California State University, Chico
Collegiate Wind Competition 2019

Site Development Team Members and Contributors			
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Presented By:
College of Business & College of Natural Sciences

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Brief Site Description

Our site rests along the Capay Hills in Yolo County in Northern California. The hilly terrain is home to ridge features and rangelands utilized for pasture bearing cattle, goats, sheep and lambs for grazing ("Capay Valley Area Plan 2010"). The average wind speed at the location is 6.9 m/s and in a given 8760 year (24 hours in a day multiplied by 356 days in a year results in 8760 year) with the majority of the wind blowing from the North through the North-Northwest direction with the greatest wind speed blowing in a direction +10 through -30 degrees in relation to True North at 0 degrees. Refer to Appendix A for the average wind speed at Capay Hills in a given year provided by the System Advisory Model (SAM) wind resource files. The site spans approximately five square miles and has 24 turbines, 1 substation, and 1 operations and maintenance building. Our turbine model chosen for this site is the Vestas 4.2 MW with 150-meter rotor diameter and stands at 100 meters tall. The climate consists of hot, dry summers and cool, damp winters which contributes to the wind regime for this area. ("Capay Valley Area Plan 2010") Approximately five miles northeast from the site lies a 230-kV transmission line that parallels Interstate Highway 5 which will connect to the 137kV gen-tie line to transport energy generated onsite to the grid.

Design Changes

In order to achieve a financially viable project, the siting team decided to choose a location with higher wind speeds than the siting team chose in the 2018 competition which was 7.73 miles away in the Capay Hills in Yolo County. Similarly, the change in site location has altered the overall area of the site location, which was 18.9 square miles in Colusa and is now 5 square miles at the new Capay Hills site. The decision to change the location of the wind farm was due in part to environmental concerns and available wind speeds. Colusa County is home to the Little Brown Bat and the Golden Eagle, as presented in NREL Wind Prospector software. Yolo County does not have natural Golden Eagle habitat, although it does have Little Brown Bat habitat. Overall, there are fewer species concerns in Yolo County, which decreased the number of necessary mitigations to protect the species there, making it a more attractive site from an environmental standpoint. Considering wind speeds, unlike the Colusa site, which was flat and leveled terrain, Capay Hills has rugged geologic features in the form of ridges which allows for greater wind shear to build up as it blows past the elevated surfaces. Although the terrain in Yolo County demands higher capital expenditures for construction, the increase in average wind speed by 1 m/s compared to the wind speeds in Colusa County will result in greater electricity generation. This translates into greater revenues which will ultimately outweigh the greater initial capital costs.

Financial Analysis

Initial Capital Costs

A wind farm of this magnitude is going to have significant initial costs. There are a number of permits that need to be obtained from several government levels in addition to studies of the land for a more detailed outline of the necessary permits, see Appendix B. Costs of studies include biological surveys and cultural studies among many other state required costs. We estimated this first step to cost $1,290,000.

Once all of the permits and regulations are obtained, the next step is to secure the land. These contracts can be structured in a number of different ways, we can give a lump sum to the original landowner for each turbine or we could structure each contract to give the owner a percentage of revenue generated by each turbine (Garlick and Chat). The most realistic way to do this would be to allocate a lump sum for the amount of land that we will be used for the site as a whole. Due to the number of rules and regulations that need to be followed, legal fees will be another major expense for the project.

Once we have obtained all of the preliminary permits, we can begin with the preparation of each site for the turbines. The first step is to conduct a geotechnical investigation to understand the geology of the land to build effectively. We communicated with Ryan King at Terracon Consultants, Inc. to get an estimate of $3,500-$4,500 per turbine. According to King, this will cover the grading and inspection necessary for the roads and all electrical components of the site. Then, construction can get underway. This will include costs for the roads getting to and from each location, which will cost approximately $2,000,000, according to wind industry professional Dr. Chris Purvis, to fully re-engineer the roadways to allow for the massive turbines to even get to the location. During this process, we will also install a security system on site in order to protect and ensure our site from potential vandalism, totaling $350,000 (Purvis).

A main operating building that can be used as a command center and a place to store spare parts and any other equipment that would be needed in order to maintain the site will cost approximately $1,000,000-$1,500,000.

After the infrastructure is in place to allow for heavy machinery to access each site, we will be able to begin the construction of each foundation. Given the size and weight of each turbine, we were able to estimate costs of $650,000-$750,000 for each of the 24 foundations (Purvis). Once this is completed, the turbines can be purchased, delivered and erected. The turbines themselves are $3,500,000-$4,000,000 each for a grand total of $86,500,000 for all 24 turbines (Purvis). There are two Vestas facilities in Colorado: Pueblo and Brighton (Cooper). We contacted Steve Cooper, a wind project manager at a wind turbine transportation company called ATS, to estimate the costs of shipping the 24 turbines to our site. The estimate came out to about $16,600,000 to deliver all parts (Cooper).

Next, the interconnection elements of the project can be built. There will be one central substation for the site which will cost $7,600,000 (Purvis). The balance of plant components including the electrical system circuits and the interconnection of turbines to the substation will cost $11,600,000 (Purvis). The substation then needs to tie in with the nearest transmission line. This demands the installment of gen-ties as well as a switchyard for metering and protection at the point of interconnection (Purvis). Other upgrades to the grid may be required as well (Purvis). The installation of gen-ties will come out to $3,000,000 and the switchyard and upgrades will cost $7,649,000 (Purvis).

The costs of the physical elements of the project highlighted are not the only expenses of the initial capital costs. There will be many engineers, crane operators, laborers, studies, consultants, project managers, construction managers, administrative management and services and inspections that will contribute to the costs (Purvis). At the commencement of the construction phase of the project, we estimated the total initial capital cost will be $181,256,000 (Purvis). Reference Appendix D for further detail.

Annual Operating Expenses

The operating expenses, in general, will include service of turbines, maintenance of turbines, maintenance of the site, 24-7 proactive monitoring and scheduling coordination and on-site site security (Purvis). Of these operating and maintenance costs, there are material as well as employee costs considered. The service and maintenance of turbines include the expense of employing wind turbine technicians and quality assurance staff plus the costs of any materials needed to complete service and maintenance (Purvis). Additionally, the maintenance of the site includes the costs of employing a maintenance supervisor and any construction workers or other employees plus the costs of the materials needed in the maintenance work (Purvis). Another site maintenance cost includes safety training for employees. The 24-7 monitoring and scheduling costs will include employing a coordinator to do real-time monitoring and energy scheduling (Purvis). Finally, the on-site site security includes the costs of staffing a security team as well as any costs associated with the security system. Overall, the total costs for general operations and maintenance come out to $1,180,000 per year (Fehrman). For a more detailed breakdown of the general operating expenses, see Appendix C.

Operating expenses accounted for, there are other general and administrative costs associated with the operation of the wind farm. The general costs include insurance, property tax, on-site electric power and the cost of the letter of credit (Purvis). Concerning insurance, this will cover the turbines and all related equipment in addition to the electrical equipment. This can be covered by an insurer such as Travelers through the WindPak Inland Marine Renewable Energy Insurance policy ("Inland Marine Renewable Energy Insurance"). Property tax will apply to all permanent buildings and structures, but this does not include the turbines themselves because they are considered temporary structures (Purvis). On-site electric power refers to the costs of running lights and any computers or security equipment.

In addition to the general costs, there are the costs of employing administration and the costs of their activities or contributions to the operations of the farm. These professionals include general administrative and management overhead for asset management; accounting, tax and audit services; legal services; owner's representative; site project manager; environmental health and safety manager and owner's engineer (Fehrman). The general administrative and management overhead for asset management covers various costs such as accounting fees, advertising, interest, labor burden, rent, repairs and supplies (other than turbine repairs), telephone and internet bills, travel expenditures, utilities, as well as insurance (other than for the turbines) (Purvis). All general and administrative costs considered, the yearly costs come out to $4,570,000 (Purvis). For a more detailed breakdown of the general and administrative expenses, see Appendix C.

Finally, there will be annual costs to lease the land for the wind farm, to maintain a community fund, to make Payments in Lieu of Taxes (PILOT), and to pay the premium for a decommission bond (Purvis). We estimated the land lease is $160 per acre, coming out to a total of $419,680 per year (Purvis). The community fund and pilot payments will cost $60,000 annually (Purvis). Lastly, the decommissioning bond will have an annual premium of $80,000 and will mature at 3% per year, yielding $2,917,000 at the end of the project (Purvis). This will fund the decommissioning of the project at the end of the 20-year life. This takes the financial burden of decommissioning and restoration away from the landowners and taxpayers and ensures that we, the project owners, will be fully responsible ("Decommission Performance Bonds - Solar & Wind Energy").

In sum, the main categories of annual operation and maintenance expenses are: operating, general and administrative, land lease, community fund, PILOT and decommission bond costs. The total annual operation and maintenance cost considering all categories comes out to $6,316,000 (Purvis). See Appendix C for a more detailed breakdown of the annual operating and maintenance costs.

Financing

Financing fees were calculated using the System Advisory Model (SAM). The cost of acquiring financing is $1,000,000 (SAM), and is an element included in total equity capital. The internal rate of return (IRR) is 7% at which year 20 is when the return rate will be fulfilled to the investor. Overall, there is a net salvage value of the site at 13% which will amount to $21,762,012 in value at the end of the analysis period, otherwise considered as the end of the project's 20-year plan.

In order to get the construction financed, a total of $3,348,002.00 was borrowed and will be paid through loan periods every 6 months. The amount borrowed per each construction loan is known as the principal amount and equals $164,700,096.00. This principal amount coincides with the up-front fee involved to acquire the loan which is set at 1% of that $1,647,096.00 and is equivalent to $16,470.96. A 4% annual interest rate for loans is applied, with loans being paid semi-annually, interest is calculated to be $1,674,000.96. Adding the interest to the up-front fee cost calculated from the principal amount results in the $3,348,002.00 borrowed in total.

Table 1 - Depreciation Schedule

5-yr MACRS		
Year	%	Amount ($)
1	20	33,230,843
2	32	53,169,348
3	19.2	31,901,609
4	11.52	19,140,965
5	11.52	19,140,965
6	5.76	9,570,483
Total	**100**	**166,154,214**

Depreciation is distributed on a federal level and calculated according to a 5-yr MACRS schedule. The deducted tax percentages and the amount received per year is listed in Table 1 and was calculated by SAM. Allocations of property eligible for depreciation is at 90%, which results in a gross amount of approximately $166,000,000 over the span of the schedule.

The California standard rate on income tax is 7% while the federal income tax rate is 21%, a total of 28% applied to our wind farm. In addition to income tax, California requires a 4% sales tax on total direct costs affiliated with projects such as our wind farm. This sales tax covers 66% of our total equipment costs and calculates to $4,305,692 in sales tax.

Insurance for the duration of the project construction equals $3,600,000. Annual insurance for the lifetime of the project is estimated at $240,000 a year, and covers workers, machinery, or any property that is at risk of damaged.

Items included in the balance of plant, as well as operations and maintenance, are taxed approximately $33,000 a year. Overall, the assessed percentage of installed cost equals 20% and results in around $33,480,000 in assessed value. With a property tax rate of 1.03% a year and an assessed value of $33,480,000, $345,050 is the final total cost of taxable property in a given year of the wind farm.

Table 2 - Property Tax

Item	Amount ($)	% of Total Cost
Turbine Foundations	27,812	50
BOP collection system	1,160	10
O&M building	100	10
Site Roads	2,244	10
Gen-Tie	300	10
Collection Substation	750	10
Total	**33,276**	**100**

Equity that is owed at the beginning of the project is $73,875,977 while the size of debt at the beginning is $110,739,816. Debt service coverage ratio is 0.81 and is assumed to remain constant throughout the duration of the twenty-year plan. Table 3 displays the percentage of returns based off yearly revenue, every 5 years.

Table 3 - Return on Equity

Year of Project	Yearly Revenue ($)	Cost of Wind Farm ($)	% of Return
1	18,241,598	178,416,000	10.22%
5	18,793,166	178,416,000	10.53%
10	19,506,142	178,416,000	10.93%
15	20,246,164	178,416,000	11.35%
20	42,776,274	178,416,000	23.98%

In regard to debt, our wind farm holds 60% of total capital cost in debt and will be paid off at an annual interest rate of 7%. Debt will be paid in full at the end of year ten of operation through standard amortization. This allows for equal payments of just under $16,000,000 a year, as displayed in Table 4. Debt closing costs equal $500,000 with an up-front fee of 2.75% of total debt (SAM).

Table 4 - Return on Debt

Year 1	**$**
Total P&I	15,766,858
Interest payment	7,751,787
Principal payment	8,015,071
Ending balance	102,724,745
Year 5	
Total P&I	15,766,858
Interest payment	5,260,735
Principal payment	10,506,124
Ending balance	64,647,233
Year 10 (end of debt schedule)	
Total P&I	15,766,858
Interest payment	1,031,477
Principal payment	14,735,382
Ending balance	0

Simply providing the number for an investor is not going to be enough to get them on board with our project. With a project that requires this amount of capital investors will want to know how long it will take for them to get a return. The fully completed wind farm would generate roughly $18,000,000-$19,000,000 annually. Knowing the total cost of the farm would roughly be $178,000,000, we are looking at breaking even and turning a profit in year 10 of the project. This allows for 10 years of profit after we have taken care of the annual operating expenses.

Alternatives in the Market

Something that our team identified as a potential alternative to purchasing each turbine would have been to lease each one. This would greatly reduce the initial capital cost for the farm making it more attractive to investors. After looking into this option, conversing with a number of professionals in the field, and speaking with professors we were unable to identify a realistic way to create a financial model based on this method.

With a project of this magnitude, it is incredibly important to look at any and all alternatives that could benefit the project. Through our exploration of the industry's market and in a phone conversation with California Independent System Operator (CAISO) representative, Don Tretheway, and other industry professionals, we determined that the inclusion of a battery in our project would be beneficial from an energy supply and financial standpoint. A battery on a wind farm would have multiple uses by allowing the operators to manipulate the flow of electricity into the main power grid. One of the most beneficial uses would be the storage of electricity that is generated during non-peak demand hours. This allows the wind farm to continuously generate electricity and store it until the demand for electricity increases. At our site, we were able to identify that there is, on average, a 2-3 meter per second increase in wind speed between 9 pm and 9 am (SAM).

With this in mind, it makes our project even more attractive compared to other renewable energy generation sources such as solar. Solar is not capable of generating electricity overnight while our turbines have the opportunity to produce electricity on a much more reliable and consistent basis during that time. It's great to see an increase in wind speed like this on a wind farm. However, it does not translate into increased profit for the wind farm since this increase in wind speed and electricity generation is during non-peak demand hours. For this to be as beneficial as possible, we would need to store and then sell the electricity during peak demand hours, which is between 4 pm and 9 pm. Given the size of our wind farm, there are only a few batteries that would be able to store and then transfer enough electricity to make this a viable option. After consulting with professionals in the industry, crunching the numbers and comparing them to our initial reports, we identified that a 60 MWh battery would be the most cost effective and efficient means of storing energy on our farm (Purvis). This is what made implementing a battery like this so attractive; if we were able to store this increased amount of electricity and sell it during peak hours, we would be able to increase our annual revenue by $770,000.

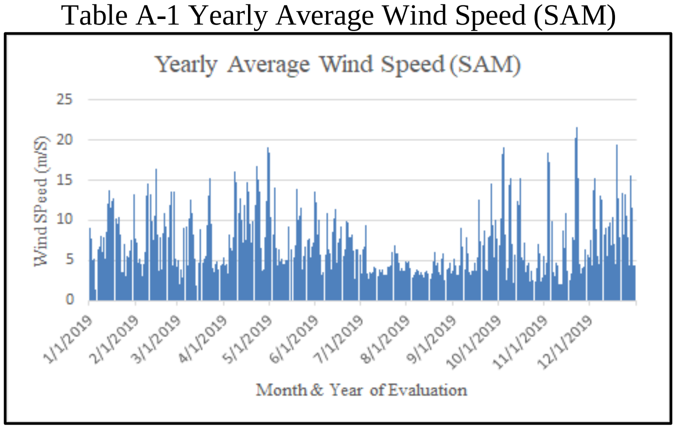
Table 5 - Added Revenue from a 60 MWh Battery

ENERGY TIME-SHIFTING ANALYSIS FOR BATTERY OF GIVEN SIZE									
			BATTERY POWER SYSTEM--->				**15**	MW	
		$ 50.00	Wind Power Base Price			PWR MOVED			
							60		
	days	**OFF PEAK**	**PEAK**	$/MWh	$/MWh	GAIN/MV	MWh		
Jan	31	0.77	1.20	$ 38.71	$ 59.91	$ 21.21	60	$	39,441
Feb	28	0.77	1.20	$ 38.71	$ 59.91	$ 21.21	60	$	35,624
Mar	31	0.77	1.20	$ 38.71	$ 59.91	$ 21.21	60	$	39,441
Apr	30	0.66	1.19	$ 32.93	$ 59.71	$ 26.78	60	$	48,204
May	31	0.66	1.19	$ 32.93	$ 59.71	$ 26.78	60	$	49,811
Jun	30	0.66	1.19	$ 32.93	$ 59.71	$ 26.78	60	$	48,204
Jul	31	0.81	2.23	$ 40.34	$ 111.52	$ 71.19	60	$	132,404
Aug	31	0.81	2.23	$ 40.34	$ 111.52	$ 71.19	60	$	132,404
Sep	30	0.81	2.23	$ 40.34	$ 111.52	$ 71.19	60	$	128,133
Oct	31	0.77	1.20	$ 38.71	$ 59.91	$ 21.21	60	$	39,441
Nov	30	0.77	1.20	$ 38.71	$ 59.91	$ 21.21	60	$	38,169
Dec	31	0.77	1.20	$ 38.71	$ 59.91	$ 21.21	60	$	39,441
								$	**770,719**
								per years	
				Rough % of the revenues needed					40%

Appendices

Appendix A

Table A-1 Yearly Average Wind Speed (SAM)



Appendix B

Table B-1 - Required Permits (Tschudin and Shasta County)

Permits	
Yolo County	
	Major Use Permit
	Major Site Plan Review
	New Septic System Permit
	Building and Grading Permits
State - CA	
	CA Dept of Transportation Division of Aeronautics
	CA Dept of Fish and Wildlife Incidental Take Permit under CESA
	CA Regional Air Quality Mangement District Authority to Construct and Permit to Operate for proposed concrete batch plants
	CA Regional Water Quality Control Board - NPDES General Construction Permit
Federal	
	Federal Energy Regulatory Commission - approval to be an Electric Whoelsale Generator and to sell electricity at market-based rates
	Federal Aviation Administration - notice of proposed construction
	USFWS Incidental Take Permit
	Cultural Resources Report
	US Army Corps of Engineers Nationwide or Individual permit under CWA

Appendix C

Table C-1 - Annual Operating Expenses (Purvis)

Annual Operating Expenses		$
Operating Expenses		$
	Service and Maintenance of Turbines	732,000
	Operation and Maintenance Other than Turbines	240,000
	Maintenance of Grounds	12,000
	24x7 Proactive Monitoring and Scheduling Coordinator	102,000
	On-Site Site Security	96,800
	Total Operating and Maintenance Expenses	1,182,800
General and Administrative Expenses		$
	Insurance	240,000
	Property Tax	325,190
	General Administrative and Management overheadfor Asset Management	72,000
	On-Site Electric Power	52,800
	Accounting, Tax and Audit Services	12,000
	Legal Services	60,000
	Owner's Representative	280,000
	Independent Engineer	2,800,000
	Site Project Manager	120,000
	Environmental Hazard Saftey Manager	120,000
	Owner's Engineer	60,000
	Cost of Letter of Credit	432,000
	Total General and Administrative Expenses	4,573,990
Land Lease		$
	2,623 acres at $160/acre	419,680
		$
Community Fund/PILOT Payments		60,000
		$
Decommissioning Bond		80,000
		$
Total Annual Operating Expenses		6,316,470

Appendix D

Table D-1 - Initial Capital Costs (Purvis)

CSU Capay Wind 100.8MW CapEx			**$K**	*$K*	*$K*
Wind Turbines			$86,766		
BOP (incl Engr, IC, Commiss)			$52,784		
BOP & Construction				*$33,384*	
BOP Contractor - Turbine Related					*$16,040*
BOP Collection System					*$11,600*
O&M Building					*$1,000*
Public Road Improvements					*$2,000*
Misc Support Services					*$500*
On Site Roads - miles x $/ft	*17*	*$ 25*			*$2,244*
Interconnection Costs				*$15,735*	
IC Study Fee (CAISO)					*$151*
IC Facilities and Network Upgrades					*$7,649*
Gen-Tie					*$3,000*
Consultants					*$175*
Collection Substation					*$4,760*
Constr Mgmt & Owner's Eng				*$3,290*	
Wind Consultants					*$100*
Project Mgmt					*$665*
Construction Mgmt					*$555*
Site Admin Svcs					*$140*
Site Inspection					*$205*
Site Expenses					*$175*
Construction Inspection					*$175*
Site Security					*$310*
Owners' Engineering					*$650*
Misc Consultants					*$315*
Commissioning				*$375*	
Sales tax on equipment (Calif)			$4,284		
Project Insurance - during construction			$3,600		
Land			$350		
Legal Costs			$880		
Permitting & Environmental			$1,290		
Financing Fee			$1,000		
Development Costs			$5,349		
Project Dev Fees			$8,000		
G&A			$750		
Contingency			$2,476		
Project Cost (ex-Pre COD Int and Loan Fees)			**$167,528**		

Appendix E

Table E -1 – Project Pro Forma

CSU WIND 100.8 MW		**V4.2-150 C 100m**					**Interest during Construction**					
CAPAY HILLS			**Turbines**	**BOP**	**CA Sales Ta**	**Non - BOP**	(+Loan Fee)					
Capital cost	**$ 1,714.00**	**$/kW <-----**	**$861**	**$524**	**$43**	**$225**	**$62**					
CA Sales Tax (est)	4.00%	(w/ 2017 partial abatement)			**Note - Project is assumed to enter svc for tax purp. Last day Yr 0**							
Usefull life	20	years		**XIRR (20yr)**	**7.12%**							
PPA Rate	$ 52.00	$/MWh @esc	**1%**	**XIRR with T**	**7.59%**	1	<--- Terminal Value? (yes=1)			Term Val%	12.00%	
Other Esc (non-ppa)	2%	Per year				0	<--- Reserves Spent (No=0)					
Operating Expesnes	8.5%	$/MWh (First Year)				28.54	per kW-year		Acres	$/acre/year	Land escala	
NCF	38.3%		**V150-4.2 C 100M**						2623	160	2%	
Plant Size	100.8	MW	**24**	Num of WT	**4.2** WT rated MW-capacity							
PTC Base Rate	$ 9.00	$/MWh	(might subsititute capacity pmt)									
ITC	0%											
Depreciation rate	95%	% of Capex allowed under MACRS										
Degredation	0.25%	/year										
Tax Rates	**28%**	21%	Federal	7%	State							
		PPA/Perm/IC	Construction	CO YR 1								
		12/31/2020	12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026	12/31/2031	12/31/2036	12/31/2041	12/31/2042
Year		**0**	**0**	**1**	**2**	**3**	**4**	**5**	**10**	**15**	**20**	**21**
Exp. And Lease Esc.		1.00	1.00	1.02	1.04	1.06	1.08	1.1	1.22	1.35	1.49	1.52
Degredation		0.00%	0.00%	0.00%	0.25%	0.50%	0.75%	1.00%	2.25%	3.50%	4.75%	5.00%
Investment		0	172,809,512									
Terminal Value	12%	0	0	0	0	0	0	0	0	0	0	31,430,587
				1.00	1.01	1.02	1.03	1.04	1.09	1.15	1.21	
Generation		0	0	338,192	337,347	336,501	335,656	334,810	330,583	326,355	322,128	0
Revenue		0	0	17,585,987	17,717,443	17,849,768	17,982,969	18,117,048	18,800,781	19,507,127	20,236,614	31,430,587
Expense		0	0	-2,933,997	-2,992,677	-3,052,513	-3,113,581	-3,175,853	-3,506,398	-3,948,774	-4,274,280	-250,000
Reserves, 13 years	-	0	0	0	0	0	0	0	0	0	0	
Land Lease		0	0	-428,074	-436,635	-445,368	-454,275	-463,361	-511,588	-564,834	-623,622	-415,748
EBITDA		**0**	**0**	**14,223,917**	**14,228,130**	**14,351,870**	**14,415,113**	**14,447,835**	**14,782,795**	**15,070,946**	**15,338,712**	**30,764,839**
PTC Rate (Unrounded)		9	9.00	9.18	9.36	9.55	9.74	9.94	10.97	12.11	13.37	13.64
PTC Rate (Rounded)		9	9.00	9.00	9.00	10.00	10.00	10.00	11.00	12.00	13.00	14.00
PTCs		**0**	**0**	**3,043,729**	**3,036,119**	**3,365,011**	**3,356,556**	**3,348,101**	**3,636,410**	**0**	**0**	**0**
Unlevelewd After Tax Cash Flow												
EBITDA		-	0	14,223,917	14,288,130	14,351,870	14,415,113	14,477,835	14,782,795	15,070,946	15,338,712	30,764,839
PTC		-	0	3,043,729	3,036,119	3,365,011	3,356,556	3,348,101	3,636,410	0	0	0
Tax (benefit)/Liability		-	-8,709,599	-9,952,662	-4,360,539	-998,206	-980,498	1,545,429	4,139,183	4,219,865	4,294,839	8,614,155
Total After Tax Cash Flow		**0**	**-164,009,913**	**27,220,308**	**21,684,789**	**18,715,087**	**18,752,167**	**16,280,507**	**14,280,023**	**10,851,081**	**11,043,872**	**22,150,684**
XIRR 20-yr	**7.12%**			-83.40%	-54.40%	-35.50%	-22.60%	-14.80%	1.1%	5.20%	7.10%	7.60%
XIRR 20-yr	**7.59%**											
XNPV 20-yr	12,575,345	6.50%	100	0	0	0	0	0	0	0	0	0
Npv of Benefits	7.59%											
Energy	187,920,915		72%									
Terminal Value	6,764,145		3%									
PTC	22,803,992		9%									

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