF, 50 WHF	4									Fuel Cell	Nat. Gas	250	90	50
Commercial Office	fuel, kW, CF, WHF	None		-	15	-	-	-	-	-					
Commercial Retail - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	12	660	414	0.6	4,968	497	1,242	4,968	Wind Turbine	None	660	24	0
Commercial Retail - Medium	fuel, kW, CF, WHF	None	32	-	76	-	-	-	-	-					
Commercial Retail - Small	fuel, kW, CF, WHF	None	43	-	18	-	-	-	-	-					
Commercial Schools - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	2	660	966	1.5	1,932	193	483	1,932	Wind Turbine	None	660	24	0
Commercial Schools - Medium	fuel, kW, CF, WHF	None	11	-	184	-	-	-	-	-					
Commercial Schools - Small	fuel, kW, CF, WHF	None	73	-	111	-	-	-	-	-					
Commercial Services - Large	fuel, kW, CF, WHF	None	4	-	1,494	-	-	-	-	-					
Commercial Services - Medium	fuel, kW, CF, WHF	None	9	-	113	-	-	-	-	-					
Commercial Services - Small	fuel, kW, CF, WHF	None	52	-	-	-	-	-	-	-					
Government - Large	fuel, kW, CF, WHF	None	6	-	114	-	-	-	-	-					
Government - Medium	fuel, kW, CF, WHF	None	21	-	52	-	-	-	-	-					
Government - Small	fuel, kW, CF, WHF	None	66	-	-	-	-	-	-	-					
Residential - Electric Heat	fuel, kW, CF, WHF	None		-	-	-	-	-	-	-					
Residential - Gas Heat	fuel, kW, CF, WHF	None		-	-	-	-	-	-	-					

5 Yr. Total Economic Potential (kW):	10%	25%	100%
	5,264	13,159	52,635

ATTACHMENT 2B

ECONOMIC POTENTIAL - 10 YEAR PAYBACK OR BETTER (10%, 25% and 100%)

Assumptions:
 - Only those applications for technologies showing paybacks of 10 years or less considered viable
 - Load shapes used for "Typical Customers" serves as proxy load shape for entire customer group
 - The viable DG units identified from each customer group will be assumed installed equally over the group (i.e., for a customer sub-group where 3 unit types have paybacks all equal to or less than 10 years, kW is estimated by assuming 1/3 from each unit type)
 - If of customers for each "Typical" customer group are from load shape data provided by Affiant and correspond to Billing Promises
 - Due to capital-intensive nature of DG investments (& divergence from customer's key business line), only 10% of those meeting above criteria are estimated as likely to be installed, however, 10%, 25% & 100% are presented
 - Economic potential estimates will vary greatly depending on the assumptions used in the screening model to calculate simple payback (note: paybacks are calculated using numerous simplifying assumptions regarding utility rates, fuel costs, technology installation costs, etc.)

Customer Type/Sub-Group	Technology Configuration	Simple Payback (yrs)	# of Customers	Average Unit Size (kW)	Average Customer Group Load (kW)	Potential # of Units Installed	TOTAL Installed Capacity (kW)	Economic Potential 10%	Economic Potential 25%	Economic Potential 100%	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Agriculture - Large	Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	4	5	72	170	2.4	850	85	213	850	Stirling Engine	Bio-Gas	52	90	50
Agriculture - Large	Micro-Turbine, Bio-Gas fuel, 75 kW, 90 CF, 50 WHF	5									Micro-Turbine	Bio-Gas	75	90	50
Agriculture - Large	Stirling Engine, Bio-Gas fuel, 25 kW, 90 CF, 50 WHF	5									Stirling Engine	Bio-Gas	25	90	50
Agriculture - Large	Micro-Turbine, Bio-Gas fuel, 45 kW, 90 CF, 50 WHF	6									Micro-Turbine	Bio-Gas	45	90	50
Agriculture - Large	Micro-Turbine, Bio-Gas fuel, 60 kW, 90 CF, 50 WHF	6									Micro-Turbine	Bio-Gas	60	90	50
Agriculture - Large	Micro-Turbine, Bio-Gas fuel, 30 kW, 90 CF, 50 WHF	7									Micro-Turbine	Bio-Gas	30	90	50
Agriculture - Large	Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	7									Stirling Engine	Bio-Gas	52	90	50
Agriculture - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8									Wind Turbine	None	250	24	0
Agriculture - Large	Micro-Turbine, Bio-Gas fuel, 75 kW, 90 CF, 50 WHF	8									Micro-Turbine	Bio-Gas	75	90	50
Agriculture - Large	Stirling Engine, Bio-Gas fuel, 25 kW, 90 CF, 50 WHF	9									Stirling Engine	Bio-Gas	25	90	50
Agriculture - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10									Wind Turbine	None	100	24	0
Agriculture - Small	None with 10 yr or better payback	None	15	-	-	37	-	-	-	-	-	-	-	-	-
CI Manufacturing - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	5	14	247	963	3.9	13,482	1,348	3,371	13,482	Wind Turbine	None	650	24	0
CI Manufacturing - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	8									Stirling Engine	Nat. Gas	52	90	50
CI Manufacturing - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	9									Stirling Engine	Nat. Gas	25	90	50
CI Manufacturing - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9									Wind Turbine	None	250	24	0
CI Manufacturing - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10	23	100	298	3.0	6,854	685	1,714	6,854	Wind Turbine	None	100	24	0
CI Manufacturing - NEC	Wind Turbine, None fuel, 600 kW, 24 CF, 0 WHF	6	5	330	10,354	31.4	51,770	5,177	12,943	51,770	Wind Turbine	None	600	24	0
CI Manufacturing - NEC	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	10									Wind Turbine	None	250	24	0
CI Manufacturing - Small	None with 10 yr or better payback	None	76	-	-	56	-	-	-	-	-	-	-	-	-
CI Sewerage Systems	Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	5	2	74	241	3.3	482	48	121	482	Stirling Engine	Bio-Gas	52	90	50
CI Sewerage Systems	Micro-Turbine, Bio-Gas fuel, 75 kW, 90 CF, 50 WHF	6									Micro-Turbine	Bio-Gas	75	90	50
CI Sewerage Systems	Stirling Engine, Bio-Gas fuel, 25 kW, 90 CF, 50 WHF	6									Stirling Engine	Bio-Gas	25	90	50
CI Sewerage Systems	Micro-Turbine, Bio-Gas fuel, 45 kW, 90 CF, 50 WHF	7									Micro-Turbine	Bio-Gas	45	90	50
CI Sewerage Systems	Micro-Turbine, Bio-Gas fuel, 60 kW, 90 CF, 50 WHF	7									Micro-Turbine	Bio-Gas	60	90	50
CI Sewerage Systems	Micro-Turbine, Bio-Gas fuel, 30 kW, 90 CF, 50 WHF	8									Micro-Turbine	Bio-Gas	30	90	50
CI Sewerage Systems	Stirling Engine, Bio-Gas fuel, 52 kW, 90 CF, 50 WHF	9									Stirling Engine	Bio-Gas	52	90	50
CI Sewerage Systems	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9									Wind Turbine	None	250	24	0
CI Warehouse - Large	Wind Turbine, None fuel, 600 kW, 24 CF, 0 WHF	6	1	247	946	3.8	946	95	237	946	Wind Turbine	None	600	24	0
CI Warehouse - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	8									Stirling Engine	Nat. Gas	52	90	50
CI Warehouse - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	9									Stirling Engine	Nat. Gas	25	90	50
CI Warehouse - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9									Wind Turbine	None	250	24	0
CI Warehouse - Small	None with 10 yr or better payback	None	6	-	-	10	-	-	-	-	-	-	-	-	-
CI Wholesale Trade - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	6	5	75	540	7.2	2,700	270	675	2,700	Stirling Engine	Nat. Gas	25	90	50
CI Wholesale Trade - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	7									Wind Turbine	None	250	24	0
CI Wholesale Trade - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8									Wind Turbine	None	100	24	0
CI Wholesale Trade - Large	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	10									Micro-Turbine	Nat. Gas	30	90	50
CI Wholesale Trade - Large	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	10									Micro-Turbine	Nat. Gas	45	90	50
CI Wholesale Trade - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	10									Stirling Engine	Nat. Gas	25	90	50
CI Wholesale Trade - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	10									Stirling Engine	Nat. Gas	52	90	50
CI Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	3	23	51	700	14.7	17,250	1,725	4,313	17,250	Stirling Engine	Nat. Gas	25	90	50
CI Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	3									Stirling Engine	Nat. Gas	52	90	50
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	4									Micro-Turbine	Nat. Gas	30	90	50
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	4									Micro-Turbine	Nat. Gas	45	90	50
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	4									Micro-Turbine	Nat. Gas	60	90	50
CI Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	4									Reciprocating Engine	Nat. Gas	10	90	50
CI Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 61 kW, 90 CF, 50 WHF	4									Reciprocating Engine	Nat. Gas	61	90	50
CI Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	5									Stirling Engine	Nat. Gas	52	90	50
CI Wholesale Trade - Medium	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	5									Wind Turbine	None	250	24	0
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	6									Micro-Turbine	Nat. Gas	75	90	50
CI Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 27 kW, 90 CF, 50 WHF	6									Reciprocating Engine	Nat. Gas	27	90	50
CI Wholesale Trade - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	6									Stirling Engine	Nat. Gas	25	90	50
CI Wholesale Trade - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	7									Wind Turbine	None	100	24	0
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 60 kW, 90 CF, 50 WHF	7									Micro-Turbine	Nat. Gas	60	90	50
CI Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 10 kW, 90 CF, 50 WHF	7									Reciprocating Engine	Nat. Gas	10	90	50
CI Wholesale Trade - Medium	Reciprocating Engine, Nat. Gas fuel, 61 kW, 90 CF, 50 WHF	7									Reciprocating Engine	Nat. Gas	61	90	50
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	8									Micro-Turbine	Nat. Gas	30	90	50
CI Wholesale Trade - Medium	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	8									Micro-Turbine	Nat. Gas	45	90	50
CI Wholesale Trade - Medium	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	9									Wind Turbine	None	30	24	0
CI Wholesale Trade - Medium	Reciprocating Engine, Diesel fuel, 11 kW, 90 CF, 50 WHF	10									Reciprocating Engine	Diesel	11	90	50
CI Wholesale Trade - Medium	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	10									Wind Turbine	None	10	24	0
CI Wholesale Trade - Small	None with 10 yr or better payback	None	64	-	-	41	-	-	-	-	-	-	-	-	-
Commercial Assembly - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	8	7	46	152	3.3	1,064	106	266	1,064	Stirling Engine	Nat. Gas	25	90	50
Commercial Assembly - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	8									Stirling Engine	Nat. Gas	52	90	50
Commercial Assembly - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8									Wind Turbine	None	100	24	0
Commercial Assembly - Large	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	9									Micro-Turbine	Nat. Gas	30	90	50
Commercial Assembly - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	10									Stirling Engine	Nat. Gas	25	90	50
Commercial Assembly - Small	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	10	17	30	39	1.3	663	66	166	663	Wind Turbine	None	30	24	0
Commercial Health Care - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	4	249	1,880	7.6	7,520	752	1,880	7,520	Wind Turbine	None	660	24	0
Commercial Health Care - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	6									Stirling Engine	Nat. Gas	52	90	50
Commercial Health Care - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	6									Stirling Engine	Nat. Gas	25	90	50
Commercial Health Care - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	7									Wind Turbine	None	250	24	0
Commercial Health Care - Large	Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	9									Micro-Turbine	Nat. Gas	75	90	50
Commercial Health Care - Large	Reciprocating Engine, Nat. Gas fuel, 770 kW, 90 CF, 50 WHF	9									Reciprocating Engine	Nat. Gas	770	90	50
Commercial Health Care - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9									Wind Turbine	None	100	24	0
Commercial Health Care - Large	Reciprocating Engine, Nat. Gas fuel, 255 kW, 90 CF, 50 WHF	9									Reciprocating Engine	Nat. Gas	255	90	50
Commercial Health Care - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	10									Stirling Engine	Nat. Gas	52	90	50
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	4	13	46	127	2.8	1,651	165	413	1,651	Stirling Engine	Nat. Gas	25	90	50
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	5									Stirling Engine	Nat. Gas	52	90	50
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7									Stirling Engine	Nat. Gas	25	90	50
Commercial Health Care - Medium	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	7									Micro-Turbine	Nat. Gas	30	90	50
Commercial Health Care - Medium	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	7									Micro-Turbine	Nat. Gas	45	90	50

ATTACHMENT 2B

ECONOMIC POTENTIAL - 10 YEAR PAYBACK OR BETTER (10%, 25% and 100%)

Assumptions:

- Only those applications for technologies showing paybacks of 10 years or less considered viable
- Load shapes used for "Typical Customers" serves as proxy load shape for entire customer group
- The viable DG units identified from each customer group will be assumed installed equally over the group (i.e., for a customer sub-group where 3 unit types have paybacks all equal to or less than 10 years, kW is estimated by assuming 1/3 from each unit type)
- # of customers for each "typical" customer group are from load shape data provided by Alliant and correspond to Billing Premises.
- Due to capital-intensive nature of DG investments (& divergence from customer's key business line), only 10% of those meeting above criteria are estimated as likely to be installed, however, 10%, 25% & 100% are presented
- Economic potential estimates will vary greatly depending on the assumptions used in the screening model to calculate simple payback (note: paybacks are calculated using numerous simplifying assumptions regarding utility rates, fuel costs, technology installation costs, etc.)

Customer Type/Sub-Group	Technology Configuration	Simple Payback (yrs)	# of Customers	Average Unit Size (kW)	Average Customer Group Load (kW)	Potential # of Units Installed	Total Installed Capacity (kW)	Economic Potential 10%	Economic Potential 25%	Economic Potential 100%	Technology	Fuel	Capacity	Capacity Factor	Waste Heat Factor
Commercial Health Care - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	7									Stirling Engine	Nat. Gas	25	50	50
Commercial Health Care - Medium	Micro-Turbine, Nat. Gas fuel, 75 kW, 50 CF, 50 WHF	9									Micro-Turbine	Nat. Gas	75	50	50
Commercial Health Care - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9									Wind Turbine	None	100	24	0
Commercial Health Care - Medium	Reciprocating Engine, Nat. Gas fuel, 100 kW, 80 CF, 50 WHF	10									Reciprocating Engine	Nat. Gas	10	80	50
Commercial Health Care - Small	None with 10 yr or better payback	None	19			15									
Commercial Hotel / Motel - All Electric	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	5									Stirling Engine	Nat. Gas	25	90	50
Commercial Hotel / Motel - All Electric	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	8	3	46	189	4.1	567	57	142	567	Micro-Turbine	Nat. Gas	30	90	50
Commercial Hotel / Motel - All Electric	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	8									Stirling Engine	Nat. Gas	25	50	50
Commercial Hotel / Motel - All Electric	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	8									Stirling Engine	Nat. Gas	52	50	50
Commercial Hotel / Motel - All Electric	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9									Wind Turbine	None	100	24	0
Commercial Hotel / Motel - All Electric	Micro-Turbine, Nat. Gas fuel, 45 kW, 90 CF, 50 WHF	10									Micro-Turbine	Nat. Gas	45	90	50
Commercial Hotel / Motel - Gas Heat	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	8	5	50	114	2.3	570	57	143	570	Stirling Engine	Nat. Gas	25	50	50
Commercial Hotel / Motel - Gas Heat	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9									Wind Turbine	None	100	24	0
Commercial Hotel / Motel - Gas Heat	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	10									Stirling Engine	Nat. Gas	25	50	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 200 kW, 90 CF, 50 WHF	4	7	453	180	0.4	1,260	126	315	1,260	Fuel Cell	Nat. Gas	200	90	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 250 kW, 90 CF, 50 WHF	4									Fuel Cell	Nat. Gas	250	90	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 1000 kW, 50 CF, 50 WHF	6									Fuel Cell	Nat. Gas	1000	50	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 2000 kW, 50 CF, 50 WHF	6									Fuel Cell	Nat. Gas	2000	50	50
Commercial Housing	Stirling Engine, Nat. Gas fuel, 28 kW, 50 CF, 50 WHF	6									Stirling Engine	Nat. Gas	25	90	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 250 kW, 50 CF, 50 WHF	7									Fuel Cell	Nat. Gas	250	50	50
Commercial Housing	Fuel Cell, Nat. Gas fuel, 200 kW, 50 CF, 50 WHF	8									Fuel Cell	Nat. Gas	200	50	50
Commercial Housing	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	9									Stirling Engine	Nat. Gas	52	50	50
Commercial Housing	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9									Wind Turbine	None	100	24	0
Commercial Office	None with 10 yr or better payback	None				10									
Commercial Retail - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	12	288	414	1.6	4,968	497	1,242	4,968	Wind Turbine	None	660	24	0
Commercial Retail - Large	Stirling Engine, Nat. Gas fuel, 25 kW, 50 CF, 50 WHF	8									Stirling Engine	Nat. Gas	25	90	50
Commercial Retail - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8									Wind Turbine	None	250	24	0
Commercial Retail - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10									Wind Turbine	None	100	24	0
Commercial Retail - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	9	32	100	78	0.8	2,432	243	608	2,432	Wind Turbine	None	100	24	0
Commercial Retail - Small	None with 10 yr or better payback	None	43			18									
Commercial Schools - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	5	2	337	965	2.9	1,932	193	483	1,932	Wind Turbine	None	660	24	0
Commercial Schools - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8									Wind Turbine	None	250	24	0
Commercial Schools - Large	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10									Wind Turbine	None	100	24	0
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	6									Stirling Engine	Nat. Gas	25	90	50
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	11	62	184	2.0	2,024	202	506	2,024	Stirling Engine	Nat. Gas	25	90	50
Commercial Schools - Medium	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	8									Wind Turbine	None	250	24	0
Commercial Schools - Medium	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	10									Wind Turbine	None	100	24	0
Commercial Schools - Medium	Micro-Turbine, Nat. Gas fuel, 75 kW, 90 CF, 50 WHF	9									Micro-Turbine	Nat. Gas	75	90	50
Commercial Schools - Medium	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10									Stirling Engine	Nat. Gas	52	50	50
Commercial Schools - Small	Stirling Engine, Nat. Gas fuel, 25 kW, 90 CF, 50 WHF	7	73	52	111	2.1	8,103	810	2,026	8,103	Stirling Engine	Nat. Gas	25	90	50
Commercial Schools - Small	Wind Turbine, None fuel, 100 kW, 24 CF, 0 WHF	8									Wind Turbine	None	100	24	0
Commercial Schools - Small	Micro-Turbine, Nat. Gas fuel, 30 kW, 90 CF, 50 WHF	10									Micro-Turbine	Nat. Gas	30	90	50
Commercial Schools - Small	Stirling Engine, Nat. Gas fuel, 52 kW, 50 CF, 50 WHF	10									Stirling Engine	Nat. Gas	52	50	50
Commercial Services - Large	Wind Turbine, None fuel, 660 kW, 24 CF, 0 WHF	6	4	902	1,494	1.6	5,976	598	1,494	5,976	Wind Turbine	None	660	24	0
Commercial Services - Large	Stirling Engine, Nat. Gas fuel, 52 kW, 90 CF, 50 WHF	9									Stirling Engine	Nat. Gas	52	50	50
Commercial Services - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9									Wind Turbine	None	250	24	0
Commercial Services - Medium	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	9	250	113	0.5	1,017	102	254	1,017	Wind Turbine	None	250	24	0
Commercial Services - Small	None with 10 yr or better payback	None	52												
Government - Large	Wind Turbine, None fuel, 250 kW, 24 CF, 0 WHF	9	6	250	114	0.5	684	68	171	684	Wind Turbine	None	250	24	0
Government - Medium	None with 10 yr or better payback	None	21			52									
Government - Small	Reciprocating Engine, Nat. Gas fuel, 10 kW, 50 CF, 50 WHF	7	66	12							Reciprocating Engine	Nat. Gas	10	50	50
Government - Small	Wind Turbine, None fuel, 30 kW, 24 CF, 0 WHF	7									Wind Turbine	None	30	24	0
Government - Small	Reciprocating Engine, Diesel fuel, 11 kW, 50 CF, 50 WHF	8									Reciprocating Engine	Diesel	11	50	50
Government - Small	Wind Turbine, None fuel, 10 kW, 24 CF, 0 WHF	9									Wind Turbine	None	10	24	0
Government - Small	Wind Turbine, None fuel, 1 kW, 24 CF, 0 WHF	10									Wind Turbine	None	1	24	0
Residential - Electric Heat	None with 10 yr or better payback	None													
Residential - Gas Heat	None with 10 yr or better payback	None													

	10%	25%	100%
10 Year Total Economic Potential (kW)	13,477	33,691	134,785

APPENDIX 4E

Distributed Generation Assessment – Update Minnesota

February 13, 2009

Prepared by:

GDS Associates, Inc.

February 13, 2009

Mr. Doug Litwiller, P.E., CEM
Alliant Energy
1284 XE Place
Ames, IA 50014

Subject: **Distributed Generation Assessment – Update
Minnesota**

Dear Mr. Litwiller,

As requested, GDS Associates, Inc. (GDS) has reviewed our 2003 report entitled *Distributed/Onsite Generation Options Identification and Assessment Project (Minnesota)*. The purpose of the review was to identify potential areas where performing updates to the previous model would be beneficial, and to develop a proposed scope of work for implementing those updates and reissuing the findings.

Specifically, GDS reviewed current fuel costs, available distributed generation (DG) equipment and costs, and state and federal incentives, and performed a high level evaluation of several additional technologies. Results from our review are presented below, followed by a summary of the areas where updates would be beneficial, and a work plan is presented for incorporating the updates and reissuing a current report.

I. RESULTS FROM REVIEW

Based on our review, the installed cost of several distributed generation technologies has increased since the 2003 evaluation. The cost increases are associated with updated information from vendors and based on actual cost expenditures from recently completed projects. Table 1 summarizes changes to installed costs from the 2003 evaluation.

Table 1: Changes to Installed Costs of Previously Included Technologies

DG Technology	2003 Installed Cost Estimate (\$/kW)	2009 Installed Cost Estimate (\$/kW)	% Variation from 2003 Model
Gas Fueled Fuel Cell (Natural Gas and Biogas) - 200 kW	\$5,500	\$6,000	109%
Wind Turbine - 1 kW	\$3,500	\$7,500	214%
Wind Turbine - 10 kW	\$3,000	\$6,200	207%
Wind Turbine - 30 kW	\$2,500	\$3,050	122%
Wind Turbine - 100 kW	\$1,750	\$5,400	309%
Wind Turbine - 250 kW	\$1,500	\$2,600	173%
Wind Turbine - 660 kW	\$1,100	\$1,200	109%

New distributed generation technologies and models were also evaluated. Table 2 summarizes the new technologies and identifies key performance characteristics. A more in-depth discussion of the new technologies is provided in Section II below.

Table 2: New DG Technologies

DG Technology	Electrical Output (kW)	Variable O&M Costs (\$/kWh)	Installed Cost Estimate (\$/kW)
Wind Turbine	50	\$0.025	\$2,600
Wind Turbine	1,500	\$0.005	\$2,600
Wind Turbine	1,800	\$0.005	\$1,667
Solar Energy	2	\$0.001	\$9,750
Solar Energy	4	\$0.001	\$9,400
Solar Energy	8	\$0.001	\$10,674
Solar Energy	32	\$0.001	\$9,356
Solar Energy	50	\$0.001	\$14,016
Solar Energy	200	\$0.001	\$9,400
Biomass with CHP	0	\$0.008	\$600
Biomass with CHP	50	\$0.008	\$4,000
Combustion Turbine	2,000-22,000	-	-
Concentrated Solar	3	-	-

The cost of fuel (diesel, biodiesel, and natural gas) has changed significantly since the 2003 model evaluation. Table 3 summarizes the fuel costs utilized in the 2003 model compared to current fuel costs.

Table 3: Fuel Cost Comparison

Fuel Type	2003 Cost Estimate	2009 Cost Estimate	% Variation from 2003 Model
Diesel (\$/gal)	\$1.070	\$2.315	216%
Bio-Diesel (\$/gal)	\$1.320	\$2.894	219%
Natural Gas (\$/therm)	\$0.502	\$0.878	175%

State and federal incentives were also reviewed and are discussed in detail in Section II. There have been key changes to some incentives that will affect the fiscal viability of some projects, including several incentives that have either been terminated or whose funding has been fully allocated.

A summary table of the customer data profiles utilized in the 2003 model is included as Attachment 1 to this report. We recommend that the customer profiles be reviewed by Alliant to determine whether any significant demographic or energy usage changes have occurred that would require the customer sectors and associated energy usage profiles to be updated during Phase II implementation.

II. AREAS WHERE UPDATES WOULD BE BENEFICIAL

Updated Assumptions and Associated Changes to 2003 Model

Required modifications from the 2003 model can be broadly categorized into one of three groups; scope and cost of DG equipment, state and federal incentives, and fuel costs. Changes from the 2003 model in each of these groupings are discussed below.

Scope and Cost of Distributed Generation Equipment

The installed cost per kW of generating capacity of wind turbines has changed since the 2003 report based on recent manufacturers cost quotations and review of actual project costs. In some cases, the cost per kW increased by >100%. In addition, new wind turbine manufacturers and products have surfaced in the marketplace. Wind turbines capable of producing electrical outputs of 50 kW, 1,500 kW and 1,800 kW are available and have been incorporated into more recent DG evaluation models. The maximum generating capacity reviewed for wind turbines in the 2003 model was 660 kW.

Available solar PV generating technology has expanded since the 2003 model to include equipment with electrical output capacities of 2 to 8 kW, 32 kW, 50 kW, and 200 kW. The previous model considered only a solar PV product with an electric output capacity of 1 kW. It may be beneficial to include these additional solar PV technologies in an updated distributed generation model. The costs for solar has also been update to current prices. The price for installed solar PV has risen slightly since 2003. The global demand for solar PV has been strong over the past few years.

The total installed cost of the 200 kW gas fueled fuel cell increased by approximately \$100,000 based on discussions with a product manufacturer. The total increase is approximately 9% higher than assumed in the 2003 model.

The 2003 model evaluated natural gas fueled micro turbines with electrical output capacities up to 2 MW. Solar Turbines Incorporated¹, a subsidiary of Caterpillar, produces gas fueled turbines up to 22 MW in generating capacity. Installation and maintenance costs and load characteristics for the larger capacity turbines should be developed and input into the model to determine the effectiveness of these larger capacity gas fueled turbines.

State and Federal Incentives

The area of incentives offered for renewable power generation is the most changed since 2003 and may affect the fiscal viability of some DG and CHP projects. Incentives that have changed significantly since the 2003 evaluation are discussed below. Additional incentives related to renewable generation may also occur as part of the proposed federal stimulus package in Q1 of 2009. Although this language is not yet finalized, GDS is tracking the legislation closely and should be capable of incorporating any future changes into an updated model.

¹ <http://mysolar.cat.com/cda/layout?m=6637&x=7>

The federal Business Energy Tax Credit program² was expanded significantly by the Energy Improvement and Extension Act of 2008. The new law extended the duration -- by eight years -- of the existing credits for solar energy, fuel cells and micro turbines; increased the credit amount for fuel cells; established new credits for small wind-energy systems, geothermal heat pumps, and combined heat and power (CHP) systems; extended eligibility for the credits to utilities; and allowed taxpayers to take the credit against the alternative minimum tax (AMT), subject to certain limitations. Key changes to the Business Energy Tax Credit Program include the following.

- Solar generation credit expanded to 30% of total expenditure, with no maximum
- Fuel cell credit expanded to 30% with no maximum. Credit based on \$1,500 per 0.5 kW generation
- Small wind (up to 100 MW) credit up to 30% of expenditures, or \$4,000, whichever is less.
- Micro turbines (up to 2 MW) credit up to 10% of expenditures, with no maximum. Credit based on \$200 per kW generated
- CHP, credit up to 10% of expenditures with no maximum. Applies to generators up to 50 MW with minimum 60% efficiency

The PV Solar Rebate program offered by the Minnesota Department of Commerce is still active, however all funds have been reserved as of the date of this review. New applications are being placed on a waiting list. This is a change from the 2003 evaluation that considered an incentive of \$2,000 per kW generated up to a maximum of \$8,000 per project under this program.

The Renewable Energy Production Incentive (REPI)³ funded by the U.S. Department of Energy has been extended through 2026 and expanded to include bio-gas and hydrogen fuel cells. The REPI program and the Energy Production Tax Credit (IRS) are both indexed for inflation, meaning that the incentive rate per kWh for both has increased since the 2003 evaluation. The 2003 model was based on incentives of 15 cents per kWh (\$0.15/kWh) for each program whereas the current incentives offered are approximately 21 cents per kWh (\$0.21/kWh) to account for inflation.

The 2003 Climate Change Fuel Cell Buy Down Program that was considered in the 2003 evaluation is no longer active and should be removed from an updated model. A new incentive that may be available and that was not included in the 2003 model is the Mainstay Energy Awards program. Mainstay Energy is a private company offering customers who install renewable energy systems the opportunity to sell the renewable energy credits (REC's) and receive a one-time payment for five years worth of credits.

² http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US33F&State=federal¤tpageid=1&ce=1&re=1

³ http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US33F&State=federal¤tpageid=1&ce=1&re=1

Cumulatively, changes to the incentive programs discussed above will impact the cost effectiveness and paybacks of the distributed generation technologies evaluated.

Fuel Costs

The cost of fuel has risen drastically since 2003; these changes will have a significant impact on the results of the model. The current cost of diesel in Minnesota is \$2.315 per gallon⁴. This represents a 116% increase in price from the costs used in the 2003 model. The cost of biodiesel has risen at a similar rate. The cost per therm of natural gas has increased to an average of \$0.878/therm⁵ in November 2008 as reported by the Energy Information Administration (EIA). This represents an increase of 75% above the costs used in the 2003 model. Based on these price increases since 2003, it would be prudent to update the current fuel prices in a new model.

New Technologies

GDS reviewed several distributed generation technologies that were not included in the 2003 report and one technology (concentrated solar power) that was included in the 2003 evaluation but was not commercially available at the time. Each of the new technologies considered are discussed below.

Biomass CHP

Biomass combined heat and power generation can offer potential to certain customers. System capacity factors can often be quite high, over 90% in cases where there is a need for year round waste heat. Based on these conditions, woodchip-fired combined heat and power systems could provide excellent benefits to end-use customers from both an operating cost and environmental perspective (including the potential for lowering greenhouse gas emissions). Biomass gasification equipment would likely achieve the highest efficiency levels and lowest greenhouse gas emissions as compared to burner box type units.

Based on previous studies conducted by GDS, the typical installed cost of biomass CHP systems is on the order of \$4,000 per kW, with a heat rate of 10,000 Btu per kWh. The maintenance costs were estimated at \$0.0075 per kWh based on vendor input. Modeling used in the previous studies showed a simple payback of less than 10 years for applications where customers might have year round heating needs.

Currently, except for RPS renewable energy credits, there are no well defined incentive programs available to encourage increased development of biomass-fueled electric generation facilities. The USDA does offer several potentially helpful programs, but each would need to be assessed carefully to determine applicability and eligibility for projects that might be considered for development.

⁴ AAA website, www.fuelgaugereport.com

⁵ EIA website, http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SMN_m.htm

Biogas CHP

Quantifying the performance of biogas CHP systems will require further evaluation if so desired for an updated model. GDS was able to procure general cost information on one recently installed biogas CHP system that was installed at the University of New Hampshire (UNH). The UNH project consisted of a 4.6 MW Solar Turbine connected to a biogas processing plant. The total installed cost of the turbine alone was approximately \$6.1 Million representing a cost of nearly \$1,350 per kW.

When a low- or no-cost fuel source exists, or in situations where there is a year-round heating demand (process or absorption chilling), then biogas CHP systems have the potential for financial viability. With fossil-fuel costs rising, these types of systems are becoming more cost-effective.

Combustion Turbines

Combustion turbines are most likely to have financial viability in applications where large year-round system or process heating demands are present. These applications typically exist within large commercial or industrial buildings and large institutional campus settings. For the large commercial building and institutional campus systems, absorption chilling is often an integral part of the on-site demand and can help to keep paybacks within a cost-effective range (approximately 5 to 10 years).

Concentrated Solar Power

Concentrated solar power technology was identified in the 2001 and 2003 reports but was not commercially available at that time. It is our understanding that at least one manufacturer, Infinia Corporation⁶, has developed a concentrated solar product capable of producing up to 3 kW of AC energy. Commercial production of the products was launched in late 2008 and retail units are expected to be available mid-late 2009. Further research into the cost and capability of these units is required; however it may be worth including this technology in an updated model.

III. PROPOSED WORK PLAN FOR A RIGOROUS ANALYSIS:

GDS has developed a work plan to incorporate the changes discussed above and to issue the findings in an updated distributed generation assessment report. Each proposed task and an estimate for the number of hours to complete are provided below. Attached to this letter is a labor matrix that identifies the cost for each task based on allotted hours and billable rates.

- **Task 1: Additional Secondary Research**
 - Review and update the distributed generation technologies and key performance/cost input information for use in the assessment tool.

⁶ <http://www.infiniacorp.com/main.php>

- (Optional) Review new technologies including biomass CHP, biogas CHP and large combustion turbines and identify performance/cost information for use in the assessment tool.
- Review the existing Company-specific information from previous projects with Alliant staff to verify that there has been no major changes to the key customer sectors (i.e., number, and associated loads shapes of industrial, small and large commercial, residential, and agricultural customers, and relevant subcategories including manufacturing, hospitals, schools, office, retail, etc.) since 2003.
- **Task 2: Revisions to Existing Screening Model**
 - Review and update the existing model as necessary. Updates may include revisions to technology assumptions, incentive amendments, use of current fuel costs, and/or changes to the Alliant load profiles and related demographics.
 - Updates to the Model Documentation Development – revise as necessary user notes explaining functionality, presenting instructions for model use, identifying any limitations and requirements for more detailed analysis.
- **Task 3: Customer Group Screening / Prioritization & Economic Potential**
 - Utilize the screening model to determine on-site generation potential for various customer groups then scale results using customer profiles (based on generic & sector-specific inputs collected in Task 1). Initial screen of 5 sectors (industrial, small commercial, large commercial, residential, & agricultural). Additional analyses on potentially cost-effective buildings/business types within specific sector categories (i.e., hospitals, schools, manufacturing, retail, office).
 - Develop an estimate of the economic potential (potential loss of load) for all projects with a payback of ten years or less.
 - Develop summary of information, including prioritized list of opportunities, and present results.
 - Results will be presented in a way to help Alliant identify and target cost-effective technologies for marketing to specific customer sectors and building types.

Sincerely,

Scott Albert
Principal and Region Manager
GDS Associates, Inc.



Attachment 1

Customer Data Profiles – 2003 Model

DISTRIBUTED/ONSITE GENERATION SCREENING MODEL

Prepared by GDS Associates, Inc. for Alliant Energy Corporate Services, Inc. - June 2003

Data - Customer Profiles

Information provided by Alliant Energy Corporate Services, Inc.

Code	Customer Type	Rate Class	0.95		Peak kW Demand	Annual Therm Consumption	Annual Therms / Peak kw ratio
			Natural Gas Avg. Cost (\$/therm)	Electricity Avg. Cost (\$/kWh)			
1	Residential - Electric Heat	Residential	0.900	0.083	0	163	n/a
2	Residential - Gas Heat	Residential	0.900	0.083	0	1,068	n/a
3	Commercial Assembly - Large	Large Power & Lighting Rates	0.958	0.074	152	23,219	153
4	Commercial Assembly - Small	General Demand Metered	0.978	0.087	39	10,040	257
5	Commercial Health Care - Large	Large Power & Lighting Rates	0.612	0.062	1,880	337,344	179
6	Commercial Health Care - Medium	Large Power & Lighting Rates	0.965	0.066	127	20,865	164
7	Commercial Health Care - Small	General Demand Metered	0.950	0.069	15	2,578	172
8	Commercial Hotel/Motel - All Elec	Large Power & Lighting Rates	0.950	0.060	189	14,697	78
9	Commercial Hotel/Motel - Gas	General Demand Metered	0.898	0.064	114	8,865	78
10	Commercial Housing - Aprtmnt Bldgs	Large Power & Lighting Rates	0.944	0.068	180	30,374	169
11	Commercial Office	General Demand Metered	1.213	0.071	15	361	24
12	Commercial Services - Large	Large Power & Lighting Rates	0.950	0.045	1,494	69,319	n/a
13	Commercial Services - Medium	Large Power & Lighting Rates	0.980	0.046	113	5,243	46
14	Commercial Services - Small	General	0.950	0.063	0	524	n/a
15	Commercial Retail - Large	Large Power & Lighting Rates	1.065	0.059	414	14,387	35
16	Commercial Retail - Medium	Large Power & Lighting Rates	0.950	0.061	76	12,450	n/a
17	Commercial Retail - Small	General Demand Metered	1.064	0.075	18	5,272	293
18	Commercial Schools - Large	Large Power & Lighting Rates	0.705	0.054	966	125,748	130
19	Commercial Schools - Medium	Large Power & Lighting Rates	0.950	0.060	184	40,232	n/a
20	Commercial Schools - Small	General Demand Metered	0.705	0.077	111	34,092	307
21	C/I Sewerage System	Large Power & Lighting Rates	0.950	0.049	241	0	n/a
22	C/I Warehouse - Large	Large Power & Lighting Rates	0.950	0.050	946	73,046	77
23	C/I Warehouse - Small	General Demand Metered	0.950	0.074	10	730	73
24	C/I Wholesale Trade - Large	Large Power & Lighting Rates	0.950	0.070	540	16,026	30
25	C/I Wholesale Trade - Medium	Large Power & Lighting Rates	0.950	0.108	750	22,258	30
26	C/I Wholesale Trade - Small	General Demand Metered	0.950	0.076	41	1,217	30
27	C/I Manufacturing - NEC	Large Power & Lighting Rates	0.950	0.039	10,354	307,277	30
28	C/I Manufacturing - Large	Large Power & Lighting Rates	0.977	0.049	963	38,586	40
29	C/I Manufacturing - Medium	Large Power & Lighting Rates	0.950	0.059	298	8,844	30
30	C/I Manufacturing - Small	Large Power & Lighting Rates	1.064	0.063	56	1,080	19
31	Agriculture - Large	Large Power & Lighting Rates	0.950	0.056	170	0	n/a
32	Agriculture - Small	Farm Rates	0.950	0.063	37	0	n/a
33	Government - Large	Large Power & Lighting Rates	0.950	0.046	114	2,744	24
34	Government - Medium	General Demand Metered	0.950	0.061	52	1,251	24
35	Government - Small	General	0.950	0.133	0	626	n/a

APPENDIX 4F

Distributed Generation Assessment – Update Minnesota

September 27, 2010

Prepared by:

GDS Associates, Inc.



GDS Associates, Inc.
 Engineers and Consultants

September 27, 2010

Mr. Brent Kitchen
 Alliant Energy
 1284 XE Place
 Ames, IA 50014

Subject: **Distributed Generation Assessment – 2010 Update
 Minnesota**

Dear Mr. Kitchen,

As requested, GDS Associates, Inc. (GDS) has reviewed our previous Distributed Generation Memo Report, prepared in 2009 to identify potential equipment and fuel cost assumptions that may have changed since the previous model update and new incentives and technologies that have become available. These findings are presented in the following sections.

I. SUMMARY OF KEY CHANGES SINCE 2003

Major changes that have occurred since the 2003 model update can be broadly categorized into one of three groups; fuel costs, state and federal incentives, and scope and cost of DG equipment.

Fuels costs are a key component of the model, as they have strong influence on the estimated savings calculations and cost-effectiveness of distributed generation technologies. As shown in Table 1, the cost of diesel and biodiesel has dramatically increased since the 2003 model development and 2009 assessment update. Incorporating this updated cost information would considerably improve the accuracy of DG technology economics and savings estimates.

Table 1 - Updated Fuel Costs

Fuel Type	2003 Cost Estimate	2009 Cost Estimate	2010 Cost Estimate	% Change 2003 – 2010
Diesel (\$/gal)	\$1.07	\$2.315	\$3.020 ¹	182.2%
Biodiesel (\$/gal)	\$1.32	\$2.894	\$3.120 ¹	136.36%
Natural Gas (\$/therm)	\$0.502	\$0.878	\$0.673 ²	34.1%

The installation cost is another key factor with potentially large impacts on the cost-effectiveness and modeled payback period of distributed generation technology. The installation cost information presented in this memo was determined through conversations with vendors and actual cost expenditures for completed projects. It should be noted however, that the cost of installation can vary greatly depending on a number of project-specific factors. This data was

¹ <http://www.afdc.energy.gov/>

² <http://www.centerpointenergy.com/services/naturalgas/business/naturalgasprices/gaspriceupdate/MN/>

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supplemented with a review of other sources, such as the California Distributed Energy Resource Guide³, but does not represent a guaranteed estimation of cost.

Based on available data, installed cost of distributed generation technologies has exhibited no discernable overall trend since 2003. However, there have been significant shifts in price within some specific technology types. Natural gas and bio-gas microturbines have become much more costly, exhibiting an estimated 14.5% increase in the price of natural gas microturbines and a 56.5% overall increase for bio-gas microturbines. Wind turbine costs have also climbed since 2003, though this can in part be attributed to inflation. Contrary to these patterns and despite the 15.6% devaluation of dollar, the price of solar photovoltaics systems has declined since 2003. Key installation cost shifts (>10%) are presented in Table 2 below. A detailed discussion of significant installed cost changes since the 2009 memo is provided in section II.

Table 2 - Distributed Generation Technologies and Associated Shifts in Installed Cost

DG Manufacturer and Model	2003 Installed Cost Estimate (\$/kW)	2010 Installed Cost Estimate (\$/kW)	% Change Since 2003
Solar			
Generic 1kW PV	\$10,000	\$8,568	-14.32%
Wind Turbines			
Fuhrlander FL100	\$1,750	\$3,800	117.14%
Fuhrlander FL250	\$1,500	\$1,960	30.67%
Bergey BWC XL.1-24	\$3,500	\$5,670	62.00%
Bio-Gas Microturbines			
Capstone C30	\$2,200	\$6,600	200%
Captstone C60	\$1,900	\$3,600	89%
Natural Gas MicroTurbines			
Capstone C30	\$3,500	\$2,520	-28%

New distributed generation technologies and models were also reviewed and evaluated for this memo. Table 3 on the following page summarizes technologies that are not included in the current (2003) model. The DG options presented below include a combination of new and emerging technologies, and technologies that were previously included but are now available in different capacities.

³ <http://www.energy.ca.gov/distgen/>

Table 3 - New Distributed Generation Technologies

DG Manufacturer and Model	Electrical Output	Variable O&M costs (\$/kWh)	Estimated Installed Cost (\$/kW)
Solar Photovoltaic			
Generic PV	2 kW	\$0.001	\$8,500
Generic PV	4 kW	\$0.001	\$8,250
Sunny Boy ASE 300	8 kW	\$0.001	\$6,000
Power Light Shell Solar	32 kW	\$0.001	\$9,356
Generic PV	50 kW	\$0.001	\$6,200
Generic PV	200 kW	\$0.001	\$5,000
Biomass CHP			
Emery Energy Company*	75 kW	\$0.011	\$12,350.00
Entropic Energy*	250 kW	\$0.011	\$3,000 to \$5,000
Wind Power			
EWS	50 kW	\$0.025	\$2,600
Zephyr (GE)	1,500 kW	\$0.005	\$1,900
Vestas V80	1,800 kW	\$0.005	\$1,200
Vestas V90 & V112	3 MW	\$0.005	\$1,915
Dish/Sterling Concentrated Solar Power			
Infinia PowerDish*	3 kW	\$0.04	\$4,850
SES Systems*	10 Kw or 25 kW	\$0.04	\$10,000
Concentrated Photovoltaics			
Cool Earth Solar*	.5 kW	-	\$1,000
Soliant Energy SE-500X	0.335 kW	-	\$5,500
Combustion Turbines (with Heat Recovery)			
Solar	up to 15 MW	\$0.0096	\$1,000 to \$1,200
Kawasaki Gas Turbines	650 kW to 18 MW	\$0.0096	\$1,000 to \$1,200
Rolls-Royce	2.2 to 51.2 MW	\$0.0096	\$1,000 to \$1,200
Vericor Power Systems	500 kW to 50 MW	\$0.0096	\$1,000 to \$1,200

*Denotes technologies currently in development

Upon review of state and federal incentives, it has been determined that changes have been made to many of the incentive and rebate programs since 2003. Several programs have changed the requirements and incentive levels, which could significantly impact the cost effectiveness and viability of certain distributed generation projects. Major changes are summarized below.

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The federal Business Energy Tax Credit program⁴ was greatly expanded by the Energy Improvement and Extension Act of 2008. The law extended the duration of existing credits for solar energy, fuel cells and micro turbines as well as expanded the eligible technologies to include small wind-energy systems, geothermal heat pumps and combined heat and power systems.

The PV Solar Rebate program offered by the Minnesota Department of Commerce is still active, though currently all funds are reserved and applications are being placed on waiting list. This represents a substantial change as the 2003 evaluation included this program in the model, considering an incentive of \$2,000 per kW generated up to a maximum of \$8,000 per project. Similarly, The Climate Change Fuel Cell Buy Down Program, which was included in the 2003 model, is no longer active and should be removed from an updated model.

The Renewable Energy Production Incentive (REPI)⁵ funded by the U.S. Department of Energy has been extended through 2026 and expanded to include bio-gas and hydrogen fuel cells. The REPI program and the Energy Production Tax Credit (IRS) are both indexed for inflation, meaning that the incentive rate per kWh for both has increased since the 2003 evaluation. The 2003 model was based on incentives of 15 cents per kWh (\$0.15/kWh) for each program whereas the current incentives offered are approximately 21 cents per kWh (\$0.21/kWh) to account for inflation.

In addition, a number of new programs are now available which are funded primarily by the American Recovery and Reinvestment Act (ARRA) of 2009. Further details regarding these new incentive options and changes to existing programs will be discussed in Section II.

A summary table of the customer data profiles currently utilized in the model is included as Attachment 1 to this report. As these profiles have not been updated since the 2003 model, we recommend that the customer profiles be reviewed by Alliant to determine whether any significant demographic or energy usage changes have occurred that would require the customer sectors and associated energy usage profiles to be updated.

II. DETAILED KEY CHANGES SINCE 2009

Updated Assumptions and Associated Changes to 2009 Memo

Required modifications from the 2009 Memo can be broadly categorized into one of four groups; fuel cost, scope and cost of DG equipment, new DG technologies and incentive programs. Changes from the 2009 memo in each of these groupings are discussed below.

Fuel Costs

The cost of fuel has changed slightly since 2009 and these changes will greatly affect the results of the model. The current cost of diesel fuel in Minnesota is \$3.02 per gallon. This figure represents an increase of over 30% in the past year. The cost of biodiesel fuel has also risen to \$3.12 representing an increase of 7.8% from last year. Lastly, the cost of natural gas

⁴http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US33F&State=federal¤tpageid=1&ee=1&re=1

⁵http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US33F&State=federal¤tpageid=1&ee=1&re=1