

APPENDIX O

37 LINE / 4X1 NON-WIRES ALTERNATIVES FOR LOAD RELIEF REQUEST FOR INFORMATION EVALUATION

37 Line / 4X1 Non-Wires Alternatives for Load Relief **Request for Information Evaluation**

September 18, 2019

1 Introduction

In early 2019 as part of the UES-Capital system planning process Until identified the possible overload of the 37 line from Penacook to MacCoy Street tap in 2020 following the switching to restore all load for the contingent loss of the circuit 4X1 supply with all generation off-line¹.

The proposed traditional option to resolve this constraint is to reconductor the 37 line from Penacook to the MacCoy Street tap in 2020. The estimated cost to reconductor the 37 line is \$750,000 without overheads. Additional information regarding the constraint and options considered can be found in the UES-Capital 2020-2029 Electric System Planning Study.

This project was evaluated per Unutil's Project Evaluation Procedure. Per the procedure non-wires alternatives (NWA) were not required to be evaluated, because the implementation date of the proposed traditional option is less than three years in the future. However, it was determined that Unutil would obtain information regarding NWA projects to defer this project.

In order for the NWA project/portfolio of projects to be considered the project(s) must reduce load in the area by approximately 3.5 MW by 2022 and 0.3 MW per year from 2023 to 2029 at the time of peak.

Unutil's Project Evaluation Procedure workflow for this constraint can be found in appendix A.

2 NWA Request for Information (RFI) Process

On March 29th, 2019 an RFI was released to the following vendors.

Vergent Power Solutions	EI Services
Josh Hotvet	Clean Energy NH
Con Edison	Leidos
Solar Power Financial	Revision Energy
Barrington Power LLC	E.ON Climate and Renewables
WEG/BESS	Tangent Energy Solutions
OED Granite Apollo	CVE
New England Battery Storage	Pellet Heat
TRC	KW Management
Primary Lines/ABB	

Of the nineteen vendors that received the RFI eleven expressed interest in participating in the RFI process.

¹ Wheelabrator/SES is the largest generator in the area and is modelled offline per planning criteria. All three hydroelectric generators are modelled offline because they are typically offline during summer conditions due to low river flow.

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Unitil received and responded to twenty-two clarifying questions and after the clarifying question and answer process four of the eleven remaining participants notified Unitil that they would not be submitting a response to the RFI.

Unitil received submittals from the four participants below with the others electing not submit information.

Barrington Power LLC
WEG/BESS

New England Battery Storage
Primary Lines/ABB

All four of the responses were for the installation of energy storage with one response pairing the energy storage with a photovoltaic (PV) facility. The energy storage capacities proposed ranged from 3.5MW/7.0MWh to 5MW/20MWh and the proposed PV facility had a peak output rating of 3MW.

The pricing structure of three of the submittals had Unitil owning the infrastructure with one submittal having the vendor owning the infrastructure with Unitil paying an annual fee. The cost of the proposals ranged from \$6.7 million to \$11.5 million over a ten year period.

Additionally, two of the submittals called for a one time installation and two if the submittals proposed an initial installation to meet near term requirements with smaller installations/upgrades to accommodate future load growth.

3 Evaluation Process

A financial model was created to quantifiably capture some of the additional benefits of DER and perform a net present value analysis against the traditional option.

Results of that analysis are below with a negative result indicating that the NWA is more costly and a positive result indicating that the NWA is less costly than the traditional option.

Primary Lines/ABB Submittal

NPV - 5 Year	-\$2,522,119
NPV - 10 Year	-\$2,271,491
NPV - 20 Year	-\$3,801,938

Barrington Power LLC

NPV - 5 Year	-\$7,097,539
NPV - 10 Year	-\$5,053,594
NPV - 20 Year	-\$2,495,755

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New England Battery Storage

NPV - 5 Year	-\$1,630,371
NPV - 10 Year	-\$2,881,063
NPV - 20 Year	-\$4,070,362

WEG/BESS

NPV - 5 Year	-\$3,653,377
NPV - 10 Year	-\$3,435,701
NPV - 20 Year	-\$1,853,750

The financial calculations used for this analysis can be found in appendix B.

Using the financial analysis the detailed cost/benefit analysis detailed in Unitol's Project Evaluation Procedure was performed. For this analysis the projects were condensed into three options: 1. Reconductor the 37 Line – Traditional Option; 2. Energy Storage – NWA; 3. Energy Storage/PV – NWA. Below is a summary of the results.

Evaluation Criteria	Weight Factor	Ranked Score (N Best, 1 Worst, N= # of Options)			
		Option 1	Option 2	Option 3	
Functionality <i>(See Below)</i>	15%	3	2	1	
Environmental <i>(See Below)</i>	10%	2	3	1	
Reliability <i>(See Below)</i>	15%	3	2	2	
Feasibility <i>(See Below)</i>	25%	3	2	1	
Unitol Cost	30%	3	2	1	
Value Added Benefit of DG	5%	1	2	3	
Totals	100%	2.8	2.1	1.25	

Overall Rankings	1	2	3	
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Unitol's Project Evaluation Procedure detailed cost/benefit analysis can be found in the appendix C.

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4 Conclusion

Based on the financial analysis and the cost benefit analysis the proposed project to address the identified 37 line constraint is to reconductor the 37 line from Penacook to the MacCoy Street tap.

Additionally, based on the information obtained as part of the NWA RFI process it is recommended that the traditional project cost to trigger an NWA review remain at \$250,000 without overheads. However, it is also recommended that the review of NWA projects be triggered when equipment is expected to exceed 80% of its normal rating during the first five years of the study period and exceed 90% of its normal rating in year five of the study period under basecase/normal configuration conditions. Under planned contingency configurations it is recommended that NWA project reviews be triggered when equipment is expected to exceed 90% of its normal rating during the first five years of the study period and exceed 100% or its normal rating in year five of the study period.

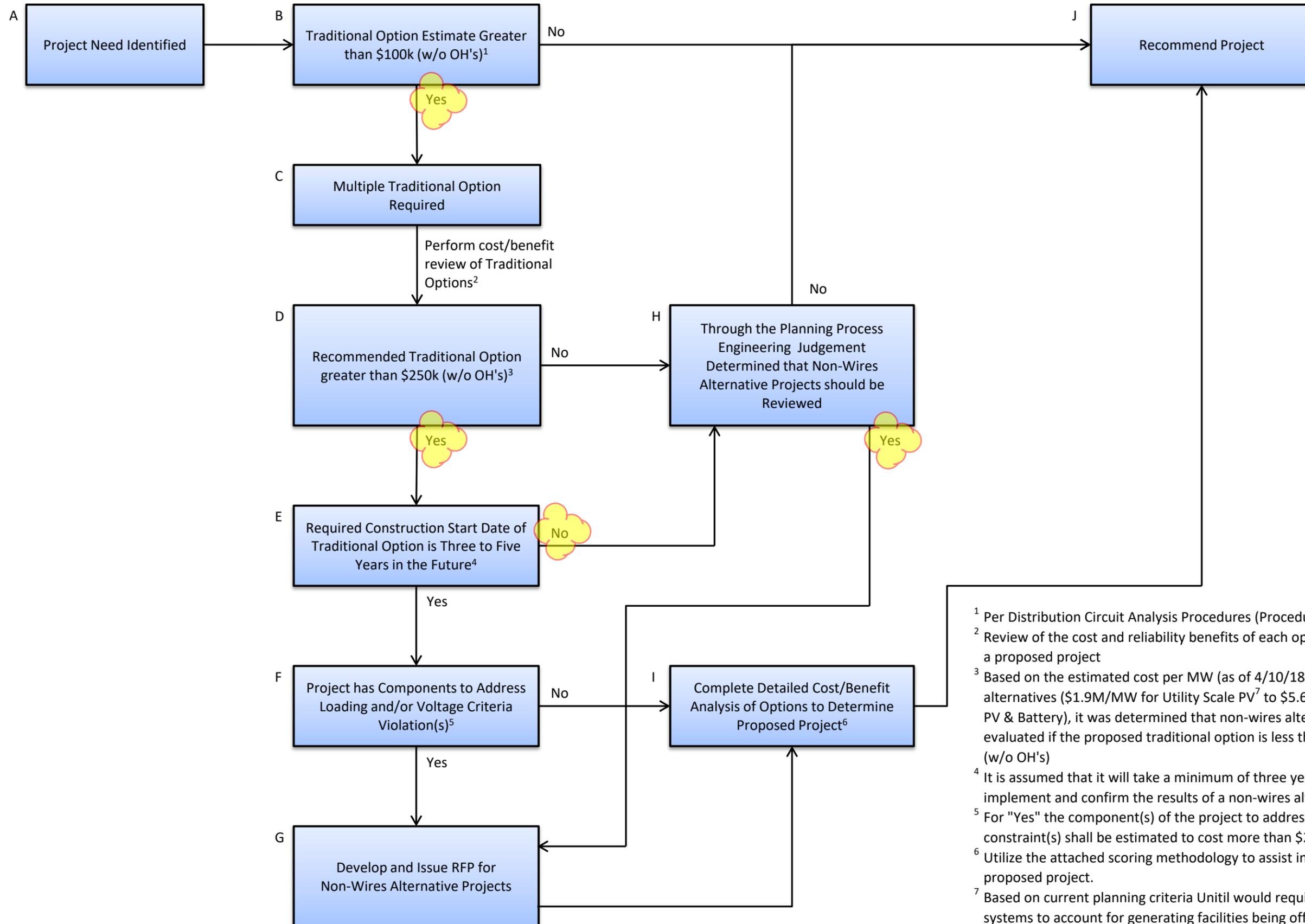
The intent of these loading thresholds is to review and possibly implement NWA projects to defer planning violations opposed to using NWA projects to resolve planning violations.

Appendix A

Project Evaluation Procedure Workflow

Project Evaluation Workflow

37 Line Loading Violation
7/15/2019



¹ Per Distribution Circuit Analysis Procedures (Procedure No. PR-DT-DS-03).
² Review of the cost and reliability benefits of each option to determine a proposed project
³ Based on the estimated cost per MW (as of 4/10/18) to implement non-wires alternatives (\$1.9M/MW for Utility Scale PV⁷ to \$5.6M/MW for Roof Top PV & Battery), it was determined that non-wires alternatives would not be evaluated if the proposed traditional option is less than \$0.25M (w/o OH's)
⁴ It is assumed that it will take a minimum of three years to evaluate, implement and confirm the results of a non-wires alternative project.
⁵ For "Yes" the component(s) of the project to address loading and/or voltage constraint(s) shall be estimated to cost more than \$250k (w/o OH's).
⁶ Utilize the attached scoring methodology to assist in selecting a proposed project.
⁷ Based on current planning criteria Unitil would require multiple utility scale systems to account for generating facilities being off-line.

Appendix B

RFI Evaluation Financial Calculators

NEBS

Income Tax Rate	27.34%	Frequency Credit (\$/MW/yr)	\$6,956	Reduction in MWh System Consumption (\$/MWh)	\$110	Assumptions are highlighted in blue
Property Tax Rate	2.70%	Capacity Credit (\$/MW/yr)	\$55,560	REC (\$/MWh)	\$25	
Cost of Capital	8.00%	RNS Trans Cost Reduction (\$/MWh/yr)	\$113,712	MWh generated/yr/MW	1275	
		RNS Trans Cost Reduction (hours/day)	6			

	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
NWA Installation Construction Installed in Given Year																							
Battery Cost Installed in Given Year		\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	
Battery Size (MW) Installed in Given Year		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Battery Size (MWh) Installed in Given Year		20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Battery Expected Life (yrs)	10																						
PV Cost Installed in Given Year																							
PV Size (MW) Installed in Given Year																							
PV Generation (MWh/yr) Installed in Given Year			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PV Expected Line (yrs)	20																						
O&M NWA		\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	
Traditional Alternative Cost																							

NPV - 5 Year	(\$1,630,371.16)
NPV - 10 Year	(\$2,881,063.57)
NPV - 20 Year	(\$4,070,362.20)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	
Net Plant	\$0	\$1,080,000	\$2,052,000	\$2,916,000	\$3,672,000	\$4,320,000	\$4,860,000	\$5,292,000	\$5,616,000	\$5,832,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000	\$5,940,000
Merchant Regulation (Frequency)		\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780	\$34,780
Capacity Credit		\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800	\$277,800
RNS Trans. Cost Reduction (Savings)		\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040	\$379,040
Energy Consumption Reduction		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
REC		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Revenues		\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620	\$691,620
Property Tax		\$29,160	\$55,404	\$78,732	\$99,144	\$116,640	\$131,220	\$142,884	\$151,632	\$157,464	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380	\$160,380
O&M		\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Depreciation - Installation		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Depreciation - Battery		\$0	\$108,000	\$216,000	\$324,000	\$432,000	\$540,000	\$648,000	\$756,000	\$864,000	\$972,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000
Depreciation - PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Taxable Income	-	\$642,460	\$508,216	\$376,888	\$248,476	\$122,980	\$400	(\$119,264)	(\$236,012)	(\$349,844)	(\$460,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)	(\$568,760)
Income Tax	-	\$175,649	\$138,946	\$103,041	\$67,933	\$33,623	\$109	(\$32,607)	(\$64,526)	(\$95,647)	(\$125,972)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)	(\$155,499)
Cashflow From Operations	-	\$466,811	\$477,270	\$489,847	\$504,543	\$521,357	\$540,291	\$561,343	\$584,514	\$609,803	\$637,212	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739	\$666,739
Investment Activity:																						
Installation Construction	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Battery Investment	\$0	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000
PV Investment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Deferred Traditional Alternative Cost	\$0	\$0	\$0	(\$750,000)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cashflow From Investments	\$0	\$1,080,000	\$1,080,000	\$330,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000	\$1,080,000
Cashflow	\$0	(\$613,189)	(\$602,730)	\$159,847	(\$575,457)	(\$558,643)	(\$539,709)	(\$518,657)	(\$495,486)	(\$470,197)	(\$442,788)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)	(\$413,261)

Barrington

Income Tax Rate	27.34%	Frequency Credit (\$/MWh/yr)	\$6,956	Reduction in MWh System Consumption (\$/MWh)	\$110	Assumptions are highlighted in blue
Property Tax Rate	2.70%	Capacity Credit (\$/MWh/yr)	\$55,560	REC (\$/MWh)	\$25	
Cost of Capital	8.00%	RNS Trans Cost Reduction (\$/MWh/yr)	\$113,712	MWh generated/yr/MW	1275	
		RNS Trans Cost Reduction (hours/day)	6			

	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NWA Installation Construction Installed in Given Year	\$11,063,278																				
Battery Cost Installed in Given Year Included in above																					
Battery Size (MW) Installed in Given Year		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Battery Size (MWh) Installed in Given Year		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Battery Expected Life (yrs)	20																				
PV Cost Installed in Given Year included in above																					
PV Size (MW) Installed in Given Year		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
PV Generation (MWh/yr) Installed in Given Year		3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825	3825
PV Expected Line (yrs)	20																				
O&M NWA		\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500	\$ 27,500
Traditional Alternative Cost																					

NPV - 5 Year	(\$7,097,539.68)
NPV - 10 Year	(\$5,053,594.30)
NPV - 20 Year	(\$2,495,755.04)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	
Net Plant	\$11,063,278	\$10,510,114	\$9,956,950	\$9,403,786	\$8,850,622	\$8,297,459	\$7,744,295	\$7,191,131	\$6,637,967	\$6,084,803	\$5,531,639	\$4,978,475	\$4,425,311	\$3,872,147	\$3,318,983	\$2,765,820	\$2,212,656	\$1,659,492	\$1,106,328	\$553,164	(\$0)	
Merchant Regulation (Frequency)		\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736	\$41,736
Capacity Credit		\$0	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360	\$333,360
RNS Trans. Cost Reduction (Savings)		\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424	\$227,424
Energy Consumption Reduction		\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750	\$420,750
REC		\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625	\$95,625
Total Revenues		\$785,535	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	\$1,118,895	
Property Tax		\$283,773	\$268,838	\$253,902	\$238,967	\$224,031	\$209,096	\$194,161	\$179,225	\$164,290	\$149,354	\$134,419	\$119,483	\$104,548	\$89,613	\$74,677	\$59,742	\$44,806	\$29,871	\$14,935	(\$0)	
O&M		\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	\$27,500	
Depreciation - Installation		\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	\$553,164	
Depreciation - Battery		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Depreciation - PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$1	\$0	\$1,913	\$2,104	\$2,295	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Taxable Income	-	(\$78,902)	\$269,393	\$284,329	\$299,264	\$314,200	\$329,135	\$344,071	\$359,006	\$373,940	\$388,877	\$401,900	\$416,644	\$431,388	\$448,619	\$463,554	\$478,489	\$493,425	\$508,360	\$523,296	\$538,231	
Income Tax	-	(\$21,572)	\$73,652	\$77,736	\$81,819	\$85,902	\$89,986	\$94,069	\$98,152	\$102,235	\$106,319	\$109,879	\$113,910	\$117,942	\$122,652	\$126,736	\$130,819	\$134,902	\$138,986	\$143,069	\$147,152	
Cashflow From Operations	-	\$495,834	\$748,905	\$759,757	\$770,609	\$781,461	\$792,313	\$803,166	\$814,018	\$824,870	\$835,722	\$847,097	\$858,001	\$868,906	\$879,130	\$889,982	\$900,834	\$911,686	\$922,538	\$933,391	\$944,243	
Investment Activity:																						
Installation Construction	\$11,063,278	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Battery Investment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
PV Investment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Deferred Traditional Alternative Cost	\$0	\$0	\$0	(\$750,000)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Cashflow From Investments	\$11,063,278	\$0	\$0	(\$750,000)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Cashflow	(\$11,063,278)	\$495,834	\$748,905	\$1,509,757	\$770,609	\$781,461	\$792,313	\$803,166	\$814,018	\$824,870	\$835,722	\$847,097	\$858,001	\$868,906	\$879,130	\$889,982	\$900,834	\$911,686	\$922,538	\$933,391	\$944,243	

ABB

Income Tax Rate	27.34%	Frequency Credit (\$/MW/yr)	\$6,956	Reduction in MWh System Consumption (\$/MWh)	\$110	Assumptions are highlighted in blue
Property Tax Rate	2.70%	Capacity Credit (\$/MW/yr)	\$55,560	REC (\$/MWh)	\$25	
Cost of Capital	8.00%	RNS Trans Cost Reduction (\$/MWh/yr)	\$113,712	MWh generated/yr/MW	1275	
		RNS Trans Cost Reduction (hours/day)	6			

	Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NWA Installation Construction Installed in Given Year																						
Battery Cost Installed in Given Year		\$3,670,000			\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$4,050,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000
Battery Size (MW) Installed in Given Year		3.5	3.5	3.5	3.9	4.3	4.6	5.0	5.4	5.8	6.2	6.5	6.9	7.3	7.7	8.1	8.4	8.8	9.2	9.6	10.0	10.3
Battery Size (MWh) Installed in Given Year		7.0	7.0	7.0	7.8	8.5	9.3	10.0	10.8	11.6	12.3	13.1	13.8	14.6	15.4	16.1	16.9	17.6	18.4	19.2	19.9	20.7
Battery Expected Life (yrs)	10																					
PV Cost Installed in Given Year																						
PV Size (MW) Installed in Given Year																						
PV Generation (MWh/yr) Installed in Given Year			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PV Expected Line (yrs)	20																					
O&M NWA		\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000
Traditional Alternative Cost																						

NPV - 5 Year	(\$2,522,119.29)
NPV - 10 Year	(\$2,271,491.10)
NPV - 20 Year	(\$3,801,938.47)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	
Net Plant	\$3,670,000	\$3,303,000	\$2,936,000	\$2,949,000	\$2,924,000	\$2,861,000	\$2,760,000	\$2,621,000	\$2,444,000	\$2,229,000	\$1,976,000	\$5,722,000	\$5,773,000	\$5,748,000	\$5,685,000	\$5,584,000	\$5,445,000	\$5,268,000	\$5,053,000	\$4,800,000	\$4,509,000	
Merchant Regulation (Frequency)		\$24,346	\$24,346	\$26,989	\$29,633	\$32,276	\$34,919	\$37,562	\$40,206	\$42,849	\$45,492	\$48,136	\$50,779	\$53,422	\$56,065	\$58,709	\$61,352	\$63,995	\$66,638	\$69,282	\$71,925	
Capacity Credit		\$194,460	\$194,460	\$194,460	\$215,573	\$236,686	\$257,798	\$278,911	\$300,024	\$321,137	\$342,250	\$363,362	\$384,475	\$405,588	\$426,701	\$447,814	\$468,926	\$490,039	\$511,152	\$532,265	\$553,378	
RNS Trans. Cost Reduction (Savings)		\$132,664	\$132,664	\$147,068	\$161,471	\$175,875	\$190,278	\$204,682	\$219,085	\$233,489	\$247,892	\$262,296	\$276,699	\$291,103	\$305,506	\$319,910	\$334,313	\$348,717	\$363,120	\$377,524	\$391,927	
Energy Consumption Reduction		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
REC		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Total Revenues		\$351,470	\$351,470	\$368,517	\$406,676	\$444,836	\$482,996	\$521,155	\$559,315	\$597,474	\$635,634	\$673,794	\$711,953	\$750,113	\$788,272	\$826,432	\$864,592	\$902,751	\$940,911	\$979,070	\$1,017,230	
Property Tax		\$89,181	\$79,272	\$79,623	\$78,948	\$77,247	\$74,520	\$70,767	\$65,988	\$60,183	\$53,352	\$154,494	\$155,871	\$155,196	\$153,495	\$150,768	\$147,015	\$142,236	\$136,431	\$129,600	\$121,743	
O&M		\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000	
Depreciation - Installation		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Depreciation - Battery		\$367,000	\$367,000	\$367,000	\$405,000	\$443,000	\$481,000	\$519,000	\$557,000	\$595,000	\$633,000	\$304,000	\$709,000	\$785,000	\$823,000	\$861,000	\$899,000	\$937,000	\$975,000	\$1,013,000	\$1,051,000	
Depreciation - PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Taxable Income	-	(\$139,711)	(\$129,802)	(\$113,106)	(\$112,272)	(\$110,411)	(\$107,524)	(\$103,612)	(\$98,673)	(\$92,709)	(\$85,718)	\$180,300	(\$187,918)	(\$225,083)	(\$223,223)	(\$220,336)	(\$216,423)	(\$211,485)	(\$205,520)	(\$198,530)	(\$190,513)	
Income Tax	-	(\$38,197)	(\$35,488)	(\$30,923)	(\$30,695)	(\$30,186)	(\$29,397)	(\$28,327)	(\$26,977)	(\$25,347)	(\$23,435)	\$49,294	(\$51,377)	(\$61,538)	(\$61,029)	(\$60,240)	(\$59,170)	(\$57,820)	(\$56,189)	(\$54,278)	(\$52,086)	
Cashflow From Operations	-	\$265,486	\$272,686	\$284,817	\$323,423	\$362,775	\$402,873	\$443,716	\$485,304	\$527,638	\$570,717	\$435,006	\$572,459	\$621,455	\$660,806	\$700,904	\$741,747	\$783,335	\$825,669	\$868,748	\$912,573	
Investment Activity:																						
Installation Construction		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Battery Investment		\$3,670,000	\$0	\$0	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$4,050,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	
PV Investment		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Deferred Traditional Alternative Cost		\$0	\$0	\$0	(\$750,000)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Cashflow From Investments		\$3,670,000	\$0	\$0	(\$370,000)	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$380,000	\$4,050,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	\$760,000	
Cashflow		(\$3,670,000)	\$265,486	\$272,686	\$654,817	(\$56,577)	(\$17,225)	\$22,873	\$63,716	\$105,304	\$147,638	\$190,717	(\$3,614,994)	(\$187,541)	(\$138,545)	(\$99,194)	(\$59,096)	(\$18,253)	\$23,335	\$65,669	\$108,748	\$152,573

WEG

Income Tax Rate	27.34%	Frequency Credit (\$/MW/yr)	\$6,956	Reduction in MWh System Consumption (\$/MWh)	\$110	Assumptions are highlighted in blue
Property Tax Rate	2.70%	Capacity Credit (\$/MW/yr)	\$55,560	REC (\$/MWh)	\$25	
Cost of Capital	8.00%	RNS Trans Cost Reduction (\$/MWh/yr)	\$113,712	MWh generated/yr/MW	1275	
		RNS Trans Cost Reduction (hours/day)	6			

	Year 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NWA Installation Construction Installed in Given Year	\$6,040,165								\$1,824,400												
Battery Cost Installed in Given Year																					
Battery Size (MW) Installed in Given Year	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Battery Size (MWh) Installed in Given Year	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
Battery Expected Life (yrs)	10																				
PV Cost Installed in Given Year																					
PV Size (MW) Installed in Given Year																					
PV Generation (MWh/yr) Installed in Given Year		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PV Expected Line (yrs)	20																				
O&M NWA		\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000
Traditional Alternative Cost																					

NPV - 5 Year	(\$3,653,377.14)
NPV - 10 Year	(\$3,435,701.87)
NPV - 20 Year	(\$1,853,750.02)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Net Plant	\$6,040,165	\$5,738,157	\$5,436,149	\$5,134,140	\$4,832,132	\$4,530,124	\$4,228,116	\$3,926,107	\$5,448,499	\$5,146,491	\$4,844,483	\$4,542,474	\$4,240,466	\$3,938,458	\$3,636,450	\$3,334,441	\$3,032,433	\$2,730,425	\$2,428,417	\$2,126,408	\$1,824,400
Merchant Regulation (Frequency)		\$33,389	\$33,389	\$33,389	\$33,389	\$33,389	\$33,389	\$33,389	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518	\$44,518
Capacity Credit		\$266,688	\$266,688	\$266,688	\$266,688	\$266,688	\$266,688	\$266,688	\$266,688	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584	\$355,584
RNS Trans. Cost Reduction (Savings)		\$272,909	\$272,909	\$272,909	\$272,909	\$272,909	\$272,909	\$272,909	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878	\$363,878
Energy Consumption Reduction		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
REC		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Revenues		\$572,986	\$572,986	\$572,986	\$572,986	\$572,986	\$572,986	\$572,986	\$675,085	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981	\$763,981
Property Tax		\$154,930	\$146,776	\$138,622	\$130,468	\$122,313	\$114,159	\$106,005	\$147,109	\$138,955	\$130,801	\$122,647	\$114,493	\$106,338	\$98,184	\$90,030	\$81,876	\$73,721	\$65,567	\$57,413	\$49,259
O&M		\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Depreciation - Installation		\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008	\$302,008
Depreciation - Battery		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Depreciation - PV		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Taxable Income	-	\$86,047	\$94,201	\$102,356	\$110,510	\$118,664	\$126,818	\$134,972	\$195,967	\$293,017	\$301,172	\$309,326	\$317,480	\$325,634	\$333,788	\$341,943	\$350,097	\$358,251	\$366,405	\$374,560	\$382,714
Income Tax	-	\$23,525	\$25,755	\$27,984	\$30,213	\$32,443	\$34,672	\$36,901	\$53,577	\$80,111	\$82,340	\$84,570	\$86,799	\$89,028	\$91,258	\$93,487	\$95,716	\$97,946	\$100,175	\$102,405	\$104,634
Cashflow From Operations	-	\$364,530	\$370,455	\$376,380	\$382,305	\$388,230	\$394,154	\$400,079	\$444,398	\$514,915	\$520,839	\$526,764	\$532,689	\$538,614	\$544,539	\$550,464	\$556,389	\$562,313	\$568,238	\$574,163	\$580,088
Investment Activity:																					
Installation Construction	\$6,040,165	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$1,824,400	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Battery Investment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
PV Investment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Deferred Traditional Alternative Cost	\$0	\$0	\$0	(\$750,000)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cashflow From Investments	\$6,040,165	\$0	\$0	(\$750,000)	\$0	\$0	\$0	\$0	\$1,824,400	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cashflow	(\$6,040,165)	\$364,530	\$370,455	\$1,126,380	\$382,305	\$388,230	\$394,154	\$400,079	(\$1,380,002)	\$514,915	\$520,839	\$526,764	\$532,689	\$538,614	\$544,539	\$550,464	\$556,389	\$562,313	\$568,238	\$574,163	\$580,088

Appendix C

Project Evaluation Procedure Detailed Cost/Benefit Analysis

Constraint / Need for Project: 37 Line Loading Violation

Project Need Year: 2020

Date Evaluation Performed: 6/18/2019

Traditional Alternative Construction Start Year: 2020

	Project Scope
Option 1	Reconductor 37 Line - Traditional Option
Option 2	Energy Storage - NWA
Option 3	Energy Storage/PV - NWA

Number of Alternatives **3**

User Input (cell will turn white once value is entered)

Evaluation Criteria	Weight Factor	Ranked Score (N Best, 1 Worst, N= # of Options)		
		Option 1	Option 2	Option 3
Functionality <i>(See Below)</i>	15%	3	2	1
Environmental <i>(See Below)</i>	10%	2	3	1
Reliability <i>(See Below)</i>	15%	3	2	2
Feasibility <i>(See Below)</i>	25%	3	2	1
Unitil Cost	30%	3	2	1
Value Added Benefit of DG	5%	1	2	3
Totals	100%	2.8	2.1	1.25

Overall Rankings	1	2	3
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Functionality Evaluation Criteria	Weight Factor	Ranked Score (N Best, 1 Worst, N= # of Options)		
		Option 1	Option 2	Option 3
Operating Flexibility	15%	3	1	2
Availability	30%	3	2	1
Maintenance	10%	3	2	1
Load Servicing Capacity	20%	3	3	1
DG Interconnect Capacity	10%	3	2	1
System Master Plan	15%	3	2	2
Totals	100%	3	2.05	1.3
Rankings		1	2	3

Environmental Evaluation Criteria	Weight Factor	Ranked Score (N Best, 1 Worst, N= # of Options)		
		Option 1	Option 2	Option 3
Wetland Impact	25%	1	3	2
Tree Clearing	25%	3	3	1
Residential Area Impacts	25%	2	3	1
Municipal Considerations	25%	2	3	1
Totals	100%	2	3	1.25
	Rankings	2	1	3

Reliability Evaluation Criteria	Weight Factor	Ranked Score (N Best, 1 Worst, N= # of Options)		
		Option 1	Option 2	Option 3
Customer Exposure	30%	3	1	2
Miles / Equipment Exposure	30%	2	2	1
Automatic Restoration	20%	1	1	1
Power Quality	20%	1	3	3
Totals	100%	1.9	1.7	1.7
	Rankings	1	2	2

Feasibility Evaluation Criteria	Weight Factor	Ranked Score (N Best, 1 Worst, N= # of Options)		
		Option 1	Option 2	Option 3
Likelihood of Completion	50%	3	2	1
Long Term Solution	25%	3	2	2
Life Span	20%	3	2	2
Design Standards	5%	3	2	2
Totals	100%	3	2	1.5
	Rankings	1	2	3

Note: Weight factors and evaluation criteria shall be adjusted as needed