

[Link to the Google Slides that provides a brief description of the project](#)

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Augie's Solar Advantage

Imagine a situation where there is a massive storm in Sioux Falls, similar to the one experienced September 10, 2019, that included three tornados, leaving much of the city without electricity due to downed power lines. Imagine a situation where all is dark...all is dark except for the Froiland Science Complex, which is glowing like a candle. In this scenario, Augustana's Science Complex would be a light in the darkness, and it would be so because a solar panel had been installed and energy from it was now available to the University. In this scenario, Augustana would be seen not only as a light in the community physically but also figuratively, because it would represent innovative leadership and environmental stewardship.

Conversations regarding the implementation of solar energy at Augustana have occurred in the past. Through these conversations it has become apparent that embracing solar energy at Augie would constitute the following: 1) a profit-earning asset to the institution, 2) an alternative energy source that's good for the environment, 3) a learning tool, 4) a step toward becoming an energy independent institution, and lastly, 5) a way to support the local economy that is so fundamental to the success of the university.

Against this backdrop, the proposal that follows will be divided into two main sections. The first focuses on the benefits of solar energy, especially the specific benefits that would be Augustana University would receive through the installation of solar panels. The second

delineates the aspects of solar, as a viable source of energy, that have changed in recent years and that makes installing a solar panel at Augustana compelling.

As noted above, there are five principle benefits tied to installing a solar panel. First, a solar panel would generate revenue by replacing the need to purchase non-renewable energy. In recent years, the price of a solar panel has become so reasonable that the average payback period per unit in Sioux Falls, South Dakota, ranges from 14 to 15.5 years (“Cost of Solar”; “2019 State Solar”). A consumer-centric source of independent information, ohmhome, produced the previous calculations which states the average panel in Sioux Falls costs \$17,500 at 5kW \$3.50, and federal tax credit covers \$5,250 of the purchase. A panel of this type is expected to save around \$800 per year, making the payback period around the 15-year mark. Over 30 years, the total savings would be around \$24,000, and the profit generated would approach a value near \$12,000 (“Cost of Solar”).

Second, a solar panel converts photons directly from the sun into electrical energy, meaning the energy is not only renewable and zero carbon emission; but it is also an alternative to environmentally harmful energy sources such as oil, natural gas, coal, and nuclear power (Matasci, “2019 Health”). Generating electricity using solar panels instead of fossil fuels can dramatically reduce greenhouse gas emissions that contribute to climate change (Matasci, “2019 Health”).

A solar panel would help to raise environmental awareness while serving as a learning tool for students and faculty. For instance, students in Environmental Studies could learn how they work, how the panels harness solar energy in the solar cells made from sandwiching silicon (the second most abundant element on earth) and crystal between conductive layers. In physics,

they could research the ways that cells can take the energy from the flow of solar photons as they strike the silicon to create electrons and convert it into useable energy in the form of electricity; and in chemistry they could focus on electrons and how, because of the design of solar panel, the electrons are the only moving component in the cells and, in consequence, don't have any components that can be worn out or get used up (in contrast with fossil fuels) solar cells can last for decades (Dhar). In sum, in light of Augustana's view that we "are all connected as a campus and as a planet, and we are more connected than we ever have been before," it is fitting that a solar panel would provide learning opportunities to understand these connections more thoroughly ("The Next Level") and help students be stewards of the planet.

A number of reputable schools have effectively incorporated solar power into their campuses and into their curriculums, weaving the use and research of solar panels into the fabric of their curriculum, mainly within the following majors: Environmental, Engineering, Chemistry, Biology, and Data Science ("Become a Solar"). Augustana could partake in a more basic version of this integration of solar inspection and research into the curriculum. In fact, as of 2019, the top five leading schools in the utilization of solar energy are as follows: The University of Arizona (28,095kW), Arizona State University (23,567kW), Rutgers University (17,417kW), Mount St. Mary's University (17,400kW), and Colorado State University (6,754kW) ("The Top 10").

Granted, the aspirational schools have immense resources that Augustana doesn't, so the comparison can ring hollow. Smaller schools such as Saint Olaf College, Carleton College, Gustavus Adolphus College, Concordia Moorhead College, and South Dakota State University (SDSU), also either have installed solar and integrate it into the curriculum or have six-figure grant money to install and research solar panels (VanDerVeen; "Energy: Sustainability";

“Gustavus Renewable”; Erickson and Winton; “Prototype Solar Energy”).¹ The previous schools are similar enough in size to Augustana, when it comes to undergraduate enrollment, where their use of solar energy within the curriculum could be seen as a cornerstone that Augustana could build off of in working to introduce solar within their own majors, including the new environmental major that Augustana will be offering in the near future.

However, regardless of what other schools are doing by virtue of their size and/or resources, one of the most significant factors when determining whether it is worth it to pursue solar as a source of energy on a college campus pertains to what professors think about the idea of using solar panels as a teaching tool within their curriculum. A survey of Augustana faculty who mainly teach in the Froiland Science Complex is currently being conducted to query information as to the likelihood of their prusual utilization of such equipment.

In addition, experiential learning opportunities that undergraduate students would benefit from pursuing projects related to solar energy may inspire them to pursue graduate research at leading universities including in South Dakota and generate new knowledge, make novel discoveries to advance the discipline, and potentially contribute to the economy of the state.

The fourth benefit of installing solar energy at Augustana pertains to the fact that it would represent a stepping stone in helping Augustana to become a more energy-independent and self-sustaining establishment. Due to the fact that traditional big energy companies mainly utilize non-renewable energy sources , the price of purchasing the energy fluctuates (“U.S. Energy Information”). Institutions that utilize solar energy are less dependent on big energy companies that use non-renewable fuels such as oil, natural gas, coal, and nuclear energy. Augustana has no

¹ The Schools similar in size to Augustana: Saint Olaf: 5,000 kW, Carleton College: 10.6 kW, Gustavus Adolphus: 90 Panels, Concordia Moorhead: \$550,000 Grant to Purchase and Install Solar Panels, SDSU: \$725,000 5-Year Research Grant

freedom as to how much they pay for the energy that is used on campus because of the set prices of non-renewable energy. However, through the use of renewable energy, Augustana would be able to maintain a consistent flow of energy that is not subject to an increase in cost.

Though the prices have fluctuated, one should not lose sight of the fact that, on average and over time, electricity rates have risen across the nation. In fact, they have risen about 15% over the last 10 years, and these costs of energy produced by non-renewable sources such as natural gas, oil, and coal are expected to continue to increase in ways that are predictable and yet sporadic (“Are Electricity”). In contrast, the cost of solar energy is on a linear declining trend, a trend that started in 1977 and is expected to continue to fall at around \$150 per solar panel per year in the future (Aol; Matasci, “Should I”). The trend in declining cost is happening at the same time that the panels are becoming more efficient each year, yielding a greater amount of energy, and producing, in return, more revenue (Palmer; “Aggarwal, Vikram”). The combination of these two factors makes solar energy more valuable and profitable as time goes on. By becoming less dependent on big energy companies, Augustana would become partly safeguarded from the fluctuating prices of energy by virtue of solar energy being produced at a constant rate over a given interval.²

The fifth benefit tied to the installation of solar panels at Augustana concerns the fact that the local economy would be supported in the purchase and in the installation. Sioux Falls’ businesses and community are a large factor in Augustana’s success. The purchase and installment fee is a good way to keep money in the local economy rather than supporting big energy companies.

² Solar energy is reliable as long as the sun is still burning (unconditional source of energy) while energy made from oil or coal is less reliable since there is only a finite amount of fossil fuels.

However, despite the numerous positive aspects associated with the installation of the panels, and despite the above-noted faculty support, in particular, solar energy has not been implemented at Augustana. The reason is tied to its perceived expense. While it is understandable that decision makers have pointed to the expense and trouble of solar panels as the key reasons for not installing them, two compelling and undeniable, variables have changed in recent years that make the proposal worth consideration once again: 1) climate change and the correlative need to produce fewer greenhouse gasses is now an undeniable scientific fact, and, 2) the cost of purchasing and installing a solar panel in Sioux Falls has dramatically fallen due to a federal tax credit and the linear trend of decreasing cost of solar energy along with the available grant money provided to Augustana's Sustainability Fund.

In the past, some argued that the science that backed climate change wasn't sound, and others argued that the warming of the earth wasn't due to human activity. However, it is now a scientific and well-established fact that climate change is happening and that it is caused by human activity. Multiple studies published in peer-reviewed scientific journals show that 97% of climate scientists agree that climate-warming trends over the past century are very likely due to human activities ("Scientific Consensus"). In addition, most of the leading scientific organizations worldwide have issued public statements endorsing this position, including, but not limited to, the following: American Association for the Advancement of Science, American Chemical Society, American Geophysical Union, American Medical Association, American Meteorological Society, American Physical Society, The Geological Society of America ("Scientific Consensus"). Many of the previous associations or societies released their statements from 2010-2015 ("Scientific Consensus"). In other words, the scientists agree that climate

change is not only prevalent but life-threatening to mankind. It's an agreement very much in line with Augustana's guiding principle that students "enter to learn; leave to serve." In desiring this of and for their students, Augustana implicitly invites students to learn while at Augie about what they can do for the earth so that when they leave they can serve its needs by countering climate change.

The second dynamic factor that has changed in very recent years that makes the purchase of a solar panel worth consideration is the perceived cost. There are three main components to this portion of the argument: 1) the federal tax aid on solar panels in Sioux Falls is an all-time high, 2) the price and installation of a solar energy system costs a fraction of the price they used to, and, 3) the fact that Augustana recently received a six-figure grant meant for sustainability of the university. Separately and together, these variables underscore the affordability and necessity of solar panels.

Currently, in South Dakota, the federal tax credit on a solar panel is around $\frac{1}{3}$ of the cost of a solar panel installment after state rebate and credit (Matasci, "Should I"). In other words, on a \$17,500 system, a minimum of \$5,250 is offered by the IRS. In addition to the credit, Sioux Falls has a few different local companies that design and install the solar panels. It is important to note that in many cases a local installer who does not have very high customer acquisition cost can set a price that is far better than the average, especially with the additional advertising that they would receive through the installation of a solar panel at Augustana ("Cost of Solar").

In conjunction with the available tax credit, the installation of a solar energy system in 2019 costs only $\frac{1}{3}$ of what it did in 2010 with a linear decline averaging \$150 less per-year per-system (Matasci, "Should I"). There are many misconceptions regarding the perceived

expenses of solar panels and their actual functionality. Among many things, one of the contributing factors to this misconception is the fact that the hype regarding solar energy peaked in 2008³ when the average cumulative captivity of a solar panel was 22 MegaWatts. Now, in 2019, the average cumulative captivity of a solar panel is 5,760 MegaWatts (Roberts). Although it is apparent that investment in solar energy is indisputable, the perceived expenses of solar energy still fester in many people's minds, leaving a lot of hesitation.

Finally, Augustana can afford a solar panel now in ways and for reasons it could not until recently. Augustana University has received a six-figure grant dedicated to “helping society, the arts, and the environment” (“Augustana Earns”). Augustana points out that “The grant will allow Augustana to launch a campus-wide strategic plan to integrate sustainability into aspects such as its curriculum, its co-curricular initiatives, operations and identity” (“Augustana Earns”). The introduction of solar energy, as proven above, is a way to integrate sustainability of operations and elevate the brand of the institution. And with an elevated brand, especially in the eyes of current and prospective students and donors, it will be easier to earn additional support, including grant money. Other forms of support include ideas to fundraise money for the project. The University could explore such options as hosting a “Fun-in-sun run” that could be paid for in part by Augustana's “Community Development Fund;” allow for a donor system where Augustana’s Sustainability grant will match every dollar that is donated by the public, the “Oliver Fund for Innovation,” and the Xcel Energy’s “Community Solar Garden Program” grant.

³ The claim that the hype peaked in 2008 is based on the fact that the number of google searches “solar energy”, “solar power”, “solar panel”, and “renewable energy”, all peaked in 2008 (“Google Search”).

Work Cited Page:

“2019 State Solar Power Rankings.” *Solar Power Rocks*, 2019,

www.solarpowerrocks.com/state-solar-power-rankings/.

Aggarwal, Vikram. “Solar Panel Efficiency: What Panels Are Most Efficient?: EnergySage.”

Solar News, EnergySage, 13 Nov. 2019,

news.energysage.com/what-are-the-most-efficient-solar-panels-on-the-market/.

Aol, Alex. “Solar Electricity Cost vs. Regular Electricity Cost .” *Solar Cell Central*,

FourPeaks, 2011, solarcellcentral.com/cost_page.html.

“Augustana Earns Major Grant to Advance Sustainability.” *Augustana Sustainability*, 2 May

2018, www.augie.edu/news/augustana-earns-major-grant-advance-sustainability.

“Become a Solar Energy Engineer: Education and Career Roadmap.” *Study.com*, Study.com,

2019,

study.com/articles/Become_a_Solar_Energy_Engineer_Education_and_Career_Roadmap.html.

“Cost of Solar Panels in Sioux Falls, SD: Best Solar Companies, Cost and Installation.”

OhmHome, 2019, www.ohmhomenow.com/solar-panels/south-dakota/sioux-falls/.

Dhar , Michael. “How Do Solar Panels Work?” *LiveScience*, Purch, 6 Dec. 2017,

www.livescience.com/41995-how-do-solar-panels-work.html.

“Energy: Sustainability: Carleton College.” *Energy | Sustainability | Carleton College*, 17 Apr. 2018, apps.carleton.edu/sustainability/campus/energy/.

EnergySage. “Are Electricity Prices Going Up or Down in 2019?: EnergySage.” *Solar News*, EnergySage, 2 June 2019, news.energysage.com/residential-electricity-prices-going-up-or-down/.

Erickson, Anna, and Ron Winton. “Sunny Disposition: Concordia Approaching Solar Panels.” *The Concordian*, 16 Oct. 2014, theconcordian.org/2014/10/16/sunny-disposition-concordia-approaching-solar-panels.

“Google Search Trends.” *Google Trends*, Google, trends.google.com/trends/?geo=US.

“Gustavus Renewable Energy Projects - Johnson Center for Environmental Innovation.” *Johnson Center for Environmental Innovation | Johnson Center for Environmental Innovation*, 2019, gustavus.edu/johnsoncenter/renewableenergy.php.

Koodali, Ranjit. “Photo Active Nanoscale Systems Home Page.” *PANS*, 2019, www.sdepscor.org/pans/pans.html.

Matasci, Sara. “2019 Health & Environmental Benefits of Solar: EnergySage.” *Solar News*, EnergySage, 4 Nov. 2019, news.energysage.com/health-environmental-benefits-of-solar-energy/.

Matasci, Sara. “Should I Go Solar Now Or Wait?: EnergySage.” *Solar News*, EnergySage, 19 Sept. 2019, news.energysage.com/should-i-go-solar-now-or-wait/.

“The Next Level in Sustainability.” *Augustana Sustainability*, 2019,

www.augie.edu/about-augustana/university-offices-and-affiliates/augustana-sustainability

Palmer, Callum. “Solar Panel Lifespan Guide: How Long Do They Last?” *Green Coast*, 11

Oct. 2019, greencoast.org/solar-panel-lifespan/.

“Prototype Solar Energy, Battery Systems to Fuel Commercialization Renewable Energy

Technologies Power Devices.” *Newswise*, SDSU, 15 Oct. 2018,

www.newswise.com/doesience/?article_id=702216&returnurl=aHR0cHM6Ly93d3cubmV3c3dpc2UuY29tL2FydGljbGVzL2xpc3Q=.

“Ranjit Koodali Ph.D.” *University of South Dakota*, 2019,

www.usd.edu/faculty-and-staff/Ranjit-Koodali.

Roberts, David. “The Falling Costs of US Solar Power, in 7 Charts.” *Vox*, Vox, 24 Aug. 2016,

www.vox.com/2016/8/24/12620920/us-solar-power-costs-falling.

“Scientific Consensus: Earth's Climate Is Warming.” *NASA*, NASA, 3 Oct. 2019,

climate.nasa.gov/scientific-consensus/.

“The Top 10 Solar Powered Colleges and Universities.” *Solar Energy*, 2019,

bill-solar.squarespace.com/the-top-10-solar-powered-colleges-and-universities/.

“U.S. Energy Information Administration - EIA - Independent Statistics and Analysis.”

Prices and Factors Affecting Prices - U.S. Energy Information Administration (EIA),

2018, www.eia.gov/energyexplained/electricity/prices-and-factors-affecting-prices.php.

VanDerVeen, Kari. "St. Olaf Celebrates Carbon-Free Electrical Power." *St. Olaf College*, 3 Oct. 2017, wp.stolaf.edu/news/st-olaf-celebrates-carbon-neutrality.