Siri Pierce

February 8, 2020

SolaRISE Maine Schools

In October of 2019, hundreds of students broke out in a drum roll on the bleachers of Mount Desert Island High School in Maine. They weren't cheering for a basketball game or a speech by the class president, but rather a newly installed rooftop solar array. For close to two years, students, school officials, and community members had been working towards a solar installation. Their efforts culminated in a ribbon cutting to celebrate the 1,400 panel installation that will save the school district over $1 million in the next 20 years (Mitchell 1). School districts like Mount Desert Island have pioneered solar development in Maine schools, and yet there are still hundreds of schools dependent on fuel-based systems for electricity. Nationwide, 4.4% of schools have a solar installation (Solar 8). Lack of school funding and crumbling infrastructure have contributed to schools' slow transition to cleaner sources of energy. Unequipped with resources and information, blinded by misconceptions of cost, and overwhelmed by the urgent demands of day to day operations, school administrators fail to prioritize or even consider solar installations. However, strategies exist to ease the burden of time and resources for school solar projects and make them more financially viable. Through financing plans, state and federal legislation, and community involvement, solar powered schools can become a reality. Therefore, public schools should utilize solar energy systems as a cost effective strategy to mitigate their environmental impact and provide meaningful learning opportunities for students.

The long delayed refininement of solar technology and its availability to the mainstream public has influenced its integration into American life. Solar power is not a new technology.

The introduction of solar energy began with French scientist Edmond Becquerel in 1839. He discovered that some objects, when hit by sunlight, would produce sparks of energy. This process became known as the photovoltaic effect. Throughout the late 1800s, physicists, chemists, and inventors explored the potential of this process. Charles Fritts, a New York inventor, created the first solar cell using selenium in 1883. This cell achieved an energy conversion rate of 1 to 2 percent while most modern solar cells work at an efficiency of 15 to 20 percent (2). Throughout the following decades, scientists experimented with different types of light, storage methods, and thermal energy. By the 1950s, Bell Laboratories had discovered a new way of constructing solar panels, with silicon rather than selenium. They managed to create a solar cell that was 6 percent efficient (Smithsonian 8). The Bell Laboratories' panels had reached the highest energy conversion rate ever achieved at that time. However, the cell cost an enormous amount to reproduce. The technology was available, but it could not be utilized unless it was subsidized.

Federal policy subsidizing solar installations revolutionized the solar market in the United States. In the mid 1970s, the United States was in the midst of an energy crisis. Federal price controls on oil and the Arab oil embargo of 1973 increased the favorability of alternative energy sources like solar energy (Sabas 1). The instability of the fossil fuel industry prompted Congress to pass the Solar Energy Research, Development and Demonstration Act in 1974 which aimed to make solar more marketable. The federal government began awarding grants and tax incentives to encourage home and business owners to transition to solar energy. President Carter passed the Energy Tax Act of 1978, that created a commercial investment tax credit and a residential energy credit, providing financial incentives to transition to solar. The tax credits still had only minimal success expanding solar development in the United States, and in 1985 the

solar tax credit expired and the solar industry stalled. It would not be until the early 2000s that solar development would take off again. In 2006, Congress reinstated the solar tax incentive with the passing of the Solar Investment Tax Credit in 2006. Subsidies and grants issued by the federal government expanded the financial feasibility of solar panels and allowed the industry to grow immensely in the early 21st century. As solar panels have become more financially feasible, individuals, businesses, and even some schools have begun transitioning to solar energy.

The lack of awareness about solar energy has delayed schools' adoption of photovoltaic solar systems. Most schools have not even considered the possibility of harnessing solar energy. However, the ability of solar arrays to reach schools' electricity demand is ever growing. According to a study conducted by Stanford University, solar PV in US educational institutions could provide 100 TWh of electricity services annually, meeting 75% of these buildings' current electricity consumption (Hanus et. al. 2). There is significant potential for electricity generation through school solar projects. Solar can fulfill and even surpass school buildings' electricity needs, and yet only a small number of schools utilize solar energy. As of the fall of 2017, there were 5,489 K-12 school solar photovoltaic (PV) installations in the U.S (Solar 6). That is only a miniscule portion of the hundreds of thousands of schools that exist and can reap the benefits of solar power. However, schools must shift their perspective in order to see the value of solar energy. Most school administrators focus on the short term demands of running a school rather than preparing for the future. The national average tenure of principals in their schools was four years as of 2016–17 (Levin et. al 1). Principals remain at schools for so short a time, they fail to consider the long term. The process of transitioning to solar energy requires stable leadership for several years to see through the process, from proposal to installation. When principals remain at

schools for only a few years, they do not initiate large scale, systematic change. Until school districts become aware of the unfulfilled potential of solar energy in schools and shift their focus towards the future, project initiation will be slow paced.

The lack of school funding and poor condition of public school infrastructure have deterred school districts from pursuing alternative sources of energy like solar. According to a report published by the Center on Budget and Policy Priorities, twenty-nine states provided less overall state funding per student in the 2015 school year (the most recent year available) than in the 2008 school year, before the recession took hold (Leachman et. al. 2). The state government is the primary source of funding for public schools. When education cuts occur at the state level, it can severely limit schools' budgets. Maine was among the states where overall school funding declined. The total state funding per student between 2008 to 2015 decreased 9% in the state of Maine (Leachman et. al. 5). The lack of school funding causes school districts to focus their budgets towards maintaining the current quality of education. They dedicate their limited funding to the essential and practical costs of school districts, like teachers' salaries. Large scale solar installations can cost hundreds of thousands if not millions of dollars. When school districts are constrained by insufficient budgets, they cannot spare a cent for seemingly superfluous costs like solar panels. Joe Blotnick, Co Coordinator of A Climate to Thrive, spearheaded Mount Desert Island High School's transition to solar power. He reflected, "Principals and superintendents have lots of issues to deal with that are much bigger than where their electricity is coming from" (Blotnick 5). School administrators are overwhelmed by securing funding to maintain their current operations, so costs like electricity end up becoming the least of their

concern. The constant pressure of declining school funding inhibits exploration into opportunities for the future, like solar development.

Funding for facilities management of school campuses is perhaps the most restricted. States rely on capital funding to build and renovate schools and facilities, and yet capital funding continues to decrease. A report by the National Center for Education Statistics on the conditions of America's public school facilities found that 53 percent of public schools needed to spend money on repairs, renovations, and modernizations to put the school's onsite buildings in good overall condition (Alexander 11). As a result of the lack of funding, school districts are unable to pay for the necessary renovations and modernization of school buildings. However, as the demand for repair and renovation has grown, the cost to meet the need for repair has increased. The total amount needed was estimated to be approximately $197 billion, and the average dollar amount for schools needing to spend money was about $4.5 million per school (Alexander 11). Schools are already encumbered by limited school funding. They can barely allocate additional money towards renovation projects, much less solar technology. School districts prioritize the deteriorating conditions of school buildings over technological advancements like solar installments.

The poor conditions of school buildings also jeopardize the ability of districts to install solar arrays on school roofs. Old, damaged roofs may not be able to support solar installations. The average of the reported number of years since the construction of the main instructional building was 44 years...The average functional age of the main instructional building was 19 years (Alexander 12). The average school building age exceeds the recommended age by almost double. With already fragile infrastructure, school administrators and facilities' departments are

hesitant to overextend the capacity of buildings by installing rooftop solar projects. Solar installations may threaten the integrity and safety of the buildings' construction. The vulnerability of public school infrastructure impairs the viability of solar development.

Despite the lack of school funding, financing plans such as Power Purchase Agreements (PPA) enable schools to afford solar installations. Financing plans like PPAs allow schools to purchase the panels from a third party investor, avoiding upfront costs. PPAs have grown to become the primary financing method in school solar adoption, representing nearly 90% of all installed school solar systems (Solar 8). Often, school districts are unable to secure funding to pay for the upfront costs of development for a project of large scale, however PPAs allow districts to circumvent that barrier. Schools can pay back the investors over many years, at a rate that is likely lower than their typical utility rate. However, PPAs have some disadvantages. A technical report from the U.S. Department of Energy noted, "A PPA is a complicated transaction that requires the school district to invest time and money in assuring that it negotiates a fair and equitable contract" (Coughlin et. al. 12). Just like any contract, the process of negotiation can be tiresome, and school districts have limited time and resources to dedicate to the cause. The process involves lawyers and solar experts, and can consequently dissuade school administrators from moving forward. Nevertheless, many experts still believe this type of financing plan is the most cost effective for school districts. Gabrielle Wong-Parodi, a behavioral scientist and author of the Stanford study said, "Schools are paying for electricity anyway. This is a way, in some cases, that they can reduce their costs" (Garthwaite 2). If schools are able to adopt solar systems, they can gain immense savings. Utilizing PPAs, can enable school districts to capitalize on the opportunity that solar energy provides.

Through third party ownership and PPAs, schools can take advantage of tax incentives that are typically unavailable to schools and nonprofits. The solar investment tax credit (ITC) is a federal policy that incentivizes transitioning to solar energy. The tax credit leads to a reduction in income taxes for the person or company that installs the panels. Through a PPA, the investor can claim the credit and sell the power back to the school or nonprofit at a reduced rate. The residential and commercial solar ITC has helped the U.S. solar industry grow by more than 10,000% percent since it was implemented in 2006, with an average annual growth of 50% over the last decade alone (Solar...Association 2). The solar tax credit significantly reduces the cost of panels, as a result more customers, both commercial and residential, are inclined to transition to solar. This is true for school solar customers. Employing the tax credit through a PPA can make school solar projects even more financially achievable for districts. However, the credit decreased from 30% to 26% at the end of 2019. The credit will continue to decrease to 22% in 2021, and in 2022 down to 10% for commercial and utility scale and 0% for residential projects (Solar...Association 2). This credit has been essential to school adoption of solar, and without it, school districts may not be as economically motivated to execute solar projects. Nevertheless, there is some chance that Congress may renew and extend the credit before it expires in 2022. The solar investment tax credit is essential to reducing the burden of cost for school solar installations.

Recent Maine legislation has also contributed to making solar projects in the State of Maine more financially feasible for school districts. LD 1711, a bill sponsored by Senator Dana Dow of Waldoboro, was signed into law by Governor Mills on June 26th. This law has transformed the solar market in that state of Maine. LD 1711 “modernizes Net Metering by

eliminating a 10 meter cap on community shared solar projects, raises project size limit to 5,000 kilowatts (enabling economies of scale), and makes it explicit that third-party ownership (e.g. non profit PPAs, solar leases) are allowed under net metering" (Greenhalgh 1). This new project size limit will expand the potential cost savings for larger solar projects, including those in schools. Additionally, the inclusion of third-party ownership in net metering allows schools to be compensated for putting power back into the grid, heightening the financial reward of school solar projects. These policy changes are allowing more school districts to see the financial desirability of solar panels. This was the case for the Mount Desert Island school solar system. The original estimated cost savings was $293,000 over 25 years. Estimated savings after new progressive solar legislation signed in July 2019 rose to $1,465,000 over 25 years (Blotnick 3). Under LD 1711, the savings became five times greater for the school system. This legislation dramatically changed the feasibility of solar for MDI, and it has the potential to change the landscape for solar in schools across the state. When solar installations enable school districts to lower their electricity costs, they can dedicate more funds to augment other aspects of the district. LD 1711 has broadened the scope of solar and made projects more cost effective for schools.

Furthermore, the involvement of nonprofit organizations in the process of creating solar proposals can help school districts overcome the barrier of shortage of time and resources. The solar initiative at Mount Desert Island High School exemplifies the crucial role nonprofits can play in the process. A Climate to Thrive (ACTT), a local nonprofit seeking to help MDI transition to 100% clean energy, helped MDI successfully implemented a flat roof photovoltaic system. Joe Blotnick reflected, "We had to do a lot of work to understand the RFP and the Power

Purchase Agreement as a task force" (Blotnick 2). ACTT was able to complete the time consuming research and analysis that school administrators and facilities directors would typically have to do. The assistance of a nonprofit eliminated much of the time and effort required of the MDI school district, enabling them to focus on day to day operations. The involvement of a third party organization also sped up the process of transitioning to solar. Blotnick noted, "It might have been 50 years from now that they would have put those panels on the school if it wasn't for somebody who had time dedicated to making this process happen" (Blotnick 5). Utilities are a low concern for school districts. It can take years for districts to review and decide on proposals to modernize their energy systems. Third party organizations, like ACTT, can propel school districts to move forward with solar projects at a rapid pace.

Public schools should implement photovoltaic solar energy systems in order to embody the principles of environmental stewardship that they hope to instill in their students and transition towards a more sustainable future. As the climate crisis intensifies, clean energy solutions will become even more imperative. It is only logical that this monumental energy transformation begins where students expand their earliest ideas and knowledge. Schools can play a pivotal role in preparing youth for their future, a future tainted by looming crisis. Solar installations provide the opportunity for teachers to connect real world dilemmas to classrooms, engaging students with meaningful, hands-on teaching tools. Solar projects are even more powerful when students initiate the action. SolaRISE Portland, a collaboration of students in Portland, Maine, organized hundreds of community members to support solar schools. They successfully persuaded the school board to commit an offsite solar array that would offset 80-90% of the schools' electricity consumption. Students can and should lead the movement to

solarize Maine schools. Financing plans, tax incentives, state legislation, and non profit involvement are all important strategies to combat the barriers that prevent schools from utilizing solar energy. However, unless schools are aware of these strategies, they are useless. For that reason, I am organizing a summit for students interested in motivating their schools to transition to solar power. I hope that by equipping students with accurate resources and information they will be prepared and empowered to create change. MDI was one of the first schools to take advantage of solar energy, but they will certainly not be the last. School gymnasiums across Maine will erupt in applause as students lead our state towards a solar powered future.

Works Cited

Alexander, Debbie, et al. “Condition of America's Public Schools: 2012-13.” *National Center for Education Statistics*, Mar. 2014, nces.ed.gov/pubs2014/2014022.pdf.

Berdik, Chris. “Schools Lead National Net-Zero Building Boom and Students Learn from It.” *The Hechinger Report*, 6 June 2018. Web. 15 Jan. 2020.

Blotnick, Joe. Personal Interview. 17 Dec. 2019.

Cheung, Rebecca, and Steve Tozer. *Understanding and Addressing Principal Turnover*. National Association of Secondary School Principals, *Understanding and Addressing Principal Turnover*.

Chu, Elizabeth, and Lawrence Tarazano. “A Brief History of Solar Panels.” *Smithsonian.com*, Smithsonian Institution, 22 Apr. 2019. Web. 15 Jan. 2020.

Coughlin, J., and A. Kandt. *Solar Schools Assessment and Implementation Project: Financing Options for Solar Installations on K–12 Schools*. U.S. Department of Energy, 2011, pp. 1–38.

Garthwaite, Josie. “What Happens When Schools Go Solar?” *Stanford News*, Stanford University, 2 May 2019. Web. 15 Jan. 2020.

Generation 180. *Powering a Brighter Future: A Report on Solar Schools in Virginia*. Generation 180, 2019, pp. 1–16, *Powering a Brighter Future: A Report on Solar Schools in Virginia*.

Greenhalgh, Fred. “Huge Victories for Solar in Maine's 2019 Legislative Session.” *ReVision Energy*, 2 July 2019. Web. 15 Jan. 2020.

Hanus, Nichole L, et al. “Solar PV as a Mitigation Strategy for the US Education Sector.” *Environmental Research Letters*, vol. 14, no. 4, 2019, p. 044004., doi:10.1088/1748-9326/aafbcf.

Leachman, Michael, et al. “A Punishing Decade for School Funding.” *Center on Budget and Policy Priorities*, 29 Nov. 2017. Web. 9 Jan. 2019.

Sabas, Matthew. “History of Solar Power.” *Institute for Energy Research*, 16 Feb. 2016. Web 15 Jan. 2020.

Solar Energy Industries Association. “Brighter Future: A Study on Solar in U.S. Schools Report.” *SEIA*, Nov. 2017. Web. 9 Jan. 2020.

Solar Energy Industries Association. “Solar Investment Tax Credit (ITC).” *Solar Energy Industries Association.* Web. 15 Jan. 2020.

Union of Concerned Scientists. “How Solar Panels Work.” *Union of Concerned Scientists*, 11 Sept. 2015. Web. 9 Jan. 2020.

Wiser, Ryan, et al. “The Environmental and Public Health Benefits of Achieving High Penetrations of Solar Energy in the United States.” *Energy*, vol. 113, 15 Oct. 2016, pp. 472–486., doi:10.1016/j.energy.2016.07.068.