



Battery Storage Grant Overview

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Board of Directors Meeting

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TCEQ

New Technology
Implementation Grant



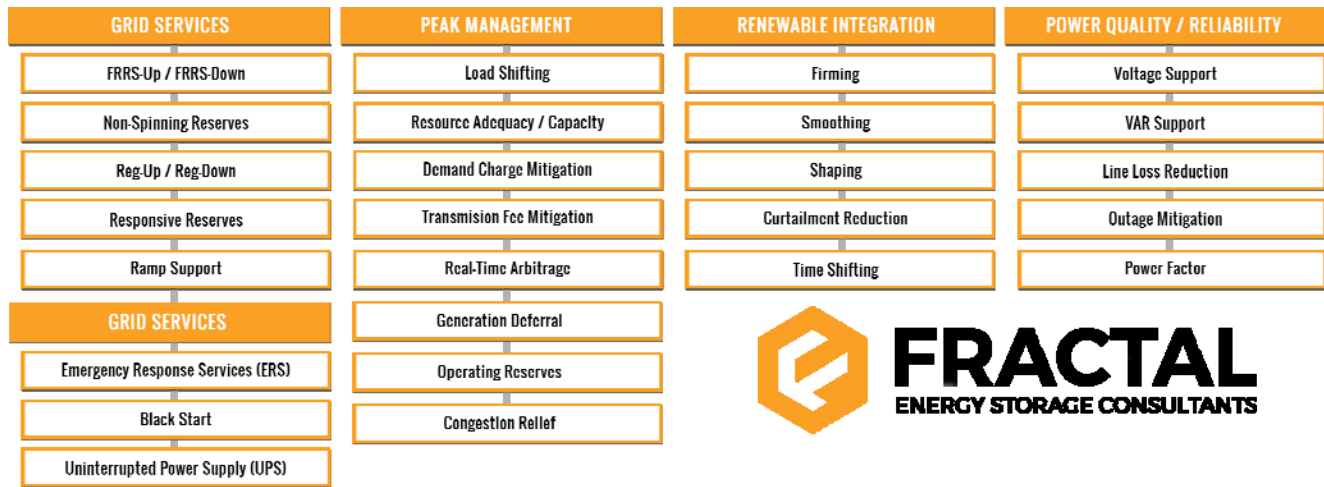
Texas Commission on Environmental Quality

The primary objective of the NTIG program is to assist with the implementation of new technologies to reduce the emissions from facilities and other stationary sources in Texas.

(Texas Health and Safety Code, Section 391.002)



Energy Storage Applications



FRACTAL
ENERGY STORAGE CONSULTANTS



Energy Storage Applications Benefit/Cost Review



B/C = Benefit ÷ Cost

Benefit = Present value of 20 year revenues


Cost = Present value of 20 year costs

Applications	Duration	2016
Ancillary Services		
FRRS	30 min	1.65
Reg Up / Reg Dn	2 hour	0.87
Responsive Reserves	2 hour	0.60
Non-Spin	2 hour	0.24
Ramp Support	30 min	0.31
Renewable / DG Integration		
Firming, Smoothing, Shaping	2 hour	0.03
Peak Management		
Demand Charge Mitigation	2 hour	0.72
Real-Time Arbitrage	30 min	0.43
Demand Response	2 hour	0.40
4CP + Arbitrage	1 hour	0.32
Load Shifting (two 4-hr shifts)	4 hour	0.16
Load Shifting (one 2-hr shift)	2 hour	0.08
Emergency Services		
Emergency Response Services (ERS)	2 hour	0.35
Black Start Services	2 hour	0.05
Power Quality / Reliability		
T&D Deferral / Cost Avoidance *	2 hour	0.13
Power Factor	2 hour	0.06
Congestion Relief	2 hour	0.07



		Secondary Storage Applications															
Primary Applications	B/C Ratio	FRRS	Reg Up/Reg Down	Responsive Reserve	Non-Spinning Reserves	Ramp Support	Firming	Smoothing	Shaping	Load Shifting	Real-Time Arbitrage	Resource Adequacy / Capacity	Demand Charge Mitigation	4CP	Black Start	Emergency Response Services	Uninterruptible Power Supply
Ancillary Services																	
FRRS	1.65																
Reg Up/Reg Down	0.87																
Responsive Reserve	0.60																
Non-Spinning Reserves	0.24																
Ramp Support	0.31																
Renewable / DG Integration																	
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Smoothing	0.03																
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Load Shifting	0.16																
Real-Time Arbitrage	0.43																
Resource Adequacy / Capacity	N/A																
Demand Charge Mitigation	0.72																
4CP	0.32																
Emergency Services																	
Black Start	0.05																
Emergency Response Services	0.35																
Uninterruptible Power Supply	N/A																
Power Quality / Reliability																	
Voltage Support	0.15																
VAR Support	0.15																
Power Factor	0.15																
Congestion Relief	0.15																
Outage Mitigation	0.15																

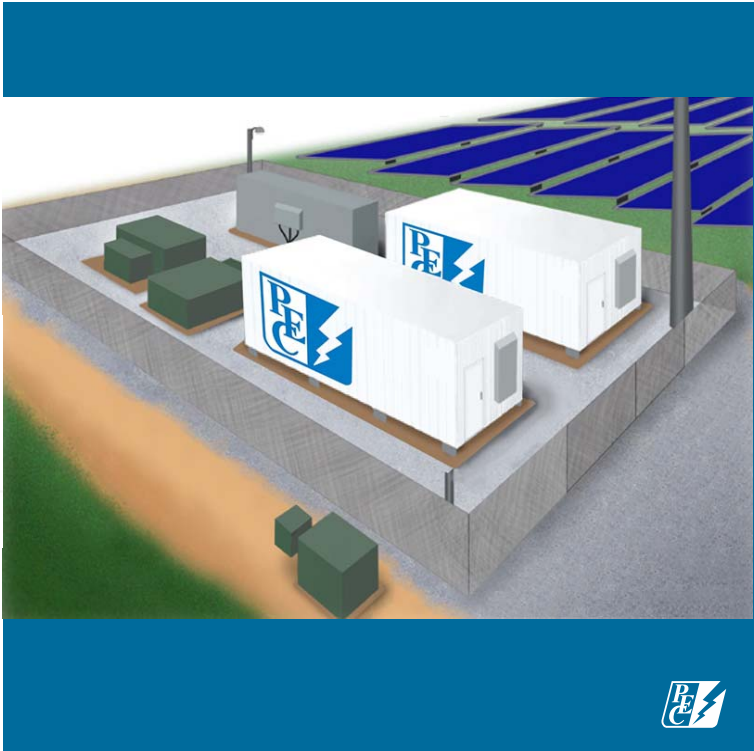
Concurrent
Split Capacity
Separate hours
Possible, not recommended

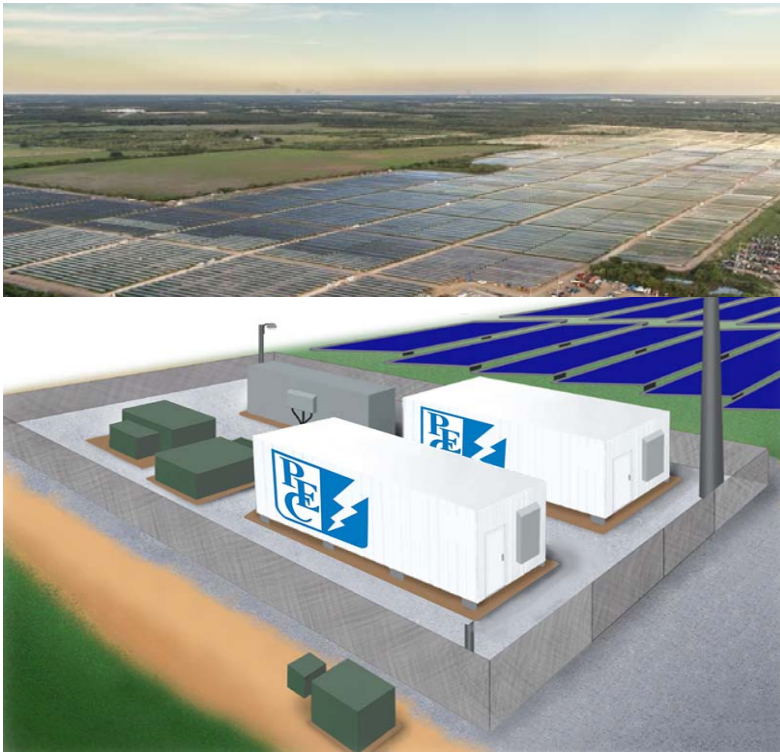


PEC Proposal

PROJECT HIGHLIGHTS

Power-energy 2.0 MW - 4.0 MWh	Cost-effectiveness \$787/kWh	<div> Emissions displacement </div> <div> 85,815,296 lbs. CO₂ 36,927 lbs. NO_x 7,400 lbs. Particulate 86,787 lbs. SO₂ </div> <div> </div>
Duration 2 hours	Cost per lifetime energy \$0.0580/kWh	
Implementation cost \$3,147,454	No. cycles to 80% 6,000	
Grant request \$1,500,000 (47.7%)	Project life 20 years	Roundtrip efficiency 90.9%





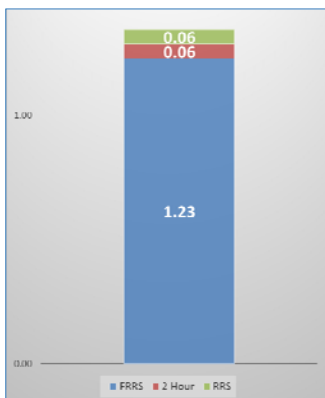
Benefit/Cost Analysis

Cost	\$3,147,454
Matching Award	\$1,500,000
Ownership	100% PEC
Timeline	Operating Q3 2018
Applications	Solar Shift, FRRS
Size	2 MW / 4 MWh
Project Life	20 years
Location	Johnson City
Footprint	4,000 SQFT
Registration	Energy storage system registered as both a Generation Resource and as a Load Resource
Charging	Wholesale Rate in PEC Load Zone
Financials	IRR = 12.9%, Payback = 7.8 yr

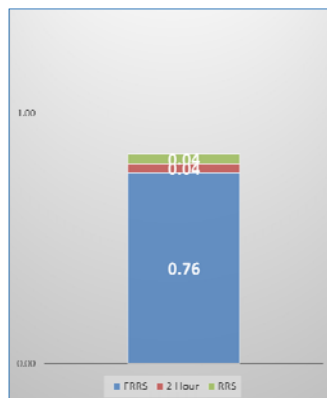


Benefit Cost Analysis

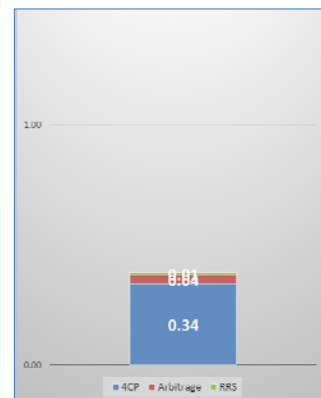
With NTIG Grant
FRRS
B/C = 1.34
IRR = 12.9%
Payback = 7.8 years



Without NTIG Grant
FRRS
B/C = 0.84
IRR = 5.0%
Payback = 13.6 years



With NTIG Grant
4CP + Arbitrage
B/C = 0.38
IRR = -4.40
Payback = N/A



PEC Responsibilities and Expectations

PEC will receive \$1,500,000 from TCEQ towards the cost of battery installation

PEC is responsible for the remaining cost of the battery

PEC will own 100% of the battery

PEC will conduct RFP to get refreshed pricing

PEC will request for proposals on the battery to receive best pricing and ensure best benefit cost scenario

Prior to purchase of battery and installation, further modeling will be done to evaluate best economic business case for battery use



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