

Economic Impact of the Proposed Crab Orchard Wind Farm on Cumberland County and Tennessee

Matthew N. Murray, Director
Howard H. Baker Jr. Center for Public Policy

Jilleah G. Welch, Research Associate
Howard H. Baker Jr. Center for Public Policy

Report Prepared for
Crab Orchard Wind, LLC

April 18, 2016



Baker Center Board

Cynthia Baker
Media Consultant
Washington, DC

Sam M. Browder
Retired, Harriman Oil

Patrick Butler
CEO, Assoc. Public Television Stations
Washington, DC

Sarah Keeton Campbell
Attorney, Special Assistant to the Solicitor General and
the Attorney General, State of Tennessee
Nashville, TN

Jimmy G. Cheek
Chancellor, The University of Tennessee, Knoxville

AB Culvahouse Jr.
Attorney, O'Melveny & Myers, LLP
Washington, DC

The Honorable Albert Gore Jr.
Former Vice President of The United States
Former United States Senator
Nashville, TN

Thomas Griscom
Communications Consultant
Former Editor, *Chattanooga Times Free Press*
Chattanooga, TN

James Haslam II
Chairman and Founder, Pilot Corporation
The University of Tennessee Board of Trustees

Joseph E. Johnson
Former President, University of Tennessee

Fred Marcum
Former Senior Advisor to Senator Baker
Huntsville, TN

The Honorable George Cranwell Montgomery
Former Ambassador to the Sultanate of Oman

Regina Murray
Knoxville, TN

Lee Riedinger
Vice Chancellor, The University of Tennessee, Knoxville

Don C. Stansberry Jr.
The University of Tennessee Board of Trustees
Huntsville, TN

The Honorable Don Sundquist
Former Governor of Tennessee
Townsend, TN

Baker Center Staff

Matt Murray, PhD
Director

Nissa Dahlin-Brown, EdD
Associate Director

Charles Sims, PhD
Faculty Fellow

Krista Wiegand, PhD
Faculty Fellow

Jilleah Welch, PhD
Research Associate

Jay Cooley
Business Manager

Elizabeth Woody
Office Manager

Kristin England
Information Specialist

William Park, PhD
Director of Undergraduate Programs
Professor, Agricultural and Resource
Economics

About the Baker Center
The Howard H. Baker Jr. Center for
Public Policy is an education and
research center that serves the University
of Tennessee, Knoxville, and the public.
The Baker Center is a nonpartisan
institute devoted to education and public
policy scholarship focused on energy
and the environment, global security,
and leadership and governance.

Howard H. Baker Jr. Center for Public
Policy
1640 Cumberland Avenue
Knoxville, TN 37996-3340

Additional publications available at
<http://bakercenter.utk.edu/publications/>

865.974.0931
bakercenter@utk.edu

Disclaimer

This research was funded by Apex Clean
Energy, Inc. and carried out by researchers
at the University of Tennessee's Howard
H. Baker Jr. Center for Public Policy. The
views expressed herein are those of the
authors alone and do not necessarily repre-
sent the views of Apex Clean Energy, Inc.

Economic Impact of the Proposed Crab Orchard Wind Farm on Cumberland County and Tennessee

Matthew N. Murray, Director
Howard H. Baker Jr Center for Public Policy

Jilleah G. Welch, Research Associate
Howard H. Baker Jr Center for Public Policy

Introduction

Advances in wind technologies, declining costs, and continued environmental concerns have led to increased investments in the wind industry sector. Crab Orchard Wind, LLC (Crab Orchard Wind), a subsidiary of Apex Clean Energy, Inc., is an example of such an investment. The purpose of this report is to summarize the anticipated economic impacts that would arise from this wind farm. The construction and ongoing operation and maintenance of the wind farm will result in a direct increase in spending at the site within Cumberland County and in other places in Tennessee that will create new jobs and incomes. The initial impacts from Crab Orchard Wind's spending will also create ripple effects and additional spending within Cumberland County and across the state of Tennessee.

The analysis presented here estimates economic impacts associated with the construction phase of the wind farm which is expected to be completed in 2017, as well as the impacts that would arise from ongoing operational activities. Impacts are presented for both Cumberland County and for the state of Tennessee in terms of employment, personal income, and gross domestic product (GDP). Additionally, estimates of state and local sales tax revenues are presented that would arise from increased purchases of goods and services by businesses and individuals. This report does not estimate the other tax revenues that will accrue to the state and to local governments across Tennessee from Crab Orchard Wind's economic activity. Corporate franchise and excise tax revenues are difficult to estimate, especially for all the businesses that might be affected by the new wind farm. Property taxes associated with new business and industry are often subject to some form of exemption at the local level so no estimate of these revenues is provided here for Crab Orchard Wind's direct investment. Property taxes associated with residential households and for indirect and multiplier impacts are also exceedingly difficult to estimate with any provision so no estimate is provided. Sales tax revenue is the most important own-source revenue for state government in Tennessee and second only to the property tax at the local level. Sales tax revenue can be reliably estimated using estimates of new personal income accruing to the state and to Cumberland County.

To summarize, construction of the Crab Orchard Wind Farm is estimated to produce a one-time boost to state GDP of \$76.4 million, of which \$27.3 million will be centered on the Cumberland County economy. This increase in output corresponds to an increase in personal income of \$27.1 million at the state level and \$10.9 million at the county level. Operational impacts will require seven full-time employees. Operational impacts will increase state GDP by

an estimated \$2.9 million while the wind farm's operations are expected to raise local GDP by \$1.4 million per year. A description of the study's methodology as well as further discussions of economic impacts on the county and state are provided below.

Economic Impacts

The economic impact analysis is broken up into two components. The first considers the significant one-time impacts that would arise from the construction of the facility itself. The second examines the economic impacts that would arise from the ongoing operation and maintenance of the wind farm. For each component, economic impact estimates are provided for the Cumberland County economy and for the entire state of Tennessee. In general, the statewide impacts will be larger than the local impacts because the state economy will capture larger direct spending impacts and larger ripple effects from Crab Orchard Wind's initial spending.

The direct, indirect, and total economic impacts of the construction and operation of the Crab Orchard Wind Farm are presented below in Tables 1 through 4. The impacts from construction of the wind farm are presented in Tables 1 and 2 for Cumberland County and Tennessee, respectively, while Tables 3 and 4 demonstrate the impacts of a typical year of operations for Cumberland County and Tennessee, respectively. The direct effect is the initial change in economic activity resulting from building and operating the Crab Orchard Wind Farm. These effects reflect expenditures incurred by Crab Orchard Wind. These initial company investments and expenditures will result in additional increases in spending in Cumberland County and across Tennessee. For example, Crab Orchard Wind's direct expenditures during the construction and operational years will have impacts on the supply of goods and services provided by vendors supporting the project, both within and outside Tennessee. This initial supply chain impact, which reflects indirect impacts, will lead to the creation of additional jobs and incomes. As Crab Orchard Wind construction workers and employees, as well as workers in the supply chain spend their incomes, additional jobs and incomes are created through the ripple effects of the spending multiplier. These indirect and multiplier effects arising from the initial direct expenditures of Crab Orchard Wind are captured by using the Bureau of Economic Analysis' (BEA) RIMS II multipliers.¹ These multipliers allow estimation of the total impacts on output (i.e. GDP), income, and employment and account for leakages of spending outside of the regional and Tennessee economies.

Tables 1 and 2 below present the direct, indirect, and total economic impacts of the construction of the wind farm as measured by output, personal income, and employment on Cumberland County and Tennessee. Crab Orchard Wind's total investment in construction is expected to be about \$107.7 million which would include the cost of rotor blades, towers, generators, aggregate, rebar, etc. Crab Orchard Wind anticipates that almost \$24 million of this investment will be spent within Tennessee including about \$12 million which will be spent within Cumberland County. When accounting for additional non-payroll expenditures for construction, Crab Orchard Wind expects to incur about \$32.4 million in Tennessee (see Table

¹ Regional Input-Output Modeling System (RIMS II) multipliers were acquired from the U.S. Bureau of Economic Analysis. The multipliers quantify the cumulative effects on total industry output, earnings, and employment that result from a change in final demand. Final demand in this analysis reflects expenditures on the construction and operation of the Crab Orchard Wind Farm.

2) which includes \$18.3 million of expenditures within Cumberland County (see Table 1). Roughly 73% of this spending in Tennessee is attributable to the actual cost of construction, but spending is also anticipated to occur in the following sectors as identified by the North American Industry Classification System (NAICS): utilities; air transportation; truck transportation; transit and ground passenger transportation; broadcasting and telecommunications; data processing, internet publishing, and other information services; real estate; rental and leasing services and lessors of intangible assets; professional, scientific and technical services; management of companies and enterprises; administrative and support services; waste management and remediation services; performing arts, spectator sports, museums, and related activities; amusements, gambling, and recreation; accommodation; and food services and drinking places. Spending in these NAICS categories are mapped to the corresponding RIMS II multipliers to arrive at a total increase in output of \$76.4 million in Tennessee (see Table 2) of which \$27.3 million in output is expected in Cumberland County (see Table 1). As of 2014, nominal annual GDP for Tennessee was \$297.2 billion,² so this increase in state output represents roughly a 0.03% increase in output.

Construction is estimated to require about 111 employees, with 50% of these employees expected to reside in Tennessee. The average annual salary is expected to be \$80,000, and it is assumed that 25 percent of the earnings of non-resident workers is spent in the state. These labor costs result in an increase in income for employees who then spend a significant portion of this income in the state. This spending will take place across a wide range of sectors including services and retail trade and will help support the creation of additional jobs and incomes while expanding the sales tax base. The direct impacts from construction are estimated to lead to an estimated total one-time impact of 576 jobs at the state level (see Table 2) and 207 jobs at the county level (see Table 1). For those employees residing in Tennessee, direct labor earnings are about \$4.2 million, but ripple effects from initial payroll and non-payroll spending are estimated to raise overall personal income by \$27.1 million for Tennessee (see Table 2) and \$10.9 million for Cumberland County (see Table 1). This increase in personal income represents approximately a 0.57% one-time increase for the county. Nominal personal income in Cumberland County was \$1.9 billion in 2014.³

The increased economic activity associated with the construction and operational phases of the wind farm will expand state and local sales tax bases and produce additional revenue collections for the state and the local community. Revenues will be derived from worker spending as well as many business-to-business transactions which are subject to sales taxation. As can be seen in the second column of Table 2, estimated state sales tax revenue from the direct increase in personal income is about \$152.6 thousand. State sales tax revenue from the indirect and multiplier effects is estimated to be about \$664.6 thousand. Together, there is an estimated one-time total increase in sales tax revenue of \$817.2 thousand for the state of Tennessee. From a local perspective, local sales tax revenue from initial labor costs is estimated to be about \$42.7 thousand. After accounting for additional rounds of spending stemming from both payroll and non-payroll expenditures and the multiplier, the total local sales tax revenue for Cumberland County is estimated to be about \$97 thousand.

² Nominal GDP figures were obtained from the U.S. Bureau of Economic Analysis.

³ Nominal personal income figures were obtained from the U.S. Bureau of Economic Analysis.

Table 1: Summary of Economic Benefits of Construction in Cumberland County

Impact	Direct	Indirect Plus Multiplier	Total
Output	\$18,297,453	\$9,000,504	\$27,297,957
Personal Income	\$4,212,500	\$6,680,744	\$10,893,244
Sales Tax Revenue	\$42,738	\$54,224	\$96,962
Employment	111	96	207

Table 2: Summary of Economic Benefits of Construction in Tennessee

Impact	Direct	Indirect Plus Multiplier	Total
Output	\$32,362,968	\$44,010,738	\$76,373,706
Personal Income	\$4,212,500	\$22,934,346	\$27,146,846
Sales Tax Revenue	\$152,587	\$664,590	\$817,177
Employment	111	465	576

Indirect and total economic impacts are calculated similarly for a typical year of operations. A summary of these economic benefits is presented in Tables 3 and 4 for Cumberland County and Tennessee, respectively. Crab Orchard Wind anticipates having seven full-time employees which will result in a direct increase in personal income of \$431,000. Non-payroll spending for a typical year of operations is anticipated to be about \$1.1 million in Tennessee and \$944 thousand in Cumberland County. Spending is expected to occur in the following NAICS sectors: utilities; construction; air transportation; truck transportation; transit and ground passenger transportation; data processing, internet publishing, and other information services; rental and leasing services and lessors of intangible assets; professional, scientific, and technical services; management of companies and enterprises; administrative and support services; and waste management and remediation services. These initial expenditures are estimated to result in a total increase of output of \$2.9 million for the state of Tennessee as a whole (see Table 4) and \$1.4 million for the regional Cumberland County economy (see Table 3). Indirect and ripple effects are estimated to increase total employment to 26 employees in Tennessee (see Table 4) of which 15 employees are expected to be located locally in Cumberland County (see Table 3). These increases in total employment equate to \$1.3 million in personal income at the state level (see Table 4) and \$781.9 thousand at the county level (see Table 3).

State sales tax revenue impacts are presented in Table 4. The increase of seven employees results in a direct increase in state sales tax revenue of about \$12,489, but the indirect effects and the ripple effect of expenditures results in a total increase of state sales tax revenue of about \$36 thousand. At the local level, sales tax revenue for Cumberland County is estimated to be \$3,498 from initial labor costs incurred while the total impact is expected to be \$6,346.

Table 3: Summary of Economic Benefits of Operations in Cumberland County

Impact	Direct	Indirect Plus Multiplier	Total
Output	\$944,000	\$485,432	\$1,429,432
Personal Income	\$431,000	\$350,890	\$781,890
Sales Tax Revenue	\$3,498	\$2,848	\$6,346
Employment	7	8	15

Table 4: Summary of Economic Benefits of Operations in Tennessee

Impact	Direct	Indirect Plus Multiplier	Total
Output	\$,1,130,750	\$1,754,006	\$2,884,756
Personal Income	\$431,000	\$823,050	\$1,254,050
Sales Tax Revenue	\$12,489	\$23,850	\$36,340
Employment	7	19	26

It should be noted that there are some potential benefits that have not been considered in this study. For example, there might be environmental benefits and health benefits associated with using renewable energy. Additionally, Crab Orchard Wind plans on supporting local organizations through financial or in-kind contributions, including \$10,000 in corporate contributions.

Conclusion

The Crab Orchard Wind Farm will provide a new source of renewable energy production in Tennessee. This report summarizes the total economic impacts of the construction and operation of this wind farm in terms of GDP, personal income, sales tax revenue, and employment for Cumberland County and for the entire state of Tennessee. Initial expenditures for labor and non-labor items not only increase these outcomes but also lead to additional spending across a range of sectors that further boost economic impacts. For the state of Tennessee, construction is expected to yield a one-time increase in output of \$76.4 million, and operations are expected to positively impact GDP by about \$2.9 million per year.