UNIVERSITY OF MINNESOTA EXTENSION

CENTER FOR COMMUNITY VITALITY

Economic Impact of the Solar Schools Project

A Report of the Economic Impact Analysis Program

Authored by Brigid Tuck and Ryan Pesch

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A REPORT OF THE ECONOMIC IMPACT ANALYSIS PROGRAM

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EXECUTIVE SUMMARY: ECONOMIC IMPACT OF THE SOLAR SCHOOLS PROJECT

In the mid-2010s, the Region Five Development Commission developed a bold plan to install solar panels on public school buildings. The plan involved working in partnership with the region's public school districts and local renewable energy companies. The project presented an opportunity to raise awareness of renewable energy, develop a skilled renewable energy workforce, and support locally based renewable energy companies—all while potentially providing cost savings and reliable energy to schools. In 2015, Xcel Energy's Renewable Development Fund awarded nearly $2 million in grant money for the project. A private tax credit investor also contributed to the project. Total project costs were slightly more than $3.5 million.

Four schools, in collaboration with three utility companies, installed six solar arrays. The arrays will generate 1.5 MW of energy. Project schools included Pine River/Backus and Pequot Lakes K-12 schools and two Central Lakes College sites (Staples and Brainerd). The development and installation of the solar panels has generated economic activity in the region. To measure this activity, the Region Five Development Commission asked University of Minnesota Extension to quantify the economic impact. The IMPLAN model 3.1 with SAM multipliers and 2017 data was used.

Major findings include:

Direct Effect: In total, the Solar Schools Project paid $3,508,500 to install the solar panels. The largest expense was for equipment, accounting for 42 percent of total project costs. The IMPLAN model estimated that 74 workers were hired to complete that work and were paid $1.6 million in labor income.

Total Economic Impact: The Solar Schools Project generated an estimated $7.8 million of economic activity in the region. Of this, $3.2 million was labor income paid to area residents. The project also supported an estimated 88 jobs.

Tax Impact: The Solar Schools Project generated an estimated $197,460 in taxes. The highest amount of taxes paid included sales taxes of $75,380 and property taxes of $54,350.

Top Industries Affected: Of the estimated $7.8 million in economic activity generated by the Solar Schools Project, $3.5 million was directly for solar schools work. The other $4.3 million was at other businesses in the region. Top industries affected included owner-occupied dwellings (homeowners), real estate, and hospitals.

Of the $3.5 million in direct spending by the Solar Schools Project, 66 percent was spent at companies that have a solar product line. Extension sent a survey to the companies involved in the project and received four complete responses. Of these, half reported this was their largest solar-related project in the region. This indicates the project increased the capacity of solar companies. For three of the companies, solar remained a relatively minor component of their business model, accounting for less than 25 percent of total sales. For the fourth company, solar accounted for more than 75 percent of sales.

Solar in the Regional Economy: Solar power generation is part of the utility industry. According to IMPLAN, the utility industry is one of the region's smallest, employing fewer than 50 people and generating $10.8 million in output. Currently, power generation in the region comes primarily from hydroelectric sources. Thus, increasing solar capacity helps diversify the local economy and power supply.

PROJECT BACKGROUND

In the mid-2010s, the Region Five Development Commission developed a bold plan to install solar panels on public school buildings. The plan involved working in partnership with the region's public school districts and local renewable energy companies. The project presented an opportunity to raise awareness of renewable energy, develop a skilled renewable energy workforce, and support locally based renewable energy companies—all while potentially providing cost savings and reliable energy to schools (Grimley & Giavarini, 2017). In 2015, Xcel Energy's Renewable Development Fund awarded nearly $2 million in grant money to the project. A private tax credit investor also contributed to the project. Total project costs were slightly more than $3.5 million.

Four schools, in collaboration with three utility companies, installed six solar arrays. The arrays will generate 1.5 MW of energy. Project schools included Pine River/Backus and Pequot Lakes K-12 schools and two Central Lakes College sites (Staples and Brainerd). On average, each school's carbon footprint was expected to decrease by 1,420 metric tons of carbon dioxide. In addition, schools were provided with curriculum on the economic and environmental benefits of solar energy (*Brainerd Dispatch*, 2019).

The development and installation of the solar panels has generated economic activity in the region. To measure this activity, the Region Five Development Commission asked University of Minnesota Extension to quantify the economic impact of the project. This report presents the results of Extension's analysis.

The EDA University Center at University of Minnesota, along with Extension, provided funding for this economic impact study. University Centers connect University resources with the economic development community and are funded by the U.S. Economic Development Administration, which is a bureau of the U.S. Department of Commerce.

ECONOMIC IMPACT

Economic impact is comprised of direct, indirect, and induced impacts. Direct impacts are primary changes occurring in the economy due to the project. In this case, it is the spending and employment related to the Solar Schools Project and the installation of the solar panels. Indirect and induced effects measure the secondary, or ripple, effects across industries affected by the project. They are measured using input-output models. In this analysis, Extension used the input-output model, IMPLAN, to calculate the indirect and induced effects. The IMPLAN model 3.1 with SAM multipliers, as well as 2017 data was used (the most recent available).

A critical component of an economic impact analysis is the study area. In this report, the study area was the five counties of North Central Minnesota, including Cass, Crow Wing, Morrison, Todd, and Wadena Counties.

Direct Effect

The Region Five Development Commission provided Extension with the project's financial records. In total, the Solar Schools Project spent $3,508,500 to install the solar panels (Table 1). The largest expense was for equipment, accounting for 42 percent of total project costs.

Table 1: Direct effect of Solar Schools Project, 2018-2019

Equipment	$1,477,202
Construction Materials	$580,469
Professional Services	$555,852
Other Direct Costs	$410,372
Labor	$484,655
Total	$3,508,550

Source: Region Five Development Commission

Indirect and Induced Effects

As mentioned, indirect and induced effects are the ripple effects generated by the Solar Schools Project. In this study, they were quantified using the input-output model IMPLAN. Input-output models trace the flow of goods and services throughout an economy. Once this flow is known, the model can estimate how a change in one part of the economy will affect others.

Indirect effects are associated with business-to-business transactions. As the Solar Schools Project purchased solar panels, electrical supplies, and services, this caused suppliers to increase purchases from their own suppliers. These are indirect effects.

Induced effects are associated with consumer-to-business transactions. People employed to install the solar panels received income. As they spent that income in the community, they triggered suppliers to increase their purchases. For example, if they bought groceries, the grocery store had to restock, pay its employees, etc., to meet this demand. These are induced effects.

Total Effect

The Solar Schools Project generated an estimated $7.8 million of economic activity in the region (Table 2). Of this, $3.2 million was labor income paid to area residents. The project also supported an estimated 88 jobs.

Table 2: Economic impact of Solar Schools Project, 2018-2019

	Output	Employment	Labor Income
Direct	$3,508,550	74	$1,613,800
Indirect	$3,268,800	4	$1,319,400
Induced	$1,018,200	10	$303,200
Total	$7,795,550	88	$3,236,400

Source: University of Minnesota Extension estimates

As detailed, the direct output effect was $3.5 million. The IMPLAN model estimated that 74 workers were hired to complete the work and were paid $1.6 million in labor income.

Tax Impacts

The Solar Schools Project generated an estimated $197,460 in taxes (Table 3). The highest amount of taxes paid included sales taxes of $75,380 and property taxes of $54,350.

Table 3: Tax impact of Solar Schools Project, 2018-2019

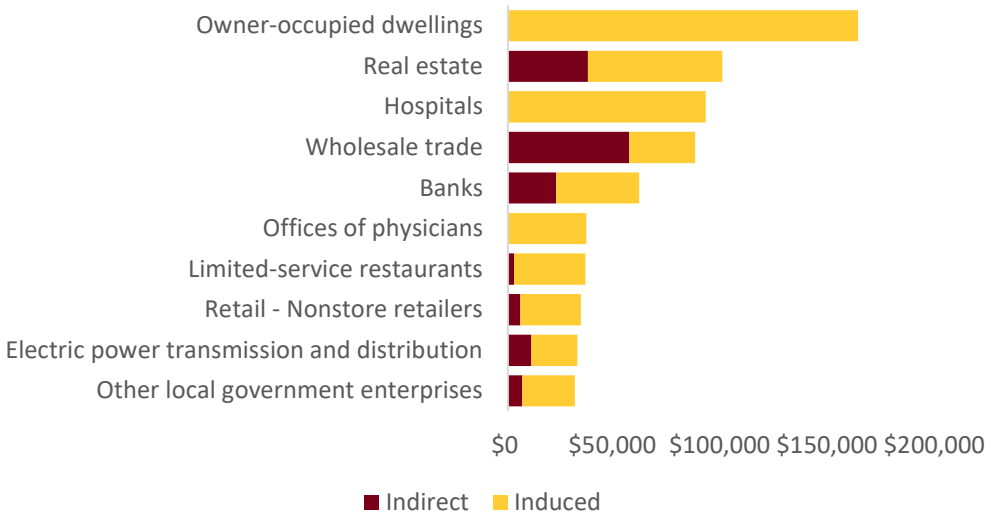
Tax Type	Value
Dividends	$500
Social Insurance	$390
Sales Tax	$75,380
Property Tax	$54,350
Corporate Profit Tax	$15,240
Income Tax	$5,000
All Other Taxes/Fees	$46,600
Total	$197,460

Source: University of Minnesota Extension estimates

Top Industries Affected

Of the estimated $7.8 million in economic activity generated by the Solar Schools Project, $3.5 million was directly for work installing the solar panels. The other $4.3 million was at other businesses in the region (Chart 1). Top industries affected included owner-occupied dwellings (homeowners), real estate, and hospitals. Indirect effects (business-to-business) were highest in wholesale trade, banking, and real estate. Induced effects (consumer-to-business) were highest in housing, hospitals, and physicians' offices. As housing and health care are the biggest portion of a household's income, this is not surprising.

Chart 1: Top industries affected by Solar Schools Project, sorted by output



Impact on Solar Companies

Of the $3.5 million in direct spending by the Solar Schools Project, 66 percent was spent at companies that have a solar product line. Extension sent a survey to the companies involved in the project and received four complete responses. Extension emailed a survey invitation to 20 companies, so this is a 20 percent response rate. Four responses, however, yields a limited dataset. While survey results are presented in this report, they were not incorporated into the economic impact analysis.

For the responding companies, half reported this was their largest solar-related project in the region, indicating the project increased the capacity of solar companies. For three of the companies, solar remained a relatively minor component of their business model, accounting for less than 25 percent of total sales. For the fourth company, solar accounted for more than 75 percent of sales.

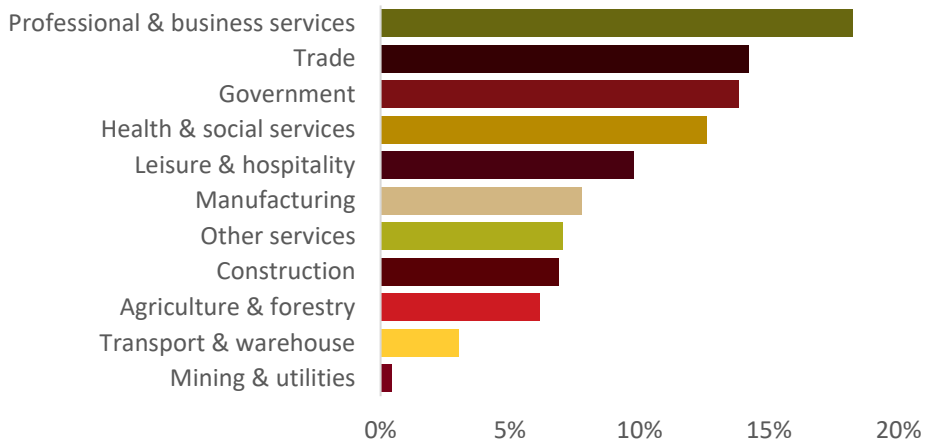
Growth for these companies has been moderate. Two companies reported their solar-related sales increased significantly between 2010 and 2018. Two others reported sales were about the same. When considering future growth, one company plans to significantly increase their sales in the next five years. The other three plan to remain about the same.

SOLAR SCHOOLS IN THE CONTEXT OF THE REGIONAL ECONOMY

In 2017, businesses in the region employed 13,100 people. In terms of industries, the largest employer in the region was professional and business services, accounting for nearly 20 percent of jobs. Trade and government were other major employers.

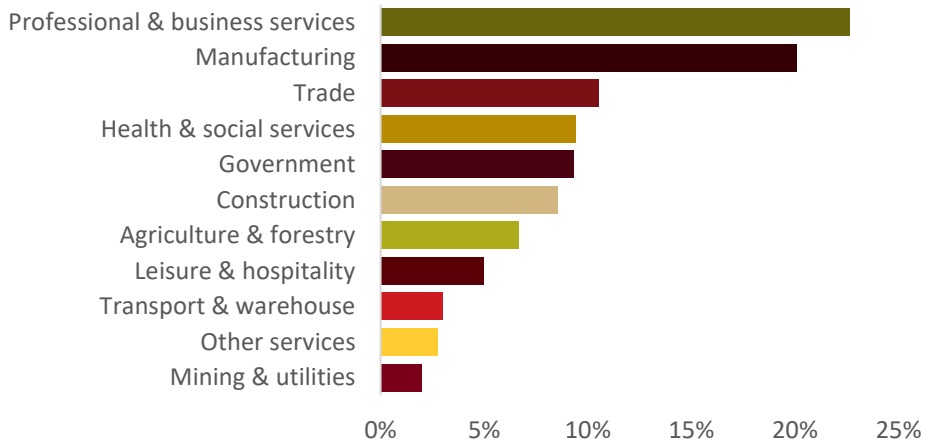
Solar power generation is part of the utility industry. According to IMPLAN, the utility industry was one of the region's smallest, employing fewer than 50 people and generating $10.8 million in output. Currently, power generation in the region comes primarily from hydroelectric sources. Increasing solar capacity helps diversify the local economy and power supply.

Chart 2: Percent of employment by industry, Cass, Crow Wing, Morrison, Todd, and Wadena counties, 2017



In 2017, businesses in the region created $12.4 billion of output. Of this, nearly a quarter came from professional and business services businesses (Chart 3). Other major sources of output in the region included manufacturing and trade.

Chart 3: Percent of output by industry, Cass, Crow Wing, Morrison, Todd, and Wadena counties, 2017



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APPENDIX: METHODS AND TERMS

Special models, called input-output models, exist to conduct economic impact analysis. There are several input-output models available. IMPLAN (IMpact Analysis for PLANning, MIG)[1] is one such model. Many economists use IMPLAN for economic impact analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations helps ensure the best results from the model.

One of the most critical aspects of understanding economic impact analysis is the distinction between the "local" and "non-local" economy. The local economy is identified as part of the model-building process. Either the group requesting the study or the analyst defines the local area. Typically, the study area (the local economy) is a county or a group of counties that share economic linkages. In this analysis, the study area includes Cass, Crow Wing, Morrison, Todd, and Wadena Counties in north central Minnesota.

A few definitions are essential in order to properly read the results of an IMPLAN analysis. The terms and their definitions are provided below.

Output

Output is measured in dollars and is equivalent to total sales. The output measure can include significant "double counting." Think of corn, for example. The value of the corn is counted when it is sold to the mill, again when it is sold to the dairy farmer, again as part of the price of fluid milk, and yet again when it is sold as cheese. The value of the corn is built into the price of each of these items, and then the sales of each of these items are added to get total sales (or output).

Employment

Employment includes full- and part-time workers and is measured in annual average jobs, not full-time equivalents (FTE's). IMPLAN includes total wage and salaried employees, as well as the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income measures the value added to the product by the labor component. So, in the corn example above, when the corn is sold to the mill, a certain percentage of the sale goes to the farmer for his/her labor. Then when the mill sells the corn as feed to dairy farmers, it includes some markup for its labor costs in the price. When dairy farmers sell the milk to the cheese manufacturer, they include a value for their labor. These individual value increments for labor can be measured, which amounts to labor income. Labor income does *not* include double counting.

[1] IMPLAN Version 3.0 was used in this analysis. The trade flows model with SAM multipliers was implemented.

Direct Impact

Direct impact is equivalent to the initial activity in the economy. In this study, it is spending by the Solar Schools Project for equipment, labor, and related services.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to **spending for inputs** (goods and services) by the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, steel, and equipment. As the plant increases its purchases of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts. In this study, indirect impacts are those associated with spending by the Solar Schools Project for operating items.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to **spending by labor**. For instance, if employment in a manufacturing plant increases by 100 jobs, the new employees will have more money to spend to on housing, groceries, and dining. As they spend their new income, more activity occurs in the local economy. Induced impacts also include spending by labor generated by indirect impacts. So, if the Solar Schools Project purchases services from a local fence installation company, spending of the installer's wages would also create induced impacts. Primarily, in this study, the induced impacts are those economic changes related to spending by those directly employed to install solar panels.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.

Input-Output, Supply and Demand, and Size of Market

Care must be taken when using regional input-output models to ensure they are being used in the appropriate type of analysis. If the models are used to examine the impact of an industry so large that its expansion or contraction results in major supply and demand shifts, causing the price of inputs and labor to change, then input-output can overstate its impacts. While the Solar School Project contributed to north central Minnesota's economy, it is not likely that its existence has an impact on national prices for it inputs. Hence, the model should estimate the impacts reliably.