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Societal Sustainability: Projects to Address the Three Dimensions of a Sustainable Future

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Societal Sustainability: Projects to Address the Three Dimensions of a Sustainable Future

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Agricultural Economics

by

Braden K. Bateman
University of Arkansas
Bachelor of Science in Agricultural Business, 2021

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This thesis is approved for recommendation to the Graduate Council.

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Abstract

Sustainability is an important, commonly discussed societal goal regarding assurance of resources for the world to be able to enjoy a prosperous future. Three primary dimensions of sustainability include environmental, economic, and social sustainability, and objectives for various projects can be aimed at any of the three dimensions to pursue societal sustainability. Solar installations, which can be used to pursue environmental and economic sustainability, convert abundant sunlight to electricity, displacing fossil fuel use that contributes harmful greenhouse gases to the atmosphere. The regulatory environment at the state level has a significant impact on the feasibility of solar projects. At present, Arkansas's regulations are favorable as they allow for net-metering and meter aggregation. A federal solar income tax credit with a 20-yr carry forward period, MACRS depreciation, and bonus depreciation in the first year are currently available to incentivize investment. To aid in investment feasibility analysis for poultry producers that intensively use electricity for ventilation, the Poultry Solar Analysis (PSA) decision support tool was developed to calculate system size, estimate installation cost, and provide capital budgeting metrics, including 23- and 30-year NPV and breakeven cost of electricity over the life of the system. Using monthly electricity bill information from several producers, six producer scenarios were developed to conduct sensitivity analyses with the PSA tool to determine which parameters have the largest influence on NPV. Results encourage the use of a tracker system to optimize solar collection efficiency from the system. At the same time monthly base fees for grid access and demand charges that vary by utility provider and electric inflation rate also have a large impact on NPV. Even with these parameters judged as very influential, age of production facilities and stage of producer investment and attendant lending capacity implications associated with taking on debt for solar investment will vary greatly. As such, the PSA tool is considered useful for estimating financial feasibility of solar investment.

The second study focuses on social sustainability as a means of creating inclusive and resilient societies where its citizens can thrive. Arkansas currently ranks 38th overall in Pre-K through 12th grade state education rankings, and 45th in college readiness, holding Arkansas back from being able to create a group of students who, when pursuing post-secondary education or a career, will effectively aid in developing a thriving, resilient society with less poverty. A business proposal is outlined for an organization to address extracurricular educational program support where students develop hard and soft skills to improve academic performance and expand access to better and more meaningful opportunities and resources through community connectivity. The operating environment for this organization was found to be heavily competitive, and thus, we stress the importance of engaging key stakeholders within various school districts to effectively achieve the organization's mission.

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I would like to sincerely thank my advisor, Dr. Micheal Popp, and my committee members, Drs. John Anderson and Rogelio Garcia Contreras for all of the time, resources, and advice dedicated to assisting me in making this achievable. I am extremely grateful for the support and motivation from the faculty and staff of the Department of Agricultural Economics and Agribusiness at the University of Arkansas. I would also like to acknowledge the numerous other individuals from various academic and professional backgrounds who have contributed to work in sustainability. Finally, I would like to thank my wife, Madeline Bateman, my parents, my grandparents, and the countless friends and family members who supported me throughout this process.

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Chapter I. Introduction

A. Problem and Study Justification

Sustainability is an important, commonly discussed societal goal regarding assurance of resources for future generations to be able to enjoy a level of prosperity at least equal to that of the present generation (Costanza, Daly, and Bartholomew, 1991). How sustainability can be attained is widely debated to this day, but sustainability should at least be considered when setting and pursuing objectives in research and projects. Three primary dimensions of sustainability include environmental, economic, and social sustainability (UCLA Sustainability, 2022), and objectives can be aimed at any of the three dimensions in order to pursue societal sustainability.

Solar power as a renewable source of energy is one instance of pursuing environmental and economic sustainability dimensions. Solar installations convert abundant sunlight into usable electricity for people to use in place of electricity from the grid that is primarily produced from fossil fuels, which contribute harmful greenhouse gasses to the atmosphere. In relation to economic sustainability, there are incentives and favorable regulations in place, particularly in Arkansas, for both private households and commercial operations to pursue installing solar systems (University of Arkansas Division of Agriculture Cooperative Extension Service, n.d.). Given that there are additional tax incentives in place for commercial-level operations to install solar systems, and that poultry operations face a large energy cost, it is likely that poultry producers in the state of Arkansas could benefit from installing a solar system on their operation, while also having the ability to positively contribute to economic and environmental sustainability.

Social sustainability is about creating inclusive and resilient societies where its citizens can thrive and be heard by their governments and those around them (Sivaraman, 2020). To effectively address long-term social sustainability, a team effort among citizens, companies, schools, governments, and other various societal institutions is necessary. Arkansas currently ranks 38th overall in Pre-K through 12th grade state education rankings, and a mere 45th in college readiness (U.S. News & World Report, 2022), which is holding Arkansans back from being able to create a group of students who, when pursuing post-secondary education or a career, will effectively aid in developing a thriving, resilient society with less poverty. With this said, creating urgency among motivated groups of students who are interested in breaking the norm can trigger a sustainable cycle of change throughout the community to build social capital and foster leaders of the future. This helps to pursue social sustainability.

B. Objectives and Chapter Overview

The objectives of Chapter II are: i) to analyze investment feasibility of solar power systems for commercial poultry operations, while considering a host of factors that are influential to the decision-making process; ii) to provide a description of how to use decision support software, the Poultry Solar Analysis, created as an interface to collect operation-specific input and report results; and, iii) to conduct sensitivity analyses comparing a group of baseline poultry producer financial situations to alternative situations by adjusting a) loan length; b) percent of system cost financed; c) loan interest rate; d) electricity inflation rate; e) whether or not solar panels track the sun's orbit; f) utility company rate structures related to demand charges and access fees in relation to per unit variable rate electricity charges; g) years to realize income tax incentives in the form of bonus depreciation and a federal income tax credit; and, h) degradation rate of the solar panels in terms of annual loss in solar conversion efficiency.

The objectives of Chapter III are to outline a business proposal which addresses the need for social sustainability in the state of Arkansas with an extracurricular educational program where students develop hard and soft skills to improve academic performance and expand access to better and more meaningful opportunities and resources through community connectivity. With the multidisciplinary curriculum tailored to reduce the educational gap that exists among the primary and secondary school student population in the state, the organization will address overall socioeconomic status, health, sanitation, nutrition, and post-graduation skill development needs among the student population to pursue impactful, social sustainability.

Chapter IV concludes by discussing overall study findings and needs for future research to continue further progress.

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Chapter II. Poultry Solar Analysis Tool for Feasibility of Solar Installations for Poultry Operations

A. Introduction

Solar systems for residential electricity consumers have become increasingly popular in recent years. Solar installation is intended to reduce one's energy bill and assist with lowering greenhouse gas (GHG) emissions to aid in pursuing a more sustainable future. The regulatory environment at the state level has a significant impact on the feasibility of solar projects. At present, Arkansas's regulations related to solar installation are favorable as they allow for net-metering and meter aggregation (University of Arkansas Division of Agriculture Cooperative Extension Service, n.d.). That is, energy produced from the solar system in excess of the customer's immediate needs can be supplied to the grid, with the customer receiving credit for the retail value of any excess electricity supplied (net metering). In addition, electricity generated on any particular day can be allocated to any other time of the year and across an aggregate set of electrical meters assigned to the same customer (meter aggregation). In effect, solar systems can use the grid as a 'battery', with electricity exchanged from and to the grid valued at retail rates on 100% of annual electricity use on the customer's aggregated meters. Any solar power generated in excess of the customer's annual electricity use is either not compensated or valued at a significant discount.

Electricity is a major expense for poultry producers, accounting for \$0.36-\$0.41 per pound of finished meat produced regardless of operation size (University of Kentucky Department of Animal & Food Sciences, n.d.). This fact, along with the favorable regulatory structure in Arkansas, suggests that poultry growers in the state could benefit from solar adoption. However, solar system installation is quite costly: easily exceeding one to two hundred thousand dollars for even a relatively small poultry farm. Several federal initiatives are in place to help mitigate those up-front costs. A federal solar income tax credit worth 26% of the installation cost with a 20-yr carry forward period is currently available to offset tax burden (Duke Energy Sustainable Solutions, 2022). Additionally, 5-yr modified accelerated cost recovery system (MACRS) depreciation and bonus depreciation allow favorable income tax management, as the useful life of a system typically exceeds 25 years (U.S. Department of Energy, 2020). Finally, poultry producers are also eligible to apply for The Rural Energy for America Program. This program offers financial assistance for the purchase of solar systems in the form of USDA loan guarantees for up to 75% of total eligible project costs, as well as grants for up to 25% of total eligible project costs, or a combination of a grant and loan guarantee funding up to 75% of total eligible project costs (U.S. Department of Agriculture, n.d.).

Given the host of incentives available to commercial poultry producers and complexities associated with the magnitude of decision-making factors regarding solar installation systems, the Poultry Solar Analysis (PSA) decision support tool was developed using Visual Basic for Applications (VBA) code in Microsoft Excel® (Microsoft Corporation, 2022). The tool requires the farmer to input a full year's monthly electricity usage and associated cost to determine fixed access fees vs. per kilowatt hour (kWh) electricity charges that vary by season and rate schedule of utility providers. The user also enters the percent of the initial solar investment financed, loan length, financing rate, and whether the system is stationary or tracks the sun (affecting panel efficiency). The tool then calculates system size, estimates installation cost, and provides capital budgeting metrics including 23- and 30-year net present value (NPV) and breakeven cost of electricity over the life of the system. The tool tracks operating, maintenance, and insurance cost and accounts for solar panel efficiency degradation at a rate of 0.5% per year. A cashflow chart projects outflows and inflows for the investment period, where cashflows hinge in part on how fast an investor could redeem the tax credit, inflation expectations regarding both solar savings and system operating charges as well as ownership charges.

The objectives of this chapter are: i) to analyze investment feasibility of solar power systems for commercial poultry operations, while considering a host of factors that influence the decision; ii) to describe and demonstrate how to use decision support software, the Poultry Solar Analysis, created as an interface to collect operation-specific input and report results; and, iii) to conduct sensitivity analyses comparing baseline poultry producer financial situations to alternative situations by adjusting a) loan length; b) percent of system cost financed; c) loan interest rate; d) electricity inflation rate; e) whether or not solar panels track the sun's orbit; f) utility company rate structures related to demand charges and access fees in relation to per unit variable rate electricity charges; g) years to realize income tax incentives in the form of bonus depreciation and a federal income tax credit; and h) degradation rate of solar panels in terms of annual loss in solar conversion efficiency. This analysis will identify those factors that have the largest impact on returns to a poultry solar system investment.

B. Materials and Methods

1. Electricity Usage Data

Data for this study was obtained from existing poultry producers located primarily in northwest Arkansas. Producers shared at least twelve months' worth of electric bills for their poultry operations. From these bills, total annual electricity usage in kilowatt hours (kWh), electricity access (base) fees, demand/usage charges, number of electric meters, and total electricity costs were recorded and consolidated for analysis with the PSA tool. Additional data included the number and size of poultry houses on each operation.

Electric companies and cooperatives charge a marginal rate for electricity consumption, which is measured in kWh by an electric meter. They also charge a base fee per electric meter, which is essentially the charge to access the grid. This fee and how it is charged varies from company to company. A demand, or usage, charge is an additional flat charge from the electric company that is based on the consumer's peak kilowatt (kW) usage within a given billing cycle (typically a calendar month) (Duke Energy Sustainable Solutions, 2019). For example, a producer's demand charge would be higher if every tunnel fan were on simultaneously for just one second compared to just one tunnel fan operating for several hours since more kW are needed at one moment in time to run all tunnel fans.

2. Tool Interface and Use

The PSA tool has two interactive sections, identified as separate spreadsheet tabs: i) monthly cost & use; and ii) farmer input. Green cells indicate whether the cell is unlocked for editing. White or yellow cells contain formulas linking to green cells and are locked for editing. Program code was developed using Visual Basic for Applications (VBA) to allow users to activate programming routines using blue arrows to move between sections as needed (Fig. 2.1A). Sections are sequenced to guide the user from inputting their operation's information to report generation. Results are presented in the form of a projected cashflow bar chart, NPV estimates summarizing cashflows prior to a second major equipment upgrade in year 24 and over the entire project period of 30 years, and, finally, an estimate of breakeven cost of electricity with the solar system (i.e., an electricity price above which the solar investment would be expected to provide a positive return). Additional VBA activated macros are accessible with a button click on form control buttons labeled to describe respective actions (Fig. 2.2A). These macros allow the user to automatically fit the tool to the computer screen size they use, refresh tool calculations to ensure up-to-date break-even calculation, re-link connected values to the monthly cost and use section in case information was overwritten, calculate sensitivity analyses, and print cashflow summary and sensitivity analysis outputs.

In the first screen, the user can enter the total monthly electricity usage in kWh for each meter on their operation (Fig. 2.2B), the costs associated with each meter for each month (Fig. 2.2C), and the zip code for their operation's location (Fig. 2.2D). This section simplifies and standardizes the multiple complex charges that producers observe on their electric bills. Information entered here is used to calculate solar system size, estimated combined variable electric rate in kWh, and estimated monthly base electric fee. The monthly base or grid access fee and variable electric rate are estimated by regressing monthly energy use against entered cost information. The y-intercept of this estimated equation represents the producer's electricity charge at zero kWh (i.e., grid access fee) (Fig. 2.2 E) while the slope of the equation represents the producer's variable rate per kWh (Fig. 2.2 F). The producer can override the model's estimated access fee by inputting a specific access fee if that value is known (Fig. 2.2G).

On the second input screen, the user can adjust various financial factors specific to their operation's financial situation. Clicking on the blue 'PVWatts Estimate' link provides an estimate of annual kWh production per kW of the solar system installation for the zip code where the solar system will be located (National Renewable Energy Laboratory [NREL], 2022). The user should indicate a direct current (DC) system size of 1 kW with a standard module type and fixed (open rack) array type for the system information on this website; all other parameters should be left at their PVWatts® default values (Fig. 2.3). The estimated annual output value from PVWatts® (Fig. 2.4) should then be placed into the PSA tool (Fig. 2.1B). The user also needs to enter into the decision tool the combined square footage of all poultry houses covered by the solar system (Fig. 2.1C). If the producer anticipates aggregating additional meters that are in the producer's name, the size of the system can be increased from its estimated value at the user's discretion. Alternatively, system size can also be reduced at the user's discretion – for example, if the producer wants to decrease the size of the solar system to lower initial investment cost or in anticipation of energy-efficiency improvements on the farm (Fig. 2.1D). It should be noted, however, that the Arkansas Public Service Commission (PSC) limits the size of solar panel installations to 1,000 kW unless approved by the PSC (Arkansas Senate, 2022).

Within the 'farmer input' section, the producer needs to specify the percentage of the estimated total system cost to be financed (Fig. 2.1E), the anticipated length of the loan (Fig. 2.1F), and the anticipated interest rate associated with the loan (Fig. 2.1G). The user can also indicate system tracker preference in the PSA tool (Fig.2.1H).[1]

The default useful life of the solar system is 30 years, but the user can adjust this number to fit personal preference for asset depreciation (Fig. 2.1I). Modifying the useful life also modifies estimated property taxes. Using a shorter depreciation period thus impacts the timing of property tax payments and the level of depreciation if straight-line depreciation is used in lieu of the 5-yr MACRS accelerated depreciation rate.

The location of the system installation is also shown on the second screen but highlighted in yellow as the location is entered by the user when recording monthly electricity use and cost information (Fig.2.1J). Electricity (Fig. 2.1K) and operation and maintenance inflation (Fig. 2.1L) rates can be adjusted by the user, but default values are provided along with notes to give guidance on ideal values to select.

[1] Other than those solar systems owned by electric companies, most solar systems currently being installed are fixed-rack systems, which means that panels are installed at a fixed angle. In addition to these fixed-rack systems, most solar installation companies offer, at a higher cost, single-axis tracking systems that track the east-to-west travel of the sun, increasing the efficiency of the system.

The federal (Fig. 2.1M) and state income tax rates (Fig. 2.1N) are to be estimated and entered by the user and should be the producer's effective tax rate. Anticipated years to use tax credit (Fig. 2.1O) is where the producer enters the number of years (1-20 years) they estimate it would take to realize the full value of the federal income tax credit from the purchase of the system. This value will most likely vary greatly across operations. Operations with lower (higher) taxable income relative to the cost of the system, will need more (fewer) years to use the full value of the tax credit.

The default discount rate in the tool is set to 6% (Fig. 2.1P) but can be adjusted by the producer for financial planning purposes (i.e., best vs. worst case scenarios). In general, the riskier the investment, the higher the discount rate should be. A conversation with Dr. Brothers at Auburn University, an agricultural economics expert in the field of solar panel investment led to the baseline value of 6%.

3. Tool System Estimates & Capital Budgeting Metric Calculations

The PSA tool uses the information entered by the user in the two aforementioned sections to estimate the appropriate solar system size and installation cost as well as 30-year projected cash flows, 23- and 30-year NPVs, and the breakeven cost of electricity in kWh associated with the installation of the system. This information along with the producer's selections entered into the tool are summarized and presented in a table (Fig. 2.5) which includes a breakdown of the expenses and revenues (avoided expenses) for 30 years. The table is replicated for a situation where bonus-depreciation and income tax credits are captured i) immediately or within the first two years, assuming bonus depreciation is recovered in the first year and the income tax credit is recovered in year 2 vs. ii) over a user-specified period of time. Bonus depreciation is limited to the lesser of annual income tax credits chosen by the user when entering the years it would take to realize the tax savings (Figure 2.1 N) or:

(1) Bonus Depreciation = Initial Cost * (1 – Income Tax Credit Rate/2) * Federal Income Tax rate;

whereas the annual amount of income tax credit a user expects to realize is:

(2) Annual Income Tax Credit = Initial Cost * Income Tax Credit Rate (26%) / Number of Years to Realize Tax Credits.

The two cash-flow projections are available by clicking on the 'Print Summary Output' button (Fig 2.5) and also available graphically (Figure 2.6).

As noted earlier, the initial variable kWh rate for electricity and monthly base fee can be modified by the user (Fig. 2.2A). The default estimate using the y-intercept is used when the user enters 0 in Fig 2.2A. Entering an alternative access fee modifies the variable kWh rate or slope of the linear regression line so that the regression line intercepts the y-axis at the user specified intercept.

The capital budgeting metrics are perhaps the most important values a producer will use in determining whether investing in a solar system is feasible for their operation. The 23-year NPV for both the immediate tax benefit (ITC_1) and delayed tax benefit (ITC_n) scenarios is calculated as follows:

(3) $$NPV_{23} = IO + \sum_{n=1}^{23} \frac{SB_n}{(1+R)^n}$$

where *IO* is the producer's initial outlay in the installation year, *R* is the discount rate selected by the producer in Figure 2.1P, and SB_n is the annual after-tax cashflow benefit of solar investment in year *n*. SB_n is a function of electricity rate, producer electricity usage, annual kWh produced by the system, interest expense, loan cost, property tax rates, effective state and federal income tax rates, and years to realize the federal income tax credit (Table 2.1). Similarly, the 30-year NPV for ITC_1 and ITC_n is calculated as:

(4) $$NPV_{30} = IO + \sum_{n=1}^{30} \frac{SB_n}{(1+R)^n}$$

The 'Solver' add-in available in Microsoft Excel® was used to determine the breakeven costs of electricity for ITC_1 and ITC_n by calculating the given electricity rate (Fig 2.1Q) which would set the NPV_{30} equal to 0 for both income tax credit scenarios.

The description and detailed calculation of SB_n and the other columns in the summary outputs (beginning with Investment Tax Credit through Est. Maint. & Insurance for Solar System) in Figure 2.1, along with other estimates regarding system size and costs are summarized and presented in Table 2.2.

4. Sensitivity Analyses

Six different producer scenarios of various electricity usage, cost, and utility provider were analyzed. Seven of the eight parameters identified in the introduction were set to default baseline values shown in Figure 2.1 E, D, F, J, G, and N. Sensitivity analyses were conducted to test the significance on 30-year NPVs and breakeven cost of electricity with varying loan length, percent of system cost financed, loan interest rate, electricity inflation rate, tracker system utilization, monthly base electric use fee, years to realize bonus depreciation and the federal income tax credit, and solar panel degradation rate.

Microsoft VBA macros were utilized to alter the parameters (not including degradation rate) and recalculate 30-year NPVs and breakeven electricity cost using the same methods mentioned in the previous section. VBA macros also reset the parameters to the original (default) values initially selected by the user. The monthly base fee default is the tool-estimated monthly base fee or the known access fee (Fig.2.2A) if it is greater than 0. As described above, altering the monthly base fee value alters the variable kWh electricity rate and thereby modifies NPVs. This is reflected in Figure 2.6. The solar panel degradation rate was set to a default baseline value of 0.5% and was manually altered in the sensitivity analysis, as the 0.5% degradation rate is a robust industry standard and thereby is not included in the sensitivity report automatically available to the farmer when using PSA. The producer can view and print the capital budgeting metrics associated with the altered parameter values summarized in a sensitivity analysis report that includes a note on the baseline assumptions (Figure 2.7). Parameter impact ratios were then calculated for each of the six parameters' alternate values in the six producer scenarios, summarized in Table 2.3, as follows:

(5) $$IR = \frac{alternative\ NPV}{baseline\ NPV} - 1 * 100\%$$

where *IR* is the percentage deviation from the default baseline NPV given a change in the decision parameter. The larger the *IR* for a particular decision parameter (e.g. loan length), the greater it's importance relative to another *IR* for another decision parameter (e.g. tracker use), should the latter's *IR* value be lower.

C. Results and Discussion

Table 2.3 summarizes key factors associated with each producer scenario description for the basis of comparison of the highest and lowest absolute value of impact ratio factors for ITC1, where tax benefits are realized in years 1&2 and ITC15, where realization of tax benefits is extended over 15 years. In each of the scenarios, the producer's estimated system size (which captures operation scale), monthly electric access fee, variable kWh electric rate, and default panel production in kWh/kW (which captures location of operation) are given.

When the producer is able to claim tax benefits immediately and is already facing a high access fee, a 20% change of the monthly base fee has the largest impact on the 30-year NPV, while a change in panel degradation rate has the smallest impact. Conversely, when looking at scenarios 2 and 3, which have a relatively low monthly access fee, a change in the electric inflation rate had the largest impact on NPV, while a 20% change of the monthly base fee (since it is already relatively low) had the smallest impact.

When producers claim tax benefits over a 16-year period (ITC15), for all scenarios but scenario 4, utilization of a tracker system had the largest impact on NPV. For scenario 4, a change in the electric inflation rate had the largest NPV impact. This differing factor for scenario 4 is likely due to the fact that the total kW size of the system is lower relative to the other scenarios' systems. For all six scenarios, a change in the monthly base fee had the smallest impact.

The PSA tool is assuming the monthly base fee (a fixed cost) remains constant throughout the life of the system. When considering time-value of money, the base fee has more of a financial impact in early years. Therefore, it makes sense that a change in this parameter is the most impactful on NPV for producers who claim tax benefits immediately and have a large access fee to begin with. At the same time, it is least impactful for producers who spread tax benefits out over a longer period of time. Similarly, if the base fee is already low to begin with, then changing the default fee by 20% in either direction does not meaningfully impact NPV when compared to other parameters. Given the results of the study, it appears that investing in a tracker system, rather than a fixed-open rack system, is recommended given it always had a positive impact on NPV, especially for those who claim tax benefits over a longer period of time. This finding is subject to minimum system size requirements for this technology to be feasible, however.

Overall, from a poultry operation management perspective, even though the NPVs found in this study appear to indicate that solar system installation is favorable, it is important to consider the producer's financial risk exposure if they were to purchase a system. Poultry farmers are likely already highly leveraged, as constructing a poultry farm is very expensive and is typically debt financed. Taking on even more debt and risk to install a solar system, even though it appears to be financially beneficial from a NPV standpoint, is likely undesirable for a poultry producer as they need borrowing capacity for improvement projects that may be necessary at the discretion of poultry contractors that place birds for a service fee that covers housing, water, labor and litter disposal by operators. As such, the risk-to-reward ratio associated with solar system investment might deter poultry producers from pursuing installation, given that being more highly leveraged is typically undesirable for poultry producers.

D. Conclusions

Numerous factors and parameters impact the financial feasibility of installing a solar system, leading to the need for complex analysis to aid in this investment decision. With the PSA tool, we analyze a number of financial parameters ultimately affecting the economic feasibility of solar system installation. One general result of the analysis appears to be that inclusion of a tracker system is beneficial as long as minimum size requirements for the technology can be met, with monthly base fee and electricity rate inflation rate also typically having a large impact on NPV. However, given that producer scenarios will vary greatly, it is difficult to pinpoint just one answer to maximize NPV. The PSA tool gives poultry producers the ability to analyze farm-specific factors to gain insight about financial parameters that are the most important for their decision. The tool thus offers a method to project financial ramifications of system installation would on their existing operating cost structure. Importantly it does not analyze financial leverage implications.

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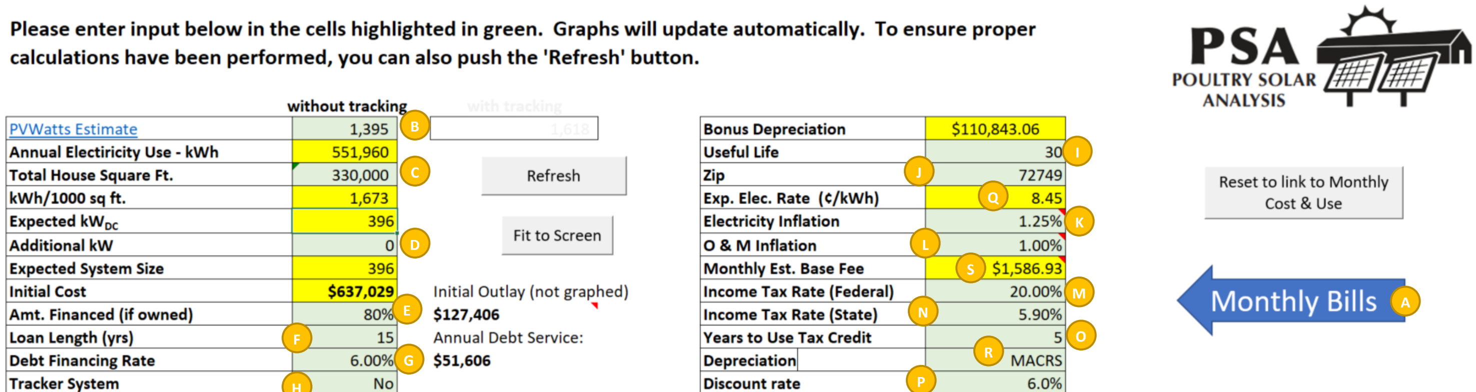
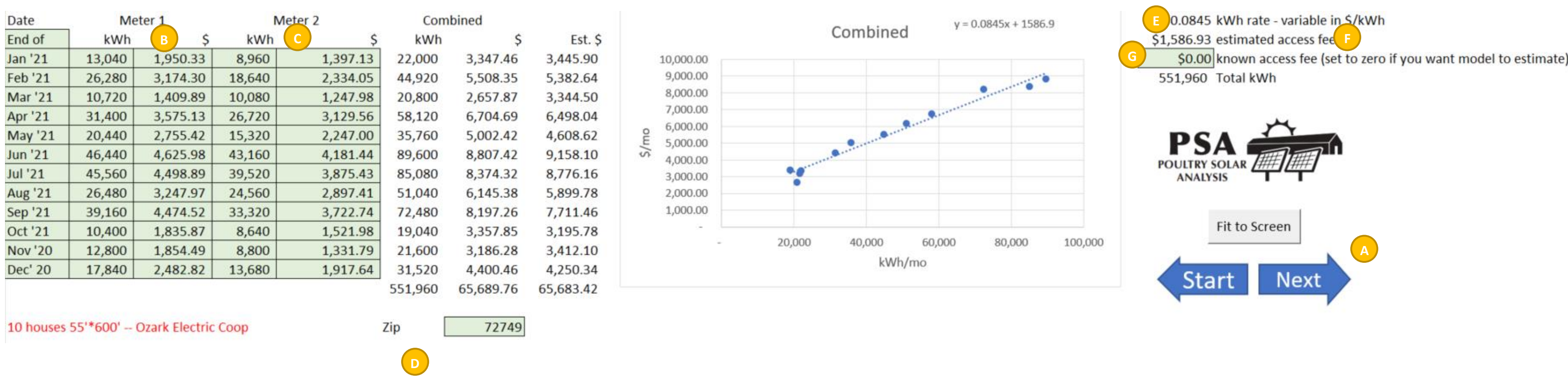
F. Tables and Figures



	without tracking	with tracking
PVWatts Estimate	1,395	1,618
Annual Electricity Use - kWh	551,960	
Total House Square Ft.	330,000	
kWh/1000 sq ft.	1,673	
Expected kW_{DC}	396	
Additional kW	0	
Expected System Size	396	
Initial Cost	$637,029	
Amt. Financed (if owned)	80%	
Loan Length (yrs)	15	
Debt Financing Rate	6.00%	
Tracker System	No	

Bonus Depreciation	$110,843.06
Useful Life	30
Zip	72749
Exp. Elec. Rate (¢/kWh)	8.45
Electricity Inflation	1.25%
O & M Inflation	1.00%
Monthly Est. Base Fee	$1,586.93
Income Tax Rate (Federal)	20.00%
Income Tax Rate (State)	5.90%
Years to Use Tax Credit	5
Depreciation	MACRS
Discount rate	6.0%

Figure 2.1. Farmer input information regarding solar system performance and size, operation size and location, and various financial factors.



Date	Meter 1		Meter 2		Combined		
End of	kWh	$	kWh	$	kWh	$	Est. $
Jan '21	13,040	1,950.33	8,960	1,397.13	22,000	3,347.46	3,445.90
Feb '21	26,280	3,174.30	18,640	2,334.05	44,920	5,508.35	5,382.64
Mar '21	10,720	1,409.89	10,080	1,247.98	20,800	2,657.87	3,344.50
Apr '21	31,400	3,575.13	26,720	3,129.56	58,120	6,704.69	6,498.04
May '21	20,440	2,755.42	15,320	2,247.00	35,760	5,002.42	4,608.62
Jun '21	46,440	4,625.98	43,160	4,181.44	89,600	8,807.42	9,158.10
Jul '21	45,560	4,498.89	39,520	3,875.43	85,080	8,374.32	8,776.16
Aug '21	26,480	3,247.97	24,560	2,897.41	51,040	6,145.38	5,899.78
Sep '21	39,160	4,474.52	33,320	3,722.74	72,480	8,197.26	7,711.46
Oct '21	10,400	1,835.87	8,640	1,521.98	19,040	3,357.85	3,195.78
Nov '20	12,800	1,854.49	8,800	1,331.79	21,600	3,186.28	3,412.10
Dec' 20	17,840	2,482.82	13,680	1,917.64	31,520	4,400.46	4,250.34
					551,960	65,689.76	65,683.42

Figure 2.2. Monthly cost & use section of PSA tool for operation electricity usage, cost, and location specification.

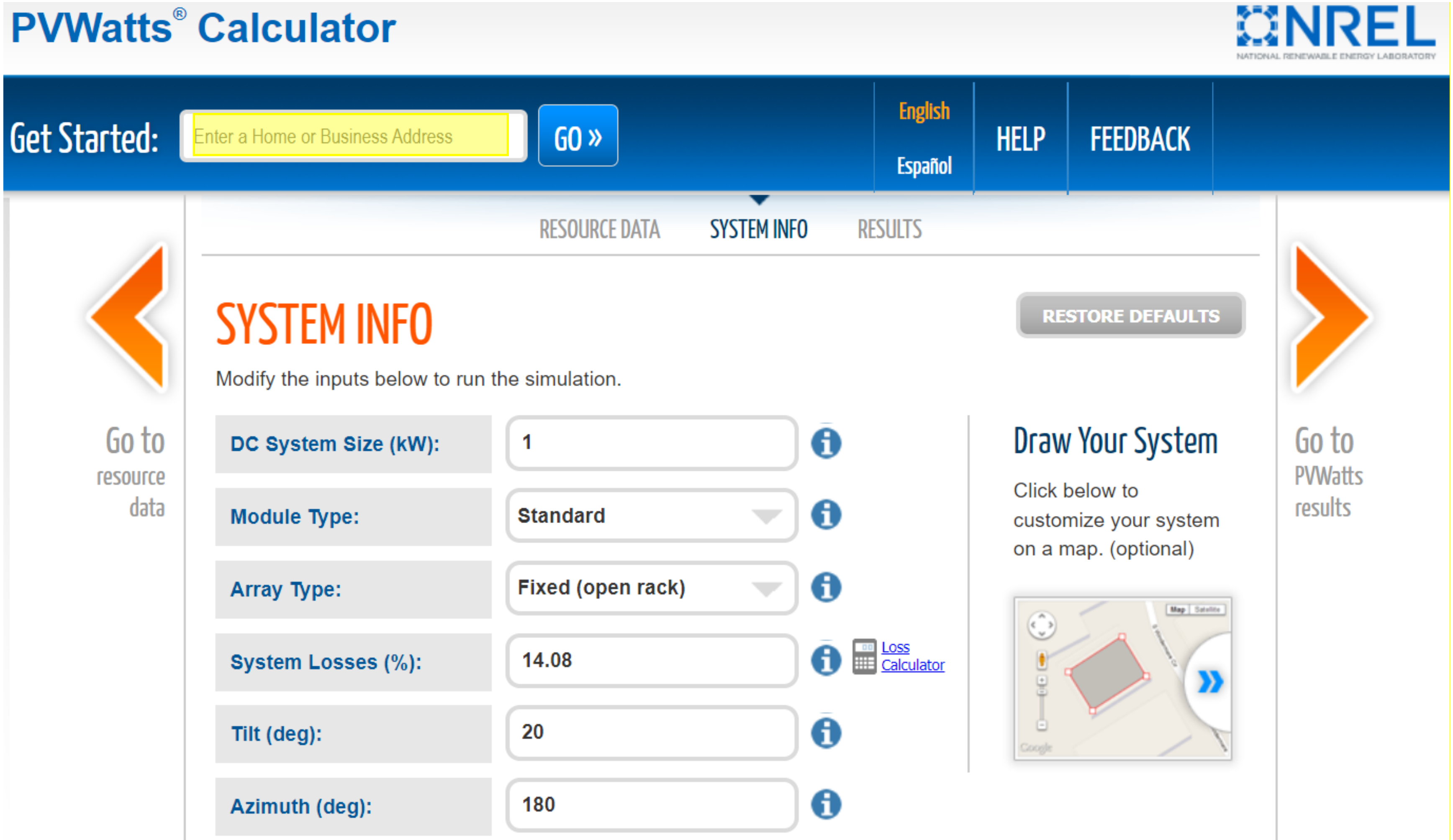


Figure 2.3. Producer input screens for NREL PVWatts calculator (NREL, 2022). Producer zip code is entered in highlighted area.

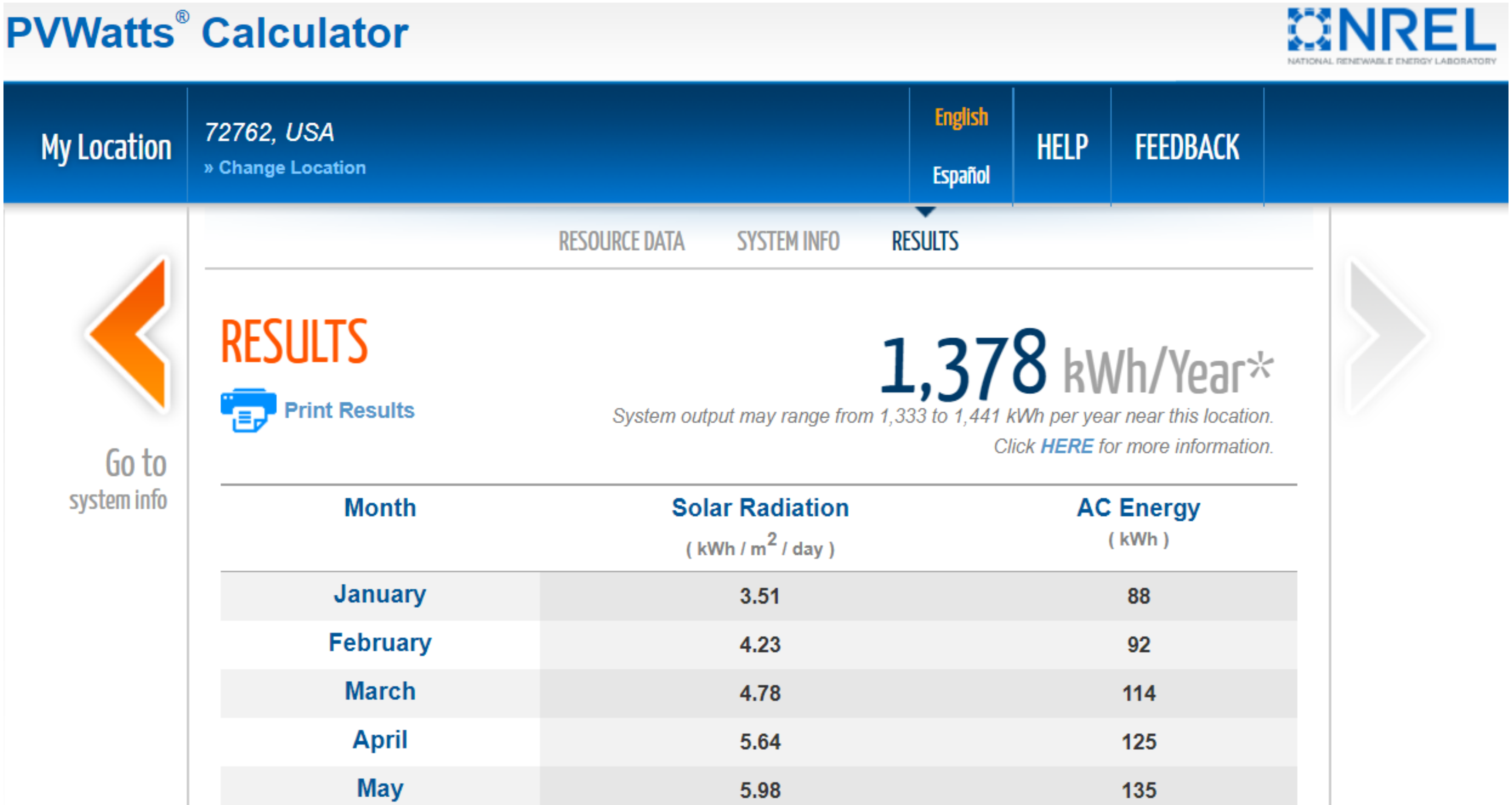


Figure 2.4. PVWatts output screen which shows the estimated solar panel output in kWh for each kW of solar system size in a given zip code.

30 yr NPV:	$216,971		**IMMEDIATE TAX BENEFIT WITH ALL BONUS DEPRECIATION REALIZED**					
Bonus Depreciation:	$110,843		Inverters:	$51,437		Down Payment:		-$127,406
B/E Elec. Cost (¢/kWh):	4.94		Size (kW_{DC}):	396		*Could be REAP benefit (if so add to NPV and B/E cost is lower)*		
Est. System Install Cost:	$637,029	1,395	80% financed @6% over 15 years.					
Tracking:	No	kWh/kW						

Year	Investment Tax Credit	Accounting Depreciation	resulting in Total Solar kWh	¢/kWh	Loan Interest	Debt Service (Principal)	Utility Bill without Solar	Utility Bill with Solar	Est. Prop. Tax for Solar System	Est. Maint. & Insurance for Solar System	Annual After Tax Benefit of Solar
1	$0	$110,843	551,960	8.45	-$29,989	-$21,617	-$65,928	-$19,281	-$4,618	-$4,155	$122,562
2	$165,628	$177,349	549,200	8.56	-$28,656	-$22,950	-$66,752	-$19,758	-$4,459	-$4,196	$193,807
3	$0	$106,409	546,454	8.66	-$27,241	-$24,365	-$67,586	-$20,243	-$4,300	-$4,238	$10,645
4	$0	$63,846	543,722	8.77	-$25,738	-$25,868	-$68,431	-$20,736	-$4,141	-$4,280	$105
5	$0	$63,846	541,003	8.88	-$24,142	-$27,464	-$69,287	-$21,237	-$3,981	-$4,323	$65
6	$0	$31,923	538,298	8.99	-$22,448	-$29,157	-$70,153	-$21,745	-$3,822	-$4,366	-$7,889
7	$0	$0	535,607	9.11	-$20,650	-$30,956	-$71,030	-$22,262	-$3,663	-$4,410	-$15,867
8	$0	$0	532,929	9.22	-$18,741	-$32,865	-$71,917	-$22,787	-$3,504	-$4,454	-$15,979
9	$0	$0	530,264	9.33	-$16,714	-$34,892	-$72,816	-$23,321	-$3,344	-$4,499	-$16,118
10	$0	$0	527,613	9.45	-$14,562	-$37,044	-$73,727	-$23,863	-$3,185	-$4,544	-$16,287
11	$0	$0	524,975	9.57	-$12,277	-$39,329	-$74,648	-$24,414	-$3,026	-$4,589	-$16,487
12	$0	$0	522,350	9.69	-$9,851	-$41,755	-$75,581	-$24,973	-$2,867	-$4,635	-$37,571
13	$0	$0	519,738	9.81	-$7,276	-$44,330	-$76,526	-$25,542	-$2,707	-$4,681	-$16,989
14	$0	$0	517,139	9.93	-$4,542	-$47,064	-$77,483	-$26,119	-$2,548	-$4,728	-$17,294
15	$0	$0	514,554	10.06	-$1,639	-$49,967	-$78,451	-$26,706	-$2,389	-$4,776	-$17,640
16	$0	$0	511,981	10.18	$0	$0	-$79,432	-$27,301	-$2,230	-$4,823	$33,934
17	$0	$0	509,421	10.31	$0	$0	-$80,425	-$27,906	-$2,070	-$4,872	$34,310
18	$0	$0	506,874	10.44	$0	$0	-$81,430	-$28,521	-$1,911	-$4,920	$34,687
19	$0	$0	504,340	10.57	$0	$0	-$82,448	-$29,146	-$1,752	-$4,969	$35,066
20	$0	$0	501,818	10.70	$0	$0	-$83,478	-$29,780	-$1,593	-$5,019	$35,447
21	$0	$0	499,309	10.83	$0	$0	-$84,522	-$30,424	-$1,433	-$5,069	$35,830
22	$0	$0	496,812	10.97	$0	$0	-$85,578	-$31,078	-$1,274	-$5,120	$36,214
23	$0	$0	494,328	11.11	$0	$0	-$86,648	-$31,742	-$1,115	-$5,171	$36,601
24	$0	$0	491,857	11.25	$0	$0	-$87,731	-$32,417	-$956	-$5,223	$19,118
25	$0	$0	489,397	11.39	$0	$0	-$88,828	-$33,102	-$796	-$5,275	$37,380
26	$0	$0	486,950	11.53	$0	$0	-$89,938	-$33,798	-$637	-$5,328	$37,772
27	$0	$0	484,516	11.67	$0	$0	-$91,062	-$34,505	-$478	-$5,381	$38,166
28	$0	$0	482,093	11.82	$0	$0	-$92,201	-$35,223	-$319	-$5,435	$38,562
29	$0	$0	479,682	11.97	$0	$0	-$93,353	-$35,951	-$159	-$5,489	$38,960
30	$0	$0	477,284	12.12	$0	$0	-$94,520	-$36,691	$0	-$5,544	$39,360

Figure 2.5. Example summary output for immediate income tax credit realization with farmer input selections summarized, system installation cost, and a breakdown of 30-year cash flow projections.

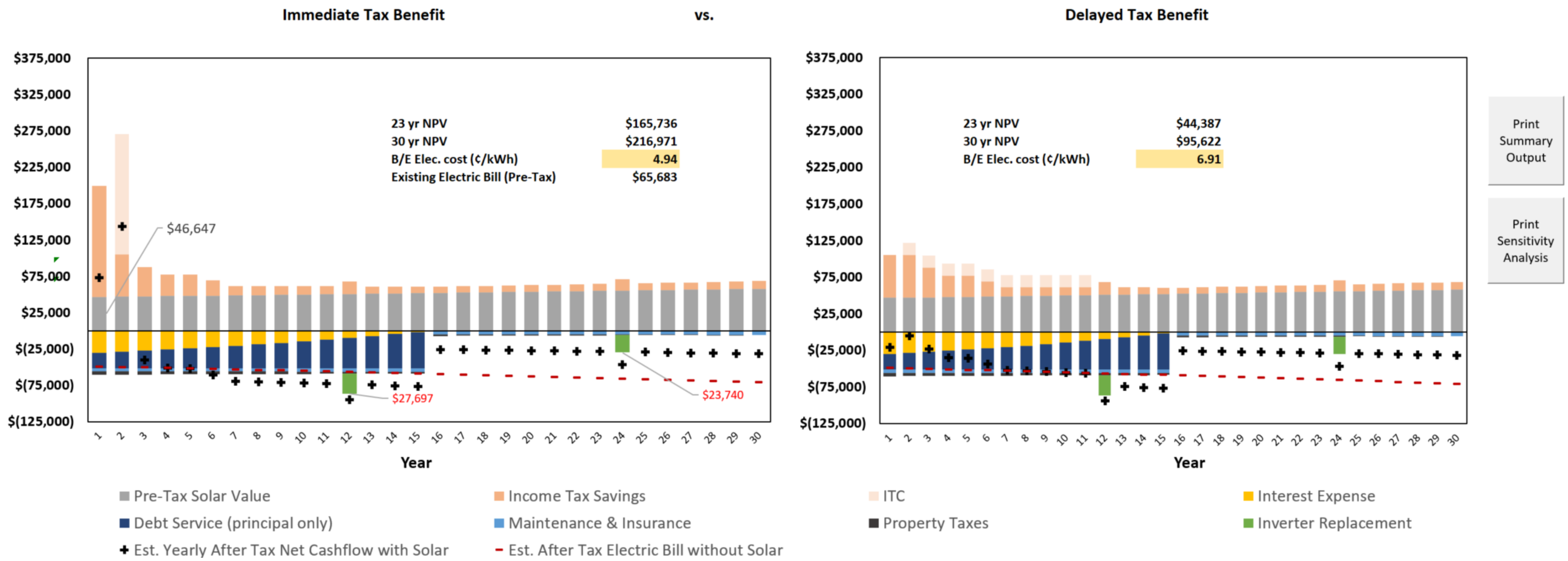


Figure 2.6. Example graphical summary of projected cashflow breakdown comparison of ITC_1 and ITC_{10} over 30 years given producer input selections. Capital budgeting metrics (breakeven electricity cost, 23-, and 30-year NPVs) and the producer's current annual electric bill are also presented for producer analysis and decision-making.

Income Tax Credit & Bonus Depreciation Tax Benefits Realized in Year 1 & 2

Loan Length	5	10	15	20	25	*% Amt. Financed*	60%	70%	80%	90%	100%
NPV	$192,091	$206,051	$218,498	$229,483	$239,081	*NPV*	$204,604	$211,551	$218,498	$225,445	$232,391
B/E ¢/kWh	5.35	5.12	4.92	4.74	4.59	*B/E ¢/kWh*	5.14	5.03	4.92	4.81	4.69
Interest Rate	5.00%	5.50%	6.00%	6.50%	7.00%	*Elec. Inflation Rate*	0.75%	1.00%	1.25%	1.50%	1.75%
NPV	$241,286	$230,001	$218,498	$206,778	$194,846	*NPV*	$191,610	$204,790	$218,498	$232,758	$247,598
B/E ¢/kWh	4.55	4.73	4.92	5.11	5.3	*B/E ¢/kWh*	5.19	5.05	4.92	4.79	4.66
Tracker	Yes	No	See note below for baseline assumptions			*Mtly Base Fee*	$1,269.54	$1,428.24	$1,586.93	$1,745.62	$1,904.32
NPV	$242,489	$218,498				*Elec. Rate ¢/kWh*	8.99	8.72	8.45	8.18	7.91
B/E ¢/kWh	4.53	4.92				*NPV*	$251,803	$235,151	$218,498	$201,845	$185,193

Income Tax Credit & Bonus Depreciation Tax Benefits Realized in Year 1-3

Loan Length	5	10	15	20	25	*% Amt. Financed*	60%	70%	80%	90%	100%
NPV	$161,630	$175,590	$188,036	$199,021	$208,620	*NPV*	$174,143	$181,089	$188,036	$194,983	$201,929
B/E cost	5.84	5.61	5.41	5.23	5.08	*B/E ¢/kWh*	5.64	5.52	5.41	5.3	5.19
Interest Rate	5.00%	5.50%	6.00%	6.50%	7.00%	*Elec. Inflation Rate*	0.75%	1.00%	1.25%	1.50%	1.75%
NPV	$210,824	$199,539	$188,036	$176,317	$164,384	*NPV*	$161,148	$174,328	$188,036	$202,297	$217,136
B/E ¢/kWh	5.04	5.23	5.41	5.6	5.79	*B/E ¢/kWh*	5.7	5.56	5.41	5.27	5.13
Tracker	Yes	No				*Mtly Base Fee*	$1,269.54	$1,428.24	$1,586.93	$1,745.62	$1,904.32
NPV	$214,092	$188,036				*Elec. Rate ¢/kWh*	8.99	8.72	8.45	8.18	7.91
B/E ¢/kWh	4.99	5.41				*NPV*	$221,342	$204,689	$188,036	$171,384	$154,731

Income Tax Credit & Bonus Depreciation Tax Benefits Realized in Years 1-6

Loan Length	5	10	15	20	25	*% Amt. Financed*	60%	70%	80%	90%	100%
NPV	$103,448	$117,408	$129,855	$140,840	$150,438	*NPV*	$115,961	$122,908	$129,855	$136,801	$143,748
B/E ¢/kWh	6.78	6.55	6.35	6.17	6.02	*B/E ¢/kWh*	6.58	6.46	6.35	6.24	6.13
Interest Rate	5.00%	5.50%	6.00%	6.50%	7.00%	*Elec. Inflation Rate*	0.75%	1.00%	1.25%	1.50%	1.75%
NPV	$152,643	$141,358	$129,855	$118,135	$106,203	*NPV*	$102,967	$116,147	$129,855	$144,115	$158,955
B/E ¢/kWh	5.98	6.17	6.35	6.54	6.73	*B/E ¢/kWh*	6.7	6.52	6.35	6.18	6.02
Tracker	Yes	No				*Mtly Base Fee*	$1,269.54	$1,428.24	$1,586.93	$1,745.62	$1,904.32
NPV	$159,855	$129,855				*Elec. Rate ¢/kWh*	8.99	8.72	8.45	8.18	7.91
B/E ¢/kWh	5.87	6.35				*NPV*	$163,160	$146,508	$129,855	$113,202	$96,550

Income Tax Credit & Bonus Depreciation Tax Benefits Realized in Years 1-11

Loan Length	5	10	15	20	25	*% Amt. Financed*	60%	70%	80%	90%	100%
NPV	$71,349	$85,309	$97,755	$108,740	$118,339	*NPV*	$83,862	$90,809	$97,755	$104,702	$111,649
B/E ¢/kWh	7.3	7.07	6.87	6.69	6.54	*B/E ¢/kWh*	7.1	6.98	6.87	6.76	6.65
Interest Rate	5.00%	5.50%	6.00%	6.50%	7.00%	*Elec. Inflation Rate*	0.75%	1.00%	1.25%	1.50%	1.75%
NPV	$120,543	$109,259	$97,755	$86,036	$74,103	*NPV*	$70,868	$84,047	$97,755	$112,016	$126,855
B/E ¢/kWh	6.5	6.68	6.87	7.06	7.25	*B/E ¢/kWh*	7.24	7.06	6.87	6.69	6.51
Tracker	Yes	No				*Mtly Base Fee*	$1,269.54	$1,428.24	$1,586.93	$1,745.62	$1,904.32
NPV	$129,932	$97,755				*Elec. Rate ¢/kWh*	8.99	8.72	8.45	8.18	7.91
B/E ¢/kWh	6.35	6.87				*NPV*	$131,061	$114,408	$97,755	$81,103	$64,450

Income Tax Credit & Bonus Depreciation Tax Benefits Realized in Years 1-16

Loan Length	5	10	15	20	25	*% Amt. Financed*	60%	70%	80%	90%	100%
NPV	$52,403	$66,363	$78,810	$89,794	$99,393	*NPV*	$64,916	$71,863	$78,810	$85,756	$92,703
B/E ¢/kWh	7.6	7.38	7.18	7	6.84	*B/E ¢/kWh*	7.4	7.29	7.18	7.06	6.95
Interest Rate	5.00%	5.50%	6.00%	6.50%	7.00%	*Elec. Inflation Rate*	0.75%	1.00%	1.25%	1.50%	1.75%
NPV	$101,598	$90,313	$78,810	$67,090	$55,158	*NPV*	$51,922	$65,102	$78,810	$93,070	$107,909
B/E ¢/kWh	6.81	6.99	7.18	7.37	7.56	*B/E ¢/kWh*	7.57	7.37	7.18	6.99	6.8
Tracker	Yes	No				*Mtly Base Fee*	$1,269.54	$1,428.24	$1,586.93	$1,745.62	$1,904.32
NPV	$112,271	$78,810				*Elec. Rate ¢/kWh*	8.99	8.72	8.45	8.18	7.91
B/E ¢/kWh	6.64	7.18				*NPV*	$112,115	$95,462	$78,810	$62,157	$45,505

NOTE: Sensitivity analyses are in comparison to a loan length of 15 years @6%, with 80% of purchase cost financed, without tracker technology, expected electricity inflation of 1.25%, O&M inflation of 1%, a base fee of $1,586.93/month, and Fed. and State Income tax rates of 20 and 5.9%, respectively.

Figure 2.7. Example sensitivity analysis output which includes resulting capital budgeting metrics from altering specific parameters: loan length, % amt. financed, interest rate, elect. inflation rate, tracker utilization, monthly base electric fee, and years to realize ITC and bonus depreciation

Table 2.1. Sensitivity Analysis parameter values across scenario impact ratios where the center column represents the baseline default value, the columns to the left are reductions from the base, and the columns to the right are increases to the base.

	- -	**-**	**Base**	+	+ +
Loan Length (yrs)	5	10	**15**	20	25
% Amt. Financed	60%	70%	**80%**	90%	100%
Interest Rate	5.0%	5.5%	**6.0%**	6.5%	7.0%
Elec. Inflation Rate	0.75%	1.00%	**1.25%**	1.50%	1.75%
Tracker	Yes	**No**			
Mtly Base Fee[a]	-20%	-10%	**Dflt.**	+10%	+20%
Degr. Rate	.3%	.4%	**.5%**	.6%	.7%

Notes: [a] the baseline default value for Mtly base fee is either the tool estimated fee or producer known access fee (if greater than 0) and the parameter is changed by subtracting 20%, subtracting 10%, 0%, adding 10%, and adding 20%, respectively

Table 2.2. Name and description of the variables used to perform various calculations within the PSA tool.

Variable Name	**Variable Description**
BD_n	*Bonus depreciation value assumed to be utilized in year n = 1 = PP * (1 - .5 * 26% federal tax credit rate) * federal income tax rate. All other* $BD_n = 0$
CFS_n	*After tax net cashflow with solar installation in year n =* $pCF_n + STS_n + FTS_n + ITC_n$
D_n	*Depreciation value in year n (where n = 1,2,3,4,5,6) calculated using the MACRS method:* D_1 *= (1 - .5 * 26% federal tax credit rate) * PP * .2;* D_2 *= (1 - .5 * 26% federal tax credit rate) * PP * .32;* D_3 *= (1 - .5 * 26% federal tax credit rate) * PP * .192;* D_4 *= (1 - .5 *26% federal tax credit rate) * PP * .1152;* D_5 *= (1 - .5 * 26% federal tax credit rate) * PP * .2;* D_6 *= (1 - .5 * 26% federal tax credit rate) * PP * .0576 OR PP/UL or zero if n>UL when straight line depreciation or SLN is chosen in Fig 2.1R*
DR_n	*Solar panel degradation rate applied multiplicatively. i.e. solar panel output in year n = initial solar panel output * (1 – DR)*$^{n-1}$
EB_n	*After tax electric bill without solar system in year n =* pEB_n ** [1 – (state income tax rate + (1 – state income tax rate) * federal income tax rate)]*
EBS_n	*Estimated producer electric bill with system installation in year n =* $EB_n + pSV_n$
ER_n	*Electricity rate in year n = tool estimated kWh rate in 'monthly cost & use' section * (1 + electric inflation rate)*$^{n-1}$
FTS_n	*Value of federal tax savings in year n =* $(D_n - PT_n - IR_n - OM_n - I_n - EBS_n)$ ** federal income tax rate + BD*
I_n	*Interest expense in a given year found by using CUMIPMT Excel function, which returns the cumulative interest paid on the loan in a year given interest rate with 12 annual payments made at the end of each month*

Table 2.2. (Cont.)

Variable Name	Variable Description
IO	*Producer's initial outlay in year of installation = (1 – percent amt. financed) * PP*
ITC_n	*Investment Tax Credit in year n = initial investment (INV) in the solar system * 26% Federal tax credit rate/YRITC where YRITC is years to realize income tax credit. Note that* ITC_n *are applied starting in year 2 as bonus depreciation (BD) is assumed to be used in year 1. Further,* ITC_n *is limited to the lesser of INV*.26/YRITC and BD*
ITS_n	*Total income tax savings (not including ITC) for year n =* $STS_n + FTS_n$
$IV_{12,24}$	*Solar system inverter replacement cost. Occurs in year 12 and 24:* IR_{12} *= SS * 1000 * .07;* IR_{24} *= SS * 1000 * .06. All other* IV_n *values are 0.*
K_n	*Annual kWh produced from solar system in year n = SS * PVWatts estimate (* 1.18 is tracker system is yes) * DR*
OM_n	*Maintenance & insurance expense in year n = [SS * 1000 * .0055(insurance rate) * .0055(if tracker is yes, then .00605; maintenance rate)] * (1 + O&M inflation rate)*$^{n-1}$
pCF_n	*Pre-tax cashflow in year n =* $PT_n + P_n + IR_n + OM_n + I_n + EBS_n$
pEB_n	*Pre-tax estimated producer electric bill without solar system installed in year n =(-1 * total annual electricity use (kWh) ** ER_n*) – 12 * monthly base fee * (1 + electricity inflation rate)*^{n}
P_n	*Principal expense in a given year found by using CUMPRINC Excel function, which returns the cumulative principal paid on the loan in a year given interest rate with 12 payments made at the end of each month annually*
PP	*System purchase price = installation cost ($/kW) * SS * 1000 (if tracker is yes, then * 1100). Installation cost is found by utilizing a VLOOKUP to return the appropriate installation cost given system size (Table 2.10)*
pSV_n	*Pre-tax value of electricity produced by solar system in year n =* $K_n * ER_n$
PT_n	*Property tax expense in year n assuming UL = [PP – (PP/UL) * n] * .0075(property tax rate) or zero if n>UL.*
R	*Discount rate selected by producer in cell J14 of the 'farmer input' section. Used to calculate NPVs*
SB_n	*After tax benefit of installing the solar system in year n =* $CFS_n - EB_n$*. Also can be stated as the difference in after-tax cashflows with solar installation and after-tax electric bill without solar installation. Note that if the producer has an initial outlay from not financing 100% of the installation cost, then in year 0,* SB_0 *= initial outlay*
SI	*Expected solar system installation size in kW = total annual electricity use (kWh)/PVWatts estimate. If tracker system is yes, then denominator is PVWatts estimate * 1.18*
SS	*System size in kW = annual electricity use/PVWatts production estimate [NREL, 2022], if tracker is yes then multiply PVWatts production estimate by 1.18. Add additional producer specified kW if necessary (Fig. 2.1C)*

Table 2.2. (Cont.)

Variable Name	Variable Description
STS_n	*Value of state tax savings in year n =* $(D_n - PT_n - IR_n - OM_n - I_n - EBS_n)$ ** state income tax rate*
SV_n	*Value of solar system production after tax in year n =* pSV_n ** [1 – (state income tax rate + (1 – state income tax rate) * federal income tax rate)]*
UL	*User-specified useful life for straight line depreciation and property tax calculations.*

Table 2.3. Producer scenario descriptions with highest and lowest absolute value impact ratios associated with realizing the tax benefits immediately (ITC1) and with realizing the tax benefits within the first 16 years (ITC15). Scenario IR summary tables included in appendix with high and low ITC1 and ITC15 values highlighted in yellow and green, respectively.

Scenario Description	Appendix Table Reference	Highest & lowest absolute value of IR factor: ITC1[a]	Highest & lowest absolute value of IR factor: ITC15[b]
1) 551,960 kWh annual use, 396 kW system size, $1,586.93 access fee, $0.0845 kWh rate, 1,395 kWh panel output, 10 houses 55'*600', Ozarks Elec. Coop	Table 2.4	Lower Base Fee (15%) Higher Degr. Rate (6%)	Tracker System (44%) Lower base fee (6%)
2) 456, 200 kWh annual use, 325 kW system size, $227.90 access fee, $0.0828 kWh rate, 1,402 kWh panel output, 6 houses 66'*600', Carroll Elec. Coop	Table 2.5	Higher Elec. Infl. Rate (14%) Lower Base Fee (3%)	Tracker System (49%) Lower Base Fee (1%)
3) 476,000 kWh annual use, 340 kW system size, $150.00 access fee, $0.0873 kWh rate, 1,402 kWh panel output, 6 houses 66*600', Carroll Elec. Coop	Table 2.6	Higher Elec. Infl. Rate (13%) Lower Base Fee (2%)	Tracker System (35%) Lower Base Fee (1%)
4[c]) 285,486 kWh annual use, 208 kW system size, $1,066.48 access fee, $0.0867 kWh rate, 1,374 kWh panel output, 10 houses 43'*500', Ozarks Elec. Coop	Table 2.7	Lower Base Fee (17.9%) Higher Degr. Rate (5%)	Higher Elec. Infl. Rate (36%) Lower Base Fee (8%)
5) 334,950 kWh annual use, 208 kW system size, 36 additional kW[d], $1,066.48 access fee, $0.0867 kWh rate, 1,374 kWh panel output, 10 houses 43'*500', Ozarks Elec, Coop	Table 2.8	Lower Base Fee (18%) Higher Degr. Rate (5%)	Tracker System (41%) Lower Base Fee (8%)
6) 423,709 kWh annual use, 308 kW system size, $1,419.74 access fee, $0.0883 kWh rate, 1,374 kWh panel output, 10 houses 43'*500', Ozarks Elec. Coop	Table 2.9	Lower Base Fee (19%) Higher Degr. Rate (5%)	Tracker System (37%) Lower Base Fee (8%)

Notes: [a] See respective appendix table to find high and low IR values highlighted in yellow
[b] See respective appendix table to find high and low IR values highlighted in green
[c] Scenarios 4-6 are the same producer with different additional kW, base fee, and operational assumptions
[d] Additional kW added to system size estimation to capture added demand of 7 residential meters assuming access fee and variable elec. rate remain constant

G. Appendix

Table 2.4. Producer scenario 1 sensitivity analysis impact ratios for decision parameters.

Scenario 1 Impact Ratios (Default base fee of $1,586.93 and electricity rate of 8.45 ¢/kWh)									
Loan Length [b]	**5**	**10**	**20**	**25**	***% Amt. Financed***	**60%**	**70%**	**90%**	**100%**
ITC1	-12.2%	-5.8%	5.1%	9.5%	*ITC1*	-6.4%	-3.2%	3.2%	6.4%
ITC2	-14.2%	-6.7%	5.9%	11.1%	*ITC2*	-7.5%	-3.7%	3.7%	7.5%
ITC5	-20.8%	-9.8%	8.6%	16.2%	*ITC5*	-10.9%	-5.5%	5.5%	10.9%
ITC10	-27.8%	-13.1%	11.5%	21.6%	*ITC10*	-14.6%	-7.3%	7.3%	14.6%
ITC15	-34.7%	-16.3%	14.4%	27.0%	*ITC15*	-18.2%	-9.1%	9.1%	18.2%
Interest Rate	**5.00%**	**5.50%**	**6.50%**	**7.00%**	***Elec. Inflation Rate***	**0.75%**	**1.00%**	**1.50%**	**1.75%**
ITC1	10.6%	5.3%	-5.4%	-11.0%	*ITC1*	-12.4%	-6.3%	6.6%	13.4%
ITC2	12.3%	6.2%	-6.3%	-12.8%	*ITC2*	-14.4%	-7.4%	7.7%	15.6%
ITC5	17.9%	9.0%	-9.2%	-18.6%	*ITC5*	-21.0%	-10.7%	11.2%	22.8%
ITC10	24.0%	12.1%	-12.3%	-24.9%	*ITC10*	-28.1%	-14.3%	14.9%	30.4%
ITC15	29.9%	15.1%	-15.4%	-31.0%	*ITC15*	-35.1%	-17.9%	18.6%	38.0%
Tracker	**Yes**	**No**			***Mtly. Base Fee***	**$1,270**	**$1,428**	**$1,746**	**$1,904**
ITC1	11.1%	0.0%			*ITC1*	15.3%	7.7%	-7.7%	-15.3%
ITC2	14.1%	0.0%			*ITC2*	17.9%	8.9%	-8.9%	-17.9%
ITC5	23.6%	0.0%			*ITC5*	6.4%	3.2%	-3.2%	-6.4%
ITC10	33.8%	0.0%			*ITC10*	6.4%	3.2%	-3.2%	-6.4%
ITC15	43.9%	0.0%			*ITC15*	6.4%	3.2%	-3.2%	-6.4%
					DR	**0.3%**	**0.4%**	**0.6%**	**0.7%**
Yrs. To realize [a]: *ITC1*	0%				*ITC1*	5.33%	2.64%	-2.60%	-5.16%
ITC2	-14%				*ITC2*	6.21%	3.08%	-3.03%	-6.01%
ITC5	-41%				*ITC5*	9.04%	4.49%	-4.41%	-8.76%
ITC10	-56%				*ITC10*	12.10%	6.00%	-5.90%	-11.71%
ITC15	-65%				*ITC15*	15.10%	7.49%	-7.37%	-14.62%

Notes: [a] The boxed in parameter impact ratio for years to realize income tax credit and bonus depreciation in the bottom left of the table is arranged vertically such that the default value is at the top (0%) and changes in NPVs from the baseline value are below

[b] Parameter column header rationale referenced in Table 2.1

Table 2.5. Producer scenario 2 sensitivity analysis impact ratios for decision parameters.

Scenario 2 Impact Ratios (Default base fee of $227.90 and electricity rate of 8.28 ¢/kWh)

Loan Length [b]	**5**	**10**	**20**	**25**	***% Amt. Financed***	**60%**	**70%**	**90%**	**100%**
ITC1	-12.7%	-6.0%	5.3%	9.9%	*ITC1*	-6.7%	-3.3%	3.3%	6.7%
ITC2	-14.9%	-7.0%	6.2%	11.6%	*ITC2*	-7.8%	-3.9%	3.9%	7.8%
ITC5	-22.1%	-10.4%	9.2%	17.2%	*ITC5*	-11.6%	-5.8%	5.8%	11.6%
ITC10	-30.3%	-14.3%	12.6%	23.6%	*ITC10*	-15.9%	-8.0%	8.0%	15.9%
ITC15	-38.6%	-18.2%	16.1%	30.1%	*ITC15*	-20.3%	-10.2%	10.2%	20.3%
Interest Rate	**5.00%**	**5.50%**	**6.50%**	**7.00%**	***Elec. Inflation Rate***	**0.75%**	**1.00%**	**1.50%**	**1.75%**
ITC1	11.0%	5.5%	-5.6%	-11.4%	*ITC1*	-12.7%	-6.5%	6.7%	13.7%
ITC2	12.8%	6.5%	-6.6%	-13.3%	*ITC2*	-14.8%	-7.6%	7.9%	16.1%
ITC5	19.1%	9.6%	-9.8%	-19.8%	*ITC5*	-22.1%	-11.3%	11.7%	23.9%
ITC10	26.1%	13.2%	-13.4%	-27.1%	*ITC10*	-30.2%	-15.4%	16.0%	32.7%
ITC15	33.3%	16.8%	-17.2%	-34.6%	*ITC15*	-38.6%	-19.7%	20.5%	41.7%
Tracker	**Yes**	**No**			***Mtly. Base Fee***	**$182**	**$205**	**$250**	**$273**
ITC1	11.5%	0.0%			*ITC1*	2.8%	1.4%	-1.4%	-2.8%
ITC2	14.7%	0.0%			*ITC2*	3.3%	1.7%	-1.7%	-3.3%
ITC5	25.1%	0.0%			*ITC5*	1.2%	0.6%	-0.6%	-1.1%
ITC10	36.9%	0.0%			*ITC10*	1.2%	0.6%	-0.6%	-1.1%
ITC15	49.0%	0.0%			*ITC15*	1.2%	0.6%	-0.6%	-1.1%
					DR	**0.3%**	**0.4%**	**0.6%**	**0.7%**
Yrs. To realize [a]: *ITC1*	0%				*ITC1*	5.45%	2.70%	-2.66%	-5.28%
ITC2	-15%				*ITC2*	6.38%	3.17%	-3.12%	-6.18%
ITC5	-43%				*ITC5*	9.49%	4.71%	-4.63%	-9.19%
ITC10	-58%				*ITC10*	12.99%	6.44%	-6.34%	-12.57%
ITC15	-67%				*ITC15*	16.59%	8.23%	-8.10%	-16.06%

Notes: [a] The boxed in parameter impact ratio for years to realize income tax credit and bonus depreciation in the bottom left of the table is arranged vertically such that the default value is at the top (0%) and changes in NPVs from the baseline value are below
[b] Parameter column header rationale referenced in Table 2.

Table 2.6. Producer scenario 3 sensitivity analysis impact ratios for decision parameters.

Scenario 3 Impact Ratios (Default base fee of $150 and electricity rate of 8.73 ¢/kWh)

Loan Length [b]	**5**	**10**	**20**	**25**	***% Amt. Financed***	**60%**	**70%**	**90%**	**100%**
ITC1	-11.2%	-5.3%	4.7%	8.7%	*ITC1*	-5.9%	-2.9%	2.9%	5.9%
ITC2	-12.9%	-6.1%	5.4%	10.0%	*ITC2*	-6.8%	-3.4%	3.4%	6.8%
ITC5	-18.0%	-8.5%	7.5%	14.0%	*ITC5*	-9.4%	-4.7%	4.7%	9.4%
ITC10	-23.0%	-10.8%	9.6%	17.9%	*ITC10*	-12.1%	-6.0%	6.0%	12.1%
ITC15	-27.5%	-13.0%	11.4%	21.4%	*ITC15*	-14.5%	-7.2%	7.2%	14.5%
Interest Rate	**5.00%**	**5.50%**	**6.50%**	**7.00%**	***Elec. Inflation Rate***	**0.75%**	**1.00%**	**1.50%**	**1.75%**
ITC1	9.7%	4.9%	-5.0%	-10.0%	*ITC1*	-11.8%	-6.0%	6.2%	12.8%
ITC2	11.1%	5.6%	-5.7%	-11.5%	*ITC2*	-13.5%	-6.9%	7.2%	14.6%
ITC5	15.5%	7.8%	-8.0%	-16.1%	*ITC5*	-18.9%	-9.6%	10.0%	20.4%
ITC10	19.8%	10.0%	-10.2%	-20.6%	*ITC10*	-24.1%	-12.3%	12.8%	26.1%
ITC15	23.7%	12.0%	-12.2%	-24.6%	*ITC15*	-28.9%	-14.7%	15.3%	31.3%
Tracker	**Yes**	**No**			***Mtly. Base Fee***	**$120**	**$135**	**$165**	**$180**
ITC1	10.2%	0.0%			*ITC1*	1.8%	0.9%	-0.9%	-1.8%
ITC2	12.7%	0.0%			*ITC2*	2.0%	1.0%	-1.0%	-2.0%
ITC5	20.4%	0.0%			*ITC5*	0.8%	0.3%	-0.3%	-0.8%
ITC10	28.0%	0.0%			*ITC10*	0.8%	0.3%	-0.3%	-0.8%
ITC15	34.8%	0.0%			*ITC15*	0.8%	0.3%	-0.3%	-0.8%
					DR	**0.3%**	**0.4%**	**0.6%**	**0.7%**
Yrs. to realize [a]*: ITC1*	0%				*ITC1*	5.07%	2.51%	-2.47%	-4.91%
ITC2	-13%				*ITC2*	5.82%	2.89%	-2.84%	-5.64%
ITC5	-38%				*ITC5*	8.12%	4.03%	-3.96%	-7.86%
ITC10	-51%				*ITC10*	10.39%	5.15%	-5.07%	-10.06%
ITC15	-59%				*ITC15*	12.44%	6.17%	-6.07%	-12.04%

Notes: [a] The boxed in parameter impact ratio for years to realize income tax credit and bonus depreciation in the bottom left of the table is arranged vertically such that the default value is at the top (0%) and changes in NPVs from the baseline value are below
[b] Parameter column header rationale referenced in Table 2.

Table 2.7. Producer scenario 4 sensitivity analysis impact ratios for decision parameters.

Scenario 4 Impact Ratios (Default base fee of $1066.48 and electricity rate of 8.67 ¢/kWh)									
Loan Length [b]	**5**	**10**	**20**	**25**	***% Amt. Financed***	**60%**	**70%**	**90%**	**100%**
ITC1	-11.9%	-5.6%	5.0%	9.3%	*ITC1*	-6.3%	-3.1%	3.1%	6.3%
ITC2	-13.8%	-6.5%	5.8%	10.8%	*ITC2*	-7.3%	-3.6%	3.6%	7.3%
ITC5	-19.9%	-9.4%	8.3%	15.5%	*ITC5*	-10.5%	-5.2%	5.2%	10.5%
ITC10	-26.3%	-12.4%	10.9%	20.5%	*ITC10*	-13.8%	-6.9%	6.9%	13.8%
ITC15	-32.4%	-15.3%	13.5%	25.3%	*ITC15*	-17.1%	-8.5%	8.5%	17.1%
Interest Rate	**5.00%**	**5.50%**	**6.50%**	**7.00%**	***Elec. Inflation Rate***	**0.75%**	**1.00%**	**1.50%**	**1.75%**
ITC1	10.3%	5.2%	-5.3%	-10.7%	*ITC1*	-12.2%	-6.2%	6.5%	13.2%
ITC2	12.0%	6.0%	-6.1%	-12.4%	*ITC2*	-14.2%	-7.2%	7.5%	15.3%
ITC5	17.2%	8.7%	-8.8%	-17.9%	*ITC5*	-20.4%	-10.4%	10.8%	22.1%
ITC10	22.7%	11.5%	-11.7%	-23.6%	*ITC10*	-26.9%	-13.7%	14.3%	29.1%
ITC15	28.0%	14.1%	-14.4%	-29.0%	*ITC15*	-33.2%	-16.9%	17.6%	35.9%
Tracker	**Yes**	**No**			***Mtly. Base Fee***	**$853**	**$960**	**$1,173**	**$1,280**
ITC1	5.1%	0.0%			*ITC1*	17.9%	9.0%	-9.0%	-17.9%
ITC2	6.2%	0.0%			*ITC2*	20.8%	10.4%	-10.4%	-20.8%
ITC5	9.6%	0.0%			*ITC5*	7.5%	3.7%	-3.8%	-7.6%
ITC10	13.2%	0.0%			*ITC10*	7.5%	3.7%	-3.8%	-7.6%
ITC15	16.7%	0.0%			*ITC15*	7.5%	3.7%	-3.8%	-7.6%
					DR	**0.3%**	**0.4%**	**0.6%**	**0.7%**
Yrs. to realize [a]: *ITC1*	0%				*ITC1*	5.26%	2.61%	-2.57%	-5.09%
ITC2	-14%				*ITC2*	6.10%	3.02%	-2.98%	-5.90%
ITC5	-40%				*ITC5*	8.77%	4.35%	-4.28%	-8.50%
ITC10	-55%				*ITC10*	11.58%	5.74%	-5.65%	-11.21%
ITC15	-63%				*ITC15*	14.27%	7.08%	-6.96%	-13.82%

Notes: [a] The boxed in parameter impact ratio for years to realize income tax credit and bonus depreciation in the bottom left of the table is arranged vertically such that the default value is at the top (0%) and changes in NPVs from the baseline value are below
[b] Parameter column header rationale referenced in Table 2.

Table 2.8. Producer scenario 5 sensitivity analysis impact ratios for decision parameters.

Scenario 5 Impact Ratios (Default base fee of $1066.48 and electricity rate of 8.67 ¢/kWh with added kW to system size)

Loan Length [b]	**5**	**10**	**20**	**25**	***% Amt. Financed***	**60%**	**70%**	**90%**	**100%**
ITC1	-11.9%	-5.6%	5.0%	9.3%	*ITC1*	-6.3%	-3.1%	3.1%	6.3%
ITC2	-13.8%	-6.5%	5.8%	10.8%	*ITC2*	-7.3%	-3.6%	3.6%	7.3%
ITC5	-19.9%	-9.4%	8.3%	15.5%	*ITC5*	-10.5%	-5.2%	5.2%	10.5%
ITC10	-26.3%	-12.4%	10.9%	20.5%	*ITC10*	-13.8%	-6.9%	6.9%	13.8%
ITC15	-32.4%	-15.3%	13.5%	25.3%	*ITC15*	-17.1%	-8.5%	8.5%	17.1%
Interest Rate	**5.00%**	**5.50%**	**6.50%**	**7.00%**	***Elec. Inflation Rate***	**0.75%**	**1.00%**	**1.50%**	**1.75%**
ITC1	10.3%	5.2%	-5.3%	-10.7%	*ITC1*	-12.2%	-6.2%	6.5%	13.2%
ITC2	12.0%	6.0%	-6.1%	-12.4%	*ITC2*	-14.2%	-7.2%	7.5%	15.3%
ITC5	17.2%	8.7%	-8.8%	-17.9%	*ITC5*	-20.4%	-10.4%	10.8%	22.1%
ITC10	22.7%	11.5%	-11.7%	-23.6%	*ITC10*	-26.9%	-13.7%	14.3%	29.1%
ITC15	28.0%	14.1%	-14.4%	-29.0%	*ITC15*	-33.2%	-16.9%	17.6%	35.9%
Tracker	**Yes**	**No**			***Mtly. Base Fee***	**$853**	**$960**	**$1,173**	**$1,280**
ITC1	10.8%	0.0%			*ITC1*	17.9%	9.0%	-9.0%	-17.9%
ITC2	13.7%	0.0%			*ITC2*	20.8%	10.4%	-10.4%	-20.8%
ITC5	22.6%	0.0%			*ITC5*	7.5%	3.7%	-3.8%	-7.6%
ITC10	32.0%	0.0%			*ITC10*	7.5%	3.7%	-3.8%	-7.6%
ITC15	41.1%	0.0%			*ITC15*	7.5%	3.7%	-3.8%	-7.6%
					DR	**0.3%**	**0.4%**	**0.6%**	**0.7%**
Yrs. to realize [a]*: ITC1*	0%				*ITC1*	5.26%	2.61%	-2.57%	-5.09%
ITC2	-14%				*ITC2*	6.10%	3.02%	-2.98%	-5.90%
ITC5	-40%				*ITC5*	8.77%	4.35%	-4.28%	-8.50%
ITC10	-55%				*ITC10*	11.58%	5.74%	-5.65%	-11.21%
ITC15	-63%				*ITC15*	14.27%	7.08%	-6.97%	-13.82%

Notes: [a] The boxed in parameter impact ratio for years to realize income tax credit and bonus depreciation in the bottom left of the table is arranged vertically such that the default value is at the top (0%) and changes in NPVs from the baseline value are below
[b] Parameter column header rationale referenced in Table 2.

Table 2.9. Producer scenario 6 sensitivity analysis impact ratios for decision parameters.

Scenario 6 Impact Ratios (Default base fee of $1419.74 and electricity rate of 8.83 ¢/kWh)									
Loan Length [b]	**5**	**10**	**20**	**25**	***% Amt. Financed***	**60%**	**70%**	**90%**	**100%**
ITC1	-11.4%	-5.4%	4.8%	8.9%	*ITC1*	-6.0%	-3.0%	3.0%	6.0%
ITC2	-13.2%	-6.2%	5.5%	10.3%	*ITC2*	-6.9%	-3.5%	3.5%	6.9%
ITC5	-18.6%	-8.8%	7.7%	14.5%	*ITC5*	-9.8%	-4.9%	4.9%	9.8%
ITC10	-24.0%	-11.3%	10.0%	18.7%	*ITC10*	-12.6%	-6.3%	6.3%	12.6%
ITC15	-29.0%	-13.7%	12.1%	22.6%	*ITC15*	-15.3%	-7.6%	7.6%	15.3%
Interest Rate	**5.00%**	**5.50%**	**6.50%**	**7.00%**	***Elec. Inflation Rate***	**0.75%**	**1.00%**	**1.50%**	**1.75%**
ITC1	9.9%	5.0%	-5.1%	-10.3%	*ITC1*	-11.9%	-6.1%	6.3%	12.9%
ITC2	11.4%	5.7%	-5.9%	-11.8%	*ITC2*	-13.7%	-7.0%	7.3%	14.9%
ITC5	16.0%	8.1%	-8.2%	-16.6%	*ITC5*	-19.4%	-9.9%	10.3%	21.0%
ITC10	20.7%	10.5%	-10.7%	-21.5%	*ITC10*	-25.0%	-12.8%	13.3%	27.1%
ITC15	25.0%	12.6%	-12.9%	-26.0%	*ITC15*	-30.2%	-15.4%	16.0%	32.7%
Tracker	**Yes**	**No**			***Mtly. Base Fee***	**$1,136**	**$1,278**	**$1,562**	**$1,704**
ITC1	10.4%	0.0%			*ITC1*	19.2%	9.6%	-9.6%	-19.2%
ITC2	13.0%	0.0%			*ITC2*	22.1%	11.1%	-11.1%	-22.1%
ITC5	21.1%	0.0%			*ITC5*	8.3%	4.1%	-4.2%	-8.4%
ITC10	29.3%	0.0%			*ITC10*	8.3%	4.1%	-4.2%	-8.4%
ITC15	36.8%	0.0%			*ITC15*	8.3%	4.1%	-4.2%	-8.4%
					DR	**0.3%**	**0.4%**	**0.6%**	**0.7%**
Yrs. to realize [a]*: ITC1*	0%				*ITC1*	5.36%	2.77%	-2.29%	-4.76%
ITC2	-13%				*ITC2*	5.91%	2.93%	-2.88%	-5.72%
ITC5	-38%				*ITC5*	8.33%	4.13%	-4.07%	-8.07%
ITC10	-52%				*ITC10*	10.76%	5.34%	-5.25%	-10.42%
ITC15	-61%				*ITC15*	13.00%	6.45%	-6.34%	-12.59%

Notes: [a] The boxed in parameter impact ratio for years to realize income tax credit and bonus depreciation in the bottom left of the table is arranged vertically such that the default value is at the top (0%) and changes in NPVs from the baseline value are below
[b] Parameter column header rationale referenced in Table 2.

Table 2.10. Solar system installation cost variations dependent upon system size (NREL, 2022). Table used to VLOOKUP installation cost for PSA tool estimate.

Purchase Price Lookup Table	
System Size (kW)	**Est. Cost ($/kW)**
1	1.70
200	1.61
500	1.51
1000	1.35
2000	1.29
5000	1.28
10000	1.26
20000	1.25

Chapter III. The Student Health and Success Foundation Business Plan

A. Company Overview

According to *U.S. News and World Report*, Arkansas currently ranks 38th overall in Pre-K through 12th grade state education rankings, and 45th in college readiness (*U.S. News & World Report*, 2022b). The Student Health and Success Foundation's mission is to provide an extracurricular educational program through which students will develop hard and soft skills with the purpose of improving academic performance and expanding access to better and more meaningful opportunities and resources through community connectivity. With our multidisciplinary curriculum tailored to reduce the educational gap that exists among the primary and secondary school student population in the state in comparison to the U.S., we envision creating urgency among motivated groups of students who are interested in breaking the mold of average academic performance. The goal is for these students to trigger a sustainable cycle of change throughout the community addressing overall socioeconomic status, health, sanitation, nutrition, and post-graduation skill development needs among the student population to build social capital and foster leaders of the future.

B. Problem & Opportunity

Arkansas as a whole is lagging behind other leading U.S. states in terms of public education effectiveness and has consistently been in such a position for many years. While this is alarming at the aggregate level, individual students within public school districts in Arkansas are facing educational disparity, which is being driven in large part by the inefficient allocation and distribution of public education resources for the students that need those resources the most (Knoff, 2022). The educational disparity which exists among Pre-K through 12th grade students in Arkansas is largely contributing to Arkansas' consistent low educational rank on the national scale and is putting students at a huge disadvantage in developing the skills and abilities that are necessary for a fruitful life and career post-graduation.

1. Nutrition

An important resource for students that is often overlooked, especially the younger-aged students who are in their early physical and mental growth stages, is affordable access to nutritious food. Research has demonstrated that children in families who are not sure where their next meal may come from are likely to face educational challenges that can prohibit proper scholarly development (Weber, 2019). Additionally, kids who live in a home that lacks consistent access to food are more likely to experience developmental impairments to normal, everyday functions, like speaking and moving (Weber, 2019). While public schools within Arkansas do provide students with two meals (and at a reduced cost to students who need such adjustment), there are a large number of children who do not see a third meal during the week and experience difficulty in acquiring food on the weekends. In fact, one in four children in Arkansas struggles with hunger (U.S. Department of Agriculture [USDA] Economic Research Service [ERS], 2022) and approximately six million children nationwide (roughly 9% of all U.S. children) live in households that experience food insecurity (USDA ERS, 2022). Furthermore, more than 41% of Arkansas households fail to achieve financial stability to afford the bare household necessities (food, water, clothing, cleaning supplies, access to healthcare, reliable transportation, etc.); however, only 17% of these families met the standards for financial assistance, meaning the majority of financially instable households in Arkansas are left to struggle for necessities on their own (ALICE in Arkansas, 2022). It is extremely difficult for students to be able to focus in a classroom when they are experiencing hunger. Further still, children need proper nutrition to continue to fully develop their mind (Weber, 2019). Numerous studies show that children who are properly nourished and consume a well-balanced diet will perform better in the classroom (Healthy Food Choices in Schools, 2019; Weber, 2019). The importance of adequate, affordable access to proper nutritional resources and the knowledge of what to consume in a well-balanced diet for students cannot be emphasized enough.

2. Education

Additional education and tutoring resources outside of the typical public-school schedule are often needed for students to succeed in the classroom. Given the limited time in a school day for this type of education, it is difficult for teachers to provide adequate assistance to all students in accordance with their specialized needs. Therefore, parents/guardians often seek additional tutoring services outside of school to make sure their student keeps up and performs at a high level. Unfortunately, tutoring services are expensive and can sometimes be logistically infeasible for a family given their location and financial situation in needing to address more pressing issues (i.e., nutrition and healthcare). For elementary-aged children, parents can expect to pay approximately $20 per hour for a high-school-aged student as a tutor, but if a more experienced tutoring professional is needed, rates can be as high as $75 per hour (Elementary Assessments, 2022) for tutoring in standard school subjects (math, English, history, science). For secondary-age students who need tutoring assistance in standard school subjects, the costs are roughly the same as for elementary-aged students (Tutors.com, 2022). However, if tutoring is needed for SAT/ACT prep, parents can expect a minimum cost of $45 per hour and could pay as much as $100 per hour (Bowman, 2022). To put these tutoring costs into perspective, median annual household income in Arkansas is just $49,475 (U.S. Census Bureau, 2022), which translates to a combined household income of under $24 per hour. Essentially, the median Arkansas family can expect to pay just as much for tutoring services as what is earned by the entire household.

Families fortunate enough to afford these prices might be able to acquire tutoring services in their home or via the internet, but oftentimes, families are tasked with arranging transportation to and from the tutor's facility (tutor center, home, library, etc.) which is both time consuming and costly, adding another level of difficulty for families. Educational resources outside of public schools are often concentrated in highly urbanized communities in Arkansas that are several miles away from students in rural communities who need those resources. For example, families located in the County Line School District that were in need of educational assistance for their children indicated that the closest city to find these advanced resources is Fort Smith, AR, which is a 60 mile (80 minute) round-trip.

Through customer discovery within various Arkansas school districts (County Line, Paris, Booneville, Ozark, and Lavaca), the families that need the most support are families living under the federal poverty line, which ranges from $17,420 for a 2-person household to $44,660 for an 8-person household (U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation, 2021). In addition to these families, through customer discovery interviews within various Arkansas school districts (County Line, Paris, Booneville, Ozark, and Lavaca), Asset Limited, Income Constrained, Employed (ALICE) families also make up a large segment of the population that are in need of support. ALICE families earn just above the Federal Poverty Level but earn less than what it costs to regularly afford necessities (United for Alice, 2022). ALICE families with primary- and secondary-aged students are in need of easy and affordable access to educational assistance and nutritional resources. The two aforementioned problems with educational and nutritional disparity contribute to the vicious cycle of poverty (Arkansas Advocates for Children & Families, 2014) in Arkansas. However, it is important to note that those problems are not the only causes of poverty. Raj Chetty has determined that parental home ownership has the most direct correlation with student graduation rates (Chetty et al., 2020). Dr. Chetty's approach to determining factors that lead to social upward mobility showed that by moving from a high-poverty to a lower-poverty neighborhood in childhood, earnings and college attendance rates are increased when the child enters adulthood (Wellisz, 2018). A specific finding of their study is that for children under the age of 13, earnings were 31% more in adulthood after a move away from a high-poverty neighborhood (Wellisz, 2018).

Such a move is not easily accomplished for many poverty-stricken families. Therefore, addressing the educational gap head-on and giving students and their families access to existing resources for assistance in alleviating other poverty-related problems (such as home purchasing assistance programs and community food banks) is essential to ensure the best opportunity for success is available for students to trigger a sustainable community cycle of change, with the hope that upward mobility will allow them to offer greater opportunities for their children in the future, and the cycle continuing throughout generations.

C. Customer, Curriculum, & Competitive Advantage

Our company's curriculum will focus on directly impacting children's development and success in the most effective way possible, while ensuring children are not overwhelmed with too much at one time. By impact, we mean we will provide additional tools and resources to students and their families (which are outlined below) for students to beat the average baseline of academic performance programs (typically measured by statewide standardized tests) in students' respective communities. Key performance indicators to be measured by our organization which will quantitatively support our community impact are obesity/undernourishment rates measured through body mass index (BMI) scores, food disposal data collected by schools, members' standardized test scores/GPA, graduation rates, college acceptance rates, and financial aid (grants and scholarships) amounts received by members of our organization. Studies show that children learn and develop at an extremely rapid pace in their early years (birth – 8 years) and are learning in more sophisticated ways than scientists previously thought (Board on Children, Youth, and Families, n.d.). Hence it is important to provide necessary care and appropriate educational exposure to children during this time. Doing so will allow students to build a solid educational foundation early in their lives. Our out-of-school curriculum has two primary segments which aim to provide social upward mobility for ALICE families with traditional educational assistance (standard school subjects) while also including education on food security. The organization will place primary focus on the elementary school-aged students to target the students who our curriculum will be the most effective and impactful upon.

As previously stated, students who consume a well-balanced, nutritious diet will perform better in the classroom, all else equal (Healthy Food Choices in Schools, 2019). Additionally, pediatricians state that it is important for kids to understand the effect that different kinds of foods have on their body and mind to build healthy eating habits early-on and ensure proper nutrition for development (Booth, 2016). One segment of our curriculum will focus on the importance of nutritional access and education in young students' lives since these have such a large impact on their performance and development. Our organization will provide education around proper amounts of foods to consume from the five food groups, as well as the source of where different foods come from so kids can build an appreciation for food and to not take it for granted. We also plan to provide them with nutritious snacks to reinforce our teaching. More importantly, we will stand out from the competition because our curriculum will reinforce the scientifically proven effects that proper nutrition will have on the kids' mental and physical performance going forward (Healthy Food Choices in School, 2019; Weber, 2019) and how this will lead to student success. This curriculum segment will focus on keeping participating children fully engaged in the nutrition learning process by ensuring the process is fun for the kids to participate in through uniquely developed teaching techniques and activities. We will enlist the assistance of seasoned professionals who understand how to keep kids engaged in the most effective way to ensure the curriculum is engaging and appropriate for different aged kids in our target student segment. An example portion of this curriculum segment might include cultivating a garden or learning about sustainable food growing techniques, ultimately leading to an understanding of and appreciation for the source and consumption of nutritious food in relation to students' mental and physical developmental wellbeing. An example activity for young children might look like tasking students with constructing a pyramid with different blocks of food which make up the different levels of the food pyramid. The learning objective is for kids to know which types of foods belong in the respective levels of the pyramid, emphasizing the ratio of food types that should be consumed (as illustrated in the pyramid's construction, i.e., larger level for vegetables compared to sugar illustrates more vegetables should be eaten compared to sweets). The organization can measure the impact of this study by partnering with the school districts to collect data on the types of foods that are disposed of by the students prior to and after the activity to determine if eating habits have changed.

The second segment of the organization's curriculum will help address the other pain that families experience in expensive and hard-to-reach tutoring services. This segment is less structured compared to the first segment, as it will be individually tailored to each student primarily on an as-needed basis through the utilization of paid instructors and volunteer tutors (primarily high-school- and college-aged students and other adults in the community). In other words, the resources for educational assistance in the various school subjects that elementary students might be struggling in will be there for students to access when needed, but the organization will not overwhelm students with more information outside of school, unless needed or requested. A team-based approach will be most effective in helping those students in need, where our team of educational professionals and volunteers will work with the individual students' parents, teachers, and healthcare provider when needed to provide customized services to ensure students are put back on track to succeed in the classroom (Booth, 2016).

Where our company stands out from our competitors (traditional/online tutoring services and various student aid organizations) is that on top of our curriculum offering, we will also offer access to additional community resources and infrastructure that already exist to help ALICE families address other problems contributing to poverty. For instance, in considering Raj Chetty's work on graduation rates' correlation with owned housing (Chetty et al., 2020), our organization will be a connector for ALICE families to other organizations and government programs that currently exist to enhance access to affordable housing and to assist with acquiring a home. We will offer free transportation to these organizations, as well as allow these kinds of organizations to deliver educational materials and promotions to the members of our organization to create awareness and interest. Additionally, we plan to leverage food banks and food pantries that already exist in local and nearby communities by forming a partnership which allows our organization to collect food on behalf of our members and distribute it directly to our members and their families to help provide them with additional nutritious food. As our presence in local communities grows, we will create strategic, mutually beneficial partnerships with these organizations so that we can offer a direct channel to these resources, which families in need might have previously been unaware of. In doing so, we create additional exposure for existing organizations and government programs, and we are able to offer additional value-added services to those in need. We will also provide free transportation to these aforementioned community resources to eliminate the common issue of transportation that Arkansas families face. With free transportation, ALICE families can access community food banks that likely were previously unreachable. Furthermore, students who are members of the Student Health and Success Foundation will have access to our curriculum and offerings five days a week from: 9:00am to 4:00pm during non-school months; and after school to 6:00pm during school months.

It is important to note that while our company's target segment to provide aid for is ALICE families with primary aged students, all aspects of our curriculum and community resource enabling will also be beneficial for students who do not necessarily fall into this target segment. As The Student Health and Success Foundation grows and adds students from more districts, scholarships for high school students who volunteer and/or are members of the organization can qualify for the scholarship, which is intended to help provide aid for post-secondary education to further aid in social upward mobility and building a sustainable cycle of change through increasing standardized test scores/GPA, graduation rates, college acceptance rates, and financial aid amounts received by our members.

D. Market Overview

The initial pilot market for the Student Health and Success Foundation is the County Line School District. As part of my market research, I interviewed school board members of the County Line school district and learned that there are 525 students in the district (not including Pre-K). Roughly 72% of the students in this district are economically disadvantaged and are enrolled in a free or reduced meal program, meaning there are more than 375 students which are a part of an ALICE family. We anticipate reaching 50% of the student population within County

Line and having a positive impact on 75% of these students (measured by increased GPA/higher test scores) in the first year.

In our second year of operation, we will continue our focus on County Line, and we intend to add 25% to our enrolled members in the County Line School District, bringing our total member count to roughly 395 (or just over 76% of the district population), while still impacting 75% of the total members. In the years to follow, the organization will add the students from 7 additional school districts: Ozark (Year 3), projected 1850 students with 62% economically disadvantaged; Charleston and Booneville (Year 4), each with projected 1100 students with 51% economically disadvantaged and 1400 projected students with 80% economically disadvantaged, respectively (U.S. News & World Report, 2022a). Four districts (Mulberry, Scranton, Clarksville, and Lavaca) will be added in Year 5, contributing roughly 5100 students (U.S. News & World Report, 2022a).

E. Business Model

The Student Health and Success Foundation will generate income through membership dues/fees, charitable contributions, contributions in-kind, government grants, and fundraising. We will utilize a price discrimination model for our membership dues, assessed via an annual membership and paid monthly. During our first two years of operation, membership dues are free while we are focused on establishing proof of concept to prove our impact and expand to other districts. After two years of operation, data of student improvement in the classroom will be used alongside our early marketing strategy (described in the subsequent section) to reaffirm our impact and validate the price discrimination model to be implemented. Starting in year 3, our membership dues per student are $40 per month with an annual fee of $75. Using the rationale that the approximate median household income in Arkansas is $40,000 (Statistical Atlas, 2018), families that earn less than $40,000 in annual gross income do not have to pay anything for their children to be a member of the organization. Families that earn $40,000 to $69,999, 50th to 75th percentile for Arkansas household income (Statistical Atlas, 2018) pay only 60% of the monthly and annual costs, and families that make $70,000 or more, 75th percentile and up (Statistical Atlas, 2018) will pay full price. We conservatively estimate that 50% of the students within each district will become members of our organization. Additionally, of that 50%, we estimate that roughly 45% of families will qualify for free membership, 30% for the reduced price of membership, and 25% will pay full price (Statistical Atlas, 2018). The United States Department of Education offers dozens of grants which our organization qualifies for which we will utilize to support our organization. For instance, grants that we will target include the Innovation and Early Learning Programs grant, which awards up to 20 annual grants in amounts up to $4,000,000, and a Supporting Effective Educator Development (SEED) program grant, which awards up to 20 annual grants ranging in amount from $1,000,000 to $6,000,000 (U.S. Department of Education, 2022). We will specifically target a SEED grant in year five when we have 4 years of data to demonstrate our impact through the KPIs mentioned in the previous section, as SEED grants are awarded to nonprofit organizations which can demonstrate a record of raising student achievement (U.S. Department of Education, 2022).

With our effective marketing strategy described in the subsequent section, we anticipate testimonials spread by word of mouth will be key in garnering exposure to our organization and receiving contributions from individuals in the community and other nearby communities who want to be able to make a direct impact in students' lives. This strategy will also be helpful when conducting fundraising events to generate a substantial amount of revenue for the organization. We plan to conduct a variety of fundraising events throughout the year which include raffles, an annual silent auction, a walk-a-thon, and a golf tournament and have included a fundraising expense projection of 10% in our financial statements.

The five-year projected statement of activities (Table 3.1), balance sheet (Table 3.2), and cash flows (Table 3.3) illustrate the organization's growth and financial assumptions in what it will take to achieve our mission. These assumptions include hiring paid instructors (who have the proper certifications) to deliver and develop our curriculum, individuals to prepare food, regional operations coordinators to oversee day-to-day decisions of the organization, and dedicated marketing and accounting professionals.

F. Marketing Strategy

The organization will focus on establishing proof of concept in a cost-effective way in our early years by focusing our resources on one school district to begin with, and slowly expanding our reach to ensure impact can be established and measured with each expansion step. Marketing and advertising our organization's value and impact on the communities we are in will be key in expanding our reach to other school districts. We will primarily utilize the existing school districts as our main marketing channel. Our organization intends to engage each districts' faculty, staff, and administrators as key stakeholders in spreading the mission and vision of the organization through word-of-mouth. We will also utilize these individuals as advocates for our organization, as we anticipate having direct participation from school officials in our organization in helping deliver our curriculum to students. We plan to develop partnerships with schoolteachers and faculty who can champion our organization to students and their families. In-classroom exposure of our curriculum with the help of teacher/faculty connections to demonstrate what our organization has to offer will play an important role in acquiring new students. As data is collected to demonstrate our impact, testimonials from stakeholders will play a key role in expanding our organization and reaching more students. From customer discovery interviews with County Line District administrators, we are confident that with the support of the key stakeholders within each district, we can establish our pilot location in the first two years of operation to begin testing our curriculum and start showing the value of our organization in ALICE families and all students' lives. Additional distribution of informational pamphlets and fliers as well as presentations of our organization will further aid in acquiring students and their families.

Another key component of our marketing strategy includes leveraging the resources and individuals who work at regional education service cooperatives. Since County Line School district will be our pilot location, and the Guy Fenter Education Service Cooperative is located right next to the district's elementary school, this will allow our organization to foster relationships with key stakeholders who are a part of the cooperative to aid in advocating for our company's mission and impact to other schools. The Guy Fenter Education Service Cooperative is the fourth largest education service cooperative in the state of Arkansas, serving 97 different schools reaching nearly 45,000 students and 3,500 teachers. A strategic relationship with this cooperative early on provides our organization with access to a very important marketing channel which is key in expanding our reach to maximize our impact.

With expansion into neighboring school districts, the cycle will continue with engaging key stakeholders in each district and distributing information via pamphlets, fliers, and presentations. As the Student Health and Success Foundation grows and we have a larger historical number of students who have been members of our organization, we can measure our impact via the KPIs mentioned in the customer, curriculum, and competitive advantage section and leverage these in future informational sessions and testimonials to acquire the support and engagement of other school districts.

Furthermore, as we engage with other well-established, reputable organizations that offer community resources and aid, such as local government agency offices, local insurance agencies, local banks, community outreach services, shelters, or employment assistance agencies and regional public officials, such as county judges or state representatives, we will seek out endorsements. These individuals and organizations often have a large amount of trust and support from the residents of the communities they are in. Establishing ourselves as legitimate in the public eye through these key endorsements helps ensure our organization is not viewed in a negative light, as is often the case with other nonprofit organizations.

G. Competitive Environment

The Student Health and Success Foundation will be competing with other well-established companies and non-profits to achieve our mission. Dominant players in our competitive field include the Boys & Girls Club of America, community or soup kitchens (such as Red Shield Diners, operated by the Salvation Army), and traditional tutoring services. Our organization has important competitive edges over each of these organization types. Communicated in Figure 3.1, our organization offers access to more resources than soup kitchens, traditional tutoring services, and the Boys & Girls Clubs. Additionally, our organization can provide all of our services at a more affordable price to our target customers compared to Boys & Girls Clubs and traditional tutoring services due to our price discrimination model. The Student Health & Success Foundation has committed to reinvesting 50% of the revenue generated from membership dues into continual development of our curriculum and 25% of revenue into providing nutritional meals and transportation to ensure we are effectively addressing the educational gap and fostering resource connectivity to provide assistance for social upward mobility to ALICE families.

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I. Tables and Figures

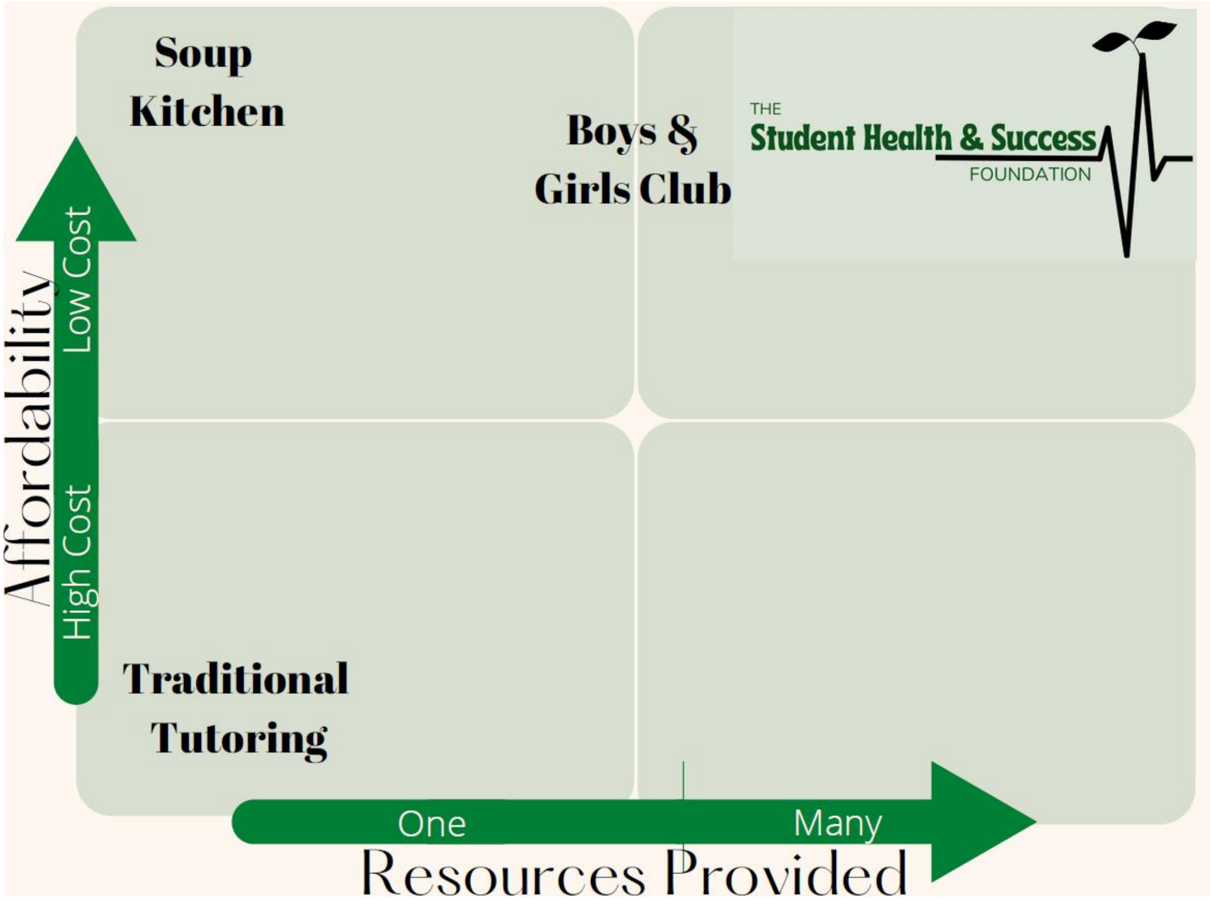

Figure 3.1. Competitive set matrix which demonstrates how the Student Health & Success Foundation has a competitive advantage over our direct competitors.

Table 3.1. The Student Health and Success Foundation's projected statement of activities for fiscal year ending 2023 through fiscal year ending 2027 (five years).

The Student Health and Success Foundation
Projected Statement of Activities
November 30, 2023 - 2027

Changes in Net Assets	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
Revenues and other support:					
Student Fees	$0	$0	$303,130	$616,599	$1,381,278
Contributions	$10,000	$25,000	$90,939	$246,640	$483,447
Contributions In-Kind	$5,000	$17,500	$60,626	$123,320	$276,256
Government Grants	$75,000	$200,000	$500,000	$750,000	$2,500,000
Fundraising	$25,000	$60,000	$151,565	$246,640	$552,511
Investment Income, Net	$0	$150	$300	$600	$1,350
Total Revenues and other support	$115,000	$302,650	$1,106,560	$1,983,799	$5,194,842
Expenses and losses:					
Curriculum development	$33,000	$85,500	$313,690	$557,964	$1,475,171
Space Rental	$30,000	$70,000	$70,000	$161,000	$421,000
Food & Supplies	$16,500	$42,750	$156,845	$278,982	$737,585
Transportation Services	$11,000	$28,500	$104,563	$185,988	$491,724
Fundraising	$2,500	$6,000	$15,157	$24,664	$55,251
Advertising	$5,000	$10,000	$10,000	$25,000	$75,000
Rent & Utilities	$1,150	$3,025	$11,063	$19,832	$51,935
Miscellaneous	$863	$2,269	$8,297	$14,874	$38,951
Scholarships	$0	$0	$5,000	$10,000	$20,000
Merchant Fees from Credit Cards	$225	$563	$8,867	$19,423	$41,956
Salary & Benefits Expense	$0	$35,000	$345,000	$610,000	$1,680,000
Website Dev. & Maintenance	$0	$10,000	$50,000	$50,000	$50,000
Accounts Payable			$4,928	$7,146	$14,478
Total Operating Expenses	$100,238	$293,606	$1,103,410	$1,964,872	$5,153,052
Net Assets Earned (Not Including Interest)	$14,763	$9,044	$3,151	$18,927	$41,790
Net Assets at Beginning of Year		$14,763	$23,806	$26,957	$45,883
Net assets at End of Year	$14,763	$23,806	$26,957	$45,883	$87,674

Table 3.2. The Student Health and Success Foundation's projected balance sheet for fiscal year ending 2023 through fiscal year ending 2027 (five years).

The Student Health and Success Foundation
Projected Balance Sheet
November 30, 2023 - 2027

	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
Assets:					
Cash & Cash Equivalents	$9,763	$18,735	$14,103	$15,362	$33,013
Accumulated Fund	$5,000	$10,000	$20,000	$45,000	$95,000
Property	$0	$0	$0	$0	$0
Total Assets:	**$14,763**	**$28,735**	**$34,103**	**$60,362**	**$128,013**
Liabilities:					
Accounts Payable		$4,928	$7,146	$14,478	$40,339
Total Liabilities:	$0	$4,928	$7,146	$14,478	$40,339
Net Assets:					
Net Assets without restrictions	$14,763	$23,806	$26,957	$45,883	$87,674
Total Equity:	$14,763	$23,806	$26,957	$45,883	$87,674
Total Liabilities & Net Assets:	**$14,763**	**$28,735**	**$34,103**	**$60,362**	**$128,013**

Table 3.3. The Student Health and Success Foundation's projected cash flow statement for fiscal year ending 2023 through fiscal year ending 2027 (five years).

The Student Health and Success Foundation **Projected Statement of Cash Flows** **November 30, 2023 - 2027**					
	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
Cash Flows from Operating Activities					
Change in Net Assets	$14,763	$9,044	$3,151	$18,927	$41,790
Adj. for Change in Net Assets to Cash provided by Operating					
Net Realized/Unrealized Investment Gains	$0	$0	$0	$0	$0
Change in accounts payable	$0	$4,928	$2,218	$7,332	$25,861
Net Cash Flow from Operating Activities	$14,763	$13,972	$5,368	$26,259	$67,651
Cash Flows from Investing Activities					
Purchase of Investments (est. 3% return)	-$5,000	-$5,000	-$10,000	-$25,000	-$50,000
Proceeds from Sale of Investments					
Purchase of Property & Assets					
Net Cash Flow from Investing Activities	-$5,000	-$5,000	-$10,000	-$25,000	-$50,000
Cash Flows from Financing Activities					
Net Cash Flow from Financing Activities	$0	$0	$0	$0	$0
Change in Cash and Cash Equivalents	$9,763	$8,972	-$4,632	$1,259	$17,651
Beginning Balance	$0	$9,763	$18,735	$14,103	$15,362
Ending Balance	$9,763	$18,735	$14,103	$15,362	$33,013

J. Appendix

Table 3.4. The Student Health and Success Foundation's Revenue Forecast Assumptions for fiscal year ending 2023 through fiscal year ending 2027 (five years).

The Student Health and Success Foundation Sales Forecast (Projected) October 2022 through FY 2027					
Product Lines	FY 2023 Total	FY 2024 Total	FY 2025 Total	FY 2026 Total	FY 2027 Total
# of New Districts	1	0	1	2	4
Total Districts	1	1	2	4	8
Students enrolled District	263	329	1,270	2,584	5788
Dues from Enrolled students	0	0	303,130	616,599	1,381,278
Contributions	10,000	25,000	90,939	246,640	483,447
Contributions In-Kind	5,000	17,500	60,626	123,320	276,256
Government Grants	75,000	200,000	500,000	750,000	2,500,000
Fundraising	25,000	60,000	151,565	246,640	552,511
Gross Revenue	115,000	302,500	1,106,260	1,983,199	5,193,492

Table 3.5. Schedule of Salaries for The Student Health and Success Foundation for fiscal year ending 2023 through fiscal year ending 2027 (five years).

The Student Health and Success Foundation Schedule of Salaries										
	FY 23		FY 24		FY 25		FY26		FY27	
CEO	1	$0	1	$0	1	$40,000	1	$60,000	1	$70,000
COO (Operations)	1	$0	1	$0	1	$40,000	1	$50,000	1	$60,000
CCO (Curriculum)	1	$0	1	$0	1	$40,000	1	$50,000	1	$60,000
CMO (Marketing)	1	$0	1	$0	1	$40,000	1	$50,000	1	$60,000
Marketing	0	$0	0	$0	1	$35,000	1	$50,000	1	$50,000
Food Prep (Part Time)	0	$0	0	$0	2	$70,000	4	$140,000	16	$560,000
Accountants	0	$0	0	$0		$0	1	$50,000	1	$50,000
Regional Ops. Coordinator	0	$0	0	$0	0	$0	0	$0	1	$50,000
Paid Instructors (Part Time)	0		1	$35,000	2	$80,000	4	$160,000	16	$720,000
Total Salary Expense	**4**	**$0**	**5**	**$35,000**	**9**	**$345,000**	**14**	**$610,000**	**39**	**$1,680,000**
Average Salary		$0		$7,000		$38,333		$43,571		$43,077

Table. 3.6. The Student Health and Success Foundation's Expense Projections for fiscal year ending 2023 through fiscal year ending 2027 (five years).

The Student Health and Success Foundation Expense Projection Years 1 through 5						
		FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
Expense Type	SHS Foundation % of Total Revenue (less in-kind)	Annual Expense				
Curriculum development	50.0%	33,000	85,500	313,690	557,964	1,475,171
Space Rental		30,000	70,000	70,000	161,000	421,000
Food & Supplies	15.0%	16,500	42,750	156,845	278,982	737,585
Transportation Services	10.0%	11,000	28,500	104,563	185,988	491,724
Fundraising		2,500	6,000	15,157	24,664	55,251
Advertising		5,000	10,000	10,000	25,000	75,000
Utilities	1.0%	1,150	3,025	11,063	19,832	51,935
Miscellaneous	0.8%	863	2,269	8,297	14,874	38,951
Scholarships				5,000	10,000	20,000
Merchant Fees from Credit Cards	3.0%	225	563	8,867	19,423	41,956
Salary & Benefits Expense			35,000	345,000	610,000	1,680,000
Website Development & Maintenance			10,000	50,000	50,000	50,000
Total		**100,238**	**293,606**	**1,098,482**	**1,957,726**	**5,138,574**

Chapter IV. Summary of Conclusions with Future Study Opportunities

A. Summary of Study Results and Conclusions

Chapter II found that investing in a solar system with a tracker, rather than a fixed-open rack system, can be recommended to producers as fewer panels with greater electricity generating potential lead to lower initial investment and thereby greater NPV than investing in more, less efficient panels. This is subject to minimum size installation requirements that solar panel installers may have. That impact was pronounced for those who claim tax benefits over a longer period of time. Sensitivity analyses surrounding the monthly base fee and electric inflation rate also had a large impact on NPV. However, given that producer scenarios will vary greatly in the real world, it is difficult to pinpoint just one answer to maximize NPV. Therefore, poultry producers can utilize the PSA tool to plug-in parameters for their unique operation to gain insight about what parameters are most important to their investment decision. Additionally, when considering solar investment feasibility from the perspective of the operation's manager, it is important to consider the financial risk associated with purchasing an expensive solar system. Since poultry producers are likely already highly leveraged, it is unlikely that those that are highly leveraged will pursue a project of this magnitude as they need to conserve borrowing capacity for capital improvement projects that may be dictated by their integrator. However, for producers who are considering environmental and economic sustainability dimensions in their decision-making progress, it is plausible that financial risk might be overlooked.

Chapter III outlined and discussed what it would take for the Student Health and Success Foundation to succeed in building social capital and fostering leaders of the future to pursue social sustainability. We are aware of the heavily competitive environment we will be operating in and how important engaging key stakeholders within various school districts will be to overcome the competition and effectively achieve our mission to provide an extracurricular educational program for students to build various hard and soft skills with the purpose to improve academic performance and expand access to better and more meaningful opportunities and resources through community connectivity.

B. Study Limitations and Future Opportunities

Ultimately, just two projects are presented and proposed to attempt to address the issue of sustainability. Even if these two projects were to work perfectly, continuous work towards sustainability is necessary to effectively pursue that societal goal of future resource assurance.

The study performed in Chapter II was conducted utilizing 6 producer scenarios. This is a limited view of the scope of operational differences that actually exist among poultry operations. Therefore, more data should be collected from producers to compile a larger set of impact ratios to determine if a pattern of parameter impacts on NPV will continue. Additionally, a survey of poultry producers would be useful to help gauge public perception of solar panel adoption and interest. Results and conclusions are also heavily dependent upon the current regulatory structure in Arkansas. Calculation methods and assumptions built into the PSA tool will need to be adjusted going forward if the tax incentives and/or regulations surrounding solar system installation were to change.

Further customer discovery is necessary to help expand the business proposal outlined in Chapter III. Particularly, it is important to interview additional school districts which have access to resources different than the districts chosen as pilot locations and early adopters of the organization's curriculum. Additional due diligence is also necessary to validate business model assumptions around the price discrimination brackets, which were determined based on Arkansas income data, built into the revenue assumptions beginning in year 3 of operations. Legitimate testing of the organization’s curriculum and offerings to students and their families will be essential to gather impact data to validate proof-of-concept. This proof-of-concept will be key for the organization to garner community support and donations to help cover organizational expenses.