Michigan Community Solar: An Economic Assessment

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Executive Summary

The Coalition for Community Solar requested from the Michigan State University Product Center/Center for Economic Analysis an assessment of the economic contributions of community solar power installations. This assessment is based on a program that enables the installation of 150 MW capacity per year for six years, or a total of 900 MW of new capacity spread out over 30 installations per year (180 total) each with a capacity of 5 megawatts direct current (5 MW). This 900 MW of new capacity is about three percent of total installed electricity generation capacity in Michigan according to the Energy Information Administration 2021 [1]. That is, the scale of generation targeted by community solar represents a small component of overall in-state generation of electricity [2].

This assessment considers two channels of economic contribution of community solar in Michigan, the temporary construction phase of the facilities and the ongoing operations and maintenance (O&M) of the installations which persist throughout the life of the installation. This assessment assumes widespread installation of community solar photovoltaic (PV) arrays across the state totaling 900 MW of total capacity. As is the nature of community solar projects, the installations will be limited in size and distributed around the state. The assessment assumes the 180 installations will be installed over a six-year period at a rate of 30 facilities a year; the lifespan of a facility is estimated to be 25 years. We discount future streams of social incomes to assess the social value of community solar from the policy perspective of the value placed on the expected stream today. The resulting economic valuation should not be interpreted as a comprehensive economic impact estimate. Rather, the measured economic effects represent our best estimates of the economic contributions of community solar expenditures to Michigan's economy as measured by the value of transactions that can be attributed to the installation and O&M expenditures captured in state.

The IMPLAN economic simulation model for Michigan is used to project annual economic contribution estimates on employment and income. The IMPLAN model traces transactions across industries and institutions, like households, to account for all direct and secondary transactions arising from community solar expenditures. We use a discount rate of 5 percent to account for social preferences for earlier benefits rather than later benefits. Data used to estimate community solar companies' expenditures were acquired from both published documents and input from the industry.

Michigan's gross state product is perhaps the most comprehensive measure of income generated in Michigan. We project expected annual contributions to gross state product of community solar projects expenditures captured in state and discount these flows. Accordingly, installation alone will generate $474.84 million in discounted, cumulative gross state product. The installed community solar facilities will generate stateside expenditures through the facilities' estimated 25 years of operation. Though annual O&M expenditures per facility is less than expected annual installation expenditures during the installation phase, the long sequence of year-over-year expenditures is expected to generate $952.01 million in discounted gross state product. Over the life of the project, the combined discounted contributions to gross state product are estimated to be $1.47 billion. Breaking these down into annual terms, we show that the industry-wide construction contribution to gross state product is $79.14 million for the six years of installation, while the annual contributions from O&M averages to about $30.71 million over the 31-year projections.

As the product of all income generated in the state, gross state product entails incomes earned by all institutions in the economy, including workers, we also project contributions to Michigan labor income and employment. Accordingly, our estimates suggest that approximately 900 Michigan jobs per year with a discounted total of $318.56 million in labor income over the initial six years will be linked to community solar installations. Alternatively, about 423 annual jobs, will be linked to O&M operations on average over the 31-year span. The projected labor income, discounted to current values over this same period is expected to be $412.36 million. The current, discounted value of expected labor income over the 31-year horizon of this analysis (including incomes of both installation and O&M phases) is $730.92 million, while the current value of future stream of contributions to gross state product exceed $1.426 billion over this same horizon. These findings are summarized in the accompanying table.

	Installation (Yrs 0-5)	O&M (Yrs 1-31)	Combined (Yrs 0-31)
Average Annual Contribution to…			
Employment	900	423	578
Labor Income	$53.09M	$13.30M	$22.84M
GSP	$79.14M	$30.71M	$44.59M
Current Value of Contribution of…			
Labor Income	$318.56M	$412.36M	$730.92M
GSP	$474.84M	$952.01M	$1,426.84M

Table ES 1: Summary of Economic Contribution Estimates

Another way of reflecting on the expected job contributions of community solar is to calculate the total number of annual job equivalence. While a single job in existence over thirty years is still considered one job, when measured in annual job equivalence, it would total 30. Accordingly, the 900 estimated installation jobs each year during the installation phase, generates 5,400 annual job equivalence over the project span. Similarly, the 423 average annual jobs tied to O&M expenditures is equivalent to 13,104 annual job equivalence. Collectively, we estimate that about 18,500 annual job equivalence will be realized over the 31-year span of these initial community solar installations.

Methodological Overview

This report documents the expected economic contributions, or significance, of community solar, if community solar in Michigan should reach 900 MW of capacity. As an economic significance study, the resulting estimates represent the extent to which we anticipate community solar will interact with the state economy. That is, our estimates show the number of jobs, labor income and contributions to gross state product that can be linked either directly or indirectly to community solar expenditures in their construction and day-to-day operations. Direct linkages are those transactions and employment that are directly paid by a community solar project in the state. Indirect linkages are those transactions and employment that arise in response to direct transactions and employment. Indirect linkages are the analog to multiplier effects commonly found in economic impact studies.

We posit a couple of disclaimers about this report. First, the report and report findings should not be interpreted as communicating feasibility or infeasibility of the community solar model. Neither should it be the basis of investment decisions in community solar projects. Assessing the financial vitality of such business models was not an objective of this effort. Additionally, this report is not an economic impact analysis. An economic impact estimate will ask what is the net change in economic activity associated with widespread implementation of community solar? Such an assessment would have to account for how community solar shifts the energy balance in the state based on net changes to contributions and use of electricity transiting the Midcontinent Independent System Operator (MISO), which operates the reginal electricity grid spanning from Manitoba Canada to Louisiana. As such, only new earnings made from community solar without supplanting other instate purchases would be counted as contributing to an economic impact of energy sales. As an economic contribution analysis, all expenditures captured in the state's economy that can be linked to community solar installation or operations are attributed to community solar.

Other potentially relevant sources of social and economic impact are not assessed in this report. The analysis also does not account for pecuniary and non-pecuniary social and private returns associated with environmental benefits and carbon credits of renewable designation of solar energy generated. Similarly, the forgone economic values of the next best uses of acreage under community solar arrays are not considered in the analysis. If the land used for community solar installation is currently vacant or has use limitations that prohibit most commercial uses, the expected alternative revenues lost when placing the property in community solar use will be approximately zero. A relevant example may be a brownfield site that restricts uses other than solar. Alternatively, if the panels are installed on farmland, then the net value of the crops that would otherwise be grown on those acres are not included in the analysis. Forgone uses may also entail lost future opportunities for development given the long contract horizon.

Rather, this report constitutes an economic contribution analysis. Economic contribution analyses are limited in scope in that they measure the value of all transactions and subsequent secondary transactions that can be linked to the installation or O&M of community solar installations. That is, all expenditures the community solar industry makes in Michigan will be measured and traced rather than only the share of expenditures that arise from new earnings for the state. Additionally, while community solar rates tend to be about 10 percent lower than that of commercial providers of electricity [3], we do not model the economic contributions of household savings in utilities payments. We also do not account for substitution from conventionally-sourced electricity produced in the state from coal, natural gas, hydrological and other electricity sources – all of which compete with solar.

Assumptions and Approach

This assessment is based on a total of 180 community solar projects, or installations, each with a capacity of 5 megawatts (5 MW). A 5 MW system typically supplies enough electricity to offset the electricity use of about 950 homes. It is also considered a standard scale for a community solar system. This assessment considers two channels of economic contribution: the one-time contribution from construction expenditures required to install the solar panel arrays, and the ongoing contributions through operations and maintenance (O&M) expenditures. The assessment also assumes that while it takes about a year to install a 5 MW system, it will take six years to install all 180 foreseeable community solar projects at a rate of 30 new facilities a year. Based on industry expectations, once a project is established, the panels have an expected lifespan of about 25 years. At the end of the life, the panel structures may be removed or repurposed for a new set of solar panels.

IMPLAN, a standard economic simulation software package, is used to generate the estimates of employment and income contributions throughout the state's economy. The IMPLAN economic simulation model is a well-established and highly respected economic simulation model for estimating economic impacts [4] and is a class of economic simulation models called an input-output model. These models, grounded in social accounting theories, trace economic linkages across industries and between industries and institutions, like household, corporations, government and the rest of the world (trade accounts). Input-output models recognize that one's expenditures is another's revenues and when one party increases revenues, they also increase expenditures. Through these interrelationships, input-output models trace the economic transactions arising from a distinct segment of the economy as it disseminates throughout the economy. For instance, when a company invests to install a community solar project in Michigan, many of the expenditures that the company will make to install the panels will be made to Michigan vendors. They will also hire Michigan electricians and construction workers in installing the panels. As these new revenues are introduced to the economy, they set in motion subsequent rounds of transactions as those dollars are re-spent in the state's economy. This second round evokes further rounds of transactions, where subsequent rounds continue up to the extent to which dollars leave the state for the purchase of imported goods and services or retained as savings and not re-spent through financial intermediaries like banks.

Economy-wide economic modeling of community solar expenditures is designed the capture all direct and secondary transactions linked to community solar operations. That is, in addition to the direct, instate expenditures made by community solar companies, the estimates also trace how other businesses and households spend from earnings captured from the companies' direct expenditures. Because community solar projects will generate expenditures over the expected 25-year life of the installation, we apply a discount rate of 5 percent to account for the timing of income projections, where income earned in immediate years are favored over the same income earned in later years. This accounts for an estimated inflation rate of two to three percent per year plus a real foregone rate of return of two to three percent per year. Estimates of direct expenditures by community solar companies was generated using published documents and input from industry participants.

Two channels by which community solar contributes to the Michigan economy are estimated. The first is through expenditures for installing photovoltaic panels. These installations usually take up less than a year to install, and the installation covers around 25 to 30 acres of land on average. The second channel is through ongoing annual O&M expenditures. While installation expenditures are short-term, the annual O&M expenditures are recuring over the expected 25-year life of the installation.

We develop a typified utility-scale, 5 MW PV system as the basis for economic contribution assessment. The base case assumes a single-axle tracking system for all installations. Monocrystalline and multicrystalline PV modules are the two dominate PV technologies on the market. However, the relative costs of these competing technologies are comparable. As PV modules will most likely be purchased from outside the state of Michigan, the purchase of PV modules will not be captured by the state's economy and accounting for the differences in PV technology costs will have no material effect on economic contribution estimates. Hence, from an economic modeling perspective, we only account for the expenditures and the value of those expenditures that are captured by Michigan-based suppliers and households.

We generate an expected economic contribution of a standard, or typical, community solar installation, and then to use that estimate to scale up, so as to estimate state-level economic contributions of community solar installations across the state. As we anticipate installations will occur over multiple years, we must assume the timing of installations and recognize the time-value of revenue flows for projected future installations. Finally, any economic contribution estimate must contend with the question of which purchases, and activities are captured in the local economy, and which purchases, and activities are realized by other economies. In this, we assume that the local economy is the state of Michigan and is bound by the state's political boundaries. Dollars generated by the community solar activity that leave the state are assumed not to return to the state. That is, as soon a dollar leaves the state, it ceases to circulate in the Michigan economy and no longer contributes to the state's economy through further secondary transactions.

Two simulations are carried out for a typified 5 MW utility-scale PV system. The first simulation models the economic contributions of instate expenditure for the installation and construction of PV installations. The installation expenditure profile starts with baseline national average cost breakouts provided by the National Renewable Energy Laboratory [2]. These baselines are then shared with six community solar providers (outside of Michigan) for further refinement. The final cost breakouts are then applied to an economic simulation model for a 5 MW – utility scale community solar installation. This construction and installation phase of the project is a one-time investment and therefore, is treated as a temporary expansion of economic expenditures to establish the system. Upon completion of the construction and installation phase, economic activities switch to operations and maintenance (O&M) activities. Expected O&M cost categories are developed for a typical PV system. We vet these annual O&M expenditure estimates with the same six community solar companies. The resulting O&M annual expenditure profile is assumed to persist throughout the life of the system, which we assume is 25 years. Hence, the second simulation represents the annual O&M expenditures captured in the state. Because these economic benefits accrue over time, future benefits should be discounted to current values. We apply a single discount rate of 5 percent per annum.

The underlying properties hosting installations may have very different ownership situations and be under different degrees of alternative uses. Generally, we can consider the grounds hosting PV as undeveloped, but that is not always the case. Because community solar systems must be installed in the geographic bounds of the system they serve, such installations may compete with high-valued uses in inner cities and urban regions. While the cost minimization objective will assure that low value alternative properties will be sought for installation, the costs of connectivity may make highly marketable properties attractive for community solar installation if that property has low hookup costs to the electricity grid. Hence, while we recognize expected lease payments earned by owners of properties hosting solar panels, we do not account for the loss of the next best alternative use of those properties. In many cases, the next best alternative use may be agriculture. However, given the long-term commitment horizon of 25 years, especially near or in urban centers, the next best option may be development. The analysis also does not take into account dismantling costs which due to discounting, would have immaterial effects on the total economic contribution estimates. Finally, the analysis does not take into account the effect of utility grade solar installations on property values on and around the installation site. There currently is not a well-accepted relationship between utility-grade solar installation and property values.

Property tax treatment of utility-scale solar is not well established in Michigan. For taxing purposes, PV installations, fixed equipment and fixtures can be considered industrial personal properties and taxed accordingly. However, the final tax treatment of these installations may differ by taxing entity. Hence, we do not attempt to model the direct tax implications of PV installations.

Construction and Installation Expenditures of 5 MW Capacity PV Systems

NREL tracks many aspects of PV technology including the economics of PV adoption. We use their Transparent Cost Database as the basis to assign a conversion rate of land acres necessary for a 5 MW system. The NREL asserts that on average, it requires 6.1 acres to generate 1 MW, with a range of 4.4 acres to 7.8 acres at the two extremes [5]. These estimates are for smaller utility-scale installations of less than 10 MW. Accordingly, a 5 MW system is expected to require 25 acres but can range from 22 to 39 acres.

NREL provides nation-wide estimates of the capital expenditures for utility-scale PV systems, where utility scale may be as small as 1 MW capacity to hundreds of MW capacity. NREL installation cost estimates are broken out into size categories and reported on a per MW capacity basis to facilitate scaling. We use the utility-scale, capacity range from 1 to 10 MW capacity in our estimates, as reproduced in Table 1. The final cost profile applied was moderated somewhat from NREL estimates based on industry input. Where NREL estimated installation costs of $1.34 per DC-Watt capacity, we asked six community solar operators to indicate their expected cost profiles and total expected cost per DC-Watt capacity. We averaged those responses, giving us an expected installation cost of $1.73 per DC-Watt capacity. To protect proprietary information, we do not provide the final breakout of expenditure categories, but the average breakout suggests that the category proportions are similar to those provided by NREL. Whereas NREL's cost estimates peg a 5 MW name plate capacity installation will cost $6.675 million on average, the estimate provided by industry participants puts that at $8.640 million.

Cost/watt	Category
0.19	Engineering, procurement and construction
0.03	Contingency
0.12	Developer Overhead
0.00	Transmission Line
0.03	Interconnection fee
0.03	Permitting Fee
0.02	Land Acquisition
0.05	Sales tax
0.13	Install labor and equipment
0.13	Electrical balance of system
0.15	Structural balance of system
0.05	Inverter
0.41	Module
	Total Construction and Installation Costs
$1.34	Per Watt capacity
$6,675,000	Per 5 MW capacity facility

Table 1: Primary Installation Expenditure Categories

Source: National Renewable Energy Laboratory

We apply these expenditures to appropriate IMPLAN industry categories, where instate capture of direct expenditures are based on availability of each industry category output. However, we override the model local capture estimates for engineering, procurement and construction– setting it to 50 percent, rather than IMPLAN's 100 percent, as these functions will largely be captured at the home office of the company installing the PV system. We also do not model the direct sales tax transactions, as these are largely captured in the IMPLAN software. We also assume that modules and inverters are imported into Michigan and therefore pose zero instate capture. Accordingly, about 32.7 percent of the total value of expenditures traced at installation is expected to be captured in state.

We limit the scope of estimated community solar installation capacity to 900 MW of nameplate capacity to be installed over the course of six years. We assume a widespread construction/installation phase lasting six years, where 150 MW of capacity is introduced each of the six years. The value of the first 150 MW installation is measured in current dollars. After that, the economic contributions measured in dollars are discounted by the rate of five percent per year until 900 MW of nameplate capacity is installed.

Operations and Maintenance Expenditures of 5 MW Capacity PV Systems

Like that of installation, the economic contribution of O&M is measured based on the expected value of expenditures in operating and maintaining the facilities and the extent to which those expenditures are captured by the instate economy. Also like that of installations, we can only conjecture the values of operating expenditures and the share of those expenditures captured in state. For this, we turn to other studies to develop O&M expenditure categories but rely on industry experts to provide expected average O&M costs for each category based on 5 MW capacity installations. Table 2 provides the spending categories submitted to each of the six community solar operators. Because the operators view this information as proprietary, we do not disclose the average or individual breakouts here. However, collectively, the results indicated that average annual costs for O&M of a 5 MW operation was just under $400,000 per year. We use this average estimate and the underlying breakout to allocate O&M expenditures. In modeling the transactions, we override the business and management expense categories to favor out of state capture of these expenditures. While we recognize that some community solar projects may locate back-office operations in Michigan, it is conceivable that many will maintain home offices outside of Michigan. Those with home offices outside of the state, may however, establish satellite offices in Michigan – especially if they operate more than one community solar installation in the state. Hence, we assume a 50 percent capture of administrative and business O&M expenses, representing an objective assessment in the absence of evidence suggesting these expenditures will be captured in or out of Michigan. For other sectors, the instate capture is determined by the model, which uses instate availability to determine the share captured locally. Generally, those values are set to or near 100 percent. We also attribute lease payments to household income, where household spending patterns dictate how these funds are allocated across spending categories and between instate purchases and those made outside of Michigan.

Cost Category	Cost per Watt
Equipment Maintenance	
Electrical (parts and labor)	
Mechanical (parts and labor)	
Land Management	
Mowing	
Lease Payment	
Proper Taxes on Fixed Equipment	
Administrative and Business Expenses	
Management (including office & labor)	
Advertising and Promotion	
Other Operating and Maintenance Costs	

Table 2: Estimated O&M Costs of typical Community Solar System

Based on expected annual sales of a 5 MW capacity system

Time Sequencing and Extrapolating Economic Contributions

In this section we describe the approach to sequencing expenditures over time as companies dynamically enter and set up operations in Michigan. We assume that there will be a 900 MW capacity cap to community solar installation projects. To be sure, this is not a limit on solar power generation facilities, but rather on those facilities following the community solar model of operations. We also assume that only 150 MW (30 systems @ 5 MW) of capacity is installed per year for six consecutive years, starting with year zero. For simplicity, we assume that during the installation year, no O&M expenditures from generation happens. Hence, in year zero, there is 150 MW is installed and no O&M costs. In year one, there is another 150 MW generation installation and O&M costs from 150 MW from the previous year. In year two, there is an additional 150 MW in new generation installation and O&M costs from 300 MW generation capacity installed from prior two years. This pattern persists through year six, where the seventh and beyond, only O&M from existing installations totaling 900 MW is realized year over year, until the 25th year, where the first 150 MW is retired, and an additional 150 MW is retired each year their after. Upon retirement, O&M expenditures cease. Because we are abstracting from consideration of any retirement costs, no additional sources of economic contribution are measured after retirement. The operational life of the installation is assumed to be 25 years and installation takes place in year zero.

Under this approach, we assume that generation capacity and maintenance costs are spread consistently through all operational years. This is a simplifying assumption that posits a slight positive bias on the present value of the installation, in terms of discounted contributions to the state economy. Since economic contributions are gauged by the expenditures operators make in the state's economy, changes in the price of electricity are expected to have negligible effects on the annual contributions. In valuing future contributions to the state economy, we discount future values based on a five percent annual discount rate. Discounting only applies to present value calculations of money-valued metrics.

Findings

Construction of 5 MW Capacity Installation Contributions

The installation process is a period of intense activity to purchase, ship, engineer and install a set of solar panels that may span up to 35 acres of land. Accordingly, the estimated $8.640 million per 5 MW installation is expected to generate approximately 15 direct jobs based on a continuous full-time basis. That is, it is likely that more than 15 Michigan workers will be employed in the installation process, but many will only be temporarily employed for this specific project. If we are to consider typical annual hours of Michigan jobs, the best estimate is that sufficient to fully employ 15 Michigan workers over the course of a year.

Once we consider how direct activities give rise to secondary activities that ripple throughout the economy, we show that each 5 MW installation supports about 30 Michigan jobs with total annual income of just under $2 million per year (2021 prices). Collectively, the estimated total instate income generated (as measured by gross state product) from a single 5 MW installation is $2.97 million.

Operations and Maintenance Contributions

The O&M phase is less intense as the construction phase, but results in significant instate economic activity, nonetheless. We estimate that a single facility generates sufficient demand to occupy about one in state, fulltime employee, on average. Most likely, this labor demand will be parsed out to many individuals, including contract mowers, cleaners, electricians and mechanical technicians.

Once accounting for all secondary activities tied with annual O&M activities, we assert that about three Michigan jobs will likely be traceable back to any 5 MW capacity operating system with annual labor income of $179,415. The O&M expenditures of one 5 MW PV facility is expected to contribute about $414,210 to annual gross state product. The resulting implied economic multipliers are on the high end because lease payments to households do not contribute to direct effects but do contribute to secondary effects. As the multiplier is the ratio of total effect to direct effect, this omission of direct effect to outcomes results in unusually high implied multipliers.

Time Sequence Aggregate Contributions

Table 3 shows the aggregate contribution estimates, where all dollar value projections are discounted at five percent per year. The table shows that for each of the six initial years, from year zero to year five, 30 new units are installed. Each unit has a 5 MW capacity thus when, in year seven, the total of projected

	Installations		Operations and Maintenance		
Year	Units Installed	Units Operating	Emp	Labor Income	GSP
0	30	0	900	$59,772,450	$89,096,670
1	30	30	984	$62,052,286	$96,688,543
2	30	60	1068	$63,979,456	$103,355,347
3	30	90	1152	$65,582,378	$109,167,969
4	30	120	1236	$66,887,562	$114,192,642
5	30	150	1320	$67,919,731	$118,491,228
6	0	180	504	$24,098,802	$55,636,178
7	0	180	504	$22,951,240	$52,986,836
8	0	180	504	$21,858,324	$50,463,654
9	0	180	504	$20,817,452	$48,060,623
10	0	180	504	$19,826,144	$45,772,022
11	0	180	504	$18,882,042	$43,592,401
12	0	180	504	$17,982,897	$41,516,573
13	0	180	504	$17,126,569	$39,539,593
14	0	180	504	$16,311,018	$37,656,755
15	0	180	504	$15,534,303	$35,863,577
16	0	180	504	$14,794,574	$34,155,787
17	0	180	504	$14,090,071	$32,529,321
18	0	180	504	$13,419,115	$30,980,306
19	0	180	504	$12,780,109	$29,505,053
20	0	180	504	$12,171,533	$28,100,051
21	0	180	504	$11,591,936	$26,761,953
22	0	180	504	$11,039,939	$25,487,574
23	0	180	504	$10,514,228	$24,273,880
24	0	180	504	$10,013,550	$23,117,981
25	-30	180	504	$9,536,714	$22,017,125
26	-30	180	504	$9,082,585	$20,968,690
27	-30	150	420	$7,208,401	$16,641,818
28	-30	120	336	$5,492,115	$12,679,480
29	-30	90	252	$3,922,939	$9,056,772
30	-30	60	168	$2,490,755	$5,750,331
31	0	30	84	$1,186,074	$2,738,253

Table 3: Time Sequence of Installations

Values based on number of installed or operating 5 MW PV facilities. Dollar values are discounted (5%) cash flows valued at year 0 units operating reach 180, total community solar capacity installed 900 MW (180 units times 5 MW). Because installation precedes operation by one year by assumption, two columns are provided to indicate the number of new units being installed and driving the installation contributions and the number of units operating and driving the O&M contributions. On the 26th year, the initial installations are projected to age out. We do not conjecture what economic contributions or costs are attributed to ageing out of PV installations. It is possible that there may be contracted or regulated obligation for the dismantling or reuse of PV fixtures at the end of life, but that is left to be determined. Because future values are discounted, the actual value of economic contributions and costs that may be realized at the time of dismantling is about one quarter of the value realized when dismantling.

Table 3 shows that economic contributions are most intense during the installation years. Upon year six, the collective economic contribution decreases to its steady state O&M activities. While employment contributions remain consistent at 504 Michigan jobs linked to community solar facilities across the state, the value of labor income and contributions to gross state product declines year over year. This is because we generally do not discount future jobs like we do flows of money and the year over year decline in money values in Table 3 convey the declining value we place on future economic returns in financial measurements.

The next table summarizes the estimates provided in Table 3. That is, Table 4 shows the best summarized measures of the expected economic contributions of the system-wide installation and operation of community solar in Michigan, where community solar entails installation and O&M of 900 MW capacity of utility- scale PV installations. Two measures are reported. The average annual values (over indicated years) of the discounted benefits and the present value of the discounted contributions. The installation and the O&M phases are presented in isolation and in the aggregate. During the installation years, the average number of jobs per year is estimated to be 900 Michigan jobs. From an annual jobs equivalence perspective, where one job maintained over 30 years equates with 30 annual equivalent jobs, the installation phase is expected to support 5,400 annual jobs. The average annual present value of the flow of labor income is expected to be $53.09 million and average annual contribution to gross state product of just over $79 million. Summing over the discounted flows shows the present value of labor income totaling $318.56 million and that of gross state product of $474.84 million.

	Installation (Yrs 0-5)		O&M (Yrs 1-31)		Combined (Yrs 0-31)	
	AVG	PV	AVG	PV	AVG	PV
Employment	900	N/A	423	N/A	578	N/A
Labor Income	$53.09M	$318.56M	$13.30M	$412.36M	$22.84M	$730.92M
GSP	$79.14M	$474.84M	$30.71M	$952.01M	$44.59M	$1,426.84M

Table 4: System Wide Estimated Economic Contribution of Community solar

Similarly, during the O&M phase, the average year will see 423 Michigan jobs linked directly or indirectly by community solar with average discounted annual labor income of $13.30 million and contributions to gross state product totaling $30.71 million. This is a lower rate of contribution relative to the installation phase, but because these contributions are realized over 30 years, the present value of these contributions can be much more significant than that of the installation phase. Similarly, this results in a much higher annual equivalence job estimate of 13,104 annual equivalent jobs overall. There, we see estimated present values of labor income of $412.36 million and an estimated $952.01 million annual contribution to gross state product.

The third column of Table 4 combines the installation and O&M phase estimates. Accordingly, we estimate that throughout the expected 31-year initial cycle of community solar installations and operations, we project that about 578 Michigan jobs will be linked to community solar on average giving rise to 18,500 annual equivalent jobs. Average annual labor income is estimated at $22.84 million and contributing some $44.59 million to average annual gross domestic product. From a present value perspective, this constitutes $730.92 million in labor income and $1.427 billion contribution to gross domestic product. To be sure, these present value estimates suggest the value of the cash flow to Michigan today, based on a five percent discount rate. Actual flows will be higher.

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