Application of Income Approach Valuation Method concerning Oklahoma Wind Energy Projects

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Abstract

There are three generally accepted property valuation approaches for wind energy projects: the income approach, market approach, and cost approach. In Oklahoma, counties typically use the cost approach set forth by the Oklahoma Tax Commission's (OTC) Oklahoma Business Personal Property Valuation Schedule to assess the value of wind turbines over time and apply applicable deprecation rates. Counties use the OTC schedule due to widespread participation in the law creating the Oklahoma Reimbursement Fund (ORF) which pays the ad valorem taxes for wind projects for the first five years of existence. However, now that most wind projects have aged out of the ORF program, counties have defaulted to use the OTC's schedule. While the OTC schedule is not binding, most assessors follow it because of the complexity of the income approach and the lack of comparative information for the market approach. Among Oklahoma county assessors, there is not a consensus on the proper methodology for valuing wind energy projects; however, there is a desire to explore every possible option (5). The income and market valuation approaches, while more challenging to conduct, are both options that could increase assessor's overall ability to assess the value of wind projects. My thesis explores how the income approach for wind project valuations could stand to increase or decrease county tax revenue that funds public services within wind dense counties. I analyzed the FPL Energy Cowboy Wind project within Custer County, and while the evidence supports using the OTC cost schedule, I was able to determine which variables would impact the study differently. The results of my thesis reinforced that every wind project must be evaluated on per project basis with proprietary information supplied by wind energy company's if they should choose to use the income method.

Sections

Introduction to Wind

Wind farm development in the United States has grown significantly over the past two decades, fueled by federal and state incentives as well as mandated state Renewable Portfolio Standards (RPS) and goals. These incentives plus Oklahoma's optimal location, have allowed the wind power industry in Oklahoma to grow from a zero capacity in 2002 to an 8,072 megawatt as of the first quarter in 2019, making it the third largest wind power capacity state in the United States (2). While Oklahoma, does not have a mandated RPS, in May 2010 the Oklahoma Legislature enacted the Oklahoma Energy Security Act or House Bill 3028, establishing a renewable energy goal for electric utilities operating in the state. The goal called for 15% of the total installed generation capacity in Oklahoma to be derived from renewable sources by 2015. However, Oklahoma easily surpassed this goal, and in 2018 wind energy provided 31.7% of all in-state electricity production (2).

Turbine Valuation Methodologies

There are three generally accepted property valuation approaches the income approach, market approach, and cost approach. These methods are used to depreciate assets and which is the processes to determine the actual, current value of an assets remaining life. Assets, like wind turbines, depreciate for several reasons. One reason is that as an asset ages, it has a progressively shorter future life over which it can earn income. Thus, the present value of the asset's future income stream, which determines its value, falls as the asset ages. A second reason is that as it ages, the asset may require more expensive maintenance or become less productive (4). While all three approaches should be used in valuing a project, for the purposes of this report the market approach is excluded due to the lack of data from comparable wind farm sales.

In Oklahoma, counties typically use the Oklahoma Tax Commission's (OTC) Oklahoma Business Personal Property Valuation Schedule to assess the value of wind turbines over time and apply applicable deprecation rates. Counties use the OTC schedule due to widespread participation in the law creating the Oklahoma Reimbursement Fund (ORF). The Oklahoma Reimbursement Fund created for all eligible wind farms, a five-year exemption of property taxes. After the exemption has expired,

assessment of the properties falls to the county assessors who typically opt to use the OTC schedule. Interestingly, the OTC schedule is not mandatory nor binding to county assessors to use. County assessors do, however, have an obligation to apply consistent valuation methodologies and ideally, this would be a combination of all three valuation methods. A common theme across Oklahoma counties that have wind farms is that there is no consensus on the best methodology for valuing wind energy systems after wind farms graduate from the ORF program for county tax revenue purposes (7). The most common valuation approach used by for wind farms is the OTC's cost approach; however, given the indefinite life and replaceability of parts, the income method may be a viable alternative method to assess wind projects in the long term.

Ad Valorem Taxes

To compare the tax implications between using the cost and income method approaches, I analyzed county ad valorem taxes from Custer County, School District 26 which contains the FPL Energy Cowboy Wind project. In total there are a total of 91 turbines that fall within the Woodward School District 26 that Custer County collects taxes for. The specific tax that is collected is an ad valorem tax. Ad valorem taxes are paid by the entity and are based on the value of the item being taxed. In Oklahoma, wind turbines are subject to ad valorem tax at the county level unless the project is subject to some form of exemption (7). Three primary factors determine the amount of tax owed for a given piece of property: the property's value, the county's assessment ratio, and the millage rate for jurisdiction containing the property (7). With a limited number of exceptions, the task of determining the market value of a property falls to a county assessor, which is why the method of depreciation selected matters.

Once the county assessor determines the fair market value of a wind turbine, that value is multiplied by the county's assessment ratio to determine the gross assessed value of the property. Any applicable deductions are applied to the total assessed value to determine the property's net assessed value. The property's net assessed value is then multiplied by the "millage rate" applicable to the tax district containing the property (7). In most cases, the majority of county ad valorem taxes paid consist

of millages for local schools, but governments can also impose millages for several county needs such as facilities, emergency medical services, fire protection, road improvement, and solid waste handling (7).

Cost of Wind

Developing a commercial wind project is a capital-intensive process. The cost of construction and installation far exceeds the cost of ongoing operations and maintenance which are variable, dependent on age and model of the turbine. All cost data used in my analysis was derived from the 2017 Wind Technologies Market Report published by the U.S. Department of Energy. This report provides the most recent aggregated cost information as well as current trends within the wind industry. Overall, construction costs for large commercial wind projects in the interior region of the United States, which is where Oklahoma is located, are estimated to have a capacity-weighted average cost of $1,550/kW in 2017. This meaning that typical cost for a 1.5-megawatt turbine is:

(1.5 megawatt x 1,000) x $1,550 = 2,325,000

Methodology Used

Challenges I encountered when developing an income approach valuation model were the proprietary nature of income data, discount rates, and the Purchase Price Agreement's (PPA). To ensure that my project was applicable to all wind projects in the interior region I used national averages from the 2017 Wind Energy Technologies Report by the United States Department of Energy and the 2017 Cost of Wind Energy by the National Renewable Energy Laboratory. Below is a table of the interior region averages used to calculate the income approach method:

2017 Interior Region	
Avg PPA (2017 $/kW)	$0.02
Discount Rate	0.0759

Specifically, for Custer County - FPL Energy Cowboy Wind, I was able to use data collected by Dr. Shannon Ferrell to assess the FPL Energy Cowboy Wind project by its' specific nameplate capacity, capacity factor, number of turbines within the project, county assessment rate, as well as the number of hours in the year.

FPL Energy Cowboy Wind	
Name Plate Capacity	1.5 megawatts
Capacity Factor	43.97%
Number of Turbines	91
Custer Co. Assessment Rate	11%
Hours in Year	8,760

Using these rates, I projected what the net income per year for FPL Energy Cowboy Wind from the year 2006 to the end of its life in the year 2030.

Equation:

Net Income Per Turbine: (8,760 x 43.97%) x (1.5-megawatt x 1,000) * $0.02 = 115,553.16 $/Kw Year

Cost Approach for Custer for FPL Energy Cowboy Wind

Using the cost approach, the value of the total system in 2006 when FPL Energy Cowboy Wind went live was $150,686,718 million which is after the OTC depreciation factor has been applied using a life of 12 years for moving parts and 25 years for stationary parts (7). From there, I divided the total system value by the ninety-one turbines in the project to derive a per turbine value in PV terms of $1,655,898.00 for the first year of the project in 2006. Over the next 25 years, the per turbine value decreases with the OTC schedule gradually. The value of the turbine is assessed at 11% each year for Custer County, and then the assessed value is multiplied by the millages.

Income Approach used for Valuation

Shifting gears from the cost approach would be the income approach method. This method is a more complex approach to valuation than the cost method because more information is needed. However, the income approach works well for the wind industry because typically rates stay constant over the period of production due to Purchase Price Agreement's (PPA). This method estimates the present value of income generated from wind PPA's at a future date when it is received. The premise of using present value is that there is "time value of money" factor to be addressed. Lastly, the income method includes an estimated salvage value at the end of the asset's life because it is unlikely that the project has a zero dollar value at the end of its life.

Using the income approach method, I used the 2017 Wind Energy Technologies Report average revenue per Purchase Price Agreement (PPA) and the 2017 Cost of Wind Energy Review's average discount rate average for the interior region to estimate revenue for a single wind turbine. I then used this value as the corresponding present value of the future expected cash flows and held all rates constant. In Excel, the present value formula sums the future cash

flows after discounting them back to the present time. Applying the PV formula to my income stream, I was able to generate the cash flows and conclude a proforma estimate of net income from taxes.

Wind projects have Purchase Price Agreements that guarantee the price of electricity that they generate, and operating and maintenance (O&M) costs do not vary dramatically from year to year. The most challenging aspect of this method is the useful life that is given to the moving parts of a wind turbine. The moving parts are given a 12-year life, and whether these parts can live beyond their useful life is an unknown factor.

In the last year of the turbine's life, there will be some salvage value that must be deducted from the stream of expected cash payments. Since most wind turbines have not yet reached their useful life, an estimate of the salvage value in the final year of life from the OTC's schedule was used. The discount rate used in the net present value calculation is what the average weighted average cost of capital is for wind turbine financing in the interior region.

Income Approach for Custer for FPL Energy Cowboy Wind

Project (by school district)	2006	2007	2008	2009
FPL Energy Cowboy Wind / NextEra Energy				
Calendar year	2006	2007	2008	2009
Life year	1	2	3	4
12 year depreciation factor	94%	87%	80%	73%
25 year depreciation factor	98%	95%	93%	90%
Total system value	$ 150,686,718	$ 142,512,885	$ 140,002,318	$ 142,590,691
Turbine value (60%)				
Systems Value (40%)				
Assessment ratio	11.00%	11.00%	11.00%	11.00%
Assessed value	$ 16,575,539	$ 15,676,417	$ 15,400,255	$ 15,684,976
Millage	92.40	90.63	88.93	89.97
OTC Reimbursements	$ 1,531,452	$ 1,420,450	$ 1,369,545	$ 1,406,528
County-collected taxes	$ 127	$ 3,351	$ 3,582	$ 4,649
Total tax revenues	$ 1,531,579	$ 1,423,801	$ 1,373,127	$ 1,411,177
School revenue information				
School General	$ 593,736	$ 561,529	$ 553,080	$ 561,836
School Building	$ 64,867	$ 80,263	$ 78,856	$ 80,307
School Sinking	$ 308,139	$ 263,677	$ 233,461	$ 253,469
County School	$ 68,125	$ 64,430	$ 63,461	$ 64,465
Votech General	$ 170,065	$ 160,840	$ 158,420	$ 180,928
Votech Building	$ 33,980	$ 32,136	$ 81,653	$ 32,154
County Schools Total	$ 68,125	$ 64,430	$ 63,461	$ 64,465
Local School District Total	$ 966,742	$ 905,470	$ 865,396	$ 895,612
Career Tech Total	$ 204,045	$ 192,977	$ 240,073	$ 213,082
Tax Revenue Using OTC Schedule Per Turbine				
Years Remaining	25	24	23	22
Net Income	$ 115,553.16			
Discount Rate	0.0759			
Present Value	$121,556,328.27	$114,605,771.62	$112,789,012.12	$110,834,360.58

Using the income approach, the value of the total system in 2006 when the project went live would have been $121,556,328.27 which is less than the cost approach method that valued the system at $150,686,718.

Project (by school district)	2011	2012	2013	2014
FPL Energy Cowboy Wind / NextEra Energy				
Calendar year	2011	2012	2013	2014
Life year	6	7	8	9
12 year depreciation factor	58%	50%	43%	36%
25 year depreciation factor	84%	81%	78%	75%
Total system value	$ 118,131,191	$ 91,481,027	$ 82,839,600	$ 77,060,082
Turbine value (60%)				
Systems Value (40%)				
Assessment ratio	11.00%	11.00%	11.00%	11.00%
Assessed value	$ 12,994,431	$ 10,062,913	$ 9,112,356	$ 8,476,609
Millage	89.38	90.14	96.30	96.52
OTC Reimbursements	$ -	$ -	$ -	$ -
County-collected taxes	$ 1,161,442	$ 907,071	$ 877,520	$ 818,163
Total tax revenues	$ 1,161,442	$ 907,071	$ 877,520	$ 818,163
School revenue information				
School General	$ 465,461	$ 360,464	$ 326,405	$ 303,632
School Building	$ 66,531	$ 51,522	$ 46,756	$ 95,971
School Sinking	$ 202,322	$ 164,327	$ 204,939	$ 192,558
County School	$ 53,407	$ 41,359	$ 37,452	$ 34,839
Votech General	$ 133,323	$ 103,245	$ 93,498	$ 86,970
Votech Building	$ 26,636	$ 20,629	$ 18,680	$ 17,377
County Schools Total	$ 53,407	$ 41,359	$ 37,452	$ 34,839
Local School District Total	$ 734,314	$ 576,313	$ 578,100	$ 592,161
Career Tech Total	$ 159,958	$ 123,874	$ 112,178	$ 104,347
Tax Revenue Using OTC Schedule Per Turbine				
Years Remaining	20	19	18	17
Net Income				
Discount Rate				
Present Value	$106,468,722.97	$104,034,361.48	$101,415,231.96	$98,597,310.51

However, by year seven of the FPL Energy Cowboy Wind project, the cost method approach of turbine decreases to below the income method value. This can be explained by looking at the deprecation factor in year seven for the 12-year and 25-year life. The OTC schedule begins to depreciate at an increasing rate, while the income approach remains fairly constant.

Project (by school district)							
FPL Energy Cowboy Wind / NextEra Energy							
Calendar year	025	2026	2027	2028	2029	2030	
Life year	20	21	22	23	24	25	
12 year depreciation factor	20%	20%	20%	20%	20%	20%	
25 year depreciation factor	00%	28%	26%	24%	23%	22%	Total
Total system value	037	$ 36,457,942	$ 35,227,846	$ 33,997,750	$ 33,382,702	$ 32,767,655	$1,988,331,619.64
Turbine value (60%)	602	$ 19,236,602	$ 19,236,602	$ 19,236,602	$ 19,236,602	$ 19,236,602	
Systems Value (40%)	035	$ 17,221,339	$ 15,991,244	$ 14,761,148	$ 14,146,100	$ 13,531,052	
Assessment ratio	00%	11.00%	11.00%	11.00%	11.00%	11.00%	Salvage Value
Assessed value	384	$ 4,010,374	$ 3,875,063	$ 3,739,753	$ 3,672,097	$ 3,604,442	$ 360,084
Millage	52	96.52	96.52	96.52	96.52	96.52	
OTC Reimbursements		$ -	$ -	$ -	$ -	$ -	
County-collected taxes	41	$ 387,081	$ 374,021	$ 360,961	$ 354,431	$ 347,901	
Total tax revenues	41	$ 387,081	$ 374,021	$ 360,961	$ 354,431	$ 347,901	
School revenue information							
School General	69	$ 142,850	$ 138,030	$ 133,210	$ 130,800	$ 128,390	
School Building	26	$ 20,533	$ 19,840	$ 19,148	$ 18,801	$ 18,455	
School Sinking	48	$ 91,076	$ 88,003	$ 84,930	$ 83,393	$ 81,857	
County School	39	$ 16,483	$ 15,927	$ 15,370	$ 15,092	$ 14,814	
Votech General	35	$ 41,146	$ 39,758	$ 38,370	$ 37,676	$ 36,982	
Votech Building	99	$ 8,221	$ 7,944	$ 7,666	$ 7,528	$ 7,389	
County Schools Total	039	$ 16,483	$ 15,927	$ 15,370	$ 15,092	$ 14,814	
Local School District Total	044	$ 254,458	$ 245,873	$ 237,287	$ 232,995	$ 228,702	
Career Tech Total	033	$ 49,368	$ 47,702	$ 46,036	$ 45,204	$ 44,371	
Tax Revenue Using OTC Schedule Per Turbine							
Years Remaining	6	5	4	3	2	1	
Net Income							
Discount Rate							Total
Present Value	87	$42,442,324.84	$35,148,359.73	$27,300,782.68	$18,857,574.52	$9,773,526.87	$1,936,606,787.09

Surprisingly, in the final five years of the project's life, the cost approach to depreciation declines less severely. In total, the value of the stream of income discounted to the present day is less than the system value using the cost approach.

Conclusions

When evaluating the FPL Energy Cowboy Wind project, the income method did provide a means of smoothing tax revenues over the life of the asset. However, the cost method depreciated at a more rapid pace early in its life, the income approach depreciated more rapidly in the last five years of its life.

Overall, I found that more tax revenue was generated using the cost approach following the OTC's deprecation schedule than the income approach; this could be for several reasons. For one, I used national averages for purchase price agreements, due to limited resources and information about the proprietary rates established between this wind energy company and the utility company. This factor alone is the defining piece of information that would if higher,

change the conclusion for this specific project. Additionally, I used national averages for the weighted cost of capital or the discount rate. The discount rate determines the accuracy of the return on investment of a project and could have significantly skewed the results.

Recommendations:

To know if the cost or income approach is better for a particular county, additional proprietary information about the project would need to be shared from wind energy companies to individual county assessors. I believe a coordinated effort among county assessors, the OTC, and wind energy developers could also lead to growth in the area of using the income approach to evaluate wind projects accurately.

Throughout researching this topic, it is apparent that the cost of manufacturing wind turbines has decreased significantly. In the future, as the cost continues to decrease, the income method may provide a greater stream of tax revenue. The future of wind energy is optimistic in Oklahoma, but to ensure all parties in the wind industry benefit equitably from this new resource, more dialogue must be had to improve open the options for depreciation methods used.

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