



MOUNT DESERT ISLAND HIGH SCHOOL SOLAR PROJECT

HOW YOUTH LED A SOLAR INSTALLATION
PROCESS AND HOW IT CAN BE REPLICATED
ANYWHERE

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“We wrote this paper because we felt it was important to spread the word about the work we did and ensure it would be possible for other students around the country to recreate it. More importantly, we understand that the issue of the climate crisis and its mitigation have fallen into the hands of the youth. We are fulfilling our duties to the Earth by assisting with the installation process and writing this paper.”

- Sirohi Kumar, Thomas Korstanje

100%

ELECTRICITY
NEEDS FROM
SOLAR

1,450

SOLAR
PANELS

~510,000

kWh/YEAR

**~252
TONS**

OF CO₂/YEAR
AVOIDED

~\$1,460,000

SAVINGS TO
SCHOOL (OVER
25 YEARS)

NO

UPFRONT
PAYMENT TO
INSTALL

MDIHS Solar Project



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Technical Summary

Student environmental activism at Mount Desert Island High School (MDIHS), located in Bar Harbor, Maine, USA, resulted in the installation of more than 1,400 solar photovoltaic (PV) panels. The MDIHS solar array is projected to produce 510,000kWh of electricity per year. It's the largest installation on a Maine school, and the first in the state that will cover 100% of the school's electrical needs. This installation process engaged students, teachers, administrators, and local stakeholders. It demonstrated potential cost savings of over \$1.46M over 25 years and the reduction of CO2 emissions by approximately 252 tons per year. This solar array showed how students and schools across the planet can undertake solar projects with economic, social and planetary benefits. For example, solar power for Maine's 206 schools could avoid approximately 51,921 tons of CO2 emissions per year (assuming they are the size of MDIHS). This represents approximately 0.29% of Maine's greenhouse emission reduction mandate, relative to 2015 gross CO2 emissions [1] and ~1.6% of the estimated reduction in annual CO2 emissions relative to the Central Maine Power Corridor project [2]. While it may seem like a school solar project requires a multitude of resources and people to accomplish, it is possible for dedicated students to start and drive this process to completion and success.



Introduction

In October of 2018, the United Nations released a report in which the facts of climate change became obvious. The already observed 1°C of warming over the last ~100 years and the projected 1.5°C warming since the pre-industrial period [3] have and will continue to disrupt societies, wreak destruction upon the planet, accelerate climate catastrophes and related deaths, threatening the social justice and the climate security of everyone. Fighting these increasingly intense wildfires, floods, droughts, diseases, sea-level rise, and extreme weather events will require an unprecedented transformation of every sector of society and the global economy by 2030. This crisis is the result of a myriad of factors, among them the burning of fossil fuels, which contribute to ever-increasing carbon dioxide (CO₂) emissions, which are now at ~407 ppm, a level unprecedented in the last 800,000 years [4]. The ever-expanding energy demand, as well as the convenience and mobility of fossil fuels show that in 2018, CO₂ emissions from the electric power sector accounted for ~33% of total US energy-based CO₂ emissions [5]. This must to change to avoid the previously mentioned catastrophic effects. Fortunately, there are alternatives such as solar energy with virtually no direct CO₂ emissions. The MDIHS story shows how students took action to make a real difference.

While it may be argued that solar power is an unreasonable alternative for fossil fuels, this is quite simply untrue. Solar energy is a more efficient option in every sense of the word -- both cost- and energy-wise. Solar energy is cost-effective in regard to installation costs and the energy it provides. With a Power Purchase Agreement (PPA), schools can install solar arrays with no up-front costs, and the renewable solar energy produced can be purchased at a highly discounted price until the array itself is purchased from the third-party investor. Energy-wise, solar panels can fulfill total energy needs if a sufficient array is installed and can even output excess energy back into the grid during the summer months to make up for the lack of energy in the winter months. Among others, MDIHS's energy utility, Emera Maine, offers solar credits in exchange for excess energy outputted into the grid by solar panels. These can be redeemed for "free energy" [6].



The MDIHS Solar Project

How It All Started

In 2017, a MDIHS senior named Drew Rich worked with a solar panel installation company and assessed the solar capacities of MDIHS. He determined that the school rooftop was capable of carrying enough solar panels to power the school year-round, but would require a ballasting system that was not economically feasible. He then looked into the grounds around the school, but there wasn't adequate land to hold the required number of solar panels. At the time, the project was shelved due to the projected high costs, but by 2018, the prices for ballasting and solar panels had dropped enough for the project to become economically viable. The cost of solar systems continues to decline, offering schools installation opportunities that could not be contemplated even three years ago [7].

After learning about new flat-roof ballasting systems, a local nonprofit called A Climate to Thrive [8] (ACTT) picked up the project. ACTT is a group of Mount Desert Island citizens dedicated to making the island energy-independent by 2030. They had the idea of using flat-roof panels that would withstand severe wind conditions with lighter weight ballasts. They had learned through other New England projects that even though flat-roof panels might be covered in snow for weeks at a time, the economics were still favorable. Community participation was a key component in the installation and will likely drive most school solar projects.

In April of 2018, Joe Blotnick from ACTT initiated discussions with MDIHS Principal, Matt Haney, and MDIRSS Superintendent, Marc Gousse, about the process required for MDIHS to go 100% solar. That June, after a monthly electricity use analysis, a Request for Qualifications was written, to search for companies qualified to install the school's solar array. This request was sent to several firms in Maine and New Hampshire to determine which of those had the capacity and experience to build a flat-roof solar array of this size. In September, 2018, two firms who met the qualifications were selected (ReVision Energy, who had done the earlier estimate, and Sundog Solar) and Joe Blotnick, working with the school administration, developed a Request for Proposal to submit to them. Responses included detailed plans for the project, including a general timeline, cost analysis, the technology used to install the panels and details on which solar panels they would use. In addition, they were asked to include a sample Power Purchase Agreement, a financial instrument through which a third party investor would pay for the project and sell the energy back to the school [9], and a 25-year estimated savings chart.



The proposals were sent to the MDIHS Board of Trustees, Matt Haney, Marc Gousse, and the high school's ECOteam for review. The MDIHS ECOteam (Environmental Concerns Organization), which is comprised of students and staff working towards sustainable solutions around the school and in the community, took an active interest in the solar project. The ECOteam has also been responsible for removing plastic utensils from the cafeteria, implementing a composting system in the school, and organizing school strikes. The ECOteam involvement began with a review of the solar proposals to determine which one would be a better fit for the school. Having students play a role in the process gave them a voice in the project and provided an educational opportunity about the solar panel installation process. After the students reviewed both proposals, they recommended the proposal that they felt was a better fit for the school, Sundog Solar. The ECOteam's selection matched that of the principal, the superintendent, and ACTT, so a recommendation for it was presented to the MDIHS Board of Trustees. The project required the Board's approval before they could continue with the installation process. In January of 2019, two years after the initial study, the Board approved the proposal.

The MDIHS Power Purchase Agreement

In the next few months, a Power Purchase Agreement that involved no-money-down and an estimated savings of \$293,000 over 25 years was developed between the three parties and reviewed by the school's legal team. The project was advantageous to all parties involved; investors take a 30% federal tax rebate and accelerated depreciation which gives them a return on their investment, and in return, they sell the energy to the high school at a discounted rate. The high school receives credits for excess power generation that can be used to offset winter months. After 6 years, the high school plans to purchase the system at a greater discount through a 15-year bond. MDIHS will only pay monthly payments on the bond and 25% of the Transmission and Delivery charges on the electric bill based on Maine's solar friendly legislation passed in July 2019 [10]. With the Maine solar-friendly legislation, the estimated savings increased to \$1,465,000 over 25 years, a very attractive outcome for the school and community stakeholders.



Celebrating the MDIHS Project

The installation of the panels began in May 2019. Four months later, in September of 2019, the high school hosted a ribbon-cutting ceremony for the solar array, organized by ACTT intern-coordinator Sam Murray and several other ACTT interns. The purpose of the ribbon cutting was to spread awareness about the project, what it meant for the school and to serve as a model for other schools. Several Maine governmental officials were in attendance, along with representatives from Sundog Solar, A Climate to Thrive and the MDI Regional School System. After the ceremony, the students who spoke were interviewed by multiple news centers. News that MDIHS had installed 1,450 panels went viral, with the Facebook post from ACTT getting over 41,000 hits, compared to the usual 400. Interviews with the students, including a four-minute Maine Public Radio piece, spread far and wide. Students from other high schools across Maine began to reach out to see if what MDIHS did would be reproducible at their schools. This was an opportunity to spread inspiration and information about the role of youth activism in climate justice, which was capitalized upon by the ACTT interns and MDIHS ECOteam. The ECOteam students in particular, were contacted by a variety of student organizations from across the country who requested guidance and information about how to start a similar process within their own school.



How Other Schools Can Replicate the MDIHS Solar Array

While it may seem like the installation requires a multitude of resources and people to accomplish, it is relatively easy for dedicated students to start and drive this process. The power of student-led projects is more than most think. If all of Maine's 206 high schools installed solar power, they would avoid emitting almost 51,920 tons of CO₂. In the US, there are approximately 24,000 high schools that, together, could change the lives of students and communities while directly addressing the cause of the climate crisis.

External Parties

There are many benefits to having an external party, like Bar Harbor's A Climate to Thrive, to develop the various proposals required for the process of solar panel installation. A school may not have the time or resources to dedicate towards a solar project, so help from a local, regional, or state-wide environmental or economic development organization can streamline the process. However, outside help is not essential to the success of the project. If no such organization is available, members of the student body or school's green team can, with the help of the school resources, complete this process.

School Administrators

It is important to contact the school administrator or facility manager who is responsible for making changes to the school's infrastructure. Their guidance will help ensure that the school can facilitate the installation. The school administrators will need a description of the project and why it is advantageous for solar panels to be installed. Administrators, along with interested students, members of any outside organizations who may be involved, and any relevant school administrator (the principal, green team faculty advisor, etc.) can make up a Solar Taskforce. Good communication between the Solar Taskforce and the school board (who ultimately approve the project) is essential to the development process.



Sizing Up Your School for Solar Power

With the permission of the school administration, the school's monthly electric bills from a one year period should be collected, analyzed, and summarized to determine annual electricity cost and consumption in kilowatt-hours (kWh). Outstanding concerns about the installation of the panels (huge loads of snow, structurally unsound roofs, etc.), should also be taken into account. The Solar Taskforce should research federal and state solar incentives and the average cost of solar energy per kWh from local solar installers [11]. This information will be useful in showing the potential savings to school administrators and in preparing the Request for Qualifications (RFQ) and Request for Proposals (RFP) that will be sent out to solar firms. An RFQ may not be necessary unless the school building has structural faults or installation that would require specific expertise and/or experience that some solar firms may not have. The RFQ is designed to ensure that the RFP only goes out to the most well qualified solar firms. At MDIHS, an RFQ was developed because the installation would require an engineering plan to ensure that the roof could adequately handle the extra weight. Resources for finding solar installation firms [12] and a guide to writing an RFQ [13] are included on the Resource Page. The solar firms will reply with the requested information, and be reviewed by the Solar Taskforce. Based on the factors written about in the RFQ, the most qualified firms should be selected for a Request for Proposals (RFP). The RFP will include a request for an estimate of the cost of a solar panel system using a Power Purchase Agreement (PPA) and projected savings over a 25 year period based on your annual kWh usage. It will also include information on the firm's experience with similar size (or larger) projects, qualifications of key employees, a timeline and other details of the process. Every project will be different and should assess all of the relevant factors in making decisions.



The Power Purchase Agreement

A PPA is a financial agreement, typically for 10-25 years, whereby the system is paid for by a third party investor, secured by the solar installation firm. The investor owns the system, is responsible for maintenance of the system, and sells the solar energy back to the school at a rate typically lower than the utility rate. The investor earns a return on their investment through federal tax credits and accelerated depreciation. After 5-6 years, the school may opt to purchase the system at a greater than 50% discount and enjoy even greater savings [14]. A detailed guide on how to write an RFP is also provided [15]. Once the firms have replied with detailed proposals, the Solar Task Force reviews the proposals based on the factors specified in the RFP. It may be necessary to generate additional clarification and questions for response by firms who submitted key proposals to be sure that all parties are all on the same page. Once the solar contractor with the best proposal is selected, the Solar Taskforce should create a letter of recommendation with 2-3 key reasons supporting the decision. The next step is to present the recommendation to the School Board to make a final decision. Afterward, the Solar Taskforce should work with the school district administration and attorney to review and edit the Power Purchase Agreement provided by the winning contractor. From this point on, the contractor will work directly with the school administrator assigned to the project to schedule the installation.

Celebrating the Project

Once the installation is completed, the next step is to plan and schedule a ribbon-cutting ceremony, preferably in a special school assembly with all students and teachers. Invitees should include local and state-wide radio and television networks, journalists, the school board, members of the local government, and everyone involved in the project. This will be an opportunity for the students on the Solar Taskforce to inspire schools in other communities with a speech about their work, and to set a goal for further sustainability at the school of 100% renewable energy, which includes heating and plumbing. The importance of using the ribbon cutting to spread the word about the actions of the Solar Taskforce cannot be understated. By showing how simple and economically feasible it is to install a solar array on a school, students from around the country and the planet are inspired to take action. The MDIHS ribbon-cutting inspired students in 3-5 Maine schools to begin a process similar to it already. The students' hope is that each one of those will inspire other schools until every school in the state takes advantage of this lower-cost fossil-fuel-free source of electricity.



Conclusion

With the 1.5°C projected increase in global temperatures over the coming decades, humanity faces what has been called the sixth mass extinction [16]. Ultimately, with its reliance on fossil fuels, it seems likely that humanity's downfall is inevitable, but MDIHS's actions show that students can make a positive difference and be active participants in fighting the climate crisis. Change needs to happen, starting with reducing and ending dependence on fossil fuels. Solar energy is the optimal alternative for fossil fuels because of its low-cost installation and its creation of excess renewable energy during peak months. MDIHS installed a more than 1,400-panel array with a PPA, and the school is estimated to save over 1.5 million dollars in energy costs over a period of 25 years. This installation is likely possible for any school with students who are dedicated to making change.



Figures 1 & 2



Figure 1: The cumulative savings of the high school solar project over the next 25 years without Governor Janet Mills' new administration, and no buyout by a third-party through the PPA. Note that without the incentives identified, the solar project would cost the school money, making solar infeasible. Data source: <https://sundog.solar>



Figure 2: The cumulative savings of the high school solar project over the next 25 years without Governor Janet Mills' new administration but with a buyout through the PPA. In this case, after a period of negative savings (years 1-12), the solar project results in positive savings. Data source: <https://sundog.solar>



Figures 3 & 4



Figure 3: The cumulative savings of the high school solar project over the next 25 years with Governor Janet Mills' legislation but no buyout through the PPA. Note that savings are rapidly realized from years 1 to 6, but decline thereafter capped at \$190,000 in year 6. Data source: <https://sundog.solar>

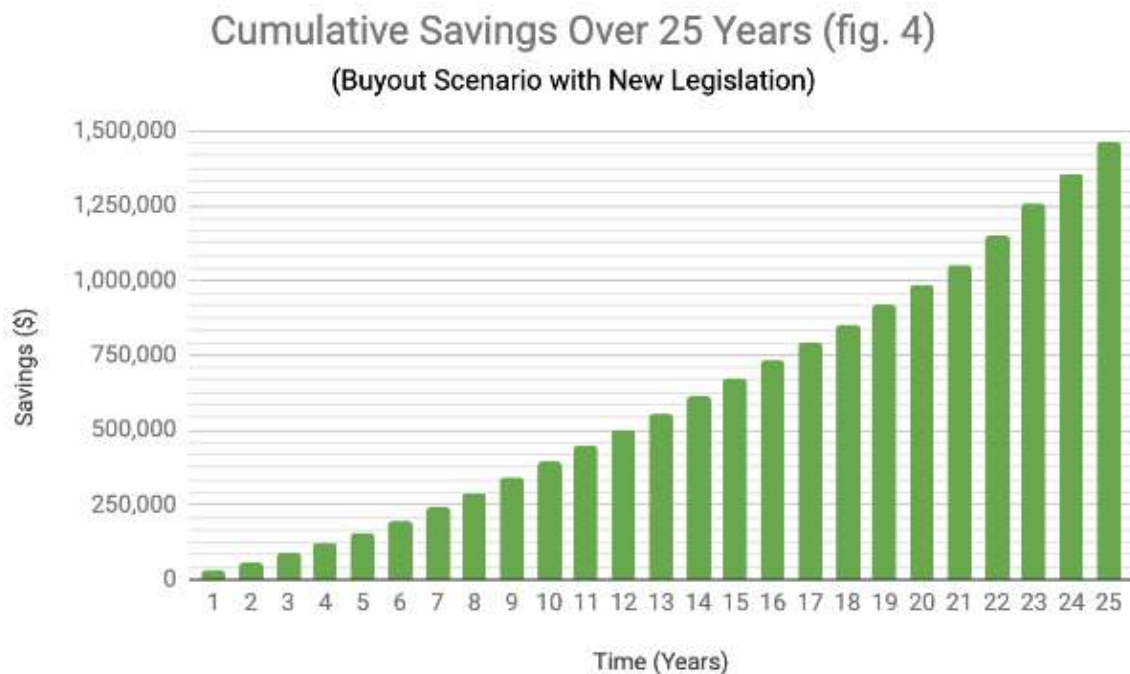


Figure 4: the cumulative savings of the high school solar project over the next 25 years with Governor Mills' new administration and the buyout through the PPA. This is the scenario adopted by MDIHS, representing the optimal solution. Data source: <https://sundog.solar>



News Media

ABC 7 Mount Desert Island High School Goes Solar

<https://foxbangor.com/news/item/mount-desert-island-high-school-goes-solar/>

WABI 5 MDI High School Celebrates Going Completely Solar

<https://www.wabi.tv/content/news/MDI-High-School-celebrates-going-completely-solar-560721471.html>

Maine Public Maine Schools Going Solar - Not Only To Protect Environment But To Boost Bottom Lines

<https://www.mainepublic.org/post/maine-schools-going-solar-not-only-protect-environment-boost-bottom-lines>

Mount Desert Island High School becoming solar hot spot

<https://foxbangor.com/news/item/48772-mount-desert-island-high-school-becoming-solar-hot-spot/>

Mount Desert High School becomes first school in Maine to run completely on renewable energy

<https://www.newscentermaine.com/article/news/mdi-gets-solar-panels/97-a5af11c4-1e20-45b9-b6d6-f996a3287f86>

School to celebrate its new solar array; Ceremony set for Sept. 18

<https://www.mdislander.com/maine-news/school-to-celebrate-its-new-solar-array-ceremony-set-for-sept-18>

MDI High School to have more than 1,300 solar panels installed on roof

<https://bangordailynews.com/2019/03/17/news/hancock/mdi-high-school-to-have-more-than-1300-solar-panels-installed-on-roof/>

Midcoast high school is Maine's first to go 100% solar

<https://www.mainebiz.biz/article/midcoast-high-school-is-maines-first-to-go-100-solar>

How Mt. Desert, Maine, residents helped double their island's solar capacity

<https://www.yaleclimateconnections.org/2019/04/how-an-island-doubled-its-solar-capacity/>



Resources

- 1) "Seventh Biennial Report on Progress toward Greenhouse Gas" 16 Apr. 2018, [https://www.eenews.net/assets/2018/04/16/document_pm_06.pdf], Accessed 12 Feb. 2020.
- 2) "State of Maine Utilities Commission" [https://mpuc-cms.maine.gov/CQM.Public.WebUI/MatterManagement/MatterFilingItem.aspx?FilingSeq=101726&CaseNumber=2017-00232]. Accessed Feb 12, 2020
- 3) "Special Report - Global Warming of 1.5°C" [https://www.ipcc.ch/sr15/]. Accessed Apr 21, 2020
- 4) "Climate Change: Atmospheric Carbon Dioxide | NOAA" 19 Sep. 2019, https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide. Accessed 12 Feb. 2020.
- 5) "How much of US carbon dioxide emissions are associated - EIA." 25 Oct. 2019, https://www.eia.gov/tools/faqs/faq.php?id=77&t=11. Accessed 12 Feb. 2020.
- 6) "Net Energy Billing - Emera Maine." [https://www.emeramaine.com/residential/rates/bhe-net-energy-billing/]. Accessed 12 Feb. 2020.
- 7) "US Solar Panel Prices Continue Dropping, Solar+Storage" 17 Nov. 2019, [https://cleantechnica.com/2019/11/17/us-solar-panel-prices-continue-dropping-solarstorage-increasing-tracking-the-sun-report/]. Accessed 12 Feb. 2020.
- 8) "A Climate to Thrive." [https://www.aclimatetothrive.org/]. Accessed 12 Feb. 2020.
- 9) "Power purchase agreement - Wikipedia." [https://en.wikipedia.org/wiki/Power_purchase_agreement]. Accessed 12 Feb. 2020.
- 10) "Maine Enacts New Law to Encourage Net Metering and Long-Term Contracts for Distributed Generation" [https://www.pierceatwood.com/alerts/maine-enacts-new-law-encourage-net-metering-and-long-term-contracts-distributed-generation]. Accessed 12 Feb. 2020
- 11) "2020 State Solar Power Rankings - Solar Power Rocks." [https://www.solarpowerrocks.com/state-solar-power-rankings/]. Accessed 12 Feb. 2020. "This chart ranks the 50 states and the District of Columbia, from best (green) to worst (red), based on their solar-friendliness." The ranking is based on 10 factors like electricity price and property tax exemption.



- 12) "Choosing a Solar Installer the Right Way | EnergySage." 12 Dec. 2019, [https://www.energysage.com/solar/decision-guide/how-to-choose-a-solar-installer/]. Accessed 12 Feb. 2020.
- 13) "What is an RFQ and How Do I Use One? - Artscape DIY." [http://www.artscapediy.org/Creative-Placemaking-Toolbox/How-Do-I-Select-and-Contract-Specialists-and-Servi/What-is-a-RFQ-and-How-Do-I-Use-One.aspx]. Accessed 12 Feb. 2020
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- 16) "Earth's sixth mass extinction event under way, scientists warn" 10 Jul. 2017, [https://www.theguardian.com/environment/2017/jul/10/earths-sixth-mass-extinction-event-already-underway-scientists-warn]. Accessed 12 Feb. 2020.
- 17) Thoughtfully Sighted Solar - [https://www.maineaudubon.org/solar/] "In partnership with solar developers, municipal planners, and environmental and agricultural organizations, Maine Audubon has created a suite of resources to guide individuals, municipalities, and decision-makers toward realizing the benefits of solar, while siting projects with wildlife and habitat in mind.
- 18) Naysayer FAQ - [https://www.aclimatetothrive.org/solar-faq] "Every tangible technology has issues that need to be managed across its life cycle creation, use, disposal. But in relation to non-renewable energy technologies such as coal and nuclear power, solar issues are small. And their benefits by avoiding greenhouse gases are overwhelming."



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Disclaimer: We have reported the best available information on this project. Please note that every project will be different and may have different outcomes relative to the MDIHS solar project.

