Techsan Wind: Overland Project Development Report

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Site Description and Energy Estimation

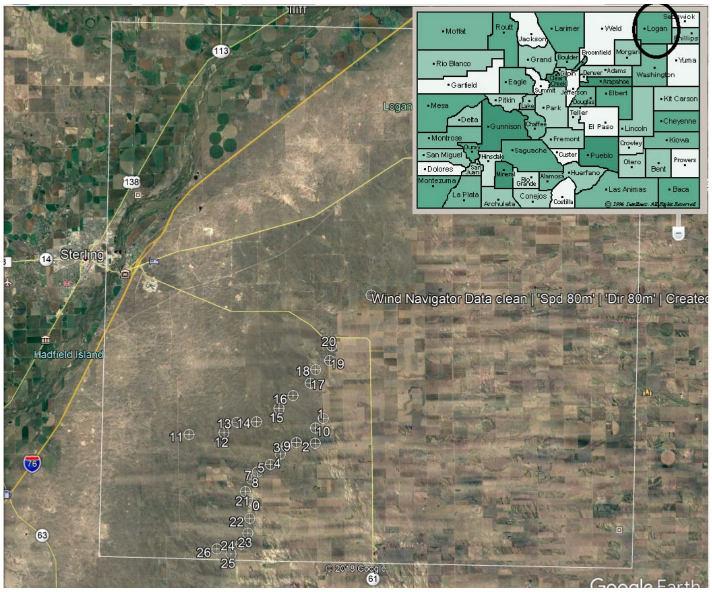


Fig. 1, An image depicting the proposed project location overlaid in Google Earth showing the project's location.

The proposed Overland Wind Project site is located in northeastern Colorado in central Logan County approximately 13.5 miles southeast of Sterling, Colorado, a portion of this site is in rural agricultural land and low wetlands. The construction of the wind project is located approximately 6 miles west of Interstate Highway 76, approximately 2.8 miles south of State Highway 61, access to the site can be gained by County Highway 53. The Overland Wind Project site lies near the South Platte River at an elevation of 3,875 feet, containing rural agricultural land area and many rural farming residences allowing for optimal wind resources averaging 7.9 m/s at heights of 82 meters. Based on average wind speeds, the project has an estimated annual production potential of 338 GWh.

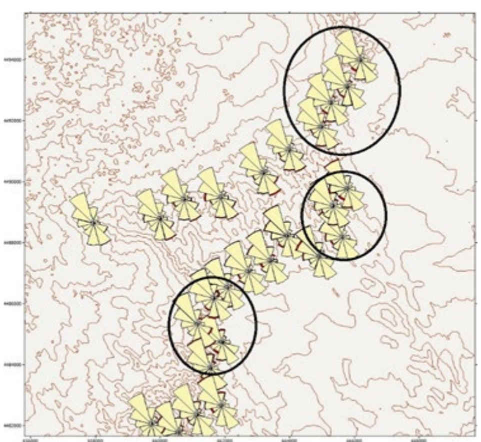
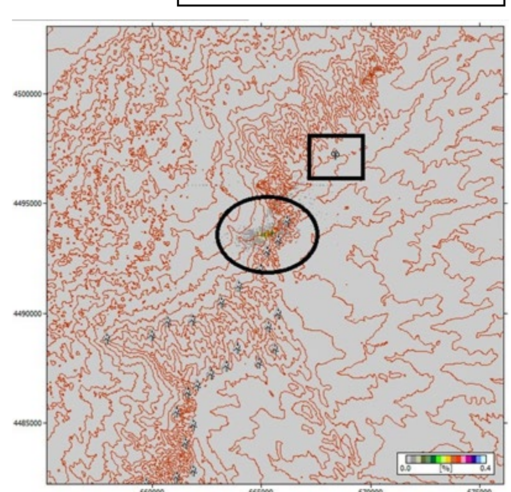


Fig. 2, An image pulled from WasP depicting the wake losses the project is predicted to experience.

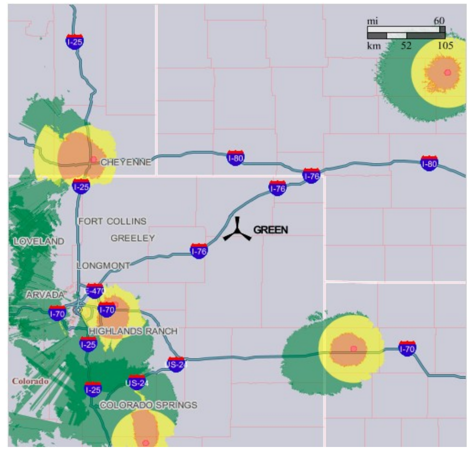
In the image to the left the wake losses experienced by each turbine is shown. The three circles indicate the areas of the project experiencing the most wake and thus, once the project is built these clusters might need more attention. The average wake loss for the project was 2.25 percent. The next image seen on the right is the Ruggedness Index from WAsP.

Fig. 3, Ruggedness Index map pulled from WAsP.



The Ruggedness Index (RIX) represents the confidence WAsP has in calculating how the wind will interact in a given area. As the image to the right shows, almost all of the project is grayed which is the lowest percentage on the RIX meaning the software is confident in how the wind will interact with the turbines. There is one spot on the map highlighted by the circle in which the RIX percentages demonstrate a lot of uncertainty. After analyzing the area using mapping software it was discovered that this area was in fact an abandoned mine explaining the uncertainty.

Fig. 4, Long range radar impacts pulled from the Department of Defense Screening Tool.



In addition, to the turbine site the project location is also important as it can potentially impact radar which can become a serious issue. These three radar types can definitely stop development of a project due to the wind turbines severely distorting the information the radar receives. In the image located to the right, long range radar impacts are observed. Long range radar has to deal with air defense and homeland security and if a wind turbine or project interferes with the radar's capabilities it can be seen as a security risk. As the picture shows the project is not near any long range radars and will not pose a security issue. NEXRAD radar deals with observing atmospheric conditions and helps meteorologists determine where severe thunderstorms and other weather patterns are moving. If a wind project is interfering with these radars it would permanently look like a thunderstorm is appearing where the wind project is or if a thunderstorm passes through the project it will be "camouflaged" and meteorologists will not know the direction of the weather pattern. From what can be seen in the image above, the project is fortunately, not in any danger of interfering with NEXRAD radars. Lastly, there are military operations. Similar to long range radars, the wind project can not interfere with any military operations or it will be shut down immediately. In the following image military impacts were analyzed using the Department of Defense's (DoD) Screening Tool. From what could be found there were no impacts to any military operations in the area.

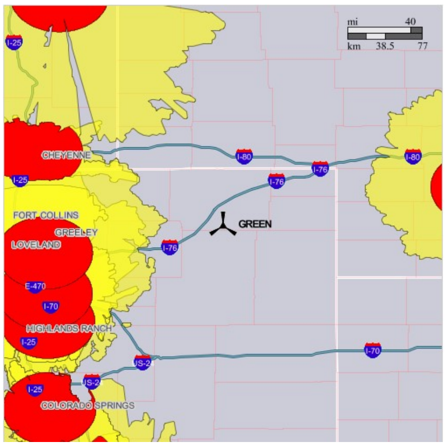


Fig. 5, NEXRAD radar impacts pulled from the Department of Defense Screening Tool.

Fig. 6, An image portraying military impacts pulled from the Department of Defense Screening Tool.

The figure to the right depicts the electrical infrastructure of the project. In addition, turbine locations (shown as green circles) in relation to the collection system (shown as red lines), meteorological tower (shown as black triangle), collection substation (shown as black square), home run (shown as black line) and the point of interconnection (shown as black lightning bolt) are shown as well. The electrical system was designed with the substation strategically placed to reduce as much electrical losses as possible. After our analysis we are expecting no more than one percent in electrical losses.

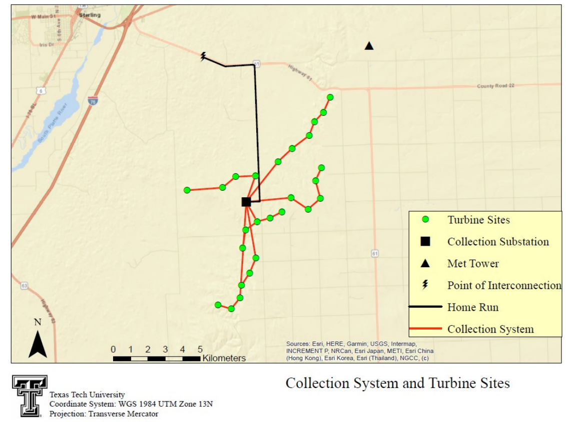


Fig. 7, An image portraying the electrical infrastructure of the project.

Project Permitting

Overview

The Overland Wind Project located in Logan County, Colorado will require five state and local permits along with one federal permit. After permits, there are a few supporting documents that need to be submitted with these permits. A plot plan, a deed and list of mineral estate owners if applicable, a certificate of taxes, a posted Notice of Public Hearing on the property 15 days prior to the hearing, and a list of adjacent property owners.

Factors of Consideration

There are many sensitive areas, topics and laws to consider when locating and acquiring permits for a wind site. The National Wind Coordinating Collaborative (NWCC) lists: land use, noise, birds, and other biological resources, visual resources, soil erosion and water quality, public health and safety, cultural and paleontological resources, solid and hazardous waste, and air quality and climate as categories to consider when obtaining permits for the project. NWCC offers an estimate of roughly one-year time frame to obtain all the necessary permits to move forward with the project. (National Wind Coordinating Committee, 2002)

Federal Agencies of Consideration

Federal Bureau of Land Management (BLM), United States Forest Service, Bonneville Power Administration (BPA), Western Area Power Administration (WAPA), Federal Aviation Administration (FAA), National Environmental Policy Act (NEPA). These agencies do not always play a part of the permitting process for every wind project. Given the location of the Overland

Wind Project the majority of these agencies will not need consideration. The project will only need the FAA obstruction evaluation/airport airspace analysis.

Permit Needed	**Agency of Consideration**	**Cost of Permit**
Conditional Use/Special Use Permit	Planning commission, Zoning and Building Department, Sterling City Council, Logan County Board of Supervisors and Commissioners	**$100**
Building Permit	Planning commission, Zoning and Building Department, Sterling City Council, Logan County Board of Supervisors and Commissioners	**$540,000**
Right of Way Permit	Colorado Department of Regulatory Agencies, Colorado Department of Transportation	**$50 per mile or portion thereof**
Colorado Oversize Overweight Permit	Colorado Department of Regulatory Agencies, Colorado Department of Transportation	
Logan county special transport permit		
Obstruction Evaluation/Airport Airspace Analysis	Federal Aviation Association	

Logan County requires conditional use, right of way, and building permits before the beginning of construction. These permit applications will be submitted to Logan County Planning, Zoning and Building Department in accordance with their rules and regulations on submitting permit applications. (Colorado Planning, Zoning and Building, 2019)

BIOLOGICAL ANALYSIS

Wildlife Impacts

Wildlife species were identified by application of the United States Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) online review map. Habitat characteristics and animal behavioral concerns were provided by evaluation of online findings published by the Cornell University Lab of Ornithology Birds of North America Program.

The presence of Whooping Cranes and Piping Plovers was recognized in the project impact area (IPaC, 2019). (Cornell, 2019). The Whooping Crane is classified as a federal endangered species, and the Piper Plover is classified as a federal threatened species. To reduce effects on the species, the project proposes implementation of the following mitigation practices:

Project operation curtailment will enforce the discontinuance of turbine operation during high usage periods of concerned birds within the project impact area. Operation will not resume until a Colorado Fish and Wildlife Service approved biologist has confirmed that no birds are in danger of turbine collisions (Allison, T. D., Diffendorfer, J. E., & Baerwald, E. F., 2019).

Project compensatory mitigation will provide substitute resources to the local habitat to replace the value of lost resources to the project impact area. Resources will feature project-managed mitigation banking and direct funded research for apposite wildlife within Logan County (U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines, 2012).

Environmental Conditions

Groundwater resource information was acquired from the National Wetlands Inventory Surface Waters Map. The proposed project site will coincide with riverine habitats and numerous small freshwater ponds (U.S. Fish and Wildlife Service National Wetlands Mapper, 2019). The project will primarily seek to avoid disturbances of surface water by strategic placement of turbines. Mitigation will also entail the establishment of mitigation banks, in-lieu fee programs, and permittee-responsible restoration (Background about Compensatory Mitigation Requirements under CWA Section 404, 2019). Mitigation practices will additionally precipitate the purchase of wetland easements and the planting of native plant species in Logan County.

The geological conditions of the project area were provided by the United States Department of Agriculture Natural Resource Conservation Service Web Soil Survey. The survey distinguished the most prevalent soil in the project area as valent loamy sand with 3 to 9 percent slopes (U.S.D.A. Natural Resources Conservation Service Web Soil Survey, 2019). The soil type is characterized as having low erodibility with low probability of water flooding. If unnatural soil and/or landscape formations are discovered, the project will compensate with mitigation banking (Potential Impacts of Wind Energy Development and Analysis of Mitigation Measures, 2005).

Operation Curtailment

Project operation curtailment will enforce the discontinuance of turbine operation during high usage periods of concerned birds within the project area. Operation will not resume until a CFW approved biologist has confirmed no birds are in danger of aerial turbine collisions (Allison, T. D., Diffendorfer, J. E., & Baerwald, E. F., 2019).

Compensatory Mitigation

Project compensatory mitigation will provide substitute resources to the local habitat to replace the value of lost resources to the project impact area. Resources will feature project-managed mitigation banking and direct funded research for apposite wildlife species within both Logan County and other regions of Colorado (U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines, 2012).

Societal Impacts

With any project community perception is key in having a successful and easy project lifetime. From what could be gathered from Logan County's newspaper, The Sterling Journal-Advocate, an article was found discussing NextEra building a project near Fleming. What was important from this was that in the article it states that landowners were concerned about decommissioning of the turbines. Due to the similar geography and locality of Fleming it was assumed a similar concern would emerge from the Overland Project as well. To help landowners with their concerns that would arise with the project, a meeting at a town hall would occur to discuss concerns. The town hall meeting or panel conference for the area would be held where qualified individuals would be able to answer general questions from the public. This way, any concerns may be allayed and there would be increased support for the wind project.

For transportation, the site is located near State Highway 61, which is connected to Interstate 76. This proves to be beneficial for the project because construction will have easy access to the location. Traffic will increase in the area but only during the construction phase and will slowly decrease once the project is fully constructed. Transportation of materials will be halted during peak times of traffic such as morning and afternoons, this will decrease the traffic times the community will feel and possibly improve public opinion of the project. As explained in the Biological Impacts section of the paper the project will create solutions to minimize impacts on the wildlife. By creating these solutions, the hunting community will have less negative feedback on the project.

The community will feel economic impacts from the project as demonstrated by the Jobs and Economic Development Impact model (JEDI) used. The summary results from the model are shown below.

Fig. 8, Summary results pulled from the Jobs and Economic Development Impact Model.

Local Economic Impacts - Summary Results	Jobs	Earnings	Output	Value Added
During construction period				
Project Development and Onsite Labor Impacts				
Construction and Interconnection Labor	59	$3.7		
Construction Related Services	4	$0.4		
Total	63	$4.1	$4.4	$4.1
Turbine and Supply Chain Impacts	160	$9.7	$28.4	$14.4
Induced Impacts	80	$4.5	$13.3	$7.7
Total Impacts	**303**	**$18.3**	**$46.1**	**$26.3**
During operating years (annual)				
Onsite Labor Impacts	5	$0.4	$0.4	$0.4
Local Revenue and Supply Chain Impacts	12	$0.7	$2.2	$1.3
Induced Impacts	5	$0.3	$0.9	$0.5
Total Impacts	**23**	**$1.4**	**$3.5**	**$2.2**

Construction Period:

It should be mentioned that ideally most of the construction of the project will utilize local companies as much as possible to possibly decrease expenses and give back to the community. During the construction time period of the project it is expected that 303 jobs will be created with the total earnings from those jobs equaling roughly 18.3 million dollars. This is incredibly important as those funds could possibly be spent within the local economy helping to drive development. Output refers to the "value of production" as the model explains within the economy. Finally, "value added" is roughly the difference between outputs and earnings with other expenses involved as well. In this case, 26.3 million dollars of value will be going back into the economy which as said before will really help local and state development.

Operating Years:

While the project is operating 23 jobs will be created, and these jobs are going to be more permanent jobs as opposed to the construction jobs as those will last roughly 6 months or the length of time it takes to construct the project. An annual 2.2 million dollars of value will be going back into the local economy as a result of routine maintenance, parts, etc.

Project Costs

Turbine Procurement and Installation Costs

The chosen turbine for the project is the Vestas V136-3.45. Other turbines that were considered include the Vestas V112-3.45, V117-3.45, GE 2.75-120 and GE 3.2-130. The V136.345 was chosen for its potential energy output as well as its locations of manufacturing facilities. The location of the factories needed to produce the turbines was also a huge advantage for the Vestas models. A limiting factor in turbine selection was access to power curve data to place into Windographer to analyze. To establish an accurate cost estimate of the turbines used in the Overland Project, NREL's SAM model was utilized to evaluate the cost of each turbine. The cost estimate for each turbine given by SAM was $3.33 million with a total turbine cost of $86.8 million ("System Advisor Model (SAM)").

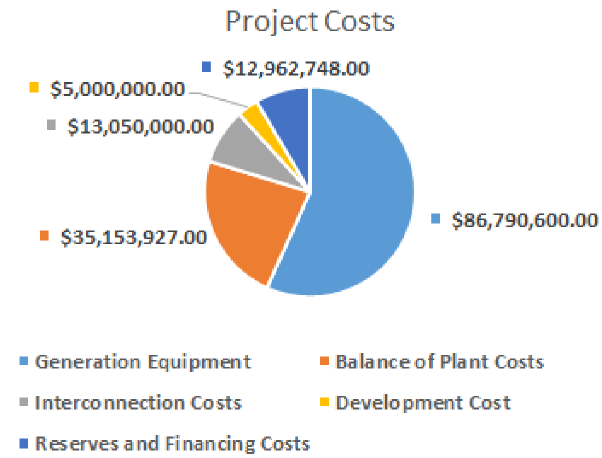


Fig. 9, The project costs are displayed in a pie graph.

Balance of Plant Costs

For Balance of Plant (BOP) costs, retrieval of a previous BOP cost estimate from a wind project done in Western Nebraska was used (Campos, "TTU WE Mock Project Construction BOP Estimate & SOW "). To keep the data as accurate as possible for the site, only estimates pertaining to construction of the site were pulled: access road and site improvement costs, turbine erection etc. Turbine specific costs such as transportation and foundation costs were estimated using SAM as the Western Nebraska project used a turbine of a different size. Electrical costs were not used since Colorado has a different market structure to Nebraska. The electrical costs were instead determined by previous interconnection studies done by the Tri-State Generation and Transmission Association. A study done by the Tri-State Generation and Transmission Association for the interconnection of a project very similar in size and turbine selection was used for interconnections costs. These costs were estimated to be $13.05 million (Ellis, Hubbard, & Pink, "Interconnection System Impact Study Final Report – February 1, 2018"). The total BOP costs totaled $53.2 million.

Annual Operating Expenses

Like many energy generation facilities, a wind project will require maintenance to operate on a yearly basis. The fixed operations and maintenance estimate comes from NREL's 2018 Cost of Wind Energy Review. Once these inputs were analyzed together it was discovered that the budget would be $44 per-kilowatt-year.

Property Taxes

For property taxes, a template issued by the State of Colorado specifically for renewable energy was utilized, it was determined that the project would pay $691,000 in the first year with a 1.43 percent increase each year annually ending at $1.1 million in the twentieth year of the project. ("Renewable Energy", 2019). (A further breakdown of the costs is provided in Appendix A)

Project Insurance

An insurance policy will also be necessary to further ensure funding can be secured for the project and reduce uncertainty. According to Windustry.org these insurance costs are predicted to be $15,000 per turbine per year (Daniels, "Chapter 8: Costs"). The average insurance cost totaled $551,000 for the life of the project.

Reserve Fund

In the event that the project experiences a prolonged period of down time or a major failure occurs in the project, a reserve account will be crucial in ensuring the project stays afloat. In the CREST model a reserve account has been developed to fund the project's debt for six months as well as operations and maintenance for six months. The amounts for each account were $4.7 million for debt services and $3.7 million for operations and maintenance.

Land Leasing/Royalties

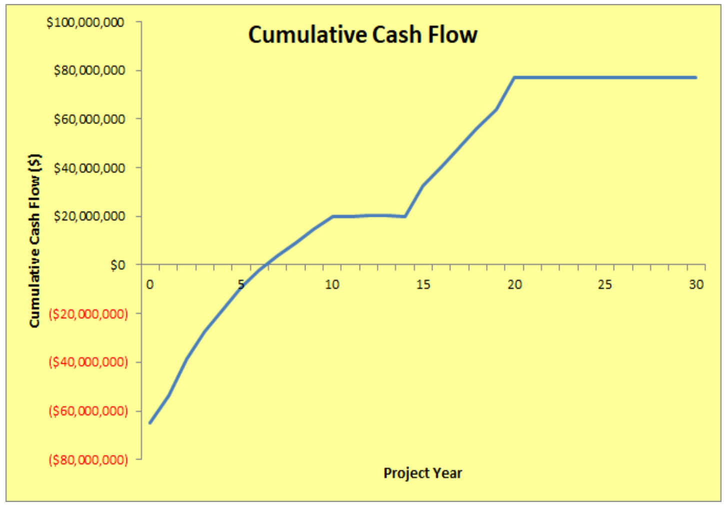
Land leasing is usually split into two forms of payment: a yearly fixed payment, and a royalty percentage of the profit made by the turbines. For the fixed payment an assumed yearly payment of $24,000 as provided by the CREST model. In establishing the royalty rate one of the National Wind Institute's instructors provided the team with a sample land lease agreement of which a rate of four percent for royalty payments was initially created. (Kassandra McQuillen, Personal Communication, January 29, 2019). An additional one percent was added to royalty payments to account for the fertile land the turbines are being built on which will fetch a higher price.

Project Financing

Market Conditions

The project area is located within the boundaries of the electric co-op Highline Electric Association (HEA). HEA's wholesale power provider is Tri-State Generation and Transmission Association. According to Tri-State's 2018 Annual Report, their average member rate is $0.075/kWh, which translates to $75/MWh ("Financials: Tri-State Generation and Transmission Association, Inc"). This puts the Overland Project in a very marketable position considering the project will attain the desired rate of return at $71.1/MWh. It is possible that a favorable power purchase rate can be acquired further considering, Dennis Herman, the General Manager of HEA, stated that a 100 MW Project would provide 80% of HEA's electrical requirements ("Electricity Market Pricing (Wind)", 2019).

Fig. 9, Cash flow model of the project is shown.



Debt Payoff/Cash Flow

The total installed cost of the project is $142.9 million or $1,594/kW. According to the CREST model, the debt percentage was broken up as fifty-nine and two-fifths percent permanent debt and forty and three-fifths percent equity. These percentages were established in such a way to maintain a minimum Debt Service Coverage Ratio (DSCR) of 1.2. A target Internal Rate of Return (IRR) of eleven percent and a thirty percent Power Purchase Agreement (PPA) escalation percentage was established to help attract investors to the project. In the figure above a cash flow analysis graph was pulled from the CREST model. As the graph shows, the project breaks out of debt at about six and a half years and flat-lined at twenty years as that is as long as the project is expected to operate per the rules established for the competition.

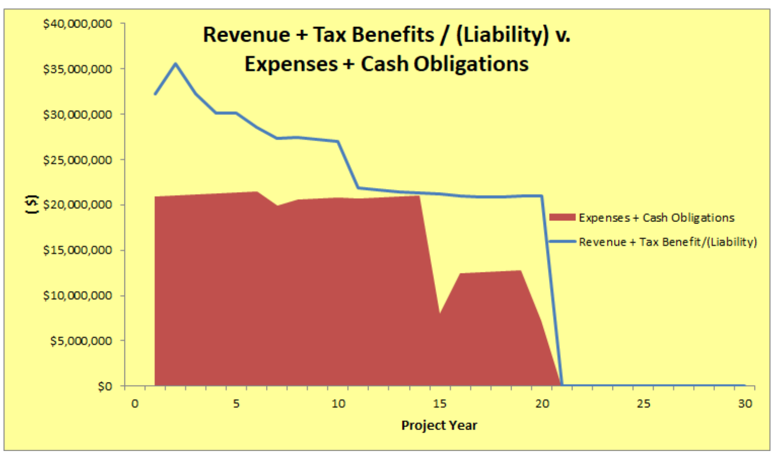


Fig. 10, A graph depicting Income vs. Expenses of the project.

The image to the left is a graph depicting income vs. expenses. From what can be seen in the first year an increase is seen in income for the project. From analyzing the cash flow of the project this was determined to be the result of the depreciating assets of the project. Following the income increase the project slowly loses income as a result of deterioration of the turbines. The next sharp decrease in income occurs at the tenth year of the project. This is the result of the Production Tax Credit (PTC) ending. The project income follows a normal deterioration following the PTC until the end of its lifetime at twenty years. Meanwhile, the expenses in the project in the first fifteen years remain relatively high demonstrating the fragility of the project's infancy stages and why maintaining the turbines will be critical in the project's survival. Finally, in the fifteenth year expenses drop dramatically as this marks the end of the term for the loan for the project. Expenses do rise again but this is taking into account the increased maintenance the turbines at that stage might be needing.

Loan Setup

According to Stoel Rives LLP the debt for a project gets split into three categories depending on the stage in the project's lifecycle, "(1) development-stage debt for the pre-construction period, (2) construction debt to finance the period of active EPC work, and (3) permanent debt for the post-construction period when a project is operational and development work is complete." Knowing this, the project shall begin acquiring debt with a development loan to fund all development activities for the project. Since the project is still only in the development stage, "the value of the project assets remains somewhat prospective at this early stage, development lenders may forgo a full collateral pledge of project assets, opting to rely solely on a pledge of project company membership interests, or may require security interests in deposits and material assets." (Stoel Rives LLP, 2018) Once, the project has successfully completed the development stage the project will enter the construction phase. This stage is difficult due to the amount of increased personnel, parts, etc. In fact, "construction loans tend to be the most procedurally complex loan transactions, involving the most detailed covenants outlining what a project may or may not do and imposing the highest hurdles to accessing funds." (Stoel Rives LLP, 2018) Lastly, once the rigorous stage of construction has been completed the project will enter its final stage in which the loan requirements "...has a comparatively gentler set of loan terms than during construction, since the tighter restrictions used to protect the lender against construction risks are no longer needed." (Stoel Rives LLP, 2018) According to Stoel Rives, the "permanent loan" given after the project has been operating, can sometimes have 12 to 15 year tenors. To properly pay off the debt a tenor of 14 years has been assumed with an interest rate of 7 percent assumed as well.

Triple Bottom-Line Opportunities

Restoring Site at The End of the Project

The predicted lifespan for this project is going to be twenty years. If chosen to do so, the project can be repowered after its projected lifespan. The turbines can be updated with newer technology and reused to produce power for an additional twenty years. This can be incredibly profitable as expenses vs income will be much more manageable as loans will have been paid off which are major expenses for the project. A decommissioning fund will also be set up to help tear down the turbines and restore the land after. If this route is taken, then the project will be torn down and will no longer produce power. The components of this project then will be evaluated and handled on what value they could possibly bring.

Asset Disposal

After the project has reached the end of its lifespan, the project needs to be shut down and the parts need to be recycled or disposed of. There are many parts to an aging project that can still be turned around and sold for value: electrical systems, turbine blades, steel from the mast, etc. to name a few. The main goal of the asset disposal is to make sure none of the wind project's assets are left to sit on the landowners' land and to leave the land as it was before the wind project was built. The removal of all the components will show that the wind project has been taken down and the assets have truly been disposed of.

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Appendix A

[1] Property Tax Template used for Colorado

Cell: E58 | STEP B | Cell: H54

	Annual Energy Production (MW hours)	Energy Price Assumption	Gross Energy Revenue	Goal Seek Multiplier (Tax Factor *)	**Actual Value**	Assessment Rate	**Assessed Value**	Prev Year's Mill Levy %	**Projected Property Tax Payment**
Year 1	322,167	$68.50	$22,068,407	1.43	$31,563,462	29.00%	$9,153,404	7.5550%	$691,540
Year 2	322,167	$70.21	$22,620,117	1.43	$32,352,548	29.00%	$9,382,239	7.5550%	$708,828
Year 3	322,167	$71.97	$23,185,620	1.43	$33,161,362	29.00%	$9,616,795	7.5550%	$726,549
Year 4	322,167	$73.77	$23,765,260	1.43	$33,990,396	29.00%	$9,857,215	7.5550%	$744,713
Year 5	322,167	$75.61	$24,359,392	1.43	$34,840,156	29.00%	$10,103,645	7.5550%	$763,330
Year 6	322,167	$77.50	$24,968,376	1.43	$35,711,160	29.00%	$10,356,236	7.5550%	$782,414
Year 7	322,167	$79.44	$25,592,586	1.43	$36,603,939	29.00%	$10,615,142	7.5550%	$801,974
Year 8	322,167	$81.42	$26,232,401	1.43	$37,519,037	29.00%	$10,880,521	7.5550%	$822,023
Year 9	322,167	$83.46	$26,888,211	1.43	$38,457,013	29.00%	$11,152,534	7.5550%	$842,574
Year 10	322,167	$85.55	$27,560,416	1.43	$39,418,438	29.00%	$11,431,347	7.5550%	$863,638
Year 11	322,167	$87.69	$28,249,426	1.43	$40,403,899	29.00%	$11,717,131	7.5550%	$885,229
Year 12	322,167	$89.88	$28,955,662	1.43	$41,413,997	29.00%	$12,010,059	7.5550%	$907,360
Year 13	322,167	$92.12	$29,679,553	1.43	$42,449,347	29.00%	$12,310,311	7.5550%	$930,044
Year 14	322,167	$94.43	$30,421,542	1.43	$43,510,580	29.00%	$12,618,068	7.5550%	$953,295
Year 15	322,167	$96.79	$31,182,081	1.43	$44,598,345	29.00%	$12,933,520	7.5550%	$977,127
Year 16	322,167	$99.21	$31,961,633	1.43	$45,713,303	29.00%	$13,256,858	7.5550%	$1,001,556
Year 17	322,167	$101.69	$32,760,674	1.43	$46,856,136	29.00%	$13,588,279	7.5550%	$1,026,595
Year 18	322,167	$104.23	$33,579,691	1.43	$48,027,539	29.00%	$13,927,986	7.5550%	$1,052,259
Year 19	322,167	$106.84	$34,419,183	1.43	$49,228,228	29.00%	$14,276,186	7.5550%	$1,078,566
Year 20	322,167	$109.51	$35,279,662	1.43	$50,458,934	29.00%	$14,633,091	7.5550%	$1,105,530
					PROJECTED 20-YEAR PROPERTY TAX REVENUE (income basis)				**$17,665,144**