



The Economic and Tax Revenue Impact of the K-Junction Solar Facility

Draft Economic Impact Memo
Prepared for EDF Renewables

Prepared by
Dr. Eric Thompson
K.H. Nelson Professor of Economics, and
Director of the Bureau of Business Research

April 22, 2022
Bureau of Business Research
Department of Economics, College of Business
University of Nebraska–Lincoln
@NebraskaBBR



<https://bbr.unl.edu>



bbr@unl.edu



402-472-9992

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A. Introduction

Solar power is a significant part of the growing renewable energy industry and an option for diversifying generating capacity. Solar power facilities also contribute to the regional economy given business opportunities present in facility development and operation. There is also a tax revenue impact due to the increase in economic activity and the Nameplate Capacity Tax.

This study from the University of Nebraska-Lincoln Bureau of Business Research estimates the annual economic and tax revenue impact of a potential 310MW (AC) solar facility located in York County, Nebraska (the K-Junction project). Estimates of the economic and tax revenue impact of the potential facility are provided for the: 1) development period when the solar facility is built and 2) annual operations for the “central Nebraska” region that includes York County as well as Adams, Clay, Fillmore, Hall, Hamilton, Polk, Saline, and Seward Counties. Economic impacts are presented in terms of output (sales), employee compensation and employment. Output provides the broadest measure of economic activity, while employment and employee compensation are key measures of the impact on the labor market. Note that employee compensation is a component of output, implying that the output and employee compensation impacts should not be summed. Tax revenue impacts examine major state and local tax revenue, including revenue from the Nameplate Capacity Tax. Development and operation of solar facilities frequently implies converting agricultural land from crop production to use in a solar facility.

The economic impact of developing a solar facility occurs in two separate phases. First, there is a temporary impact during the development phase, during the year when the solar facility is built. Second, there are annual impacts from operations of the solar facility. Annual operation impacts typically occur for several decades. There is also some loss of economic activity during both the development phase and the annual operations phase as row crop production ceases on land utilized for the solar facility.

Information provided by EDF Renewables, the developers of the York County solar project, indicate that an 310MW (AC) facility would have construction, materials and development costs of \$130 million for the balance of the facilities and would employ approximately 280 workers in the typical week when the facility is being assembled. The balance of facility costs excludes the cost of buying solar panels and other electronic equipment.

The UNL Bureau of Business Research estimates annual operating revenue of \$18,500,000 million for a 310MW (AC) facility in the Midwest region based on estimates of annual energy production per MW in the *2020 Annual Technology Baseline Data Book*.¹ Much of this annual revenue would pay for the annualized costs of solar panels, electronic equipment and site infrastructure that generate property taxes in York County, and revenue will also support annual operations including salaries for nearly 4 employees.

Economic impact analysis also considers lost economic activity of agricultural land taken out of row crop production. Crop production is typically corn and soybean production in York County.

Development costs and annual energy revenue reflect the direct economic impact of the solar facility in the development phase and operations phase, respectively. Beyond these direct impacts, there are also “multiplier” impacts on other local businesses which assist with facility construction during the development phase, or with annual facility operations. There are also multiplier impacts on local businesses due to spending by the owners of leased land, and by construction workers during the development phase and solar facility employees during annual operations. The multiplier therefore reflects opportunities for other businesses and workers in the “Central Nebraska” region. Economic multiplier impacts are estimated utilizing the IMPLAN software, which can be used to estimate multipliers for specific geographies such as states, counties, or combinations of counties. The total economic impact of the solar facility is the sum the direct economic impact of the solar facility plus the multiplier impact on other regional businesses. Lost crop production reduces the total economic impact of the solar facility.

Local tax revenue impacts flow primarily from the annual Nameplate Capacity Tax of \$3,518 per MW of solar facility capacity. Local property tax revenue, however, also increases due to real property installed at the solar facility site. There are also additional property and sales taxes related to rising local income in the region.

B. The Development Period Impact

Table 1 below summarizes the economic impact during the development phase. The development period impact is based on the \$130 million balance of facility investment. This figure excludes solar panels and other electronic equipment but includes construction costs and

¹ The UNL Bureau of Business Research estimate assumes that solar power trades at \$0.025 per kWh. The *2020 Annual Technology Baseline Data Book* utilizes a 27% capacity factor in the Midwest region.

the value of other infrastructure put in place at the facility. The analysis year is 2025. There would be 278 employees during the year-long development period with estimated earnings of \$14.6 million.

Analysis in Table 1 also subtracts the lost value of crop production during the year that the facility is developed. There would have been an estimated \$2.2 million in crop production on the land utilized for the solar facility. Analysis assumes land would have been utilized for corn and soybean production if it had remained in agricultural production, as these would be among the most productive uses of the land. USDA data suggest that within York County land devoted to corn and soybeans were allocated 70 percent to corn production versus 30 percent to soybean production during the 2011 to 2020 period, and that most production was irrigated. Analysis assumes growing yields through 2025 and USDA forecast prices for corn and soybeans for that year.²

Table 1. Estimated Economic and Tax Revenue Impacts from Solar Facility Construction			
	Solar Facility Construction	Lost Agricultural Production	Net Impact
Direct Impact			
Output (\$)	\$130,000,000	-\$2,197,000	\$127,803,000
Employee Compensation (\$)	\$14,622,000	-228,000	\$14,394,000
Job-Years	278.0	3.7	274.3
Multiplier Impact			
Output (\$)	\$54,952,000	-1,130,000	\$53,822,000
Employee Compensation (\$)	\$16,757,000	-\$332,000	\$16,425,000
Job-Years	344.6	-7.5	337.1
Total Impact			
Output (\$)	\$184,952,000	-\$3,327,000	\$181,625,000
Employee Compensation (\$)	\$31,379,000	-\$560,000	\$30,819,000
Job-Years	622.6	-11.2	611.4
Source: UNL-BBR calculations utilizing the IMPLAN model.			

² Corn yields are estimated to grow by 1.9 bushels per acre from the mean value in the 2011 to 2020 period through 2025, based on Purdue University (available at <http://www.kingcorn.org/news/timeless/YieldTrends.html>), while soybean yields are estimated to grow by 0.68 bushels per acre according to the University of Nebraska-Lincoln (<https://cropwatch.unl.edu/soybeans/yields>). Crop price projections for 2025 of \$4.20/bushel for corn and \$10.20/bushel of soybeans were taken from *USDA Agricultural Projections to 2031*.

Table 1 also shows the net direct economic impact of the development phase which is impact of building the solar facility less the lost impact due to crop production. The net direct impact during the development period is \$127.8 million in output, including \$14.4 million in labor income spread over 274 jobs.

Equally interesting is the multiplier impact during the development period, which is a measure of the impact on other businesses (besides the solar facility) and workers in the “central Nebraska.” The multiplier impact of the \$130.0 million investment for the balance of facility is much less than the direct impact, given that only a modest portion of the materials and construction services are purchased from businesses in the central Nebraska region. EDF Renewables estimates that there will be \$32 million in purchases from regional businesses. Payments to leaseholders who live in the region and wages to regional construction workers also would support regional businesses as these households spend some of their income locally. Out of state construction workers also would pay rent or for lodging and have restaurant and miscellaneous spending. EDF Renewables reports that 90 percent of leaseholders live in the central Nebraska region (primarily in York County), and that 10 percent of construction workers would come from out of state. The remaining construction workers would come from either the central Nebraska region or the nearby Lincoln Metropolitan Area. The UNL Bureau of Business Research estimates that just over 50 percent of in-state workers would come from central Nebraska rather than the Lincoln Metropolitan Area.³

The multiplier impact from solar development is estimated to be \$55.0 million in output during the development period, as seen in Table 1. As noted earlier, the multiplier impacts are estimated using the IMPLAN model. There also is a lost multiplier impact of \$1.1 million in output during the development period from lost crop production.

The net multiplier impact on other central Nebraska business is \$53.8 million during the development period. This impact also includes job and income opportunities for regional workers. Other central Nebraska businesses would add 337 jobs during the development period with employee compensation of \$16.4 million. These jobs would be created in construction

³ A 54% share for the central Nebraska region was estimated based on the number of construction workers in each county in central Nebraska or the Lincoln Metropolitan Area (U.S. Bureau of Labor Statistics, 2019 Quarterly Census of Employment and Wages) and the distance from the largest community in each county to the solar facility site.

businesses and throughout the economy as businesses purchase services and workers spend their paychecks.

Table 1 also reports the gross and net total economic impact during the solar project development period. The total economic impact is the sum of the direct economic impact and the multiplier impact.

Table 1 presented the gross and net economic impacts for the 310MW (AC) solar power facility utilizing 2,500 acres of land. Table 2 presents the net economic impacts on a per 100-acre basis. The net economic impact is the impact of developing the solar facility less lost crop production during the year. The total net impact is \$7.3 million for each 100-acres developed into a solar facility, including \$5.1 million in solar facility investment and a \$2.2 million impact for other central Nebraska businesses. A majority of labor market impacts are expected to occur at other businesses in the region.

Table 2. Estimated Net Economic Impact from Solar Facility Construction Per 100 Acres			
	Net Direct Impact	Net Multiplier Impact	Net Total Impact
Direct Impact			
Output (\$)	\$5,112,000	\$2,153,000	\$7,265,000
Employee Compensation (\$)	\$576,000	\$657,000	\$1,233,000
Jobs	11.0	13.5	24.5
Source: UNL-BBR calculations utilizing the IMPLAN model.			

Each 100-acres developed for a solar facility will generate 13.5 jobs and \$657,000 in employee compensation at other central Nebraska businesses such as construction firms, materials suppliers, hotels, restaurants, retail stores, and health care providers.

C. The Impact from Annual Operations

Annual economic impact is driven in part by the yearly revenue that the businesses generate, along with the size and wages of its workforce and purchases from local businesses. The net impact from converting 2,500 acres of cropland into a solar facility site therefore depends in part on the revenue generated in each land use. Table 3 below shows revenue generated by a solar facility on each acre of land along with the revenue generated by crop production.

Estimates in Table 3 are derived by dividing the \$18.5 million in annual revenue from the solar facility and \$2.2 million in revenue from crop production by 2,500 acres of land. The solar facility would generate an estimated \$7,393 per acre each year. The annual value of crop product is estimated at \$879 per acre. Therefore, there would be a net increase of \$6,515 in revenue per acre each year as cropland is used for solar production. This suggests a net increase in economic impact although the net change also depends on the level of employment and purchases associated with each land use.

Table 3. Estimated Annual Revenue Per Acre from Solar Facility Operations			
	Solar Facility Operations	Lost Agricultural Production	Net Impact
Per Acre	\$7,393	\$879	\$6,515
Source: UNL-BBR estimates based on USDA and Department of Energy data			

Table 4 shows the direct, multiplier and total economic from the annual operations of a 310(ac) MW facility on 2,500 acres of converted cropland. Annual labor market impacts also are provided in terms of labor income, along with associated employment. Table 4 also shows local tax revenue impacts. The 310(ac) MW facility would directly employ 3.6 full-time equivalent workers from within the Central Nebraska region with an estimated labor income of \$392,400, as seen in Table 4.

Table 4 also shows multiplier impacts. In the case of solar farm operations, the multiplier impact reflects economic activity in the Central Nebraska region generated due to 1) landowner spending of lease payments, 2) household spending of 3.6 workers who live within the Central Nebraska region and 3) the impact from annual purchases from Central Nebraska contractors for landscaping and facility repair. The multiplier impact of annual operations is \$1.75 million in output, \$0.57 million in labor income and 14.4 jobs. Table 4 also reports the lost multiplier impact from agricultural production. It is the same as reported for the development period in Table 1.

The net multiplier impact from annual operations is the multiplier impact from solar facility operations less the lost multiplier impact from crop production as land use changes at the K-Junction site. The net multiplier impact is \$0.62 million in output each year, \$0.24 million in labor income and nearly 7 jobs. This represents the annual net increase in opportunities for other business in the central Nebraska region due to the operation of the K-Junction project.

Stated another way, the annual spillover of sales opportunities, employment and labor income at other central Nebraska businesses is greater when the 2,500 acres is utilized for a solar facility than when the acres are used for crop production.

The net total economic impact is \$16.91 million per year during operations, including \$0.40 million in labor income spread over nearly 7 jobs.

Table 4. Estimated Economic and Tax Revenue Impacts from Annual Operations of 310(ac) MW Solar Facility Located on 2,500 Acres of Agricultural Land			
	Solar Facility Operations	Lost Agricultural Production	Net Impact
Direct Impact			
Output (\$)	\$18,484,000	-\$2,197,000	\$16,287,000
Employee Compensation (\$)	\$392,000	-228,000	\$164,000
Jobs	3.6	3.7	-0.1
Multiplier Impact			
Output (\$)	\$1,749,000	-1,130,000	\$618,000
Employee Compensation (\$)	\$568,000	-\$332,000	\$235,000
Jobs	14.4	-7.5	6.9
Total Impact			
Output (\$)	\$20,232,000	-\$3,327,000	\$16,905,000
Employee Compensation (\$)	\$960,000	-\$560,000	\$400,000
Jobs	18.0	-11.2	6.8
Local Tax Revenue			
Nameplate Capacity Tax	\$1,090,600	\$0	\$1,090,600
Other Property and Sales Taxes	\$377,700	-\$324,200	\$53,500
Total	\$1,468,300	-\$324,200	\$1,144,100
Source: UNL-BBR calculations utilizing the IMPLAN model.			

Table 4 also shows the Nameplate Capacity Tax paid to local government from the 310(ac) MW solar farm. The annual Nameplate Capacity Tax is \$3,518 per MW in Nebraska. At that rate, the 310(ac) MW solar facility would generate \$1.09 million each year in local tax revenue. Table 4 also shows the local tax revenue from property and sales taxes. The development of the solar facility would not change the assessed value of the 2,500 acres of farmland but would increase the assessed value of real property given the construction of an operations and maintenance building and a road on the 2,500-acre property. The value of lease payments also would add to the real property value. The sales tax impact reflects sales in central Nebraska generated by additional income. There is approximately \$0.35 in taxable purchases for each \$1 of income in Nebraska, and the typical local sales tax rate in central Nebraska is approximately 1.75. There

is also \$1.47 in taxable property value for each \$1 of income in Nebraska. Net tax revenue from the Nameplate Capacity Tax is \$1.09 million. The net tax revenue impact for other local taxes is an estimated \$0.05 million. Most of this increase is due a new building, a new road and other increases in real property value due to the solar facility development. The total annual net increase in local tax revenue is estimated at \$1.14 million.

Table 4 showed net annual impact of the 310(ac) MW solar facility project as land use changes within the 2,500-acre footprint of the K-Junction project. Table 5 shows the annual impact on economic activity and tax revenue on a per 100-acre basis. The net direct impact on Central Nebraska is \$651,500 per 100-acres. This is an increase in economic activity occurring at the K-Junction site.

Table 5. Estimated Economic and Tax Revenue Impacts from Annual Operations of a Solar Facility Per 100 Acres of Agricultural Land			
	Solar Facility Operations	Lost Agricultural Production	Net Impact
Output (Business Activity (\$))			
Direct Impact	\$739,300	-\$87,700	\$651,500
Multiplier Impact	\$69,900	-\$45,200	\$24,700
Total Impact	\$809,300	-\$133,100	\$676,200
Local Tax Revenue	\$58,700	-\$13,000	\$45,800
Source: UNL-BBR calculations utilizing the IMPLAN model.			

The multiplier impact reflects the change in economic activity for other businesses in the region. The net multiplier impact on other regional businesses (besides the solar facility) is estimated to be \$24,700 every year for each 100 acres of land moved to solar production. The net total economic impact for central Nebraska is \$676,2000 per 100 acres. The net change in local tax revenue is \$45,800 each year per 100 acres. Most of the net increase in local tax revenue is due to the Nameplate Capacity Tax.

Table 6. Estimated Labor Market Impacts from Annual Operations of a Solar Facility Per 100 Acres of Agricultural Land			
	Solar Facility Operations	Lost Agricultural Production	Net Impact
Labor Income (\$)			
Direct Impact	\$15,700	-\$9,100	\$6,600
Multiplier Impact	\$22,700	-\$13,300	\$9,400
Total Impact	\$38,400	-\$22,400	\$16,000
Employment (Jobs)			
Direct Impact	0.14	-0.15	-0.01
Multiplier Impact	0.58	-0.30	0.28
Total Impact	0.72	-0.45	0.27
Source: UNL-BBR calculations utilizing the IMPLAN model.			

Table 6 shows the annual economic impact on the labor market on a per 100-acre basis. The economic impact is provided in terms of employment and labor income. The net total impact for labor income is \$16,000 each year per 100 acres. Most of this annual labor income is due to the multiplier impact on other businesses (besides the solar facility) in central Nebraska. Further, every 400 acres converted from field crop production to use as a solar facility will support approximately one additional job, entirely due to the multiplier jobs created in other businesses in the central Nebraska region.

Appendix A. About the Bureau of Business Research and Key Investigators

A. The Bureau of Business Research

The Bureau of Business Research is a leading source for analysis and information on the Nebraska, Midwest and national economy. The Bureau conducts both contract and sponsored research on the economy of states and communities including: 1) economic and fiscal impact analysis; 2) models of the structure and comparative advantage of the economy; 3) economic, fiscal, and demographic outlooks, and 4) assessments of how economic policy affects industry, labor markets, infrastructure, and the standard of living. The Bureau also competes for research funding from federal government agencies and private foundations from around the nation and contributes to the academic mission of the University of Nebraska-Lincoln through scholarly publication and the education of students. The Bureau website address is www.bbr.unl.edu.

B. Key Personnel

Dr. Eric Thompson (Principal Investigator)

Dr. Eric Thompson is the K. H. Nelson Professor in the Department of Economics and Director of the Bureau of Business Research at the University of Nebraska-Lincoln. He received his Ph.D. in Agricultural Economics from the University of Wisconsin-Madison with an emphasis in community economic development. He has served as Director of the Bureau of Business in the College of Business at the University of Nebraska-Lincoln since August 2004. Professor Thompson has published peer reviewed articles in journals such as *Journal of Regional Science*, *American Journal of Agricultural Economics*, and *Regional Science and Urban Economics*. Thompson has twice served as President of the Association for University Business and Economic Research (AUBER). Thompson has received over one hundred national and local grants from organizations such as the U.S. Departments of Transportation, Labor, and Agriculture, as well as the National Science Foundation, the Robert Wood Johnson Foundation and numerous Nebraska business organizations, non-profit organizations, state agencies and local governments.