APPENDIX 4.16-1

Technical Review of Horse Heaven Wind Farm, LLC's Economic Impact Analysis Methodology

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Economic IMPLAN Model

Tetra Tech, Inc. on behalf of Horse Heaven Windfarm, LLC (the Applicant), prepared an IMPLAN analysis of the Horse Heaven Wind Farm (Project) (Horse Heaven Wind Farm, LLC 2022[1]). IMPLAN is a regional input-output model widely used to assess the economic impacts of energy and many other types of projects. The IMPLAN model divides the economy into 546 sectors, including government, households, farms, and various industries, and models the linkages between the various sectors. The linkages are modeled through input-output tables that account for all dollar flows among different sectors of the economy.

Using national industry and state-level economic data derived from the U.S. Bureau of Economic Analysis, U.S. Census, and other government sources, IMPLAN models how money spent in one sector of the economy is spent and re-spent in other sectors. By tracing these linkages, the model approximates the flows of initial project spending through the local economy based on the supply lines connecting the various economic sectors. These linkages vary by sector, as well as through regional differences in spending and employment patterns. The amount spent locally decreases with each successive transaction away from the initial expenditure due to the effects of savings, taxes, or other activities that happen outside the local economy, known as leakages.

The economic relationships modeled by IMPLAN allow the user to estimate the overall change in the economy that would result from construction and operation of a proposed project. The dollars spent on project construction and operation within a selected analysis area are analyzed to determine the total economic impact within that area. The direct investments in project construction and operation trigger successive rounds of spending that result in an overall increase in employment, labor income, and economic output in the local economy. Construction-related impacts are assessed as one-time impacts; operations and maintenance–related impacts are modeled as annual impacts (Horse Heaven Wind Farm, LLC 2022).

Workforce Requirements and Economic Impacts

For the Project, Project Management and Engineers would account for 3 to 4 percent of total employment for conceptualized Phases 1, 2a, and 2b, and Field Technical Staff would account for 9 to 11 percent, viewed in terms of total months of employment. The remaining employment would be made up of Skilled Labor and Equipment Operators and Unskilled Labor, with the relative distribution between these categories varying by task (Horse Heaven Wind Farm, LLC 2022). Workers in the Skilled Labor and Equipment Operators category, for example, would account for the majority of employment during wind turbine assembly, while the majority of the workforce installing turbine foundations would fall under the Unskilled Labor category.

Table 4.16-1A provides an estimate of the workforce necessary to construct Phases 1, 2a, and 2b. The Applicant anticipates that on-site jobs would be filled mostly by local workers. Classes of on-site jobs include those associated with site work, foundations, electrical work, and other construction-related labor needs. The Applicant acknowledges in the Application for Site Certification that workers from outside the region may be required to fill certain on-site positions. However, the Applicant did not include the potential for non-local workers in their workforce estimates but did evaluate the impact of per diem spending by non-local workers on the region's economy. These estimates are one-time impacts for the 11-month construction period developed using the IMPLAN modeling software and 2019 IMPLAN data for Benton and Franklin Counties.

[1] Horse Heaven Wind Farm, LLC. 2022. Horse Heaven Wind Farm Washington Energy Facility Site Evaluation Council Updated Application for Site Certification EFSEC Docket Number: EF-210011. February 2021, Revised December 2022.

The employment estimates presented in the ASC represent the average and peak numbers of people expected to be employed on site at one time and are not expressed in full-time equivalents. The workforce estimates provided by the Applicant assume that the Project would be built under a community workforce or Project labor agreement that would include the use of apprentices for 15 percent of the labor hours. The economic impact analysis, therefore, increased initial workforce estimates by 15 percent to account for apprentices.

Table 4.16-1A: Average Monthly Workforce Estimates by Technical Professional and Level

Task	Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Apprentice
Final Engineering and Design	1	5	0	0	0	0
Pre-Construction Survey and Compliance Requirements	1	1	4	0	0	0
Road Construction	1	2	1	15	12	5
Wind Turbine Foundations	1	2	5	30	88	19
Wind Turbine Assembly	1	2	10	118	20	23
Wind Plant Commissioning	1	1	19	0	0	3
Solar Array Construction	1	3	4	14	40	70
Electrical System Installation	1	2	5	19	56	12
Battery Energy Storage System	1	1	2	6	18	4
Solar Plant Commissioning	1	1	1	5	15	3
Electrical System and Substation	1	2	10	28	10	8
O&M Facilities	1	2	5	10	18	5
Final Engineering and Design	2a	5	0	0	0	0
Pre-Construction Survey and Compliance Requirements	2a	1	4	0	0	0
Road Construction	2a	2	1	13	10	4
Wind Turbine Foundations	2a	2	3	20	63	13
Wind Turbine Assembly	2a	2	7	81	15	16
Wind Plant Commissioning	2a	1	15	0	0	2

Table 4.16-1A: Average Monthly Workforce Estimates by Technical Professional and Level

Task	Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Apprentice
Solar Array Construction	2a	3	3	12	33	8
Electrical System Installation	2a	2	4	16	47	10
Battery Energy Storage System	2a	1	2	6	18	4
Solar Plant Commissioning	2a	1	1	4	13	3
Electrical System and Substation	2a	3	15	38	15	11
O&M Facilities	2a	2	5	10	18	5
Transmission Line Construction	2a	1	2	12	0	2
Final Engineering and Design	2b	5	0	0	0	0
Pre-Construction Survey and Compliance Requirements	2b	1	4	0	0	0
Road Construction	2b	4	1	25	20	8
Wind Turbine Foundations	2b	3	7	40	125	26
Electrical System and Substation	2b	3	15	38	15	11
Wind Turbine Assembly	2b	3	14	162	31	32
O&M Facilities	2b	2	5	10	18	5
Transmission Line Construction	2b	2	4	23	0	4
Plant Commissioning	2b	1	29	0	0	5

Sources:
Horse Heaven Wind Farm, LLC. 2022. Horse Heaven Wind Farm Washington Energy Facility Site Evaluation Council Updated Application for Site Certification EFSEC Docket Number: EF-210011. February 2021, Revised December 2022.
Tetra Tech, Inc. 2021. Economic Impact Assessment of the Horse Heaven Wind Farm. Appendix J.
O&M = operations and maintenance

The Application for Site Certification states that construction workforces for Phases 1, 2a, and 2b would vary over the course of the construction schedule. The following summarizes the low, mean, and high workforce estimates for each conceptual construction phase:

- Construction for Phase 1 is estimated to take place over an 11-month period. On-site activities would employ an average of 300 workers over the 11-month construction period. Viewed by month, on-site employment would range from a low of 26 workers to a high of 467 workers.
- Construction for Phase 2a is assumed to take place over an 11-month construction period. An estimated average of 267 workers per month would be employed over the 11-month construction schedule, with estimated monthly employment ranging from a low of 22 to a high of 430 jobs.
- The construction period for Phase 2b is assumed to be 10 months. An average of 271 workers per month would be employed over the 10-month construction period, with estimated monthly employment ranging from a low of 35 jobs to a high of 412 jobs (Horse Heaven Wind Farm, LLC 2022).

The economic impact of the Project's construction phase for Phases 1, 2a, and 2b are summarized for Benton and Franklin Counties in **Table 4.16-1B**. These estimates are one-time impacts for the 11-month construction period developed using the IMPLAN modeling software and 2019 IMPLAN data for Benton and Franklin Counties.

Table 4.16-1B: One-Time Construction Impacts

Construction Phase	Impact	FTE Jobs	Labor Income $ (million)	Economic Output $ (million)
Phase 1	Direct	171	19.4	19.4
Phase 1	Indirect	168	11.1	30.7
Phase 1	Induced	118	6.5	20.5
Phase 2a	Direct	152	17.2	17.2
Phase 2a	Indirect	199	13.8	35
Phase 2a	Induced	120	6.6	20.8
Phase 2b	Direct	136	15.7	15.7
Phase 2b	Indirect	269	18.8	46.7
Phase 2b	Induced	135	7.4	23.4

Sources:
Horse Heaven Wind Farm, LLC. 2022. Horse Heaven Wind Farm Washington Energy Facility Site Evaluation Council Updated Application for Site Certification EFSEC Docket Number: EF-210011. February 2021, Revised December 2022.
Tetra Tech, Inc. 2021. Economic Impact Assessment of the Horse Heaven Wind Farm. Appendix J.
FTE = full-time equivalent

The economic impact of the Project's operations phase for Phases 1, 2a, and 2b for Benton and Franklin Counties is summarized in **Table 4.16-1C**. These estimates are annual average impacts based on estimated operations and maintenance expenditures for a 35-year period of operation.

Table 4.16-1C: Annual Operational Impacts on Employment and Income

Construction Phase	Impact	FTE Jobs	Labor Income $ (million)	Economic Output $ (million)
Phase 1	Direct	11	1.0	1.0
Phase 1	Indirect	12	0.9	3.0
Phase 1	Induced	9	0.5	1.5
Phase 2a[(a)]	Direct	9	0.8	0.8
Phase 2a[(a)]	Indirect	9	0.7	2.2
Phase 2a[(a)]	Induced	7	0.4	1.1
Phase 2b[(a)]	Direct	9	0.8	0.8
Phase 2b[(a)]	Indirect	10	0.9	3.2
Phase 2b[(a)]	Induced	7	0.4	1.3

Sources:
Horse Heaven Wind Farm, LLC. 2022. Horse Heaven Wind Farm Washington Energy Facility Site Evaluation Council Updated Application for Site Certification EFSEC Docket Number: EF-210011. February 2021, Revised December 2022.
Tetra Tech, Inc. 2021. Economic Impact Assessment of the Horse Heaven Wind Farm. Appendix J.

[(a)] = Operational workforce estimates are based on if only Phase 2a or 2b were constructed. If both Phase 2a and 2b are constructed the estimated operational employment impact (direct, indirect, and induced) would range from 24 to 26 FTEs.
FTE = full-time equivalent

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