CAPTURING THE SUN

The Economic Benefits of Using Local Workers on Wisconsin Solar Projects

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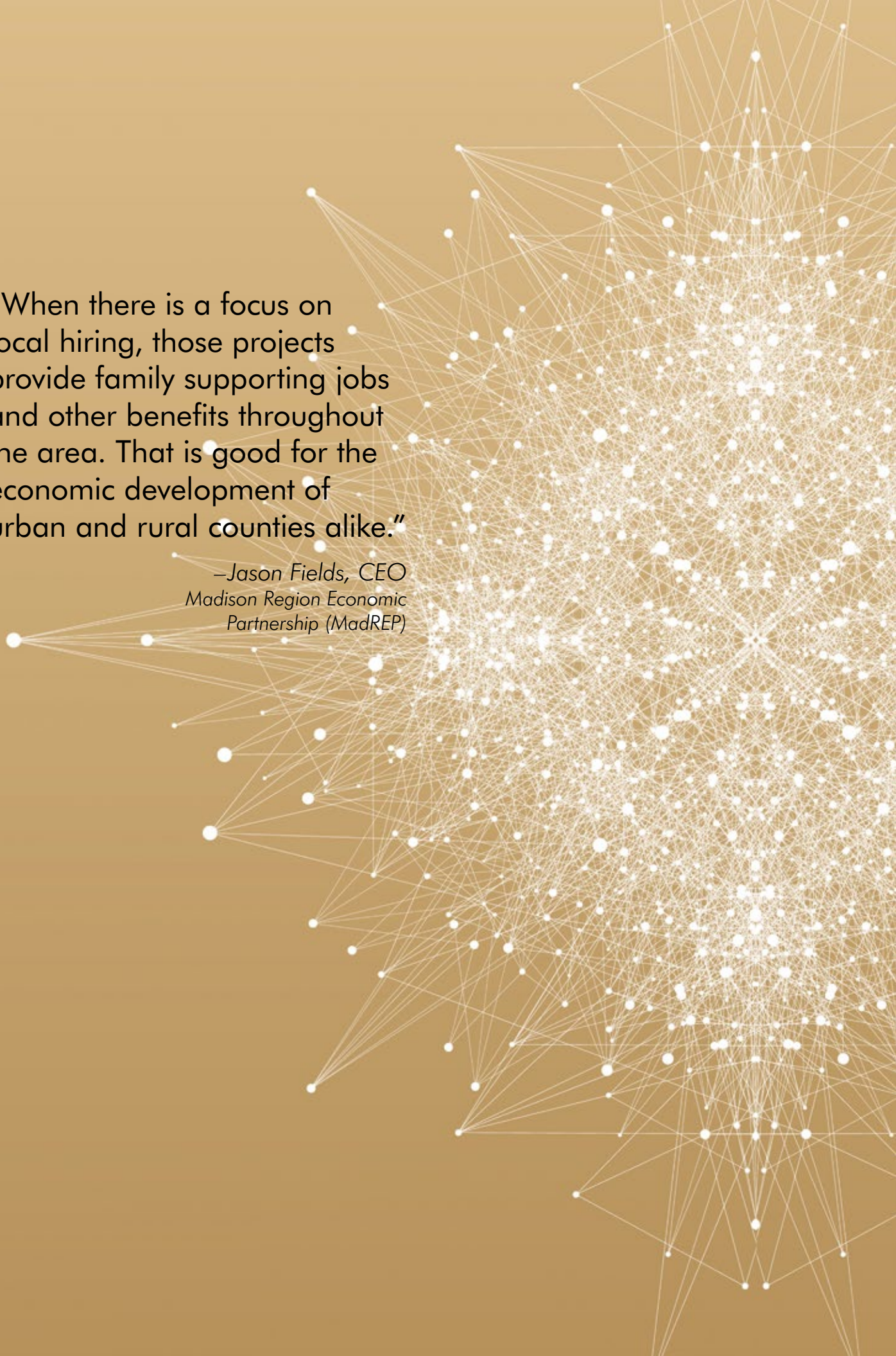

"When there is a focus on local hiring, those projects provide family supporting jobs and other benefits throughout the area. That is good for the economic development of urban and rural counties alike."

–Jason Fields, CEO
Madison Region Economic Partnership (MadREP)

Executive Summary

Capturing The Sun

Between 2016 and 2020, the U.S. added nearly 70 gigawatts (GW) of solar capacity. Nearly two-thirds of the added capacity was from utility-scale installations—solar farms that feed into the electric grid and sell the power they generate to a utility. While Wisconsin has lagged the nation in solar power capacity, the state will likely catch up over the next few years.

In 2020, the 150 megawatt (MW) Two Creeks Solar Farm in Manitowoc County came online. Another 19 projects supplying 2,488 MW (or 2.5 GW) were recently approved or are awaiting approval by the Wisconsin Public Service Commission. Construction of these solar farms will generate significant economic activity in the places in which they are sited. However, the size of the impact will depend largely on the composition of the project's workforce.

This study examines the local economic impact generated by a workforce installing a 150 MW solar farm in rural Wisconsin. In particular, the study compares the economic impact of using local workers versus an out-of-state workforce.

Key findings include:

- A 100% local workforce building a 150 MW solar installation in rural Wisconsin would generate $11.8 million in economic activity in the region. An out-of-state workforce would generate between $4.6 and $6.8 million. Using local workers creates between 73% and 158% more economic activity than using out-of-state workers.
- The 19 projects noted above could generate more than $195 million in economic activity in the regions in which they are built if local workers are used. Employing an out-of-state workforce for these projects would generate between $83 and $120 million less economic activity.
- A 100% local workforce earns a total of $21.7 million in wages and benefits. Of that, they spend $10.2 million locally. That local spending helps support jobs in local businesses and in turn as these jobholders spend their earnings locally, the economic impact increases.
- When large construction projects like these solar farms use local workers, Wisconsin's apprenticeship programs flourish. Workers looking to become carpenters, electricians, and operating engineers learn their trade through apprenticeships in these types of projects.

Capturing The Sun

The Economic Benefits of Using Local Workers on Wisconsin Solar Projects

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Over the past decade, the U.S. solar industry has grown rapidly primarily due to the construction of large, utility-scale installations. Solar expansion is expected to continue with capacity tripling over the next decade.

The existing solar infrastructure has reduced U.S. reliance on fossil fuels for electricity generation. Solar installations also generated significant economic impacts in the communities in which they were built. A recent study for the state of Ohio[1] estimated that adding 2.5 gigawatts (GW)[2] of solar capacity in the state would generate $3.6 billion of economic activity.

To a certain degree, Wisconsin has lagged the nation in solar adoption. However, that will change over the next several years. The state's first large, utility-scale solar installation came online in 2020 and another 19 projects that will generate 2.5 GW of capacity are under active development.

Construction of these solar farms will have a positive economic impact in the local communities where they are built. However, the size of the local impact will depend largely on the nature of the workforce. Specifically, the impact to the local economy will depend largely on how many workers are hired from the local workforce and reside in the area.

Labor costs for solar installations are often 10% to 20% of the total cost of the project. However, because these installations are typically in rural counties, most of the materials needed are not produced locally and thus have a negligible local economic impact. The local impact derives from workers making local purchases. Local workers spend most of their income in their community or in neighboring communities. Workers from outside the area, particularly out-of-state workers, spend much less locally; most of their earnings are spent where they live.

This study examines the local economic impact generated by the workforce installing a 150 megawatt (MW) solar installation in Wisconsin. In particular, the study compares the economic impact of using local workers versus an out-of-state workforce.

The findings indicate that a 100% local workforce would generate $11.8 million in economic activity locally. In contrast, a 100% out-of-state workforce would generate between $4.6 million and $6.8 million in economic activity, a difference of $5.0 to $7.2 million. In percentage terms, using local workers for the project generates between 73% and 158% more economic activity than using out-of-state workers.

To give context to the findings of this report, a brief examination of the growth in the solar industry nationally and in Wisconsin is provided initially. Then, after discussing economic impact studies in general, the bulk of the report explores how a variety of changes in the project's workforce affects local economic activity.

A SOLAR SHIFT

The last 20 years have seen a national shift in energy production to renewable sources, such as wind and solar. In the U.S., the expansion of solar capacity has occurred primarily over the past decade. In 2010, less than 1 GW of

1 Michaud, Khalaf, Zimmer, and Jenkins, "Measuring the Economic Impacts of Utility-Scale Solar in Ohio," August 2020.
2 One gigawatt (GW) equals 1,000 megawatts (MW).

new solar capacity was installed in this country. The vast majority of that installed capacity originated from small projects—installations on residential and commercial properties.

During the five years from 2016 through 2020, solar capacity increased an average of 13.7 GW per year (see Figure 1).[3] The expansion was driven largely by utility-scale projects. A utility-scale installation feeds into the electric grid and the power it provides is sold to a utility. Most often, "utility-scale" refers to installations that generate 20 megawatts (MW) of electricity or more. During this period, approximately two-thirds of the growth in solar capacity was from construction of these larger, utility-scale solar farms.

This rapid pace of building nationally is expected to continue. According to the Solar Energy Industries Association, solar capacity is expected to triple over the next decade.

WISCONSIN IS CATCHING UP

Wisconsin has participated in the national shift to renewable energy. In 1999, it was the first state to enact a renewable portfolio standard without restructuring its electric utility industry, setting a goal of generating 10% of the state's electricity from renewables by 2015. Wisconsin reached that goal ahead of schedule in 2013.

3 Solar Energy Industries Association, "Solar Market Insight Report," Various Years.

At least 19 solar projects creating capacity of more than 2.5 GW have been approved, or are waiting for approval, by the Wisconsin PSC.

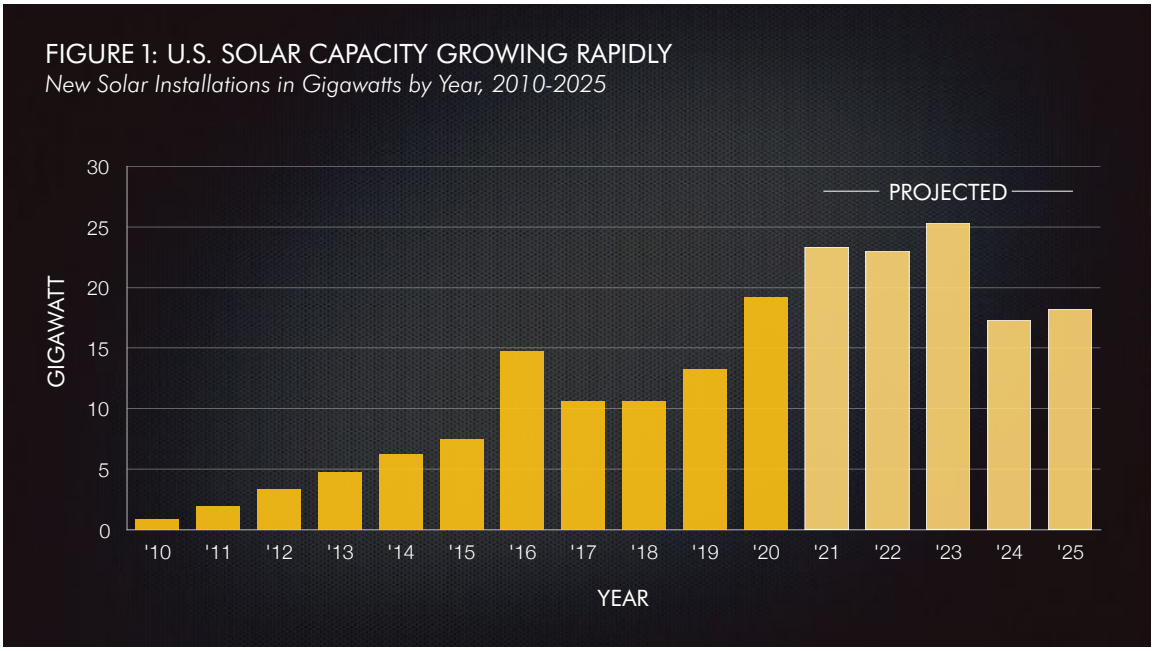
However, solar was not a significant contributor in reaching that goal. In 2020, just 4% of renewable electricity in Wisconsin was solar, with about 60% of that from small installations of 1 MW or less.[4] That is now changing in this state.

In the fall of 2020, Two Creeks Solar Farm in Manitowoc County came online providing 150

4 U.S. Energy Information Administration, "State Profile and Energy Estimates," Updated June 17, 2021.

FIGURE 1: U.S. SOLAR CAPACITY GROWING RAPIDLY

New Solar Installations in Gigawatts by Year, 2010-2025



MW of electricity—enough to power more than 33,000 homes. Another 19 solar projects with capacity of nearly 2.5 GW have been approved, or are waiting for approval, by the Public Service Commission (PSC). These projects, listed in Table 1, will increase solar capacity in Wisconsin more than 400% and will be able to provide electricity to 580,000 homes.

Construction of these projects and those that follow will not only provide renewable, clean energy, but will significantly impact the local economies where they are built.

ECONOMIC IMPACT

Economic impact studies of large-scale construction projects are common. These studies attempt to measure the overall impact of a project to both local and state economies. The total impact is more than just the amount spent on the project. It also includes the effect the project has on suppliers of materials, the impact resulting from workers spending their earnings, and often the tax revenue generated by the project.

Researchers use an input-output model to estimate economic impacts. Input-output models are designed to mimic the economy and the interdependencies between industries. The models produce "multipliers" that are used to estimate the impacts in the supply chain and the consumer expenditure impacts.

The two most commonly used input-output models are created by IMPLAN and by the federal Bureau of Economic Analysis (the RIMS II model). To study renewable energy installations, many analysts use the JEDI model created by the National Renewable Energy Laboratory (NREL) at the U.S. Department of Energy. This model, used in the Ohio solar study referenced above, supplements the IMPLAN model with additional renewable energy data.

The underlying assumption behind input-output models and the resulting multipliers is that an initial change in economic activity leads to other rounds of spending. For example, the construction of a new high-rise building requires spending on labor, as well as materials such as steel beams, concrete, lumber, etc. Workers in the industries that supply the materials are paid for the work they do producing these inputs.

TABLE 1: WISCONSIN SOLAR PROJECTS IN PROGRESS OR IN QUEUE

PROJECT	COUNTY	SIZE
Albany	Green	50
Apple River	Polk	100
Badger Hollow	Iowa	300
Badger State	Jefferson	149
Bear Creek	Richland	50
Beaver Dam	Dodge	50
Cassville	Grant	50
Crawfish River	Jefferson	75
Darian	Rock/Walworth	250
Grant County	Grant	200
Koshkonong	Dane	300
North Rock	Rock	50
Onion River	Sheboygan	150
Paddock	Rock	65
Paris	Kenosha	200
Point Beach	Manitowoc	100
Springfield	Dodge	100
Wautoma	Waushara	99
Wood County	Wood	150
TOTAL		2488

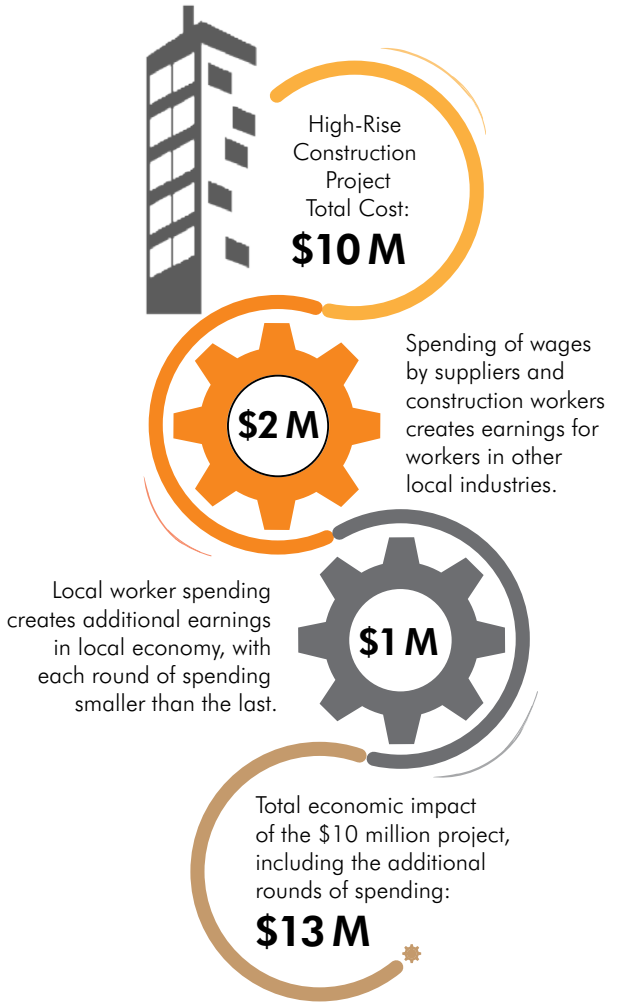
Construction workers on the high-rise project and the laborers in those supply-chain industries spend their wages in grocery stores, restaurants, hardware stores, etc. That spending helps generate wages for workers in those industries, who then spend a portion of their earnings.

These rounds of spending "multiply" the initial project investment. In other words, if the multiplier for this particular construction project was 1.3, then a $10 million investment in that project would generate a total economic impact of $13 million after the rounds of spending are totaled (see Figure 2 on page 6).

THE WORKFORCE EFFECT

While these studies are useful for measuring the total economic impact, they rarely examine how the composition of the workforce affects the results. It is common knowledge that in some

FIGURE 2: UNDERSTANDING THE MULTIPLIER EFFECT
Hypothetical Example



large construction projects a portion, if not all of the workforce is not local. Out-of-state workers are brought in for the project and return home when it is completed. Local spending by a temporary labor force is much less than the spending of local workers. That difference is subsequently enlarged by the multiplier effect.

As previously mentioned, in a typical economic impact study, the purchase of inputs, such as solar panels and construction material, would be measured in conjunction with wages and benefits paid to workers. However, the purpose of this study is to isolate the difference in economic impact between a local and non-local workforce. To focus on this workforce effect, the economic impact of material inputs is set aside. Instead, this study focuses solely on how changing the workforce from out-of-state to local affects the local economy.

Economic impact studies that focus on a local versus out-of-state workforce date back to at least 1989 when researchers studied a large construction project in a northern California county.[5] More recently, studies of wind energy projects in Minnesota[6] and North Dakota[7] explored the economic impacts of local versus out-of-state workforces in those states.

A literature review prior to this study found several economic impact studies of solar installations in Wisconsin. However, it turned up no studies on how those impacts differed with a local workforce compared to one from out of state.

A SOLAR INSTALLATION WORKFORCE

A solar installation requires labor in a variety of professions: Electricians, carpenters, operating engineers, iron workers, and general laborers comprise the bulk of the workforce. The number of workers in each of these occupations can vary from project to project.

Estimates of the total workforce needed can be found in project documents from the PSC. For example, the 150 MW Onion River project in Sheboygan County is expected to require approximately 200 workers and be completed in 12 to 18 months. A 200 MW project in Grant County is expected to require approximately 250-350 workers and be completed in 24 months or less. While the projects may last one to two years, the amount of time on the job may be slightly less due to Wisconsin winters.

While these project documents provide some information on the size of the workforce, they provide no data on the mix of occupations represented or labor costs, which is critical for an economic impact study.

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5 Carlos Davidson, "The Impact of Out-of-Area Workers in Non-Residential Construction in Contra Costa County: A Case Study of the USS-POSCO Modernization," 1989.
6 North Star Policy Institute, Catching the Wind: The impact of local versus non-local hiring practices on construction of Minnesota wind farms," June 2018
7 Lucas Franco, Ph.D., Catching the Wind 3.0: The impact of local versus non-local hiring practices on wind farms in North Dakota," October 2019.

Construction of a solar farm requires a variety of professions, from carpenters, electricians, and operating engineers to iron workers and laborers.

The JEDI model from NREL uses "worker years" to calculate economic impacts. In other words, how many workers, working 40-hour weeks, would it take to complete the project in one year. For a 150 MW project, the model assumes 228 jobs. However, the model uses national averages for its estimates of earnings, which may differ from actual Wisconsin wages.

Clearly, the accuracy of an economic impact study increases when researchers have more specific data. For this study, industry experts were consulted about the workforce required to construct a typical 150 MW solar farm. Detailed information on occupations and estimated hours worked were obtained from these experts.

WAGES AND SPENDING

Pay and benefits vary for the occupations involved in a solar installation. This study uses federal Davis-Bacon rates for a typical rural Wisconsin county. Davis-Bacon wage rates are local prevailing wages required for most federally funded (fully or partially) public building or public works construction projects. For the occupations involved in this project, hourly wages range from a little under $30 per hour to just over $40 per hour (see Figure 3).

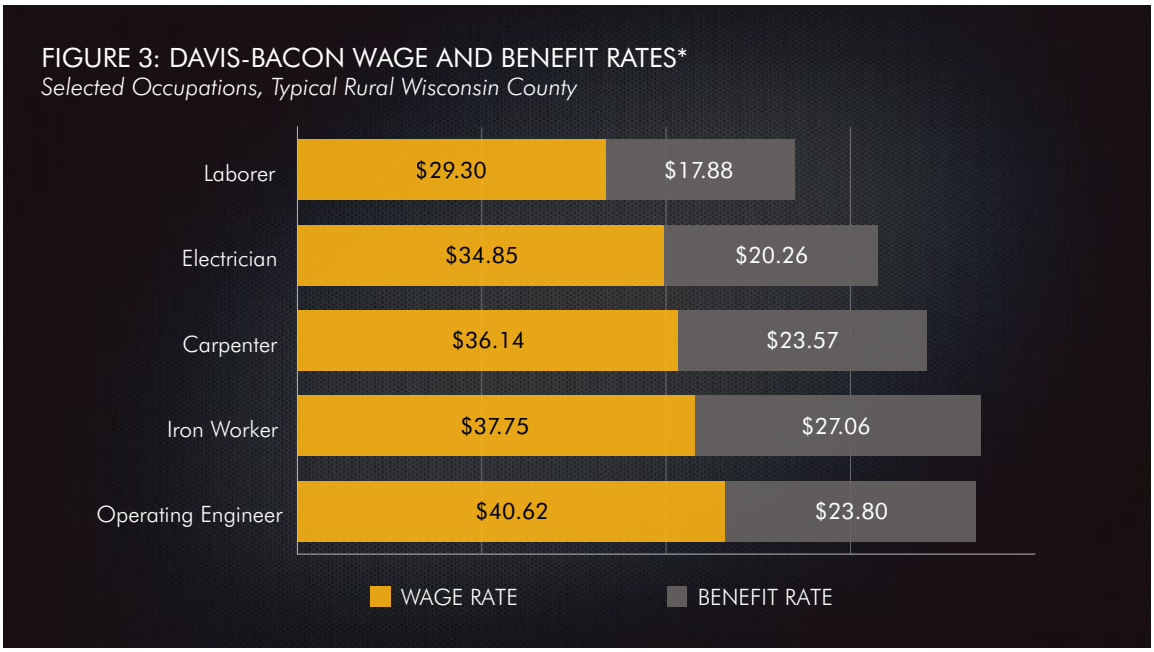
Over the life of the project, workers earning Davis-Bacon compensation would be paid a total of $13.2 million in wages and $8.5 million in benefits—a portion of which would be spent in the local economy.

Disposable Income

While workers would earn $21.7 million in total wages and benefits, not all of these earnings would be spent in the local economy or even

FIGURE 3: DAVIS-BACON WAGE AND BENEFIT RATES*

Selected Occupations, Typical Rural Wisconsin County



*Most recently published rates from U.S. Department of Labor

Of the $21.7 million in wages and benefits, a local workforce would spend $10.2 million in the local economy.

in the current year. Various taxes—federal and state income, Social Security, and Medicare—are withheld from their paychecks. Most workers also save a portion of their earnings. The online tax calculator from SmartAsset[8] is used to calculate the taxes for each occupation. A uniform savings rate of 4% is also subtracted from gross earnings.

Applying these parameters to the wage data, workers will spend a total of $9.7 million of their $13.2 million in earnings. The 73% spending rate is in line with rates estimated in other studies.

Local Workers, Local Spending

Before discussing local spending, it is important to define "local" as used in this study. Local could be defined as the county where the solar farm is installed. In other words, the study would assume local workers are from the county where the solar farm is being built and local spending takes place in that county.

However, many of the solar installations in the queue will be in relatively small, rural counties. In those cases, a local workforce may be drawn from the region rather than just one county. For this report, a regional approach is used, defining "local" as a region of four contiguous rural Wisconsin counties.

8 Wisconsin state income taxes were calculated for $40,000, $50,000, and $60,000 and compared to the SmartAsset numbers. Calculated taxes were $300 lower than those reported by SmartAsset. This is the maximum amount of Wisconsin's property tax/rent credit. SmartAsset estimates were adjusted for this discrepancy.

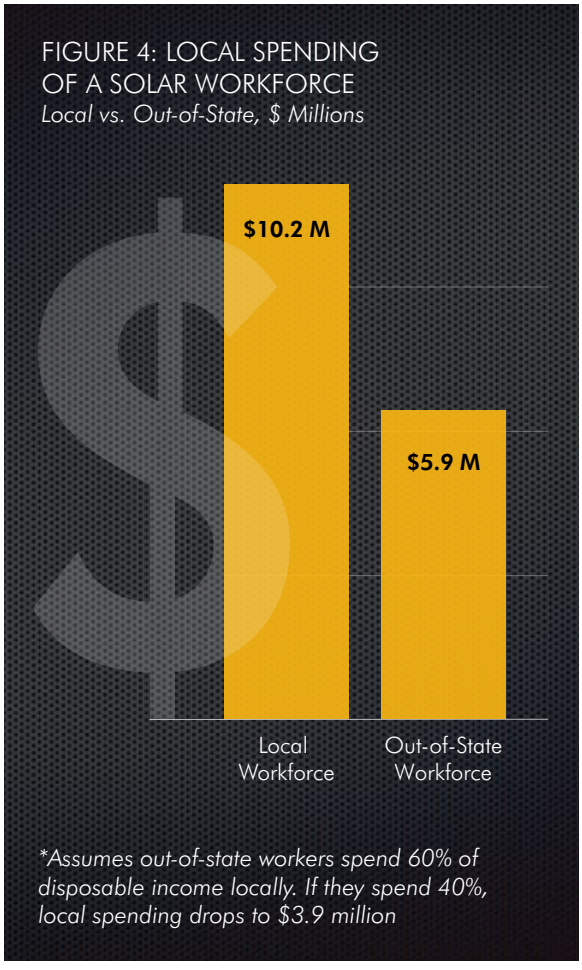
In previous studies like this one, it was assumed that local workers spent 95% of their disposable income locally. This assumption was based on the 1989 California study previously cited. While that was a reasonable percentage in 1989, the rapid rise of online shopping over the past 20 years has clearly reduced that percentage. In 2019, online sales accounted for more than 14% of all retail sales.

Moreover, residents of smaller rural counties may spend less of their disposable incomes locally than residents of more urban counties due to the greater number of shopping malls and large retail outlets in the larger counties.

To estimate local purchases, this report uses data from the 2019 survey of consumer expenditures from the U.S. Bureau of Labor Statistics. For all spending categories in this survey that

FIGURE 4: LOCAL SPENDING OF A SOLAR WORKFORCE

Local vs. Out-of-State, $ Millions



**Assumes out-of-state workers spend 60% of disposable income locally. If they spend 40%, local spending drops to $3.9 million*

are components of the retail sales calculations, this study assumes that 14% are purchased online (non-local). Using a range of local percentages on other purchases, it is estimated that between 85% and 91% of all spending is local. The midpoint of 88% is used for the calculations in this study.

Most benefits received by workers will be spent in future years. Social Security, Medicare, and pension or other retirement benefits are spent during retirement. However, some of a worker's health benefits are spent in the current year.

According to the Kaiser Family Foundation, the average employer health insurance premium in 2019 was $7,188 for single coverage and $20,576 for family coverage. Based on those numbers, estimated health insurance costs are 32% of total benefits. Most people incur medical costs less than their annual premiums. For this study, 20% of benefit costs ($1.7 million) are assumed to be spent in the current year, with nearly all of it spent locally.

An out-of-state workforce would spend 42% to 62% less in the local economy than a local workforce.

A 100% local workforce earns a total of $21.7 million in wages and benefits. Based on the above calculations, $10.2 million ($8.5 million of wages and $1.7 million of health benefits) is spent locally in the current year (see Figure 4 on page 8).

Out-of-State Workers, Local Spending

Estimating the local spending of out-of-state workers requires knowledge of their wages. For this study, it is assumed that out-of-state workers are paid the same as local workers and perform similar work. There are two reasons for this assumption. First, this study is focused on a specific question: How does the economic impact differ when local workers are used rather than out-of-state workers? Using different wages for local and out-of-state workers adds a layer of complexity that is unnecessary.

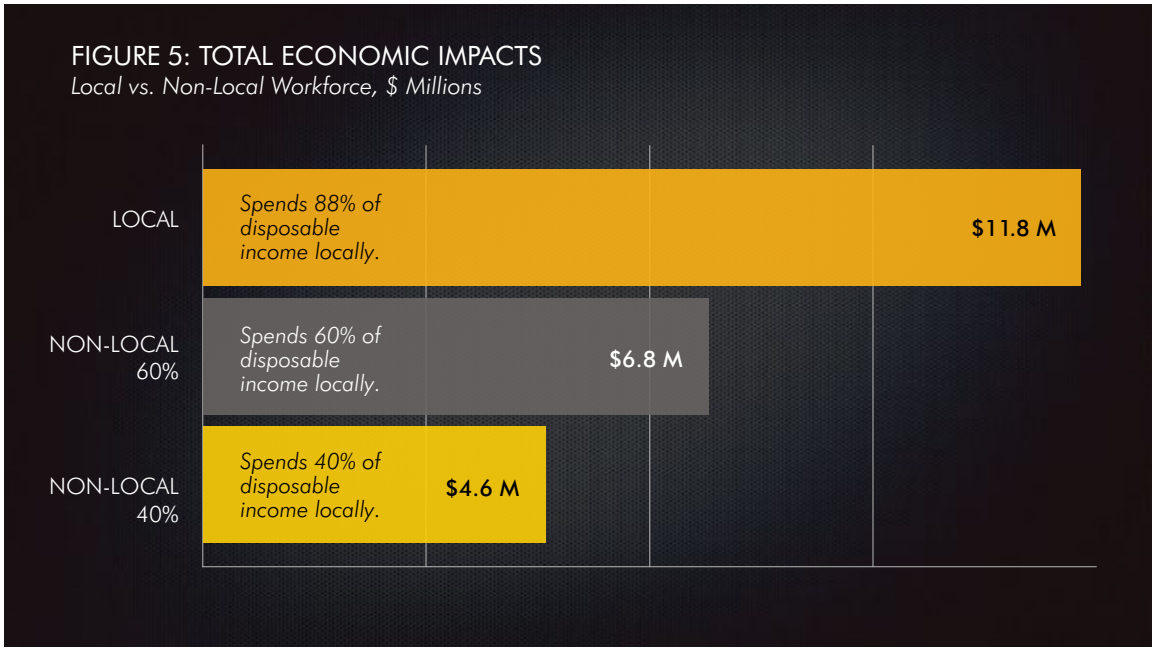
Second, assuming out-of-state workers are paid the same Davis-Bacon wages generates the most conservative estimates of the differential economic impacts. If these workers were paid less, their disposable incomes and spending would be less than if they were paid the higher wages. The resulting difference in economic impact would be partly due to the workers coming from out-of-state and partly due to the lower wages.

Since out-of-state workers are assumed to earn the same wages as local workers, they have the same disposable income as a local workforce: $9.7 million. The Davis-Bacon law requires employers to pay prevailing benefits as well, either in benefits or the cash equivalent. This study assumes these workers receive the same benefit package as local workers.

In previous studies, estimating the local spending of a non-local workforce has been approached in two ways. One approach assumed out-of-state workers were paid a per diem payment while on the job. Two studies of wind installations in Minnesota and North Dakota assumed a per diem payment of $100 per day. This approach was used based on the researchers' discussions with people in the wind energy industry in those states.

A second approach was to assume non-local workers did not receive a per diem and instead spent a certain portion of their incomes locally. The California study referenced earlier assumed 50% of disposable income was spent locally. A 2006 Florida study ran two scenarios on local spending as a share of disposable income. One scenario assumed 50% and the second assumed 70%.

In discussions with construction industry experts, per diem payments appear to be somewhat unusual for projects of this kind in Wiscon-



sin. Thus, the second approach is used in this report, with local spending ranging from 40% to 60% of disposable income. This study also assumes a small portion of health benefits for out-of-state workers is spent locally.

Under these assumptions, a 100% non-local workforce would spend between $3.9 million (40% of disposable income) and $5.9 million (60% of disposable income) locally.

Recall that a local workforce would spend $10.2 million in the local economy. An out-of-state workforce would spend between $4.3 million and $6.3 million less locally. In percentage terms, out-of-state workers will spend 42% to 62% less than local workers in the region where the solar installation is being built.

TOTAL ECONOMIC IMPACT

The figures above account only for the first round of spending by workers. As mentioned, earnings spent in the local economy support other jobs in a variety of local businesses, such as grocery and hardware stores, restaurants, plumbers and electricians, etc. A portion of the wages for workers in those businesses are also spent locally, multiplying the economic impact coming from the earnings of the solar workforce. This increases the economic impact gap between a local and out-of-state workforce.

For a small rural area, like the four-county region used for this study, multipliers can often be relatively small–the reason being that many local purchases are for items that are produced outside the area. Many of the products sold by hardware stores and grocery stores are produced in other parts of the state, country, or world. The portion of the purchase price that represents the cost of the product does not have a local impact. It is only the portion of the purchase that helps pay workers' wages or the business owner's income that has a local impact.

County and regional multipliers from the RIMS II input-output model from BEA are used to estimate the total impact of worker spending. The multiplier estimates the local impact of household spending as it cycles through the local economy.

A 100% local workforce (four-county region) building a solar farm in rural Wisconsin, assuming Davis-Bacon wages and benefits, would generate a total of $11.8 million in local spending.

For the out-of-state workforce, assuming local spending was 60% disposable income, the economic impact would be $6.8 million, or $5.0 million less than a 100% local workforce. With

Solar projects recently approved by the PSC or in the approval process could inject $196 million into the economies of the regions where they are being constructed.

local spending at 40%, the total economic impact of the out-of-state workers would be $4.6 million, or $7.2 million less than the impact of a local workforce (see Figure 5 on page 10).

The $7.2 million and $5.0 million economic differences are based on 100% local vs. 100% out-of-state workers. However, the work done here allows estimates of the economic loss of various mixes of local and out-of-state workers compared to a 100% local workforce. Table 2 shows the results of those calculations.

For example, if 90% of the workforce is local, the economic loss relative to a totally local workforce ranges from $497,200 to $720,400. However, if the local workforce is only 30% of the total, the local economic loss rises to between $3.5 million and $5.0 million. Again, the top of the table shows the maximum economic losses of $5.0 million to $7.2 million cited earlier.

IMPACT OF ALL PROJECTS

As mentioned, Wisconsin currently has at least 19 other solar projects either approved by the PSC or in the queue. These projects range in size from 50 MW to 300 MW. These projects will support more than 4,000 construction jobs. The findings in this study can be used to approximate the combined local economic impact of these projects: (1) using a local workforce and (2) using an out-of-state workforce.

Using the JEDI model, the number of workers needed for each of these projects can be estimated. Then, assuming the same mix of occupations in these projects and applying the same Davis-Bacon wage and benefit rates to each, estimates of local spending can be generated.

The spending estimates are then combined with the multiplier used in this study to approximate total economic impacts.

For each of these projects in the queue, the local multiplier will differ slightly from the one used for this study. However, since the household spending multiplier is used, those differences tend to be small.

These calculations show that for the smallest projects (50 MW), the difference in economic impact from a completely local workforce and one sourced from out-of-state ranges from $1.7 million to $2.4 million. For the large 300 MW projects, the difference ranges from $10 million to $14.4 million, depending on the spending assumptions for out-of-state workers.

TABLE 2: LOCAL ECONOMIC LOSS GROWS AS LOCAL WORKFORCE SHRINKS

Loss Relative to 100% Local Workforce

PERCENT (%) LOCAL WORKFORCE	Percent (%) of Disposable Income Spent by Non-Local Workers	
	40%	60%
0.0%	$7,204,000	$4,972,000
10.0%	$6,484,000	$4,475,000
20.0%	$5,763,000	$3,978,000
30.0%	$5,043,000	$3,480,000
40.0%	$4,322,000	$2,983,000
50.0%	$3,602,000	$2,486,000
60.0%	$2,882,000	$1,989,000
70.0%	$2,161,000	$1,492,000
80.0%	$1,441,000	$994,000
90.0%	$720,000	$497,000

Summing the total over all projects and assuming a local workforce, the total local economic impact is estimated to be $195.5 million. If the workforce for these projects is not locally sourced, the total impact ranges from $75.8 million to $112.9 million. The difference in economic impact ranges from $82.6 million to $119.7 million.

CONCLUSION

While Wisconsin has already reached the renewable energy target it set in the early 2000s, a recent push to create significantly more renewable capacity via solar farms has begun. If the utility-scale solar projects currently under consideration by the PSC are approved, Wisconsin's solar capacity will increase by more than 400% over the next few years. This will further reduce the state's reliance on fossil fuels to supply electricity to state residents.

These projects will create an added benefit for the region in which they are built. The analysis here shows that construction of a 150 MW solar farm in rural Wisconsin could create nearly $12 million of economic activity in the region if the workers on the project come from the local labor market. It also shows that if the project used an out-of-state workforce, the economic impact would be 42% to 62% less.

The local impact would vary if out-of-state workers were paid at a different rate than local workers. For example, if out-of-state workers were paid less, their impact on the local economy would be smaller, thus expanding the difference with the local workforce impact.

Although not analyzed in this report, there are other local benefits to using a local workforce on these projects. Wisconsin's construction industry has been growing rapidly. During 2011-2019, the number of workers in Wisconsin's construction industry increased 34%. That growth was more than three times greater than the 9% growth in all other private sector industries.

The pathway into the industry for many construction workers is through apprenticeship programs. These programs allow workers to learn the trade while getting paid. Using out-of-state workforces on these projects leaves fewer local opportunities for apprentices to learn their trades.

Another benefit of using a local workforce that is often overlooked relates to the family. Many workers in this industry travel across the state to work on large construction projects. They are away from home five or six days a week. Local projects allow construction workers to be home for the 12 to 18 months of the project.

In the end, it is local ratepayers who pay the costs of these solar projects and reap the benefits. Part of the benefits accruing to local residents is increased economic activity during construction. That can be maximized by considering the composition of the project's workforce.

"This study validates the idea that hiring a local workforce to complete large solar projects maximizes the economic impact for our communities."

–Rob Grover
Trempealeau County Economic Development Coordinator

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