



Potential Economic Impact of Community Solar in Pennsylvania

Introduction

Sunlight is a renewable resource in that it is part of the earth's natural system and is constantly being renewed. A variety of technologies are available for harnessing energy and light from the sun as a source of heating cooling and electricity for homeowners, business and industry, and government. Photovoltaic (PV) technology systems are used to convert sunlight into electricity. The share of total US electrical generation stemming from nonrenewable energy sources has been increasing as has the share of solar generated electricity. At the end of 2019, electricity from renewable sources was estimated to be 17.5 percent of the total US utility-scale electricity generated; the share from solar was estimated to be 1.8 percent of the total electricity generated ([US Energy Information Administration](#)).

Community solar is a way of organizing the production and distribution of electricity from solar power. Community solar refers to local solar facilities shared by multiple community subscribers who receive credit on their electricity bills for their share of the power produced ([Coalition for Community Solar Access](#)). Community solar facilities provide a means for apartment dwellers, and others living in households without sufficient space to install their own solar panels to use this cleaner source of energy. Some facilities may have an 'anchor' customer who purchases 50% or more of the electricity, such as a business or other large user of electricity. Given the large size of consumer solar facilities, they will likely be built on agricultural and other open space lands and will generate lease dollars for landowners. The taxable value of land devoted to community solar will increase due to the change of land use. Using community solar to generate electricity is becoming less costly than traditional fossil fuel facilities, which will likely provide cost savings to consumers.

The purpose of this study is to estimate the potential economic impact of community solar in Pennsylvania. Development of community solar facilities will occur in two distinct phases, each with their own unique set of economic impacts: (1) the construction phase, when the facilities are being created and being connected to the electrical grid and customers are being recruited; and (2) during the operation phase, when the facilities are fully operational and customers are receiving electricity. This study considers both phases of the potential economic impact of community solar facilities in Pennsylvania. The construction phase by its nature is one-time and temporary. While the operation phase will occur over multiple years, the study follows standard economic impact analysis practice by estimating operational impacts on an annual basis rather than total impacts across all the years of operation.

Understanding “Economic Impact”

An “economic impact” is a change in the employment, income, and output in an area based on an activity that affects the local economy, such as construction and operation of community solar facilities. Economic impact includes three components: direct impacts, indirect impacts, and induced impacts.

The *direct impacts* include the changes in employment, worker income, and total economic activity directly related to the community solar facilities. During the construction phase these direct impacts will include site preparation, installation of solar panels and other equipment on-site, upgrading of electrical lines and equipment to get the electricity produced into electrical networks, and advertising for and recruiting customers. During the operation phase, these direct impacts will include operation, maintenance, and repair of the facilities; advertising for and recruiting customers; lease payments received by owners of the land where the facilities are located; and savings accrued by customers of the facilities.

Indirect impacts measure the effect of these direct impacts on the businesses in the economy who sell products or services to the community solar facilities, such as equipment, accounting and legal services, and advertising. The *induced impacts* are the effects resulting from changes in spending by employees of the community solar facilities, of employees in other businesses indirectly affected by these facilities, by landowners receiving lease payments, and by consumers who spend the money they saved by subscribing to community solar. For example, if employees at an advertising company work more hours because their firm was hired to work on community solar facility-related activities, they’ll have more money to spend on things like groceries, clothing, local entertainment, and other household items.

The indirect and induced effects, which measure how money ripples through other sectors of the economy, is also referred to as the Economic Multiplier Effect. These impacts are measured in three different ways: (1) employment, which reflects the change in full-time equivalent jobs as a result of the community solar facility construction and operation; (2) labor income, which measures the increase in wages, salaries and other remuneration due to these job gains; and (3) output, which reflects the total change in economic activity, including the value of sales and changes in inventory.

Methodology & Data

Two estimates of the potential economic impact of community solar facilities in Pennsylvania were made: (1) during the construction phase, which is when the facilities are being created and being connected to the electrical grid and customers are being recruited; and (2) during operation phase, which is when the facilities are fully operational and customers are receiving electricity from them. Both sets of estimates are on an annual basis, rather than the total impact across the life of the facilities.

Spending and income data were estimated separately for the construction and the operations phases, and then were entered into the economic impact tool IMPLAN. IMPLAN is among the most widely used economic impact models and is frequently used nationally to estimate the job and income effects of local activities, such as tourism, the opening of a new factory, or the economic contributions of a sector of the economy. IMPLAN creates an economic model of the economy of interest, such as a state or county, which models the flow of goods and services between the economic sectors in that economy. IMPLAN uses these interconnections to estimate how a change in economic activity will ripple across local businesses and workers in that economy.

The results of this IMPLAN analysis will be reported statewide for the construction phase of community solar; statewide for the operations phase of community solar; and at the county level for the land leasing payments occurring during the construction and operations phases. In addition, the analysis considers how total real property tax collections may change at the county level.

Construction, operation, and advertising cost, and consumer savings data for the analysis was provided by the Coalition for Community Solar Access, an industry trade association that focuses on community solar issues, based upon their experience with community solar projects in Illinois, Maryland, Maine, New York, and Virginia. This was supplemented by tax data from the U.S. Census of Agriculture and household income data from the U.S. Census' American Community Survey.

According to the Coalition for Community Solar Access, solar providers currently are planning a total of 235 community solar facilities across Pennsylvania, with projected electrical generation capacity of 1,033 megawatts, and sited on 4,172 acres of land (see Table 1). Community solar facilities are planned for 48 of Pennsylvania's 67 counties.

Table 1. Currently Planned Community Solar Projects, by County

County	Number of Facilities	Total Megawatts	Acres Required	County	Number of Facilities	Total Megawatts	Acres Required
Adams	3	15	60	Lancaster	5	25	100
Allegheny	3	15	60	Lawrence	2	3	12
Beaver	4	20	80	Lebanon	6	29	116
Bedford	3	15	60	Lehigh	4	15	60
Berks	7	34	136	Luzerne	3	20	80
Blair	2	5	20	Lycoming	5	23	92
Bradford	2	4	16	Mercer	10	28	112
Bucks	13	64	256	Monroe	5	25	100
Butler	2	4	16	Montgomery	10	50	200
Cambria	2	10	40	Montour	2	4	16
Carbon	2	10	40	Northampton	4	20	80
Centre	6	31	124	Northumberland	5	17	68
Chester	14	69	276	Perry	3	15	60
Clarion	2	10	40	Schuylkill	5	15	60
Columbia	9	45	220	Snyder	3	15	60
Crawford	2	10	40	Somerset	2	9	36
Cumberland	2	10	40	Tioga	2	5	20
Dauphin	6	27	108	Union	2	10	40
Erie	12	48	192	Venango	2	5	20
Fayette	4	18	72	Washington	3	15	60
Franklin	4	20	80	Wayne	6	28	112
Fulton	2	5	20	Westmoreland	9	42	168
Indiana	4	16	64	York	21	90	360
Juniata	4	15	60	Total	235	1033	4172
Lackawanna	2	5	20				

Data source: Coalition for Community Solar Access

1. Construction Phase

Construction of the community solar facilities will involve a variety of different economic sectors within Pennsylvania’s economy, including architectural and engineering services, legal services to assist with permitting, physical construction activity, and advertising and customer recruitment. In addition, landowners will begin receiving annual lease payments as the facilities are being built on their land.

Much of the workforce involved in the construction likely will be crews who will work across county lines, at a regional level, or at the state level. It thus isn’t possible to determine in which specific counties these businesses and work crews will be located, so we limit the construction phase economic impact analysis to the statewide impact, which considers the impacts across and in all counties at once. The construction phase findings thus identify the potential total job, labor income, and output impacts that can be expected in the Commonwealth, without designating in which Pennsylvania counties these jobs and impacts will actually occur.

In addition, much of the construction costs unavoidably will occur outside of Pennsylvania because the specialized goods or services required for solar facilities currently are not readily available in the Commonwealth. For example, there currently is not a solar panel manufacturer in Pennsylvania, so the solar panels will need to be purchased outside of the Commonwealth. Using detailed construction data provided by the Coalition for Community Solar Access, we estimated how much of the construction-related purchases and costs will occur within Pennsylvania, and only used these Pennsylvania-specific estimates in the economic impact analysis. All costs associated with site preparation, roadway and fence construction, and installation of the panels were expected to be spent entirely in Pennsylvania. About 90% of costs associated with on-site electrical infrastructure, such as wiring, modules, and combiner boxes were expected to be spent within Pennsylvania, as were about 85% of racking installation costs and 80% of system design costs. In contrast, none of the costs associated with the racking systems, the modules, inverters, and other specialized solar equipment were expected to be spent within Pennsylvania. These estimates overall indicate that only about 38% of the total equipment and installation costs during construction will be spent in Pennsylvania, and thus were included in the economic impact analysis.

Once built, each community solar facility will need to be connected to the existing electrical grid within its service area. The cost to make these interconnections varies across the state, based upon the population size, complexity of the existing grid, and whether such grid updates are done routinely. The Coalition for Community Solar Access estimates the interconnection costs will be around \$300,000 per project in southeastern counties adjacent to Philadelphia, about \$750,000 in Centre County, and around \$1.5 million per project in other counties. These estimates are based upon the experience in other states, but the actual interconnection costs will not be clear until the legal framework for community solar facilities in Pennsylvania is finalized and the interconnection process is established.

Another source of economic impact during the construction phase will be lease payments to the landowners on whose land these facilities will be built. These lease payments will begin during the construction year and will continue annually throughout the years each facility is operating. They thus are included in the construction and operation phase analysis. Expected annual lease values were provided by the Coalition for Community Solar Access and vary by county and electrical service provider, ranging between \$700 and \$1,000 per acre (see Table 2). Lease income will change household income, so it was modeled in IMPLAN at the household income level. The proportion of household income which goes to savings varies by household income, with higher income households typically saving a larger percentage of their income than do lower income households. We modeled this in IMPLAN by assuming that lease income goes to median income households.

Table 2. Lease Payments to Landowners

County	Annual Lease Income to Landowners	County	Annual Lease Income to Landowners	County	Annual Lease Income to Landowners
Adams	\$60,000	Cumberland	\$32,000	Monroe	\$92,000
Allegheny	\$54,000	Dauphin	\$90,000	Montgomery	\$196,000
Beaver	\$64,000	Erie	\$172,800	Montour	\$14,400
Bedford	\$44,000	Fayette	\$50,400	Northampton	\$72,000
Berks	\$124,000	Franklin	\$56,000	Northumberland	\$61,200
Blair	\$16,000	Fulton	\$14,000	Perry	\$50,000
Bradford	\$12,800	Indiana	\$51,200	Schuylkill	\$54,000
Bucks	\$246,000	Juniata	\$70,000	Snyder	\$42,000
Butler	\$11,200	Lackawanna	\$18,000	Somerset	\$28,800
Cambria	\$32,000	Lancaster	\$94,000	Tioga	\$16,000
Carbon	\$36,000	Lawrence	\$8,400	Union	\$36,000
Centre	\$70,000	Lebanon	\$106,000	Venango	\$16,000
Chester	\$268,400	Lehigh	\$36,000	Washington	\$42,000
Clarion	\$32,000	Luzerne	\$72,000	Wayne	\$99,600
Columbia	\$162,000	Lycoming	\$77,600	Westmoreland	\$134,400
Crawford	\$30,000	Mercer	\$78,400	York	\$334,000

In addition to these economic impacts, development of the sites will increase local real property tax collections by county and municipal governments, and by school districts. The physical improvements to the land will increase the assessed value of the parcels hosting community solar facilities, and thus the real property taxes owed on these parcels. In addition to these annual changes in real property tax collections, there will be a one-time increase on most parcels because they will no longer be eligible for the Commonwealth’s ‘Clean and Green’ program which provides farm and forest land tax breaks as long as the landowner keeps the land out of development or other ineligible use. Land parcels withdrawn from the Clean and Green program have to repay the tax savings for the past seven years, plus interest.

These expected changes in real property taxes were estimated using data from the U.S. Census of Agriculture. We estimated the total taxes paid per acre of farmland by dividing the total taxes paid by farmers by the acres of farmland in each county. The Coalition for Community Solar Access’ experience with property tax increases in other states suggests that property taxes on community solar parcels will increase from 2 to 5 times their value prior to the construction. For this analysis we chose the lowest end of this range and assume that real property tax collections will double. The rollback tax collections were estimated by assuming that Clean and Green cuts landowners’ taxes by 50%, and then calculating the total savings across seven years, with the program’s mandated 6% interest.

2. Operations Phase

Spending associated with community solar facilities will be much less once they are operating than during the construction phase. The two main operational expenditures will be maintenance

and repair of the facilities, plus advertising to recruit and retain customers. IMPLAN's Pennsylvania economic model does not include a solar energy generation sector because the Commonwealth lacks sufficient numbers of such businesses to model this accurately (this is a common issue when estimating economic impacts of new types of businesses). The Coalition for Community Solar Access indicated that the majority of solar energy-related spending during the operations phase will be maintenance and repair of the facilities, so we used IMPLAN's Maintenance and Repair Construction of Nonresidential Structures as a proxy, an approach that has been used in previous economic impact analysis of solar facilities (see Bae and Dall'erba, 2015).

Advertising and customer recruitment will be much less once the facilities are subscribed than during their initial year, with a stronger focus on retention than on recruitment. Projects focused on low and moderate income customers will tend to have higher advertising costs due to customer turnover than will projects with an anchor tenant (meaning the customer will take half of the electrical load of the facility), such as a large business. The Coalition for Community Solar Access estimates that advertising and recruitment costs during the operation phase typically will range between 10% and 15% of such costs during construction. This analysis thus assumed that the typical costs will be 12.5%, the midpoint of this range.

As during the construction phase, an important source of economic impacts will be the lease payments to the landowners on whose land the community solar facilities are located. These payments will increase the landowner's household income, and as a result generate some additional household savings and spending. In addition, consumers enrolling with the community solar facilities will save money on their electrical bills, giving them more income they can spend. The estimated annual consumer savings is \$30,000 per megawatt AC capacity of the facility. In other words, a 3 MW facility will produce a total of about \$90,000 savings for their customers each year.

The consumer savings accounts for a significant portion of the economic activity during the operational phase, generating about 54.3% of the total. Maintenance and repair costs accounts for 20.1% of total operational costs and savings, while advertising costs account for about 19.3% of total operational costs and savings. Lease payments to landowners account for the remaining 6.3%.

Both lease and consumer savings effects are changes in household income, so some of the increased income will be saved rather than immediately spent. As with the construction cost analysis, these were modeled in IMPLAN assuming these go to median income households at the state or county level, depending upon the analysis.

The impact on real property tax collections during the operations phase were estimated using U.S. Census of Agriculture data, identically to how they were estimated during the construction phase.

Findings

The analysis in this study looks at two phases of the community solar facilities: (1) the construction phase, which is temporary and occurs only once; and (2) the operation phase, whose impacts will occur annually throughout the life of the facilities. The construction phase analysis estimates the economic impacts statewide, while the operation phase analysis estimates the economic impacts statewide and the narrower impact at the individual county level of the lease payments landowners in that county likely will receive. County analysis of the broader set of economic impacts isn't possible because many of the jobs associated with operation of the facilities will be working across county lines, making it difficult to accurately predict how many of the jobs will be located in each specific county. Note that the lease payment information is also included in the statewide analysis, so the state- and county-level results should not be added together.

1. Construction Phase, Pennsylvania Level

The IMPLAN results suggest that the construction phase of community solar facilities in Pennsylvania will support 11,631 jobs and generate about \$1.8 billion in economic activity within Pennsylvania (see Table 3). This includes about 5,991 jobs directly within the firms doing the construction, interconnection, and advertising work, about 1,907 jobs in businesses with more sales due to the construction work, and 3,733 jobs resulting from employee spending income earned through these jobs and landowners spending the lease dollars they receive.

Impact Type	Employment FTE	Labor Income	Output
Direct Effect	5,991	\$468,073,927	\$983,273,344
Indirect Effect	1,907	\$130,751,803	\$313,516,525
Induced Effect	3,733	\$194,382,911	\$542,207,774
Total Effect	11,631	\$793,208,641	\$1,838,997,643

Not surprisingly, the economic sector which will experience the biggest impacts from the construction activity will be the businesses constructing new power and communication structures, with about 3,819 jobs and \$601 million in economic activity (see Table 4). Architectural, engineering, and related services, as well as advertising, public relations, and related services similarly will experience large increases in employment and economic activity. Many of the remaining top ten sectors are there due to the greater household spending resulting from higher income due to the job creation and from lease dollars.

Description	Employment FTE	Labor Income	Output
Construction of new power and communication structures	3,819	\$271,188,583	\$600,994,327
Architectural, engineering, and related services	1,978	\$187,319,635	\$326,738,365
Advertising, public relations, and related services	416	\$30,046,426	\$93,178,398
Full-service restaurants	251	\$5,800,262	\$12,549,351
Real estate	241	\$6,245,691	\$51,639,474
Employment services	235	\$9,916,103	\$18,551,025
Hospitals	212	\$17,578,446	\$35,930,879
Wholesale trade	196	\$17,769,926	\$48,075,536
Limited-service restaurants	174	\$3,549,442	\$15,352,831
Management consulting services	137	\$12,981,378	\$17,563,799

It is important to recognize that the economic impacts from the construction phase will occur only one time; once the facilities are built and operating most of this spending (and thus economic impact) will no longer occur. All these construction phase impacts are thus temporary.

2. Operations Phase

a. Pennsylvania Level

Once all the community solar facilities begin operating, the IMPLAN results suggest that they will support about 520 jobs and \$83.3 million in economic activity across Pennsylvania (see Table 5). This includes 114 jobs directly within the firms operating these facilities, 53 jobs in businesses with more sales directly to these facilities, and 354 jobs resulting from employee spending income earned through these jobs, landowners spending the lease dollars they receive, and consumers spending what they save from buying electricity from these facilities.

Impact Type	Employment FTE	Labor Income	Output
Direct Effect	114	\$8,135,419	\$22,486,929
Indirect Effect	53	\$3,454,331	\$8,621,112
Induced Effect	354	\$18,565,996	\$52,205,459
Total Effect	520	\$30,155,746	\$83,313,500

The induced effects during the operational phase are higher than the direct effects because much of the operations impact is from lease payments and consumer payments, which affect household income, and thus household spending.

The economic sectors projected with the largest economic impacts include maintenance and repair construction of nonresidential structures (67 jobs) and advertising, public relations and related services (51 jobs) (see Table 6). The projected large impacts in the maintenance and repair section is a result of having to use that sector as a proxy for the electrical generation-solar energy sector because the solar energy sector currently isn't fully developed in Pennsylvania so IMPLAN doesn't model it. In actuality, a majority of these maintenance and repair construction jobs thus would likely occur within the electrical generation-solar energy sector.

Most of the other top sectors projected to experience economic impacts are there due to the greater household income and thus spending due to these facilities. These include hospitals and physicians, real estate, restaurants, and food and beverage stores.

Description	Employment FTE	Labor Income	Output
Maintenance and repair construction of nonresidential structures	67	\$4,741,167	\$11,865,406
Advertising, public relations, and related services	51	\$3,690,888	\$11,445,988
Hospitals	22	\$1,809,599	\$3,698,875
Real estate	20	\$521,314	\$4,310,235
Full-service restaurants	17	\$398,636	\$862,483
Limited-service restaurants	14	\$286,462	\$1,239,066
Wholesale trade	11	\$1,006,273	\$2,722,416
Offices of physicians	11	\$1,320,500	\$1,825,513
Individual and family services	11	\$347,115	\$422,231
Retail - Food and beverage stores	11	\$346,207	\$707,077

b. County Level

As mentioned above, the only county-specific economic impacts that can be considered are those associated with the lease payments received by landowners, and thus increased landowner spending. The impacts ranged from \$5,839 total output countywide and essentially no jobs in Lawrence County, to \$267,610 total output countywide and 2.1 jobs in York County (see Table 7). These county level differences reflect differences in the number of planned community solar facilities and thus the number of acres required, in local land lease values, and in the proportion of spending that county residents typically do in their own county (residents of counties with small economies and thus fewer local businesses are more likely to purchase goods and services from

businesses outside their home county because they may not find as full a range of choices locally as they'd prefer). It is important to note that these economic impacts are included in the state level analysis above, so the results in Table 5 should not be combined with the results in Table 7.

Table 7. Economic Impact of Lease Payments at the County Level During the Operations Phase

County	Employment FTE	Labor Income	Output	County	Employment FTE	Labor Income	Output
Adams	0.3	\$10,221	\$32,413	Lancaster	0.7	\$30,857	\$82,592
Allegheny	0.4	\$24,478	\$66,855	Lawrence	0	\$1,832	\$5,839
Beaver	0.3	\$13,662	\$41,719	Lebanon	0.6	\$23,640	\$70,359
Bedford	0.2	\$7,871	\$24,556	Lehigh	0.3	\$13,532	\$37,488
Berks	0.7	\$30,001	\$85,977	Luzerne	0.5	\$22,331	\$66,620
Blair	0.1	\$4,182	\$11,645	Lycoming	0.5	\$21,934	\$66,580
Bradford	0.1	\$2,704	\$8,328	Mercer	0.5	\$20,617	\$61,459
Bucks	1.7	\$84,548	\$242,350	Monroe	0.5	\$19,772	\$62,015
Butler	0.1	\$3,203	\$9,031	Montgomery	1.4	\$72,626	\$212,478
Cambria	0.2	\$9,078	\$27,695	Montour	0	\$2,114	\$6,081
Carbon	0.2	\$6,146	\$21,233	Northampton	0.4	\$17,233	\$50,976
Centre	0.4	\$17,333	\$51,762	Northumberland	0.3	\$10,455	\$34,484
Chester	1.6	\$90,438	\$237,541	Perry	0.2	\$4,798	\$19,282
Clarion	0.1	\$2,822	\$9,149	Schuylkill	0.3	\$9,705	\$30,181
Columbia	0.9	\$33,632	\$104,553	Snyder	0.2	\$7,201	\$23,594
Crawford	0.2	\$6,677	\$19,860	Somerset	0.1	\$5,764	\$18,430
Cumberland	0.2	\$10,728	\$29,513	Tioga	0.1	\$3,116	\$10,060
Dauphin	0.6	\$32,372	\$89,423	Union	0.2	\$9,664	\$27,062
Erie	1.3	\$54,823	\$160,740	Venango	0.1	\$2,972	\$9,955
Fayette	0.3	\$9,849	\$30,306	Washington	0.2	\$10,970	\$31,094
Franklin	0.3	\$13,337	\$37,924	Wayne	0.5	\$20,061	\$63,684
Fulton	0.1	\$2,088	\$6,875	Westmoreland	0.8	\$30,969	\$93,146
Indiana	0.3	\$11,631	\$37,922	York	2.1	\$91,018	\$267,610
Juniata	0.3	\$8,889	\$29,470	Total	21.5	\$949,491	\$2,784,146
Lackawanna	0.1	\$5,597	\$16,237				

Construction and operation of the community solar facilities similarly will increase annual local real property tax collections due to improvements made to the land where these facilities are located. The increases range from about \$920 a year in Bradford County, to about \$65,354 a year in Chester County (see Table 8). These estimates are the total estimated increased tax collections by the county and municipal governments and by the school districts in each county. Similar to the lease dollars, the amounts vary between counties due to differences in the number of community solar facilities in each county, the value of local real estate, and the size of local real property tax rates.

In addition to these annual increases in local tax collections, local governments and school districts likely will experience one-time increases in real property tax collections because the construction and operation work will violate eligibility for the Commonwealth's 'Clean and Green' program which provides farm and forest land tax breaks as long as the landowner keeps the land out of development or other ineligible use. Land parcels withdrawn from the Clean and Green

program have to repay the tax savings for the past seven years, plus 6% interest. Such rollback payments will range from about \$2,728 in Bradford County to \$193,827 in Chester County (see Table 8).

The annual increases in real property taxes and the one-time rollback payment will be paid by the community solar companies, not by the individual landowner.

Table 8. Increased Real Property Tax Payments, by County

County	Annual Increase in Real Property Taxes	One-time Rollback Real Property Taxes	County	Annual Increase in Real Property Taxes	One-time Rollback Real Property Taxes
Adams	\$6,360	\$18,861	Lancaster	\$25,846	\$76,655
Allegheny	\$11,290	\$33,483	Lawrence	\$1,121	\$3,326
Beaver	\$10,080	\$29,896	Lebanon	\$23,298	\$69,097
Bedford	\$3,165	\$9,388	Lehigh	\$7,223	\$21,422
Berks	\$23,575	\$69,920	Luzerne	\$7,583	\$22,491
Blair	\$1,692	\$5,017	Lycoming	\$6,154	\$18,251
Bradford	\$920	\$2,728	Mercer	\$9,060	\$26,870
Bucks	\$57,141	\$169,471	Monroe	\$14,877	\$44,122
Butler	\$1,457	\$4,320	Montgomery	\$63,290	\$187,706
Cambria	\$2,427	\$7,200	Montour	\$1,625	\$4,820
Carbon	\$6,321	\$18,746	Northampton	\$10,018	\$29,713
Centre	\$11,094	\$32,902	Northumberland	\$5,165	\$15,319
Chester	\$65,354	\$193,827	Perry	\$5,222	\$15,488
Clarion	\$2,182	\$6,473	Schuylkill	\$5,535	\$16,414
Columbia	\$16,255	\$48,208	Snyder	\$7,505	\$22,259
Crawford	\$2,533	\$7,513	Somerset	\$1,928	\$5,718
Cumberland	\$4,462	\$13,233	Tioga	\$1,117	\$3,314
Dauphin	\$13,665	\$40,529	Union	\$4,676	\$13,869
Erie	\$17,877	\$53,019	Venango	\$1,580	\$4,687
Fayette	\$5,034	\$14,931	Washington	\$5,731	\$16,998
Franklin	\$8,645	\$25,640	Wayne	\$10,364	\$30,738
Fulton	\$1,149	\$3,408	Westmoreland	\$15,985	\$47,409
Indiana	\$5,202	\$15,429	York	\$52,566	\$155,900
Juniata	\$6,018	\$17,847	Total	\$574,260	\$1,703,152
Lackawanna	\$2,892	\$8,577			

Limitations & Implications

As with all economic analysis, it is important to keep in mind limitations which may affect the accuracy of the estimates. Much of the data is based upon experience in other states, as reported by the Coalition for Community Solar Access, so actual costs in Pennsylvania may be somewhat different. To consider this, in our analysis we used lower end of most cost range estimates. It thus is possible that the actual economic impacts could be larger than what is estimated here.

The operation phase estimates are heavily dependent upon the estimated consumer savings, which account for 54% of total operational costs and savings. To the extent that these savings in actuality are smaller or larger than the consumer savings estimates used in this analysis, the estimated economic impacts will be smaller or larger. An important factor will be the extent to which the solar companies pass cost savings onto consumers rather than keeping those savings for investors and others (though shifts of these cost savings to investors in Pennsylvania itself would have economic impacts, potentially offsetting any lost economic impacts if consumer savings decrease).

As mentioned above, because Pennsylvania currently lacks a robust solar energy production sector, the IMPLAN economic impact model currently does not directly include this sector. We thus had to use the Maintenance and Repair Construction for Nonresidential Structures sector as a proxy for the solar companies' spending patterns during the operations phase of community solar generation. As a test of this assumption, we re-ran the analysis using electrical generation by fossil fuel plants and the findings were similar (\$83.9 million in annual output when using the fossil fuel sector, compared to the \$80.9 million we estimated using the Maintenance and Repair proxy). Bae & Dall'erba (2015) used the same proxy in their work estimating the economic impact of a new solar facility in Arizona. They suggest that labor income during the construction phase may be undercounted because IMPLAN uses the average income of a worker in the construction sector no matter what type of facility is being built.

Our analysis assumes that the land which will be used for the community solar facilities is either fallow and thus isn't currently generating income for the landowner, or that its current farming usage can continue once the facilities are operating. This is a reasonable assumption if the land is being used for pasture, but likely isn't reasonable if the land is being cropped, such as for corn or soybeans. The net value of lease income and thus the economic impacts will be less than these estimates to the extent that the facilities reduce farm production and thus farm income.

The analysis similarly relies upon Coalition for Community Solar estimates of the proportion of construction spending which will likely occur inside Pennsylvania. For example, none of the costs associated with the racking systems, the modules, inverters, and other specialized solar equipment were included in the analysis because these will likely occur outside Pennsylvania. Their estimates of the proportion of in-state spending seems reasonable to us; about 90% of costs associated with on-site electrical infrastructure, about 85% of racking installation costs, and 80% of system design costs. The actual economic impacts will be different to the extent that these

estimates are inaccurate, such as if there is a higher reliance on out-of-state contractors or firms doing the work.

This economic impact study focuses solely on the potential employment, labor income, and output impacts directly associated with building and operating community solar facilities in Pennsylvania. It does not consider the potential impacts of the environmental benefits from shifting from fossil-fuel-dependent electrical generation to a more renewable and sustainable source of electricity. It similarly does not consider the potential impacts of any negative effects of these facilities on neighboring properties or others in the community, such as changes in neighbors' property values. In addition, the analysis does not consider potential employment impacts on other electrical providers as customers switch to consumer solar. This effect may not be large because of the proportionately large market share controlled by fossil fuel-based power generation providers and their significantly large fixed asset base.

It is important to recognize that the construction phase impacts will be temporary and one-time. Once the facilities are built, the only sustaining economic impacts will be from the operation phase. As detailed in this report, these operation phase economic impact estimates are annual estimates and do not address the cumulative impacts over time during the operation phase.

Conclusions

The economic impact of community solar facilities in Pennsylvania will differ between the construction and operation phases. Our estimates, given conservative assumptions and the limitations of available data, are that construction of the currently planned 235 community solar facilities in Pennsylvania could generate a one-time, temporary \$1.8 billion increase in economic output and 11,631 jobs in the Commonwealth. This includes about 5,991 jobs directly within the firms doing the construction, interconnection, and advertising work, about 1,907 jobs in businesses with more sales due to the construction work, and 3,733 jobs resulting from employee spending income earned through these jobs and landowners spending the lease dollars they receive.

Once operating, these 235 community solar facilities annually will generate around \$83.3 million in economic output, supporting 520 jobs across the Commonwealth. This includes 114 jobs directly within the firms operating these facilities, 53 jobs in businesses who will provide goods and services to these facilities, and 354 jobs resulting from employee spending, landowners spending the lease dollars they receive, and consumers spending what they save from buying electricity from these facilities. In addition, these facilities will increase annual real property tax collections by about \$574,260 across the Commonwealth.

As with all economic impact analysis, these economic findings need to be considered in the broader context of other related issues that could not be addressed in this report, such as the potential impact of community solar on the environment and climate change, neighbors and communities, and on existing electricity generation facilities in the Commonwealth.

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